HOW TO DO IT: SINGLE-CHANNEL INSTALLATION!
ALSO—NEW R/C RULES FOR 1963!—

MAY
JUNE • 1963

GRID LEAKS

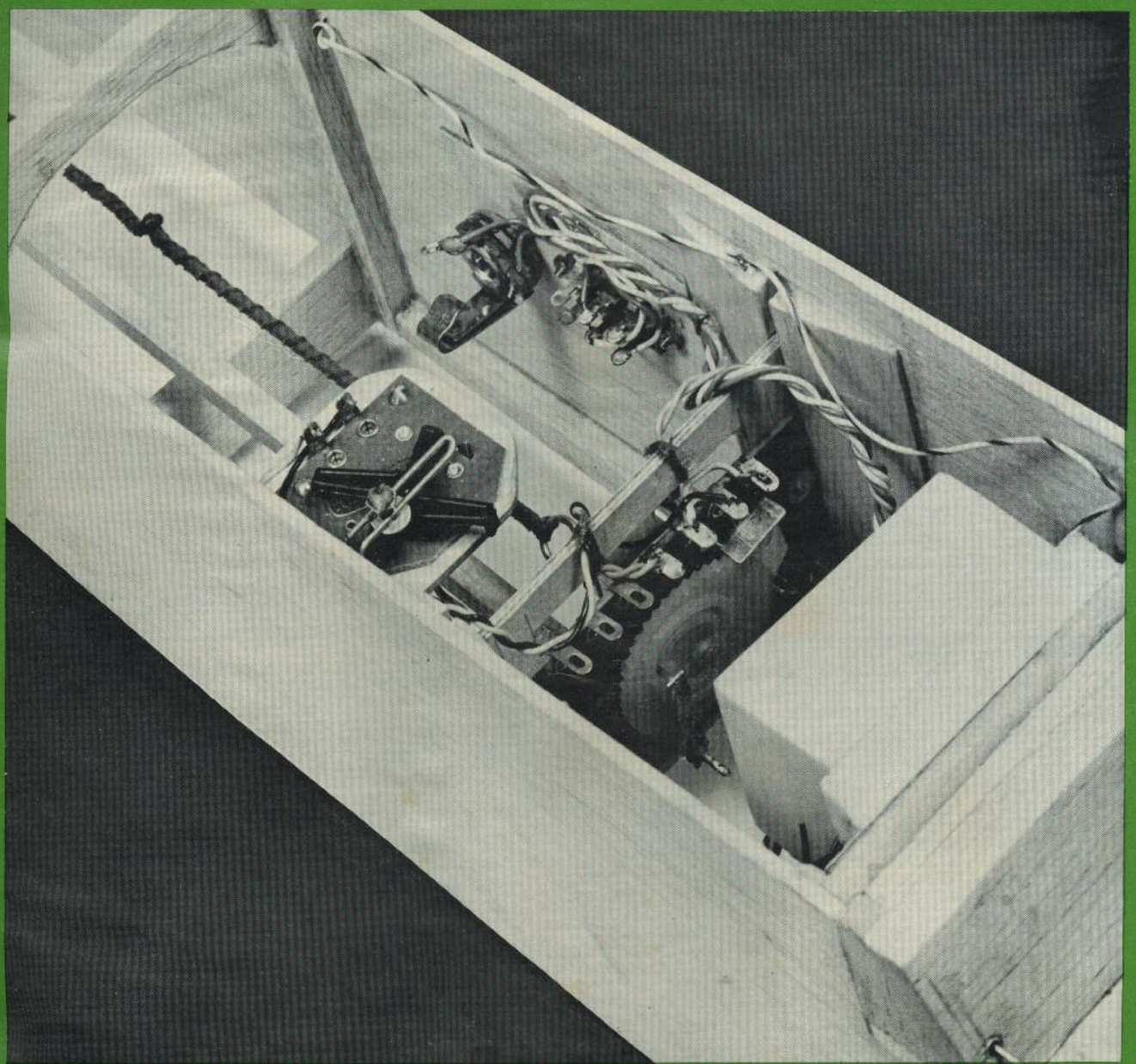
R/C
DATA
SERVICE

VOLUME 4 • NUMBER 3 • THIRTY-FIVE CENTS

FEATURING

SUPERHET RECEIVERS AND CONTROL SYSTEMS

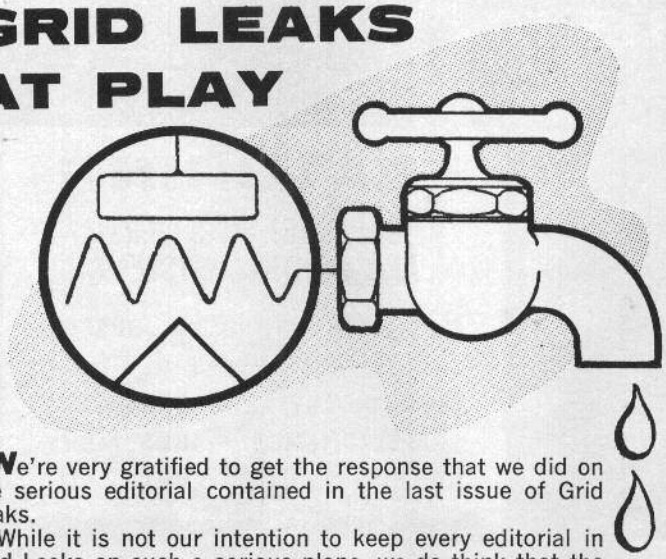
Masterful article by Jansson shines long-needed light on requirements and operating characteristics — describes construction of good r'cvr.



TYPICAL SINGLE-CHANNEL INSTALLATION SHOWS KRAFT RECEIVER, BONNER VARI-COMP, SN ESCAPEMENTS FOR RUDDER AND ENGINE CONTROL.

A Radio Control Publication for Beginner & Advanced Modeler

GRID LEAKS AT PLAY



We're very gratified to get the response that we did on the serious editorial contained in the last issue of Grid Leaks.

While it is not our intention to keep every editorial in Grid Leaks on such a serious plane, we do think that the push to register every user and prospective user of radio control with the Federal Communications Commission on the new Form 505 is of utmost importance to every reader of Grid Leaks.

A letter from Dr. Walter A. Good enclosed a speech by Frederick W. Ford, a commissioner of the Federal Communications Commission, made recently. The title of the speech is "Whither or Whether Citizens Radio." It contains much that we as users of radio can take to heart, and we quote from it:

"You may be wondering if the Commission is ganging up on your particular service by fencing it with new rules and obtaining from Congress the teeth with which to bring about enforcement. This may seem like something less than a favor, but in the long run, I believe that you will have to agree that it is entirely for the good. Strangely, radio as an art and an industry has thrived under strictest regulation. Without it, utter confusion would reign. In a phrase it is 'control or chaos'. What the Commission is trying to do is to avoid the chaos which could destroy the Citizens Radio Service. . . .

"It seems obvious that if the Citizens Service gets so out of hand that the F.C.C. is unable to cope with it; if because of extreme number of users and a general lack of care for the restrictions the service virtually destroys itself, it might become necessary to withdraw the 11 meter frequencies from the Service. This would seem to be a very drastic and unlikely measure; nevertheless, it would be most difficult to justify the extensive and expensive field force which might be required to police the band. Such disproportionate attention to one service would not be in keeping with the Commission's broad responsibilities elsewhere. Furthermore, this use of the radio spectrum has to stand up and be compared with others in the test as to whether or not it is a vital communication service, and the Commission would be hard put to find in its favor if it is faced with a sad record of flagrant violation. . .

"The happier, and I hope more probable, course which Citizens Radio may follow will be one where the individual licensees, clubs, manufacturers and others will all concentrate upon assuming their respective responsibilities in such a way that the Commission's action in establishing this service in the public interest will be vindicated. I am confident that this can and will be done."

We feel it is vitally important that every R/C'er believe that this talk was directed straight at him—and not at a bunch of other guys!

Now to another matter:

As old timers will recall, Grid Leaks will soon celebrate its sixth birthday.

For the benefit of the growing family who have just joined us within recent issues, a little dip back into early history seems appropriate.

Prior to the beginning of Grid Leaks as a magazine, Grid Leaks was the name of a column which appeared in the monthly Buck s County Pennsylvania Flypaper, ably edited by Al Abrams, Jr. In the early days the Grid Leaks column was run by Nate Rambo. Then John Worth, present President of the AMA, and yours truly became co-editors of the column.

The head of the column as used in the Flypaper was carried forward to the Grid Leaks At Play page when the magazine Grid Leaks was born. This happened after the Buck s County Flypaper had to be folded for various reasons.

In the mail recently we received the following letter:

"Remember when you wrote for the Flypaper? I re-drew the Grid Leaks head for them when they started printing on Multilith. Seems like the old head hasn't changed but the article has now become a full-blown magazine. Thought I'd re-do it a little better. The idea of coupling the electronic to the mechanical is great. Hope you like the enclosure. Sincerely, Bob Robbie."

Bob Robbie's name is seen quite frequently as a byline in model publications. But we would like to take this opportunity to thank Bob publicly for his new art which appears at the top of this page.

It is gestures such as this that make the publishing of this paper one of the rewarding experiences of life.

Yours sincerely,

Paul F. Runge, Publisher

NEW R/C RULES-EFFECTIVE JUNE 1st, 1963

To become effective June 1, 1963 the following changes in the radio rules have been approved by the R/C Section of the Contest Board. Since the biggest change also is the most controversial, GL reviews the procedure by which these changes have been made.

The preliminary proposals — including some which were rejected in this stage—are studied in a 90-day period by the Section members. Proposals then approved by the Section are published in **Model Aviation** for a three-month (formerly six-month) study period by the AMA membership (all licensed fliers). Then, after consideration of comments from the membership, the proposals are again voted upon by the Section. This vote is final and proposals that are approved become official rules.

The changes are as follows:

SECTION 22.4

General: The Radio Control Pattern Event shall be divided into three classes, based on three primary aerodynamic axes of control: Yaw, Pitch and Roll. (Note: Primary controls—Rudder, Elevators, Ailerons; Auxiliary controls — any non-Primary controls.)

a. No radio equipment limitations or requirements in any class.

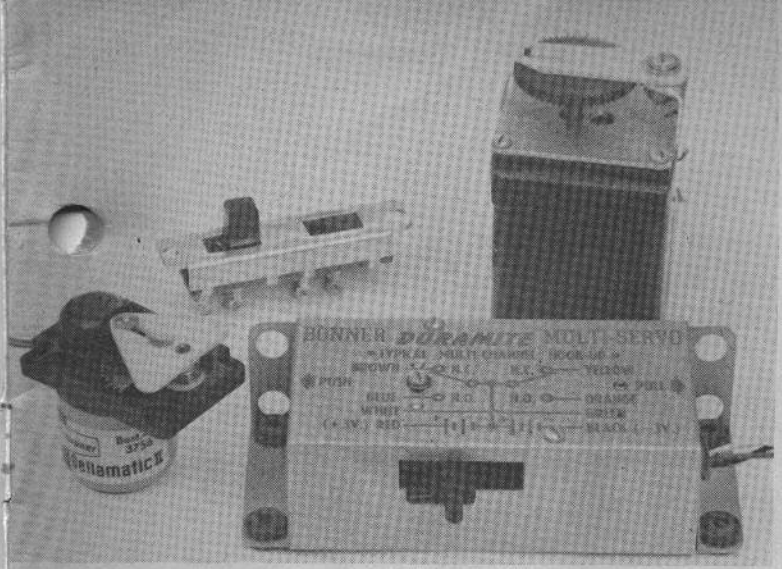
b. Engine control is permissible in all classes, by any means—trimmable, proportional, selective positioning, etc. operable simultaneously with or independently of other controls.

1. **Class I**—Planes controlled about the Yaw axis, by Rudder Control only. No auxiliary aerodynamic controls are permitted (flaps, spoilers, etc.); no auxiliary non-flight controls are permitted (brakes, steerable wheels, etc.). Trim of the Rudder Control is permissible only if obtainable with the basic actuator used for Rudder Control—no additional servos, actuators or devices are permitted. Rudder control permissible by any means—selective positioning, proportional, etc.

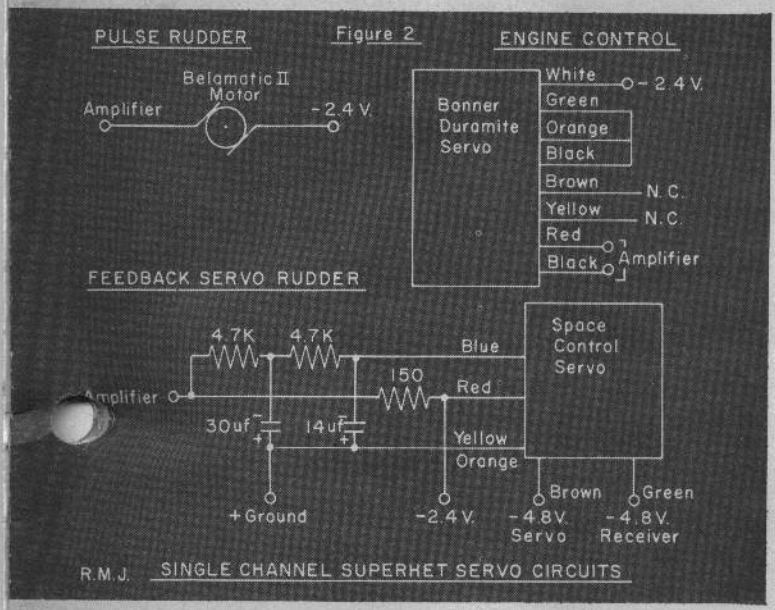
2. **Class II**—Planes controlled about the Yaw and Pitch axes, by Rudder and Elevator control only. Rudder and elevator control permissible by any means, simultaneously, independently or otherwise. Auxiliary non-flight controls (brakes, steerable wheels, etc.) are permitted without limitation or restriction. Auxiliary aerodynamic controls (flaps, spoilers, etc.) are not permitted.

CONTINUED ON PAGE 14

GRID LEAKS is a bi-monthly publication, and is intended for the modeler who is interested in Radio Control. It is published by Ace R/C, Inc., at 203 W. 19th Street, Higginsville, Mo. Copyright 1963 by Ace R/C, Inc. Subscription rate is $2.00 per 6-issue volume. For subscriptions outside the United States, add $1.00 for postage.

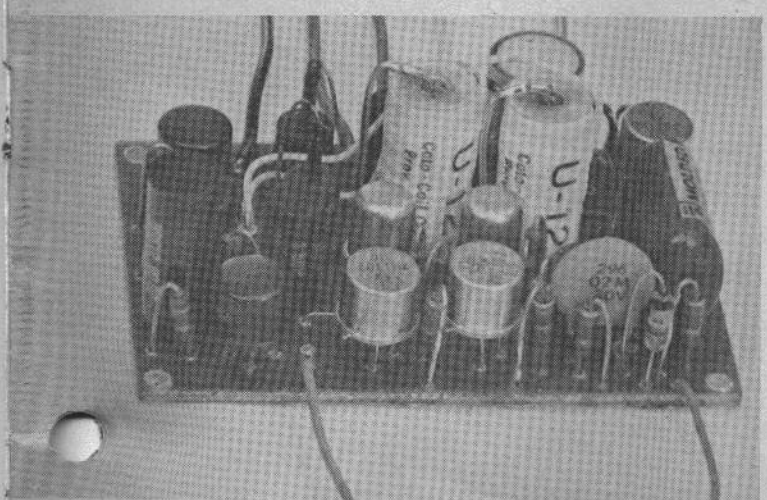


Rudder control is by Bellamatic 2 or Space Control servo; engine control by Duramite. Four-pole slide switch for power supply.

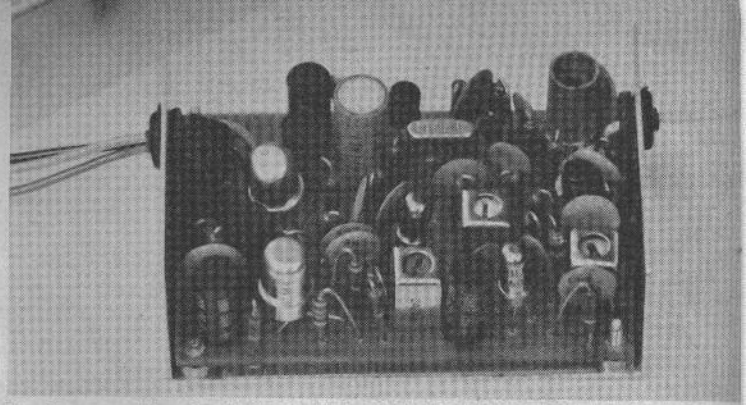


By DICK JANSSON · PART ONE

Article includes single-channel system for the proportionate rudder & trimmable engine control. Expandable to multi proportional, reeds.



Servo amplifier PC assembly. System includes receiver, selective filter, the amplifier, and pulse-omission detector to switch the servo amplifier output from the rudder servo to the engine servo.



Receiver assembly. Receiver, modified Kraft Hybrid Superhet KHFE.

SUPERHET RECEIVERS AND CONTROL SYSTEMS

MANY MODELERS HAVE HEARD about the superhet receivers that can be used for radio-control, and perhaps there are more than a few who do not know the attributes and methods of using these receivers in their models. In any R/C system the radio receiver must be designed to perform a remarkable job; specifically, a superhet must be light, reliable, inexpensive, unaffected by temperature changes, sensitive and selective.

It is this last mentioned factor that spells the major difference between superhet and super-regen receivers. Selectivity means the ability to separate the control signal from unwanted nearby signals such as those of the Citizens Band Class D transmissions and other R/C signals in adjacent channels. Super-regenerative receivers cannot do this separation effectively, resulting in planes getting "shot down." In three years of operating superhet receivers, this writer has had no recordable cases of radio interference, while other modelers in this area are inexperiencing increasing problems with their super-regen equipment.

While only a few of the available superhet receivers have been examined by this writer, good and bad examples of superhet design have been witnessed in regard to two important superhet characteristics. These are noise and automatic gain control (AGC) characteristics.

Despite soothing statements by manufacturers, radio noise is the undeniable natural enemy of superhet receivers. All is not black however, as shall be described further, since proper design in the receiver and control systems can alleviate noise problems to the point that the user is unaware of the problem. Basically, noise problems can be relieved by watching the following points:

1. The better superhet receivers will have a noise limiting diode between the mixer stage and the first I.F. amplifier. Receivers should also have adequate decoupling resistor-capacitor networks isolating the receiver radio circuits from the batteries and audio circuits.

2 Separate receiver and servo batteries, preferably nickel cadmium, should be used to avoid electrical coupling of servo noise into the receiver.

3. Relay switching of heavy servo loads should be avoided since this switching gives rise to radio noise that is very detrimental to radio operation. Some of the single-channel superhet receivers I have examined, which used a relay, suffered because of contact noise and the lack of audio selectivity.

4. Audio selectivity is a necessary feature of the control system attached to the receiver. Generally speaking, receiver noise results in broad spectrum audio frequency energy. A control tone can be a discrete tone frequency, therefore a sharply selective filter will discern the desired tone even though it is mixed with large amounts of noise. Filters for this job can be either an electrical tuned network or a mechanical filter such as a reed bank. Without a filter a superhet will respond to noise just as well as to signals. *Continued on Next Page*

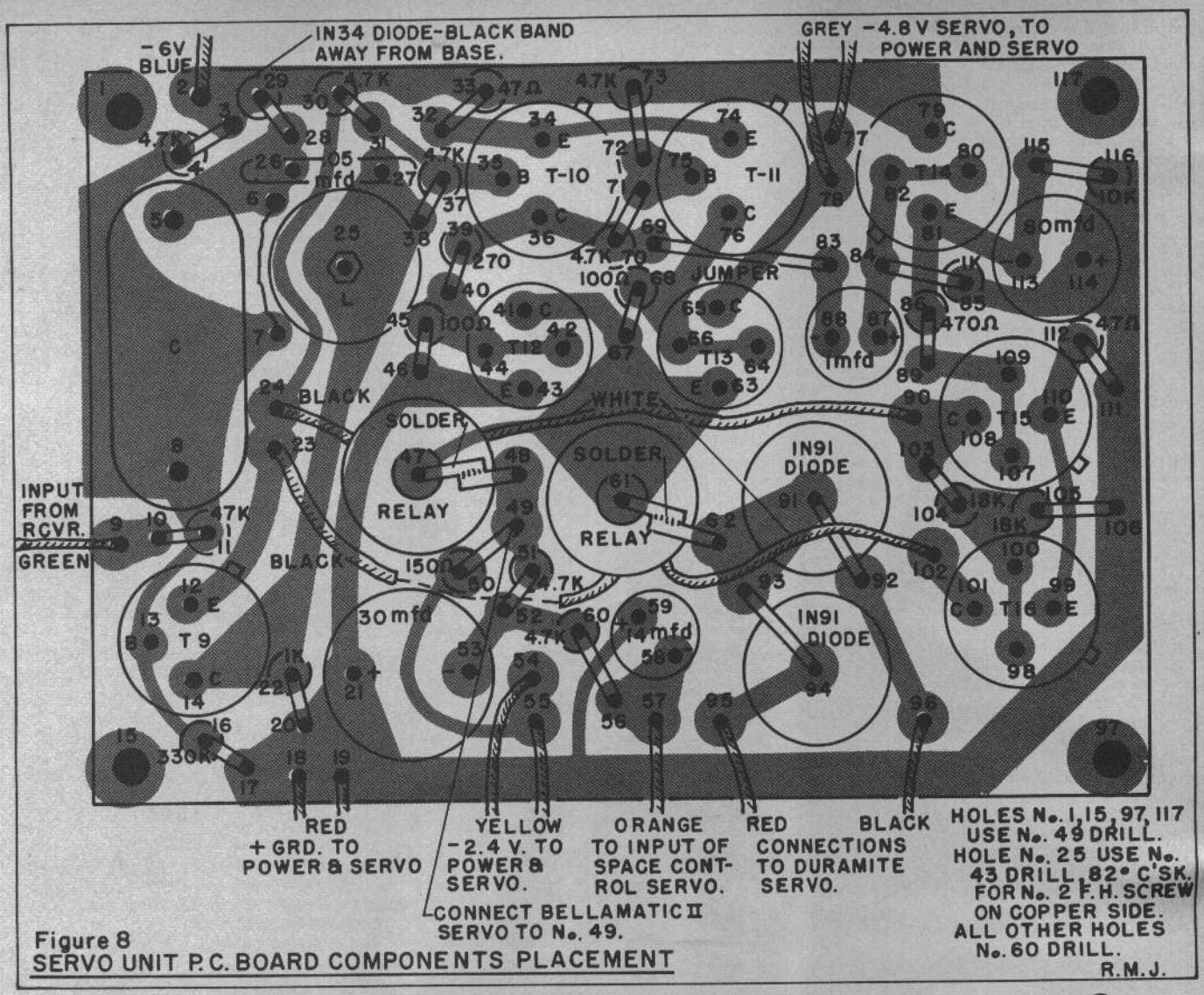
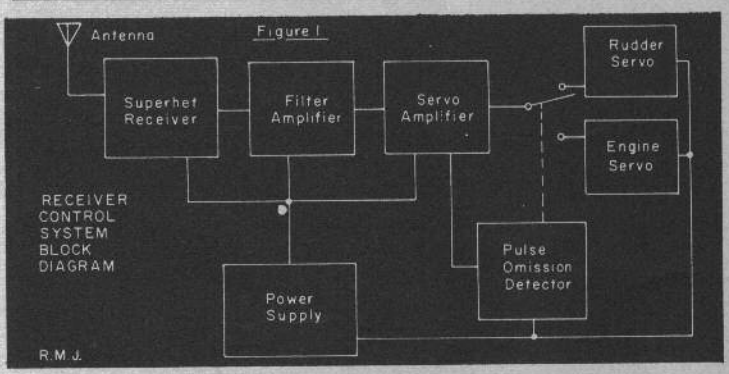
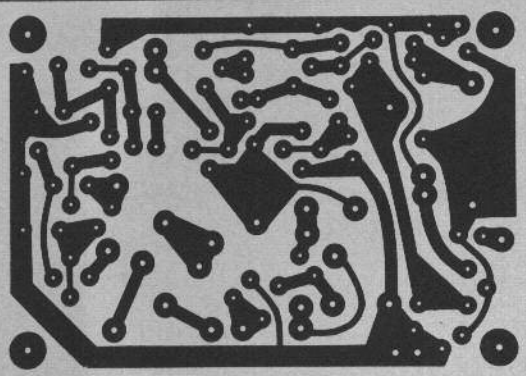


Figure 8
SERVO UNIT P.C. BOARD COMPONENTS PLACEMENT





5. Finally, such factors as keeping the receiver antenna nearly vertical as possible and away from servos and linkages should be observed. All control linkages **must** be electrically insulated from the servos, a complete reversal from super-regen practice. Linkages, if not insulated, will act as good antennas, useful only for receiving noise from the servos.

The only real way to test a superhet control system for noise sensitivity is to operate a complete system and observe its characteristics, taking note of responses to control signals as well as R.F. carrier on and off conditions. Tests should also be made with strong and very weak transmitter signals. If spurious control actions are noted, the foregoing list should be rechecked. Helpful, but not necessary, is the use of an oscilloscope looking at the receiver audio signal; be careful though as the 'scope can change some of the operating conditions.

One of the innate properties of a super-regenerative receiver is a nearly constant audio signal output for varying conditions of range from the transmitter; in other words, it has an automatic gain control. Superhet AGC characteristics have to be specifically designed for R/C uses. Again an oscilloscope can be used but is not necessary, as the tests only require the receiver, transmitter and an earphone.

Firstly the receiver should be peak tuned by connecting an earphone through a 0.05 ufd capacitor to the reed bank or audio output of the receiver. Using a plastic tuning tool and the transmitter at progressively further range (distance can be shortened by removing the transmitter antenna) tune the I.F. transformers and Mixer stage (with cover in place) for the loudest tone. Once tuned a superhet will rarely need retuning. Remove the earphone circuit from the receiver and operate the transmitter with full antenna, observing the control actions of the receiver system. If the receiver has a properly designed AGC, there should be no difference in control action when the antennas are one inch apart, at full range, or at any intermediate range. Kraft Superhet Receiver is available in a Hybrid form, with only the front end completely assembled. The finishing of the Hybrid can be left up to the individual builder. It is the purpose of this article to further describe a high quality, single channel.

proportional rudder and trimable engine control system. This system has the future potential of being expanded to a multiproportional and simultaneous reeds if desired. The second part of this article in the next issue of GRID LEAKS will deal with an all transistor transmitter to complement the described control system. This will not be a 100 milliwatt job but will be rated as a full three watts of power input, relatively inexpensive, and also expandable to handle the control system additions as needed.

Figure 1 outlines this control system, which contains, in addition to the receiver, a selective filter, a servo amplifier, and a pulse omission detector to switch the amplifier output from the rudder servo to the engine servo. While a completely transistorized unit would be desirable, and has previously been built and flown, the compact magnetic reed relays used for the P.O.D. offer simplicity as they save about seven transistors and associated components. These relays are not vibration sensitive and can be "hard mounted." In addition, the relays perform merely a transfer function and are not subject to the rigors of pulsing a servo motor. That function is left to a reliable servo amplifier.

One of the big features of this unit is that it provides the Class I modeler with a well tried control system that allows him to get "big time" control performance with a positional feed-back servo on the rudder and instantaneous engine control. If the modeler desires, he can use a compact pulse-motor servo such as the Belamatic II for a start and later convert the system with the addition of three resistors and two capacitors, Figure 2, to use a Space-Control servo on the rudder.

The best selection for an available engine servo is the Bonner Duramite. Operated with the connections shown in Figure 2, it has limit switching, power and, in this circuit, an optimum travel speed to enable the flyer to get the correct intermediate engine speeds. The control is also fail-safe, providing a neutral rudder and idle engine in emergency.

Figures 3, 4, and 5 show the completed receiver, schematic, and parts layout. As with any printed circuit board, care must be exercised in proper placement of components, such as transistors, and careful soldering of components using a pencil tip iron, such as those made by Ungar. Placement of components on the modified Kraft Hybrid Superhet, KHFE, is straight forward as shown on Figure 5. However, a few points should be noted:

1. The receiver and servo units are set up to utilize either 2N224 transistors or more recently available PNP transistors such as the Philco T-2516, whose lead locations are placed emitter, base, collector—read clockwise while viewing them. The 2N224 transistors have a red identifying mark near the collector lead while most other units have a metal tab near the emitter lead.

2. With point (1) in mind, T-8 collector lead should be placed in hole 173, emitter in hole 177, and 2N224 base in hole 176 while, for the T-2516, place the base lead in hole 172.

3. For transistor T-7 (either 2N224 or T-2516) place the collector lead in hole 155, the emitter in hole 154, and carefully bend and feed the base lead into hole 153 as shown.

4. Place the 80 mfd P.I. capacitor plus lead in hole 178 and negative lead in hole 179.

5. Place the two 1 mfd P.I. capacitors in holes 166, 164 and 138, 142 with polarities as shown.

6. Place the remainder of the components as shown in Figure 5.

7. Strip the ends, 1/8 inch back, of a green, red and black #24 vinyl wires and solder to the lands at holes 186, 187 and 188 respectively.

Checking and testing should be as for the KHFE and/or as previously described. Careful attention should be paid to a pre-operation inspection of all P.C. board solder joints and component placements.

Figures 6, 7, 8, and 9 show the constructional details of the control unit. It is built on a P.C. board of the same size as the receiver. Provisions are also made for the direct attachment of the leads from the servos to the control unit. While the schematic, Figure 7, shows only a rudder output, the printed circuit board includes optional placement of 30-mfd and 14-mfd capacitors, and 150-ohm and two 4.7K-ohm resistors in a filter network necessary for the Space Control servo.

If the component placement—numbered hole diagram (Figure 8)—is carefully followed there will be no problems in assembling this printed circuit board. A few procedural hints will help, however:

1. Start by **carefully** forming one lead of each Hamlin reed relay at a 90-degree bend to the body. Do this by pushing the lead with the soft part of a finger; do not use any other tools as glass fracture is sure to result. Apply contact cement to the end of each relay coil, opposite to the lead end, and in a 3/8-inch-diameter area around holes 47 and 61. When the cement is tack dry, insert a relay into each coil with the straight lead projecting and use this lead as a guide in holes 47 and 61 to align and bond the coils to the P.S. board. Solder a scrap of buss wire into holes 48 and 62, fold over the top of each coil and solder to the bent relay lead; finally solder the relays at

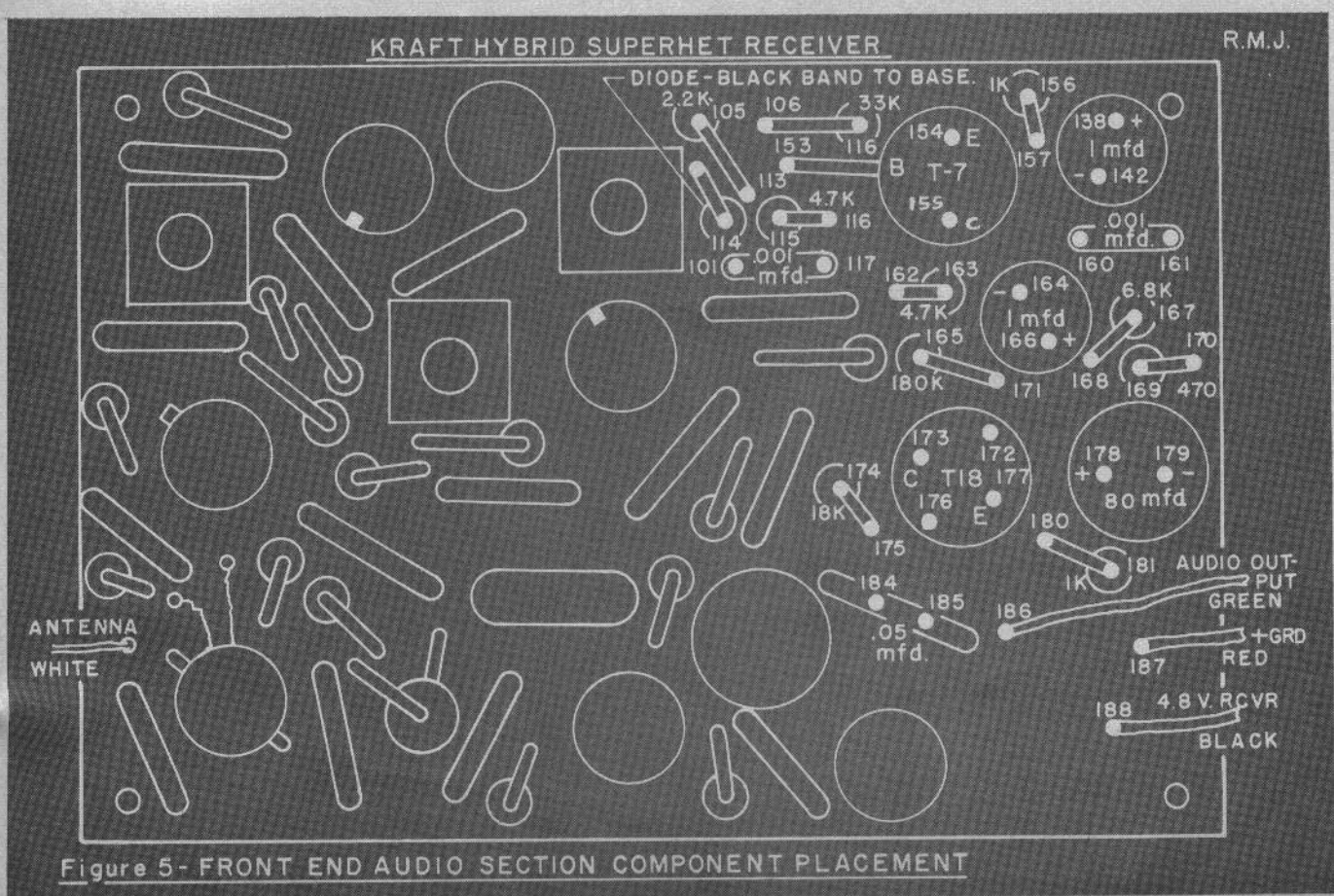
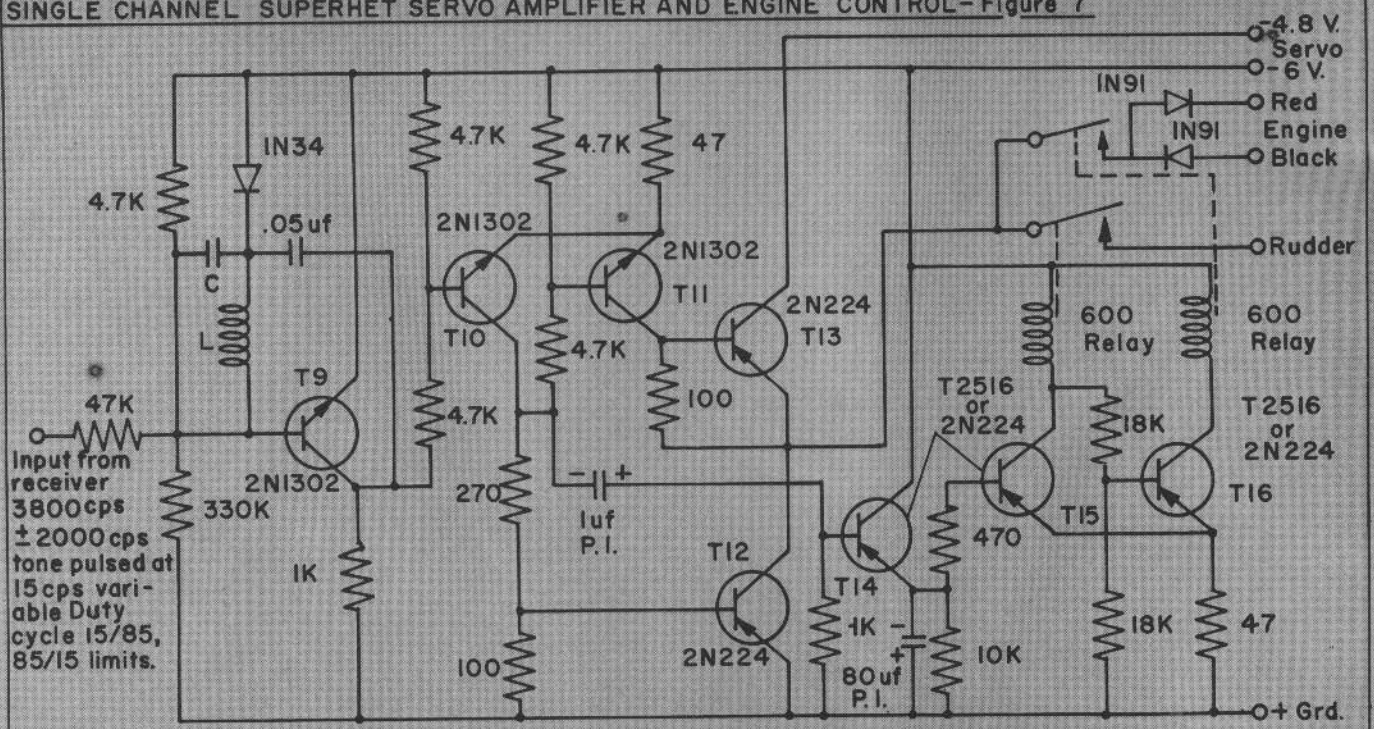


Figure 5 - FRONT END AUDIO SECTION COMPONENT PLACEMENT

SINGLE CHANNEL SUPERHET SERVO AMPLIFIER AND ENGINE CONTROL – Figure 7



For 3800 cps Tone:
C = 0.015 uf ±10%.
L = RAMECO Filter SMTF.

All resistors - 1/4 watt

Relay - MRG-1:
35±15 Amp. turns
Hamlin Inc.
Lake Mills, Wisc.

Coil - U12:
Coto-Coil
Providence, R.I.

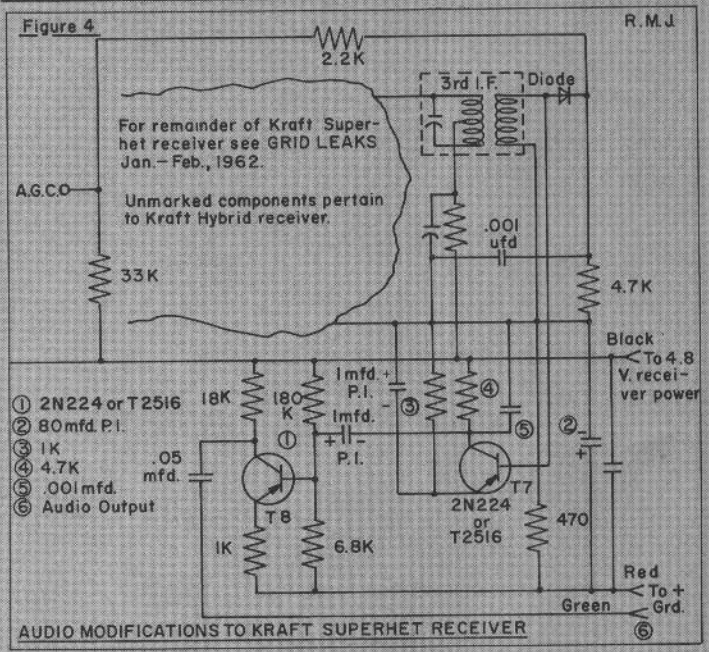
2N1302:
hfe - 40 Min
vce - 0.2 V. Max.
With:
Ic = 15 ma.
Ib = 0.7 ma.

2N224, T12, T13
vce - 0.2 V. max.
With:
Ic = 0.8 amp.
Ib = 15 ma.

Other 2N224 or T2516
hce = 80 min.

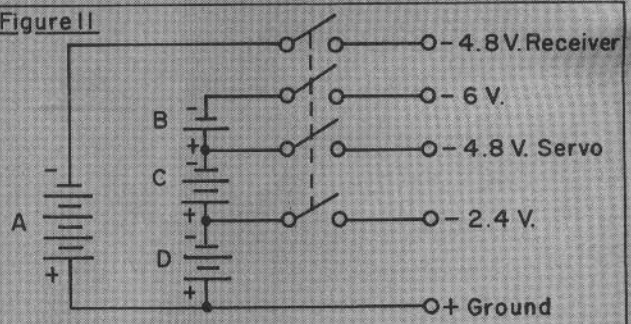
R.M.J.

Figure 4



AUDIO MODIFICATIONS TO KRAFT SUPERHET RECEIVER

Figure 11



A – Four Burgess CD-3 Cells.
B – One
C – Two
D – Two
} Burgess CD-4 Cells for Feedback Servo.

or:

B – One Burgess CD-4
C – Two VO-500
D – Two VO-500
} For Pulse Servo Motors

SINGLE CHANNEL SUPERHET POWER SUPPLY

R.M.J.

holes 47 and 61. The black relay coil leads can be trimmed, stripped, and soldered to holes 23 and 24. The white leads should not be connected until later so they may be properly routed.

2. Carefully unsolder the Rameco SMTF filter leads from their binding posts and remove the filter unit from its board. Remount the filter on hole 25 with the same 2-56 flathead screw and nut—a little cement should be used to lock the screw head and nut—and solder the filter leads in holes 6 and 7.

3. Mount and solder condenser C (.015-mfd for 3800 cps) in holes 5 and 8.

4. Mount and solder T-9, T-10, and T-11 (2N1302) in the indicated hole groupings, being careful about the proper placement of collector, base, and emitter leads (C, B, and E board markings).

5. Place selected 2N224 (not T-2516) or other suitably selected transistor in the holes for T-12 and T-13. Take care about lead placement as noted in step one of the hybrid receiver assembly.

6. Install T-14, T-15, and T-16 (T-2516 or 2N224) in their respective holes.

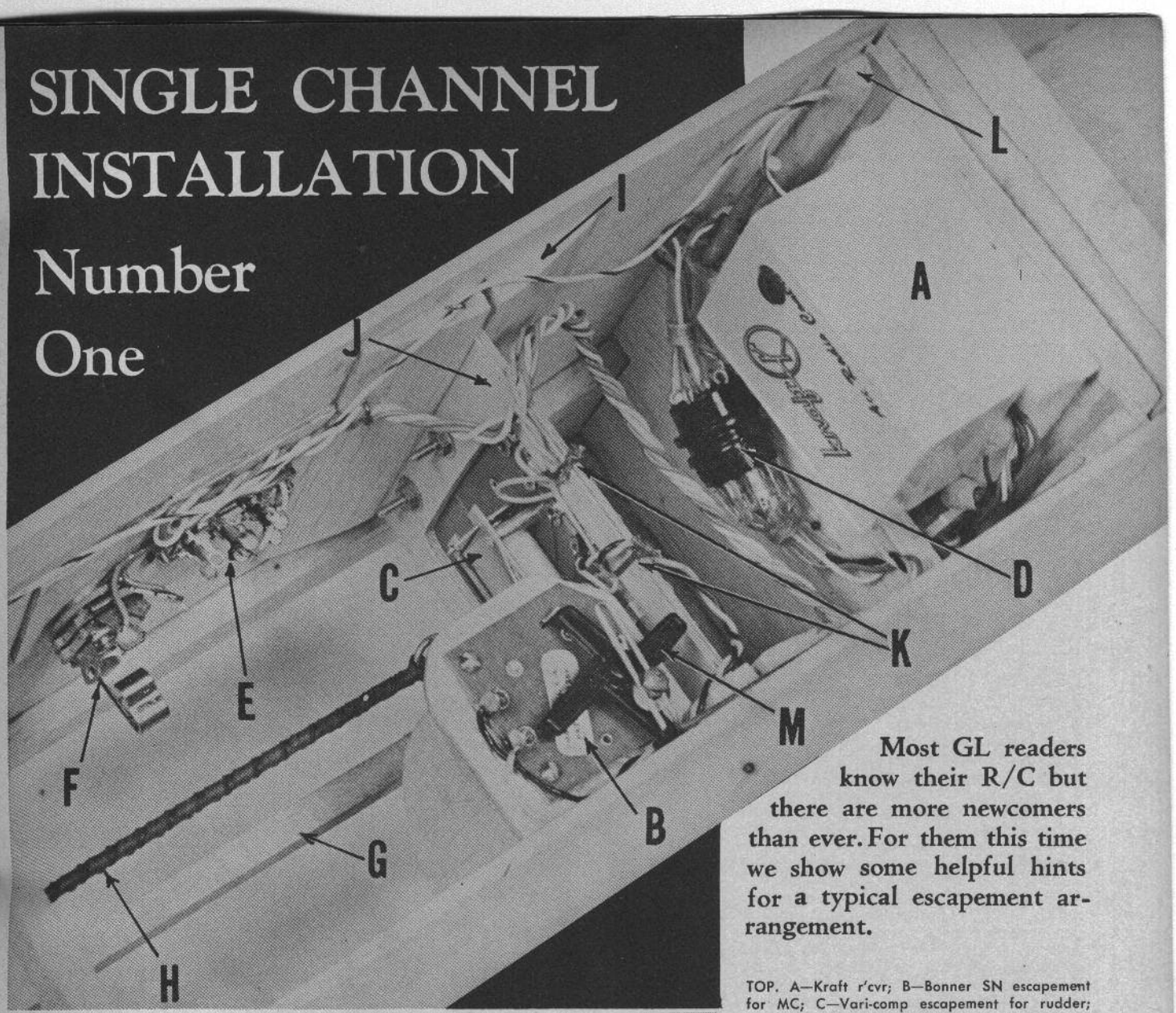
7. With a looping bend, double back the 1N91 "top hat" leads. Install the leads projecting from the bottom of the "hat" in holes 91 and 94 for each diode, while the folded leads are soldered in holes 92 and 93.

8. With a scrap of buss wire or clipped transistor lead install a jumper between holes 69 and 83 with the bends made sharp so the jumper lays flat on the board.

TEXT CONTINUED ON PAGE 16

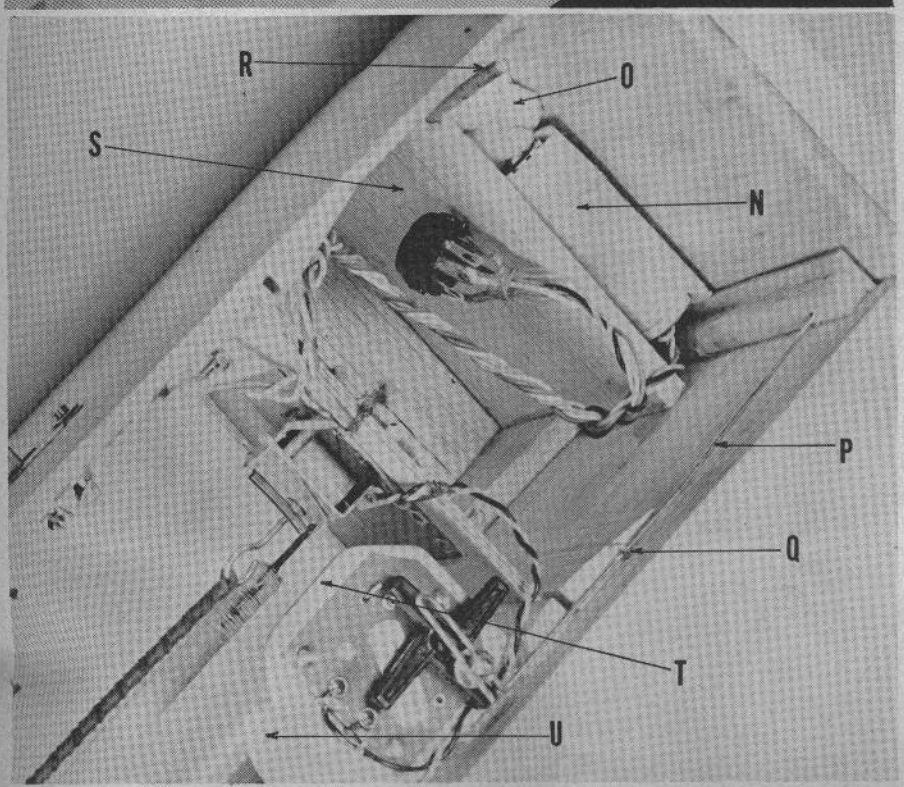
SINGLE CHANNEL INSTALLATION

Number One



Most GL readers know their R/C but there are more newcomers than ever. For them this time we show some helpful hints for a typical escapement arrangement.

TOP. A—Kraft r'cvr; B—Bonner SN escapement for MC; C—Vari-comp escapement for rudder; D—Plug and socket for r'cvr; E—Knife action slide switch; F—Jack if meter used; G—¼ in. sq. balsa torque rod for rudder action; H—¼ in. rubber for escapements; I—Trailing edge stock mount for escapement slide permits removal of unit; J—3/32 in. plywood escapement mounts; K—Tie escapement wire leads to ply; L—Quarter-round balsa glues to sides and to 1/16 in. ply r'cvr slide guides; M—.045 (aprox.) pushrod, yoke end—note soldered washer retainer.



LEFT. N—Battery pack, taped to 1/16 in. ply slide; O—Foam packing; P—MC pushrod; Q—Pin staple pushrod guide; R—Dowel: Keeps r'cvr cable away from escp.; S—¼ in. balsa; T—Escapement ply mounts; U—MC escp. supports.

▽

FOR THESE PHOTOS a dummy fuselage was assembled for an .09-.15 category Rudder job. The cabin area is approximately equivalent to a Rebel, Esquire, etc. In fact, a Rebel wing and stab fits this fuselage. For .09 engine, motor control is not essential in this size ship—for a .15 engine it is essential.

Because of a beginner's difficulties in reliably obtaining engine control by the "quick blip" signal, wiring requires holding the third pulse or signal to actuate the motor control escapement. Schematics for both receiver and escapements are to be found with manufacturer's directions.

Illustrated is a tube relay-type receiver (Kraft) because of its demonstrated all-

Continued on Next Page

round capabilities. By keeping tail construction light and going easy on aft-end paint, the center of gravity can be kept sufficiently far forward with an all-in cabin installation, provided escapements are located in mid-cabin, and batteries flat against front cabin bulkhead.

For a relayless receiver, a battery box, or battery pack, would have to be placed in the nose as far forward as possible, and additional nose ballast might have to be accepted to avoid a tail-heavy condition.

Receiver—Can be mounted in either foam-packed balsa box, per Kraft (Ace) instructions or on slide as shown. Better protection is afforded 6007 tube by very loose mounting.

Vari-comp Escapement—While acceptable reliability is available on 3-volts, some fliers prefer 4½V which does permit increasing spring tension to insure dropout when quarter-inch rubber is fully wound. Receiver instructions recommend 4½V for longer battery life. Since battery drain is higher with more voltage, this depends on what minimum voltage reading the individual will OK. Minimum voltage ought to be more for 4½ than for 3V. With two escapements and long "holds" for gentle rudder action, batteries will require more frequent replacement. Debate over battery box vs soldering is avoided if nicads can be used.

If escapement pull-in and drop-out are to be checked, use any appropriate variable resistor or "pot" and bench battery supply with escapement rubber wound. A practical test is to see if escapement pulls in and drops out with extra turns wound on—above the maximum to be used.

Switch and Jack: First should be knife action if slide switch—inspect through open end. Use appropriate resistor across jack to guard against poor contacts, or insert shorting plug—with miniature sized jack plug weight certainly acceptable.

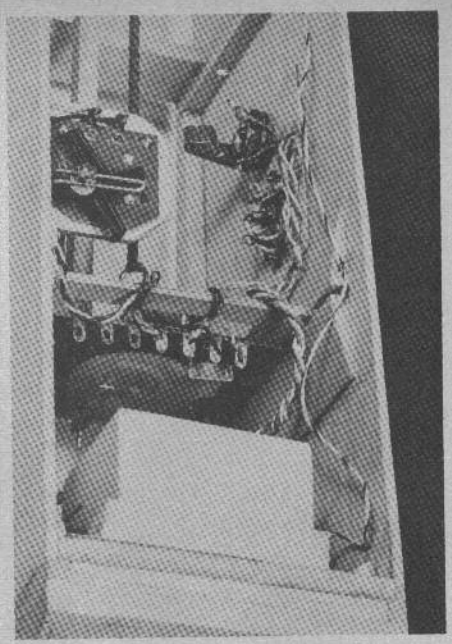
Accessibility: Vari-comp is accessible by pulling up slide plywood mount; "works" can be raised to top line of cabin without removing torque rod. Cable is spot glued to side near switch; by breaking spots, switch and jack remove. Bonner SN engine control escapement requires cutting glue joints between ply mount and cabin-side triangular braces. Ordinarily, maintenance easily performed through open top.

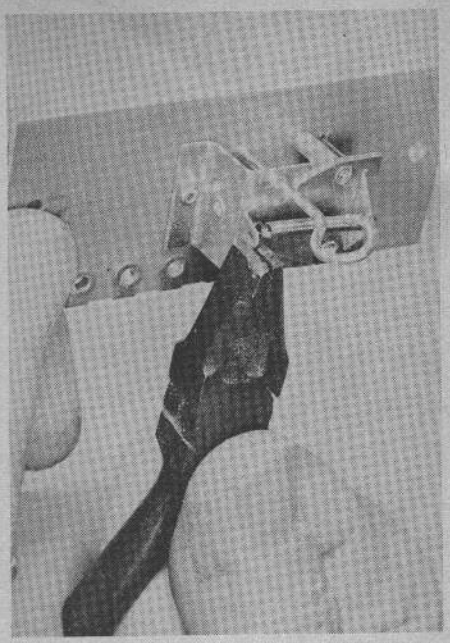
Suggestions: Having completed the mock-up for photography, certain improvements—particularly in the case of an original design—became evident. The drawing shows a superior mechanical arrangement. By moving back the primary escapement, the MC escapement can be placed in front of the Vari-comp. Both switch and jack can be located forward, thus helping to maintain desired CG and making possible shorter cable run.

By making the fuselage 4 in. wide instead of 3½, battery unit can be horizontal instead of vertical with batteries still in a row: space then is available to place receiver on slide vertically instead of horizontally. This in turn allows moving MC pushrod closer to the airplane centerline, reducing offsets in rod forward of windshield. If receiver mount is moved as far to the left as possible, this pushrod can be placed to left of SN escapement and then lie in a straight line to throttle (with 4-in.-wide fuselage.)

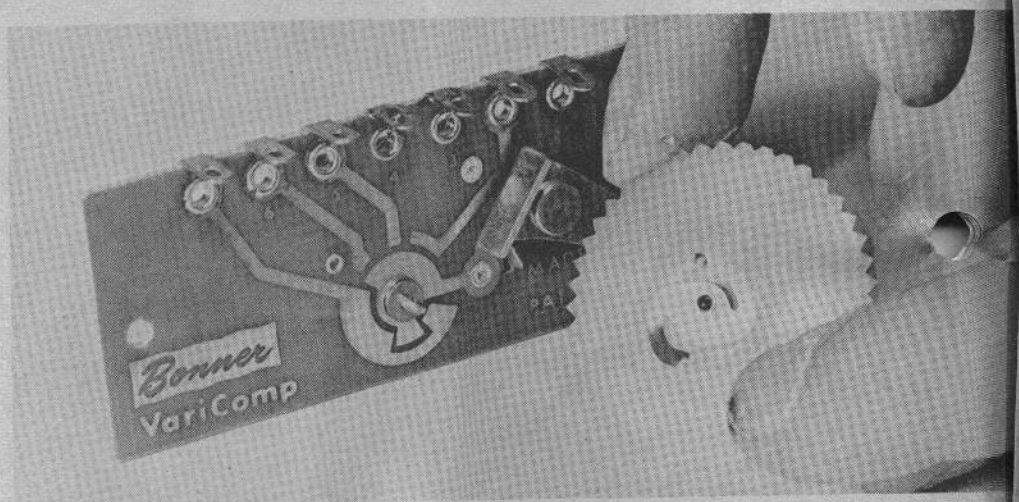
Actually, one has several choices in locating batteries. If nickle cadmium rechargeable batteries, the pack can be buried in the sealed nose, with leads coming out to external charging points to avoid disconnecting. If a box forward of cabin, top of nose requires a hatch, or cabin bulkhead requires large access hole through which box—wrapped in foam—inserts and removes. The holed portion of bulkhead then should be reinforced with 1/16-inch ply.

—BY BILL WINTER



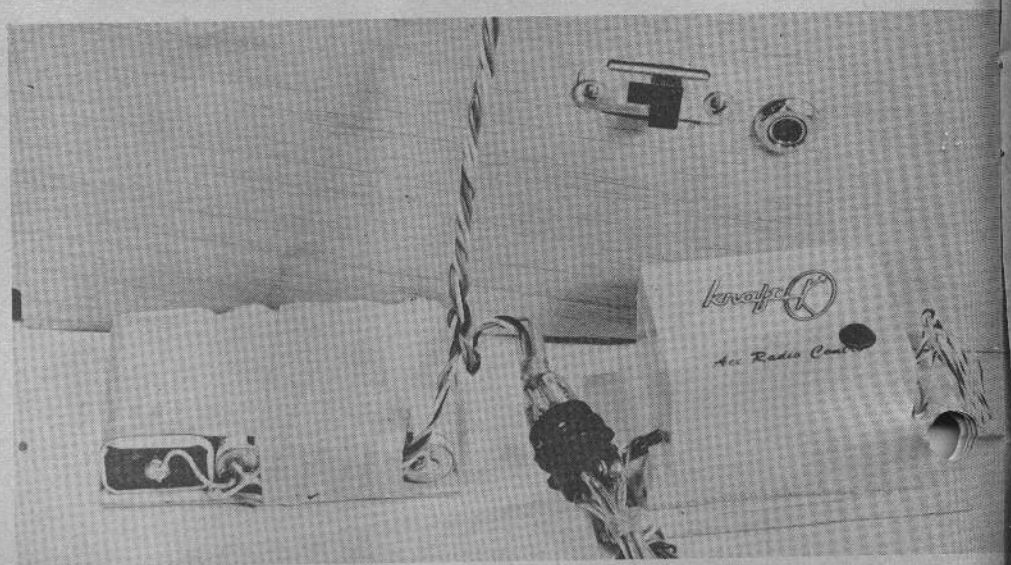


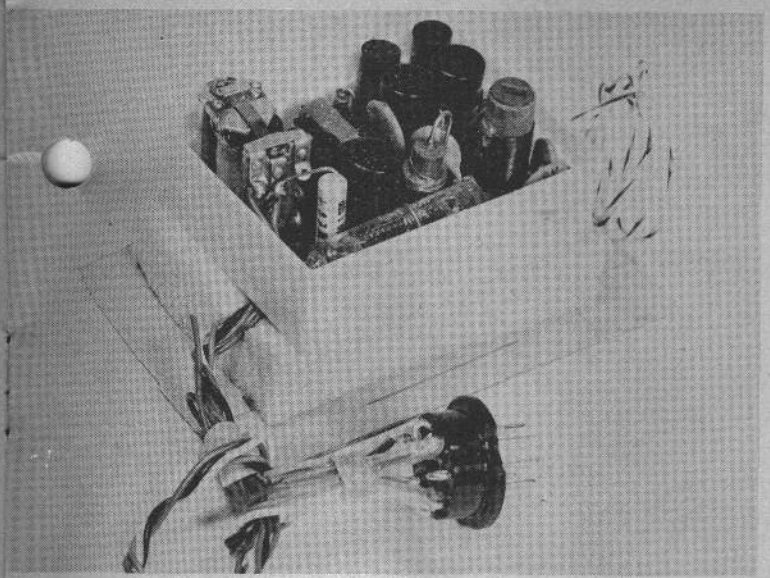
Study this view in relation to pix, previous page. Antenna fastened down, has slack for receiver movement for tuning; knot prevents antenna from pulling tight if snagged on bush, etc. If it should be desired to increase spring tension, tab is bent slightly—insures release when many turns on thick rubber. (This for advanced builders.) Adjustments should be checked with voltmeter and variable resistor or "pot." Can be done with unit installed.

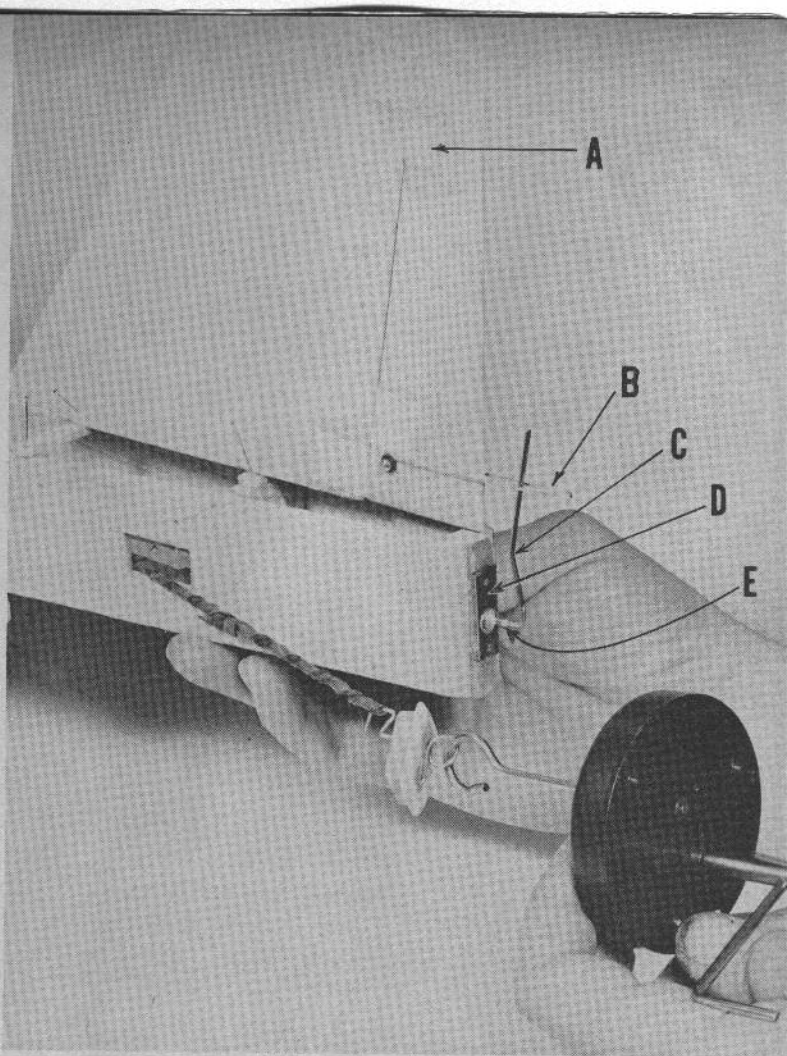


ABOVE. Always check out any new escapement. On Vari-comp check contact arms on back of the cam wheel for smooth ends. Can screws on shaft. Be sure to replace small washer if cam is removed.

BELOW. Soldered battery pack, receiver cable connector and r'cvr. Slide for r'cvr is 1/16 in. ply. Note sleeving, binding for connector leads.



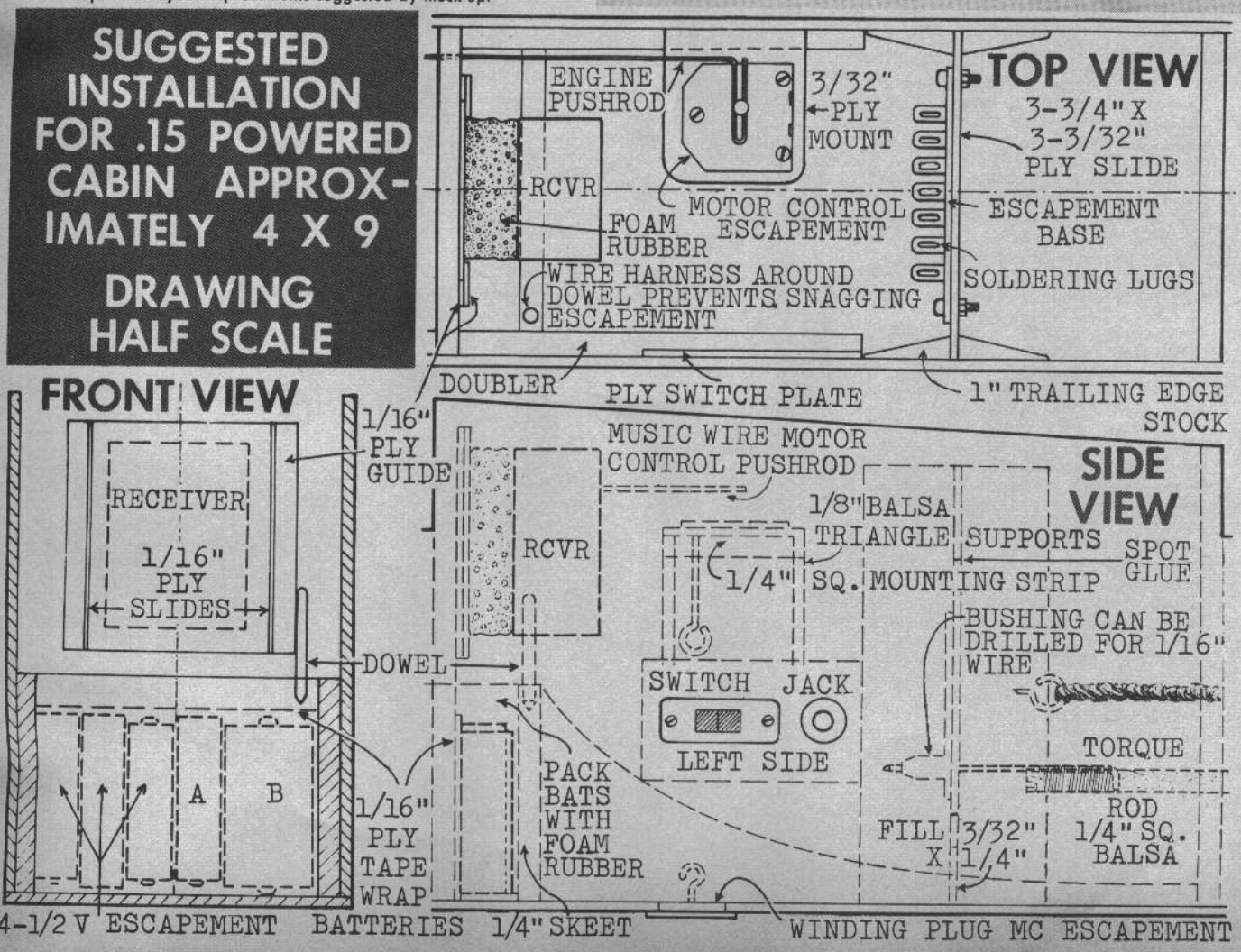




ABOVE. Kraft relay-type r'cvr is illustrated because of all-round reliability, pulse or escapement. Can also be mounted in foam-lined box. Mounting should be loose for good shock protection for tube and to insure perfect relay action with high-power engine and escapement installation. Recommended that r'cvr be mounted flat against a sturdy bulkhead so that hard knocks cannot tilt components. Sleeving for the leads should be regular "spaghetti" rather than stiffer fuel-line tubing. Installation illustrated permits the easy removal of all equipment. By measuring cable runs with scrap wire, allowing slack, wiring can be prepared as harness before installation made.

RIGHT. A—U-control cloth hinges; B—Rudder yoke (1/32 in. wire) can pivot up and down to adjust rudder movement; C—1/16 in. wire prevents blow-back; D—1/16 in. micarta bearing plate (can be metal). Avoid sloppy bushings; E—Soldered bushing or washer, with loose washer between. Fore-aft play should be minimized, but not to point of binding. Removable rubber plug permits stretch winding. Drawing below incorporates layout improvements suggested by mock-up.

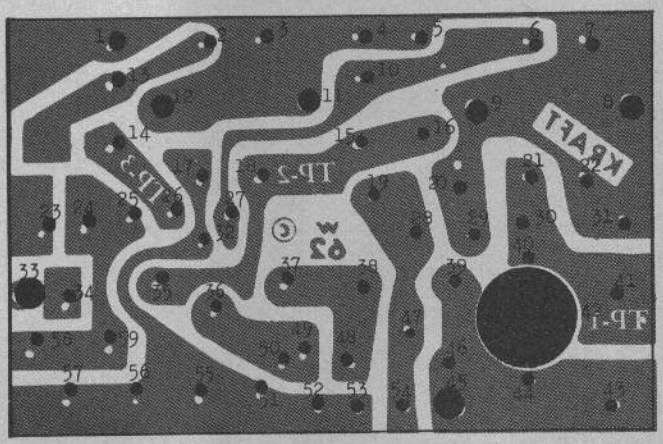
SUGGESTED INSTALLATION FOR .15 POWERED CABIN APPROXIMATELY 4 X 9 DRAWING HALF SCALE



Notes: On The 3 Volt Kraft Receiver

By DALE SPRINGSTED

Trouble shooting techniques used by servicenter pinpoint step-by-step procedures for checking faulty receiver. Tips for the home builder.



WHILE THE 100% TRANSISTORIZED KRAFT 3-volt receiver has certainly found a home in radio control, nothing much has been printed about specific service and troubleshooting techniques and, since this is our forte, we will deal with this phase.

When a normal receiver comes in to this servicenter for work, the step-by-step procedure goes something like this:

1—The receiver is first examined to determine if all of the components are properly placed as to location. Orientation of the transistors and transformers is especially noted.

2—The printed-circuit side is next examined for soldering quality, shorts and open circuits. Minor solder repairs are then made if needed.

3—The ordinary multi-tester is then used to check component continuity. Six checks are made. The RF choke, tank coil, and the primary and secondary of the two transformers. Particular attention is paid to the transformers. Primary resistance is always to be higher than secondary winding resistance. Occasionally, one slips in that is incorrectly marked. The primary winding will measure approximately 1000 ohms, and the secondary 150 ohms. Do not be confused by this because of the difference noted in the instruction manual showing primary as 10k ohms and secondary as 1k ohms. This latter value is the AC impedance of the transformer, not the DC resistance.

4—It is now time to apply voltage to the receiver and start to determine, if possible, where any trouble lies. It is not possible to relate all of the difficulties encountered, but if we show what voltage values and oscilloscope waveforms are encountered when the receiver is properly adjusted, it will simplify detecting the area of the difficulty. At the servicenter an oscilloscope is used, but for most measurements a VTVM will suffice. The readings given will all be in peak-to-peak values, not RMS. A 10 to 15% difference may well be noted on the VTVM since calibration of these instruments is generally taken on a sine wave, and we are now dealing primarily with a square waveform.

5—Power is applied to the receiver with no load device attached—no point in running down batteries unnecessarily. The test points used here will be different than those shown in the instruction manual, but are essentially the same points only varying in the location on the printed-circuit board. The ground lead of the instrument is attached to either the plus or minus battery lead. (I find no difference in results.) The hot lead is used in three places: TP-1, TP-2, TP-3. This traces the signal through the receiver in the path it takes as the unit operates.

TP-1—At TP-1 one measures basically the quench frequency of the receiver. With no carrier applied a broad pattern will be seen of about .3 to .5 volts. The characteristic of this is a ragged or squiggley edge. This will only be noted if the horizontal sync frequency is left in the low range on the scope. If the horizontal sync frequency is increased ultimately a sawtooth wave shape will appear and the quency frequency can be measured. This first observa-

FIG. 1

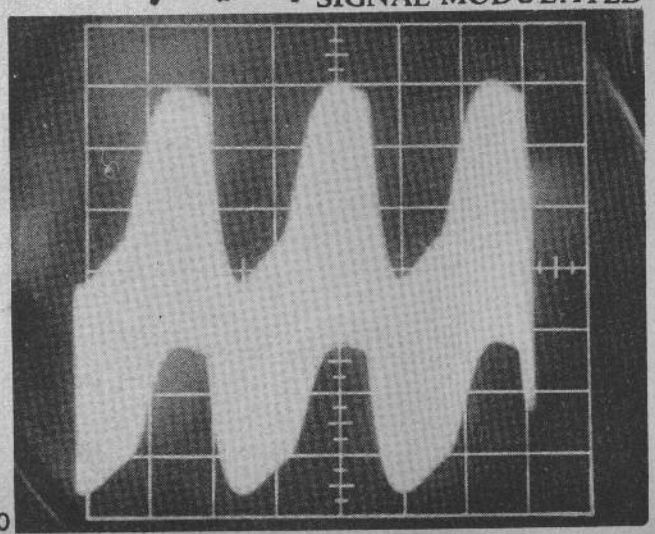
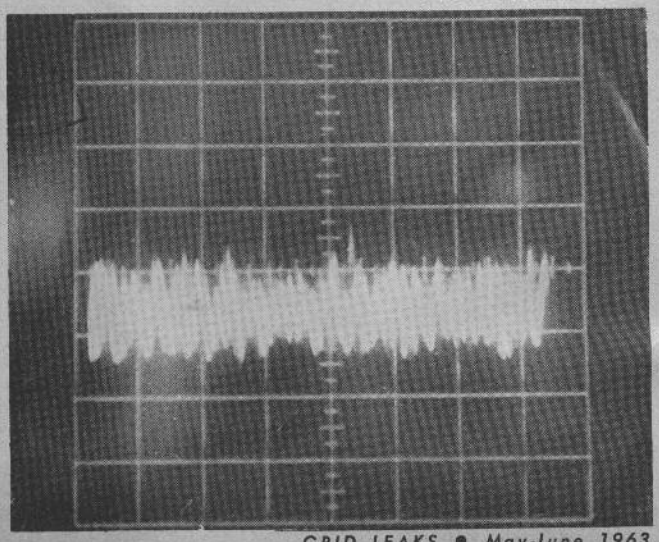


FIG. 2



tion is with no carrier tuned in. As the carrier is applied and tuned the ragged edge of this pattern will smooth out, and the pattern will diminish in amplitude very slightly. When tone is applied, the audio frequency will be seen definitely in form of a distorted square wave. (See Fig. 1.) The peaks and valleys will measure about .4 volts AC. Properly set for sensitivity, the valley of one-half of the wave should be almost deep enough to intersect the valley from the opposing half. If this is not evident then likely the 4.7k ohm resistor between the tank coil and T6058 transistor at holes #28-29 will need to be changed to 5.6k ohms. Normally this will increase the voltage amplitude at this test point.

TP-2—This test point is the collector of the first 2N229 transistor in the circuit. Just about all of the RF and quench frequencies are filtered out with the exception of hiss voltage. The waveform seen here with no carrier applied will be a ragged line and should show approximately 2 volts of amplitude. A VTVM will show voltage but the reading will appear to be unsteady. As carrier is applied this ragged line will die out and a clean straight pattern will result. The VTVM will drop to about zero volts. As tone is applied to the carrier the pattern will take on the shape of the edge of the pattern of TP-1, a slightly distorted square wave, but will be a clean line. The amplitude of the audio pattern thus seen will be 4 to 6 volts. It must be over 4 volts and about 5 volts seems to be ideal or average. (See Figs. 2 and 3.)

TP-3—This test point is the collector of the last 2N229 which is the driver stage for the output transistor. The proper waveshape will be found to appear as a straight line with spikes of voltage jutting downward in a random pattern. These spikes will measure between 2 and 3 volts in amplitude when no carrier is present. If the spikes have less voltage than 2 to 3 volts, likely low gain exists in one of the two 2N299 transistors. Simply changing transistors is the simplest cure. Usually which one is changed depends on the value found at TP-2, since if this is up to normal then the low gain unit is the transistor at TP-3, and if TP-2 is low then it is the one causing trouble. If, however, these spikes are not random but are many in number and have little spots or pips of light at the bottom, clipping is indicated which means overdriving and the circuit gain must be reduced. If a load device is attached when this clipping condition is present the device is apt to react sluggishly or hang up part of the time. Fig. 4 will show what may be seen when proper operation is obtained. As carrier is applied the spikes will disappear and a straight line will show. As tone is applied a good square wave of 2 volts amplitude will be present. This will be a nice clean waveshape not distorted at all. Excessively leaky 2N229 transistors in either stage will show up as a muddy pattern rather than nice clean figures.

At this time the load device is hooked up to the receiver and the whole unit operated. We use a standard Bonner escapement, and if a switcher is included in the job two Bonner units are used, or a magnetic pulse actuator such as Southwestern. If all of the mentioned test points have been properly adjusted, usually good operation is found immediately. If hanging-up, or sluggish operation, is noted then the 2N224 output transistor is checked to see if excessive leakage exists, and changed if required.

As stated originally, I cannot bring to you all of the service info and tricks used to eliminate various sorts of problems Many of these are coupled to operation of two stages and interact in such a way that when you correct a difficulty in one stage you must compensate by making a change in the preceding stage. Things like this cannot be put on paper; thus, only the correct patterns can be shown which, when obtained, will result in a good operating receiver.

Note that I have not said a word about a headset check of this unit which is perhaps the easiest way to find where signal is lost. This is because my findings differ with the instruction manual. If you will ground the one side of a headset to either battery lead plus-or-minus you will hear the following: (You can use either the test points shown in the manual or mine; it will make no difference.) At TP-1 a low hiss will be heard when no carrier is applied. Tone will be heard when the transmitter is modulated and tuned in. At TP-2 this hiss will be rather much louder in level. As tone is applied the tone will be louder and quite clear. At TP-3 the sound will be a ragged hiss and of much lower level than that heard at TP-2. As tone is applied this also will be heard but not quite as loud. At TP-4 of the manual this hiss and tone are almost nonexistent. You will note that this is contrary to the statement at the bottom of the step-by-step instruction page in the manual of the receiver.

Now for a couple of tips on building one of these receivers and its operation. First, of course, is the old hat tip to use good tools, and best grades of solder available. Second is to clean the board with fine sandpaper or steel-wool just prior to starting construction. Third is to scrape each component lead with a pocketknife **lightly** to both scour and clean it prior to installation of the component. Next is to tin each of the stranded wire leads after insulation is removed, which will insure good solder joints. A tip on installing the tank coil may be in order. If a pocketknife point is used to very slightly chamfer the hole on the top side of the board, one will find the coil assembly will be easier to force into this hole without crimping or damaging the coil, and it will fit much tighter because of this. Remember, you are not to enlarge the hole but only to very slightly chamfer it. Last is to remember not to bend the component leads over tight to the PC board but only to bend them a little bit, so that the part will hold in place while soldering. Next, unless you are an expert with a soldering iron, it is a wise thing to allow about ¼ inch of space between the transistors and the top of the board as this little bit of lead length will allow use of a heat sink to remove excessive soldering heat. I see too many poorly soldered jobs where the transistors are mounted close to the PC board and a cold iron has been used. The result is damaged transistors almost every time.

After built and ready to go, one should remember that these receivers will only operate as good as their power supply will allow. This means that the carbon-zinc type pencell is out. The manual states this case quite clearly but does not state why. The carbon-zinc batteries have a relatively high internal resistance which shows up as a large voltage drop in the cell when large loads are placed on it. This is not quite so true of Nicad and Alkaline type cells, which are much better for use with these receivers.

FIG. 3

TP-3

4-6 VOLTS

TONE APPLIED

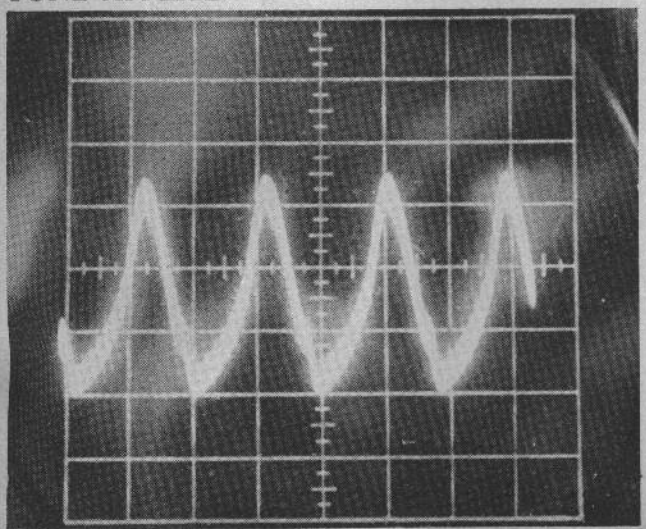
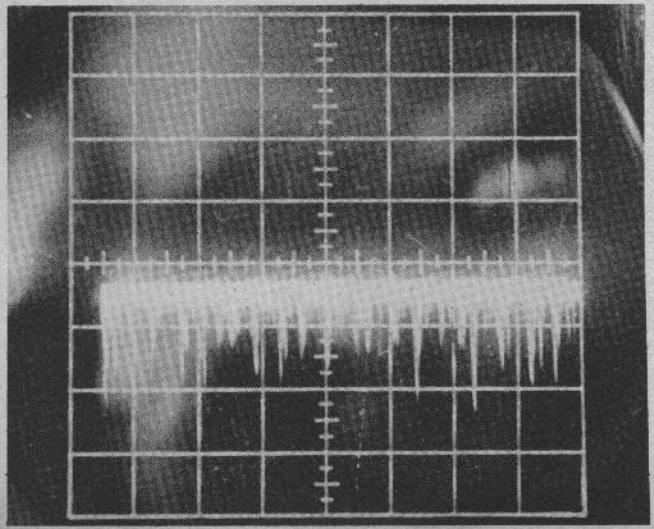


FIG. 4

TP-2

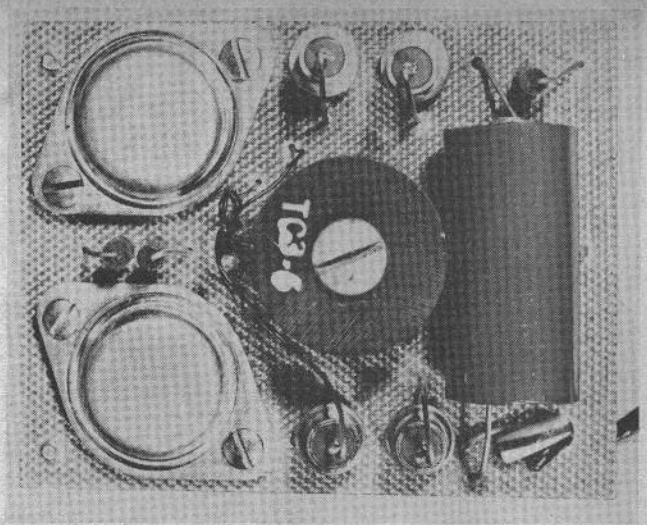
2-3 VOLTS

NO CARRIER

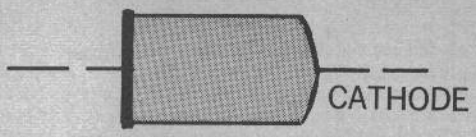


TRANSISTORIZED X-MITTERS REDUCE BATTERY COS

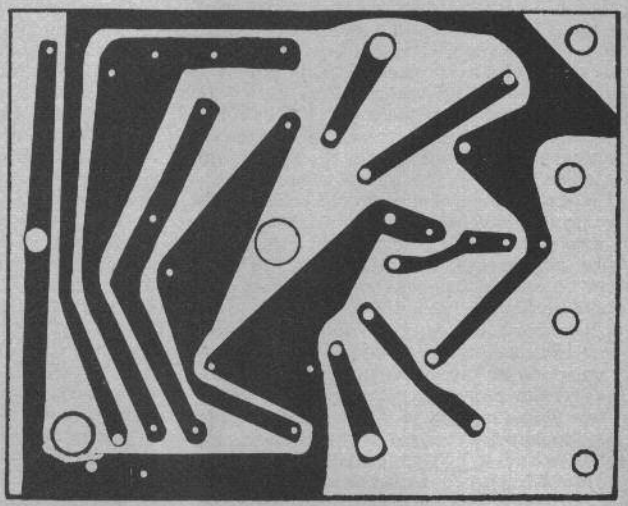
TRANSISTOR I

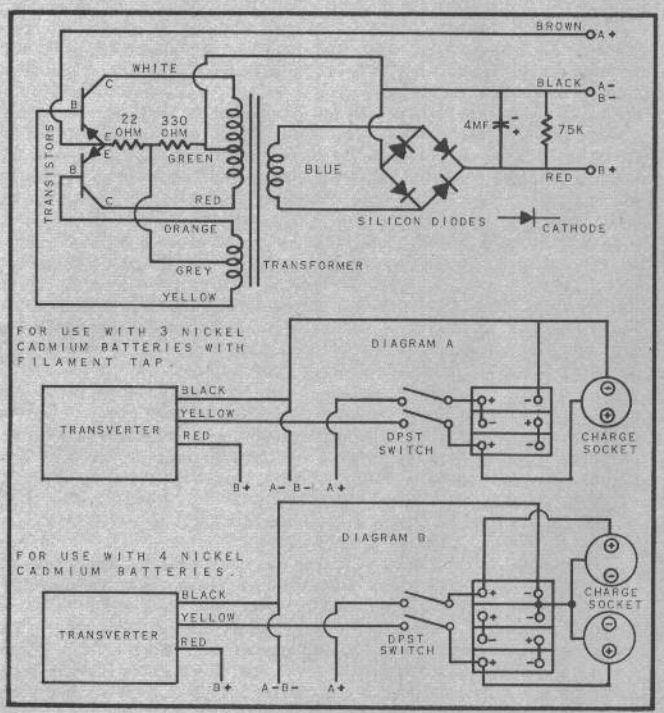


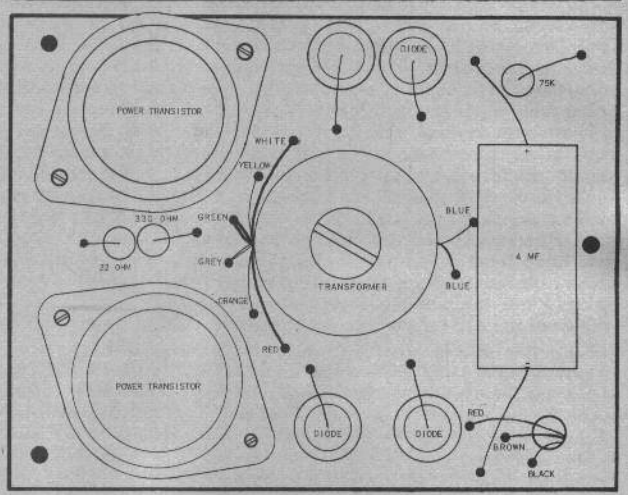
Simple to build. Drain 800 mils-1 amp on full load. Use 4 amp/hr bats.



EPOXY SILICON DIODE LEAD IDENTIFICATION



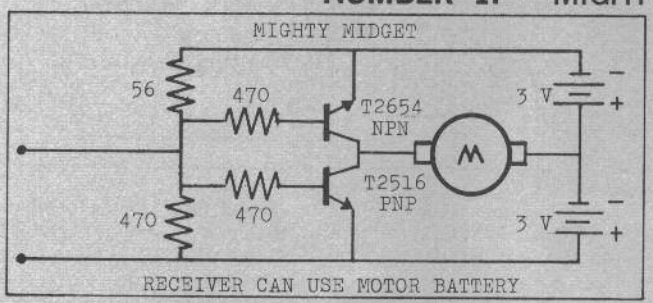


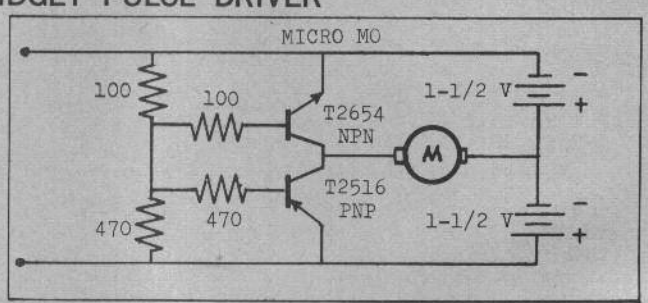


RELAYLESS CIRCUITS FOR PROPORTIONAL

Note: A NUMBER OF REQUESTS HAVE COME FROM READERS INDICATING THE FACT THAT THEY WOULD LIKE TO SEE CIRCUITS WHICH WOULD ALLOW THE USE OF RELAYLESS RECEIVERS WITH MIGHTY MIDGETS OR MOTORS OF OTHER TYPES, FOR PROPORTIONAL ACTION. HERE ARE THREE SUCH CIRCUITS WHICH CAME FROM GRID LEAKS READERS. WE'D APPRECIATE BEING ADVISED HOW YOU FIND THEM.

NUMBER 1. • MIGHTY MIDGET PULSE DRIVER





● **THESE ARE THE SCHEMATICS** for the relayless Mighty Midget pulse driver. Both models have been test-flown with several different pulsers. They seem to follow well and don't seem critical.

I checked with Philco's transistor manufacturing plant regarding transistors. The engineer I spoke with on the telephone advised that the 2N224 type was being discontinued and would be superceded by new type T2516. Philco also suggests their T2545 as a replacement for the 2N224. The nearest NPN type for a symmetry circuit he suggested was T2654. These are new low cost types

As the schematics indicate, the system has been tried with a Mighty Midget and a Micro-Mo motor.—Bob Simpson, Robert N. Simpson Co., Wilmington 3, Del.

TERY

R

COST. BUT IF YOU ARE ONE OF THOUSANDS WITH VACUUM TUBES HERE'S A MONEY-SAVER!

IZED POWER CONVERTER

THE DEEPER THE BEGINNER gets into radio control, the more he uses his transmitting and receiving equipment, and the more the cost of batteries become an increasing factor. The first cost of R/C gear is an important factor, but the upkeep looms large as well.

And, while many of the newer transmitters are of the all-transistorizd versions, which require relatively inexpensive batteries and therefore do not present a large upkeep cost factor, there are thousands of transmitters in the hands of oldtimers and beginners alike, of the vacuum tube variety that do require two 67½-volt B batteries—which sock the old budget at roughly two-and-a-half per each, or more.

It is also quite likely that the vacuum tube transmitter will be with us for some time to come, since for the home builder the vacuum tube still represents the transmitter kit which can be bought with the lowest initial investment and built most easily.

It is good, therefore, to be able to report that for these many users of B batteries, certain costs in the electronic industry really have been plummeting downward, and that these downward trends now make possible the construction of transverter power supplies which will forever eliminate the high cost of B-battery replacements.

The transverter power supplies take their name from the fact that they use transistors, and they convert low voltage on the order of 2.4 or 3.6 or 4.8 volts to the required 135 volts that the B supply portion of the transmitter needs.

There was a time, and this not too long ago, when the power transistors and the silicon diodes used in transverters, represented a pretty fair portion of the cost of one of these units, made the cost of them rather high. However, costs on semi-conductor products have been dropping sharply lately and some of those that have been dropping most sharply are the power transistor types and diodes of the silicon type.

With this thought in mind, this article is presented to enable the home builder to construct for himself a power converter using easy to get components, available from a number of sources at relatively low cost. By using a Ferroxcube cup core and bobbin which the home builder again may find very easily himself with only the simplest tools, the cost can be cut still more. And the need of ever buying transmitter B batteries again can be eliminated.

The transverter as presented here uses 3.6 volts input with 135 volts out. As designed, it will present this 135 volts at approximately 20-25 MA under load. This will power most of the single-tone transmitters that are on the market today which require 135 volts of B.

For transmitters of the high-low type, such as the Ace Kraft kits, which utilize either one B battery or two B batteries for the high-low feature, this same high-low feature may still be incorporated. The switching is done however between the batteries in the primary, and the high-low feature is retained by switching between 3.6 volts input, and 2.4 volts input. With 2.4 volts input the power converter will have approximately 90 volts output. Actually the transverter as shown will start very easily on 1.2 volts input, but the voltage out as well as the milliamps out —therefore efficiency—are considerably less than reasonably useable in R/C transmitters.

No special construction techniques are needed to duplicate this transverter, and the only parts that will have to be fabricated at home are the printed circuit board, and for this a full size PC base is given.

Winding of the Ferroxcube cup core presents no big problem and may quite easily be done by hand. Three different sizes of enamel magnet wire are required. Simply follow the winding sequence given and make the first winding nearest the inside diameter, with the second winding immediately on top of it, and with the third winding on top of the second. Neatness in winding is important, and every attempt should be made to make the winds in layers as neatly as possible. If winding is done carelessly, all of the windings may not be contained on the core so that it fits easily into the cups of Ferroxcube.

The only tedious winding is the secondary, and this involves only 750 turns. To facilitate this winding, a sheet of paper with check marks for every 10 or 25 turns being made will prove to be of help. This will prevent you losing count, should an unexpected interruption delay the finishing of the winding.

The transformer for the converter is wound on a Ferroxcube cup core bobbin for the 56-580-40/3B2 cup core. These cores are one inch in diameter and when two are stacked together they measure ⅝ inch thick.

The bobbin is of nylon and may be hand wound or can be chucked if a device is made for a hand drill to hold it, so that winding can be done as follows.

Enamel magnet wire of #24, #28, and #38 is required.

The first winding is the primary and this consists of 38 turns of #24 wire which is center tapped. In other words, turn on 19 turns, tap it, and continue turning for 19 more. The start of this coil is shown as the white connection on the schematic, with green being the center tap, and with red being the outside winding.

Continue winding the transformer by winding on the second winding, which is the secondary. This is 750 turns of #38. These are identified as the blue leads on the pictorial.

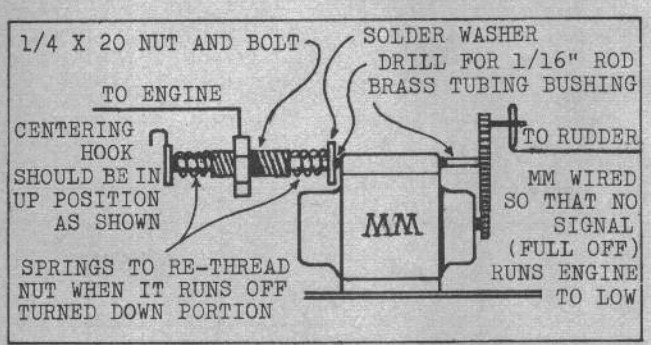
Complete winding by winding the feedback coil last. This consists of 30 to 34 turns of #28 magnet wire, which is also center tapped. The beginning winding of this is shown on the schematic as the orange wire, the center tap is shown as gray, and the outside or last turn is shown as yellow. All windings should be snug and when so wound the bobbins should fit in the two pieces of the cores. The cores may now be bolted together and mounted on the printed circuit board using a 6/32 or 8/32 iron or steel bolt and nut. Do not use brass.

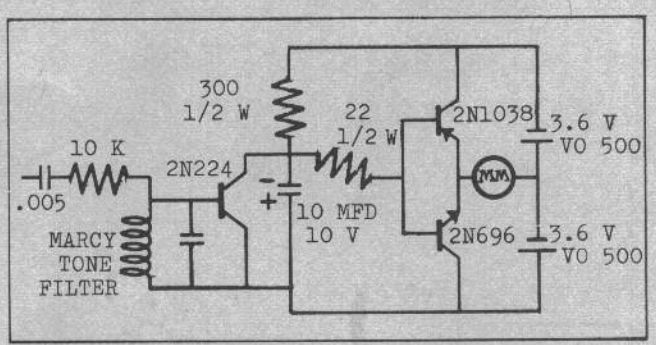
Two alternate hookups are shown for a tapped filament supply, and one showing an extra 1.2 volt nickel cadium battery for a separate filament supply.

The transverter as shown has a drain of approximately 800 MA to 1 amp under full load, and therefore should be used with batteries of 4 ampere-hour capacity. With a 4 ampere-hour capacity, this will mean almost four hours of continuous transmitting before a recharge should be necessary.

Study the drawings carefully as well as the schematics, and you should encounter little or no difficulty in duplicating this transverter which will forever eliminate the high cost of replacing B batteries for your transmitting equipment. The cost of the components required for this transverter can easily be replaced in one season of active flying.

NUMBER 2. • INCLUDES PROPORTIONAL ENGINE CONTROL





I HAVE BEEN USING this circuit for the pulse fan and find it very satisfactory. I am using it with the Marcy single-channel but it is suitable for use with any receiver which will take a 2N224 in the output stage. I have tried several combinations of switcher transistors and output transistors and the combination shown here was the best I have found. I make no claim to originality since I believe the Madison, Wisc. club has several fellows using this circuit with the Micro-mo motor and 1.2 volts per side; 3.6 volts per side drives the Mighty Midget satisfactorily and I prefer using it to the more expensive Micro-mo.

My proportional engine control also is shown. It has been flown for a year-and-a-half by myself and three others for about three years. Nothing new here either but is one way of getting proportional motor and fail-safe at the same time.

As you can see this is a go-around system which surrenders rudder while the engine is being advanced or retarded. I adjust mine so that one minute at full idle kills the engine. That way, if I have trouble and a full tank, I don't have to chase the ship as far! This system has been flown in a White Cloud, an Esquire, and a T-1000.—Donald C. Fisher, Whitewater, Wisc.

Continued on Next Page

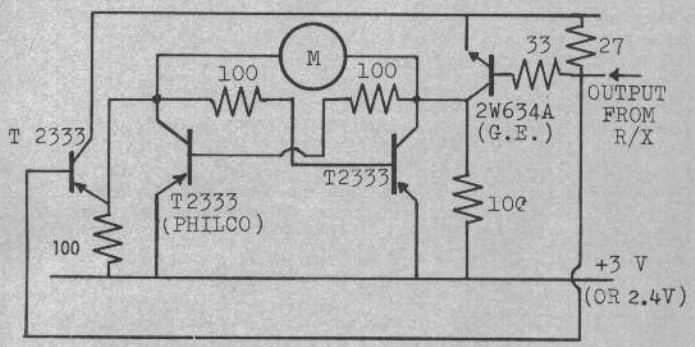
RELAYLESS CIRCUITS FOR PROPORTIONAL continued

NUMBER 3. • PC BOARD FOR ELECTRONIC SWITCH

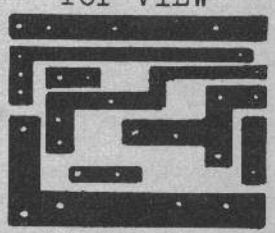
● HERE IS A COPY OF THE printed circuit board for the electronic switch. This circuit seems to work extremely well with the Mighty Midget motor. Most likely it will work with most of the proportional actuators on the market. However, I have used it with the Bonner motor and have found an intermittent oscillation problem.

Have not tracked down the source of this difficulty yet and for this reason I would initially recommend it for use with Mighty Midget actuators. (It should also work equally well with actuators such as the Propomatic etc., but I have not tried this yet.)

Also, I have an all-transistorized transmitter and pulser that I have been using (single channel) which might be of interest. The pulser is similar to John Phelps' Unijunction Pulser and drives a tone generator directly (no relays). The modulation is an excellent sine wave (100%) and the pulser characteristics are extremely good. The entire unit fits in a case 7 x 5 x 3½ and uses a single 9V battery. I will probably send this circuit in a little later as I think your readers will be interested in a good transmitter which is small and yet has proportional capability built right in. —Leonard Klebanoff, Willowdale, Ontario, Canada

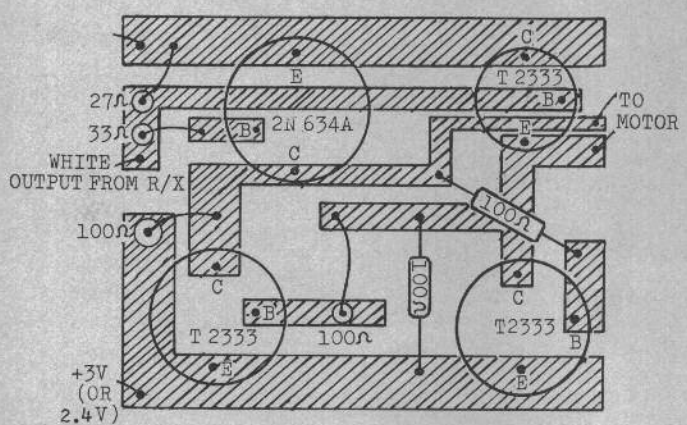


TOP VIEW



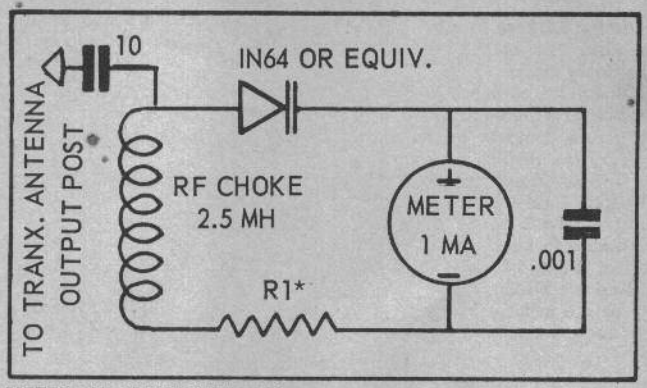
ACTUAL SIZE

PARTS PLACEMENT



KLEBANOFF

BITS AND



METER IN ORBIT X-MITTER

by Tim Brooks, Warrensburg, Mo.

■ Here is a circuit I have mounted in my Orbit transmitter and it sure works fine, not only as an indicator of transmitter condition, but an easy way to tune up. After it's hooked up, the operator will always know at a glance the condition of his transmitter; also if the tone s are working: one tone, dip-in meter, second tone another dip, no tone, normal reading. R1 in this circuit should be put in first as as 10K-ohm control, then adjusted so the meter gives the desired reading. It then should be removed and the resistance measured, and a fixed resistor installed in its place. Substitution of resistors would work all right, although it would be a little harder to do. I found a 5.6K-ohm worked best in mine, for I wanted my meter to read .18ma when OK.

WATCH THESE BATTERIES

by H. G. Oliver, El Paso, Tex.

■ It might be of interest to know of the potential risk involved in using the new type 1½ volt filament batteries in transmitters. This is the battery being marketed by Eveready as Number 742, also

NEW R/C RULES — EFFECTIVE JUNE 1, 1963

Continued From Page 2

3. **Class III**—Planes controlled about the Yaw, Pitch and Roll axes; by Rudder, Elevator and Aileron controls, with no limitations or restrictions on primary aerodynamic controls, auxiliary aerodynamic controls or auxiliary non-flight controls.

SECTION 22.8:

Add this additional sentence: "No engine restarts are permitted after the first maneuver—engine restarting is permitted only within the first three minutes of alloted time and only prior to scoring of the second maneuver."

SECTION 22.9:

Revise first sentence to read, "The highest score for the total of two best flights shall be the winner." Also, revise the fourth sentence to read, "In case of ties, the third best flight scores of the contestants concerned shall be used to determine the winner (if only two flights have been scored during the normal contest time, the highest single flight score of the contestants concerned shall determine the winner)."

SECTION 23.5:

Substitute the following in place of a., b., c.—

"Maximum engine displacement of .20 cubic inches, with a minimum wing area of 38 square inches for each .01 cubic inches of engine displacement. Examples: .049-186 sq. in., .09-342 sq. in., 15-570 sq. in., 19-722 sq. in."

SECTION 24.4:

Add the following—

"tion 24.11. At contestant's option, the Flight Plan (24.9) may be flown as the Qualification Flight at the same time. In fact, it is recommended as a time saving procedure."

SECTION 24.13:

Delete the words, "and Multi-Motors."

3V

PIECES

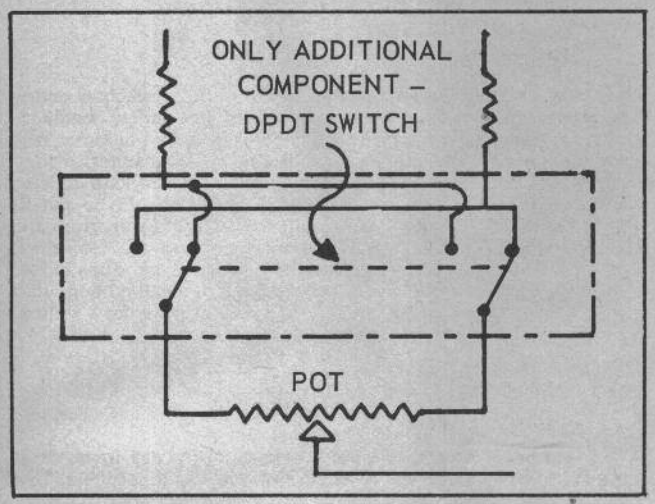
ATTENTION CONTRIBUTORS TO BITS AND PIECES: For any item used in this department, GRID LEAKS will award a one-year subscription. If you already have a subscription, it will be extended at its termination for one more year. Subscriptions also will be given for photos or drawings used in the Readers Write Department.

sold by RCA as Number VS004. The battery is in a metal can with a fiber top and bottom rather than the paperboard container formerly used.

A failure of a battery of this type led to an internal inspection which revealed that, in this type, the four individual cells rely on pressure contacts at the ends and have no soldered connections as did the earlier paper-covered types.

The metal can is crimped at the ends to retain the fiber top and bottom. The negative contact engages the zinc cases at the top edges. If too much pressure is applied inserting the plug, it is possible to bend the zinc case enough to cause a loss of contact. Also, rough handling, before or after purchase, could result in the same condition.

Before using a battery of this construction, it would be advisable to open the can and solder the cells together at top and bottom.



TIP ON PULSE LINKAGE

by John Crossan, Vienna, Va.

■ The simple circuit below eliminates the need to build pulse rudder control linkages identically in different planes. Most pulsers have 2 equal value resistors in series with the rudder pot. By switching the leads of these resistors from one end of the pot to the other, the pulse symmetry is reversed. The addition of a DPDT switch enables one to quickly and easily switch the tone pulse, for example, from right to left.

RO PULSE PROPORTIONAL USING MAGNETIC ACTUATORS

by R. J. Lind

■ Without detracting from the performance obtained using the dual-output or auxiliary-switched single output receivers, it is possible to do the same job much more simply. Several of these set-ups have appeared here, ranging from a more than five-year old, 216 sq. in. "home grown" powered by an old Thermal Hopper to a 120 sq. in., Pee Wee .020-powered ship. All have proved to be reliable and positive in action, something that can't be said for all of the dual-output set-ups we've seen.

The set-up is simple. In order to achieve a very low current drain, the coils of a Southwestern actuator were wired in series. This gave a drain on 3.6 volts of 50 to 70 ma, with the unexpected dividend that the same driving power is realized from this set-up as is achieved by the higher drain, single-coil system when a switcher is used. Of course, the only current drawn during the signal-off phase is merely the idling current of the receiver, which only runs to less than 10 ma. The Southwestern actuator has built-in stops, so the rudder is hooked up with a piece of Dacron Half-A control line for a pull cable. Mono-filament fishing line has been used, but is plagued by stretch and temperature sensitivity problems. This pulls the rudder to one side during the signal-on phase. A light spring returns the rudder to the other side during the signal-off cycle. A simple pulser then can give truly proportional flight results, with all that proportional control can mean.

Among the immediately apparent advantages are; simplest, lightest receiver (such as the K3VK) and lowest possible battery drain (series coil hook-up, with almost no drain in the "off" position).

As with any system offering more for less, certain precautions must be taken. It is a must that the rudder hinges be the "softest" possible, and aerodynamic counterbalancing is strongly recommended. Also, the power of the spring must be matched to the requirements of the actuator, but these are not beyond the abilities of the average R/C modeler. I set the pulser rate at a value that allows the actuator to hits its internal stops (about 8 to 10 pps) and I use the sound of the stops to help me set the pulser symmetrical with the plane. Some people may want to use higher or lower pulse rates; these different planes have been successfully flown on rates varying from 2 pps to 30 pps. At rates somewhere around 20 pps and up, the rudder stops flapping through its whole deflection range, but we have noticed reduced power available at these high rates. The plane, surprisingly, did not "track" the very low pulse rate, but was instantly sensitive to any pulse variation.

One problem, out of range, is easily spotted; the turn toward the signal-on side becomes "soft," warning that the extremes of range are about reached. A flip to high power, and "home to Papa." Other receivers and other actuators are usable, of course; but my system has three 225 ma. ni-cads, one spst switch, one K3VK receiver, and one Southwestern actuator. That's all the radio gear there is to it! Two planes of mine have used 2.4V, but the coils had to be wired in parallel, which gave a battery drain of 220 ma. Even at this rate, the small ni-cads are good for about 1½ hours air time, enough for two or three flying sessions.

HEART OF AMERICA R/C CONTEST—JUNE 22-23

Announcement was made of the first Heart of America R/C Contest to be held near Kansas City, Mo., on Saturday and Sunday, June 22 and 23, 1963. Carl E. Lindsey of Blue Springs, Mo., contest director, stated that the Lake Jacomo flying area, used by the KC/RC Club, had been made available by the authorities of the Jackson County Parks' System for this event. Lake Jacomo is located less than 10 miles from the heart of downtown Kansas City, Mo., and with a freeway access is only a few minutes away from excellent motel and restaurant accommodations within a 10-20-mile radius.

Contestants from all over the nation, as well as the middlewest, are expected to this event, which is being sponsored jointly by GRID LEAKS and Ace R/C, Inc. It will be a AA AMA sanctioned contest.

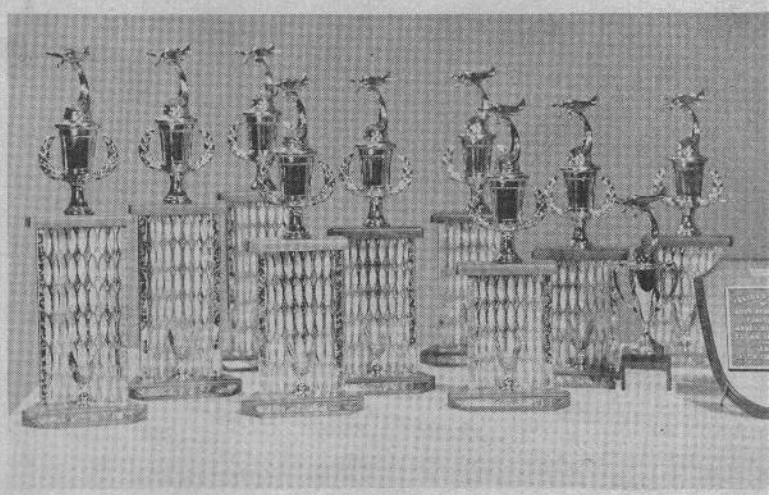
Events cover Classes I, II, and III. There would be only one classification for each of the events, and no age limits or restrictions. Trophies for the first three places in each of the three contest categories will be awarded, and the prize list will include merchandise of some of the top notch material available on the R/C market today. From present indications, every contestant will receive a merchandise prize (only one official flight will need to be made).

In order to facilitate the handling of the large number of contestants it will be required that all entries must be made by June 15, so that contest officials may have the flight line roster completely preplanned and simultaneous flights can be held.

Each contestant will have two official flights only. It is presently planned to have five judges per flight line, with the International Point System being used for scoring.

R/C Clubs in the area will assist in putting on the events, but it was pointed out that all judges will be noncompeting.

This event, in the Heart of America, does not replace any other club contest, and instead offers a real opportunity for all contestants to have a pre-Nationals shake down.



EDITOR'S NOTE—Many readers have indicated that this feature has a practical usefullness that transcends the casual interest value. Do you have a tip that might help your fellow R/Cer? Sketches or drawings should be drawn as completely and neatly as possible. The "cleaner" and more detailed your "copy" is, the better the job GL can do in putting across your idea. Material should be sent direct to Grid Leaks (Bits and Pieces Dept.), Box 301, Higginsville, Mo.

SUPERHET RECEIVERS AND CONTROL SYSTEMS

Continued From Page 6

9. Install the glass 1N34 diode over hole 29 with the lead next to the black band doubled over and soldered to hole 28.

10. Install remainder of capacitors and resistors taking care as to polarities, and location.

11. Install color coded wires in holes indicated.

12. If a Space Control servo is not to be used, then the orange rudder servo lead should be connected to hole 49 instead of hole 57.

Before connecting the servo, receiver, and battery leads, a careful inspection of this unit should be made. The inspection is more thorough if another modeler can check your work for solder joints (no shorts) and component placement.

Provided that a radio signal of the proper frequency (matching the receiver) and a properly tuned receiver are used, then successful operation is obtained with a 3800 cps tone, that is pulsed between 15 to 20 p p s. Solid tone will give a full speed engine control; no tone will give an idle speed engine control. The acid test of this design is to have a full-speed engine servo position and then to turn off the transmitter, obtaining an instantaneous response moving the servo to idle position. For each engine command the rudder servo will quickly neutralize.

Turning of the transmitter tone frequency to the filter will be covered with the transmitter article.

While this unit can be checked-out without test instruments, those modelers that can get to an oscilloscope may be interested in the waveforms that exist as noted below:

1. At the green lead input the tone bursts from the receiver approximately 4-volt peak-to-peak.

2. Collector of T-9 shows the pulse square wave with approximately 1.0- to 1.5-volt p-p tone during transistor conduction.

3. Collector of T-10 will show the fully reconstructed pulse waveform, with a little rounding of the corners, but no tone waveforms.

4. Junction between T-12 collector and T-13 emitter will have a sharp cornered pulse waveform.

5. Collector of either T-15 or T-16 will show a sharp step transistion from on to off at the time of engine command.

The two P.C. boards described can be packaged in a number of fashions: individual aluminum cases, or stacked with the receiver over the control unit in a single case. It is recommended that the following dimensions be used for the respective envelopes: (i.e. case internal volume):

Receiver:	2-19/32 in.	x	1-25/32 in.	x	1 in.
Control unit:	2-19/32 in.	x	1-25/32 in.	x	1-3/32 in.

In any event the receiver must be in a case as this is required for shielding.

Figure 10 shows the servos used for this development. They are representative of the best available for their respective applications. One of the significant features of flying a contest Class I aircraft with the feedback servo is the tight positionable control obtained. With this characteristic the model may be flown with large rudder surface area that can be operated through large deflections needed for the violent stunt maneuvers and yet retain the docile control needed for the straight flight maneuvers. One caution should be noted for this type of operation: the linkages between servo and rudder must move freely but not have any backlash or play. One help in connecting the Space Control servo to a pushrod to obtain more linear pushrod motion for the plus-or-minus 90-degree servo shaft rotation is a pin-yoke bellcrank mechanism as shown in Figure 10.

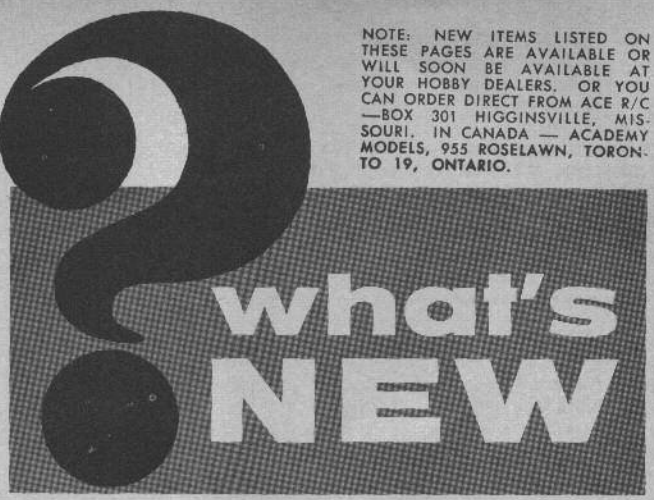
Also shown is the four-pole slide switch needed for the power supplies needed for this control system.

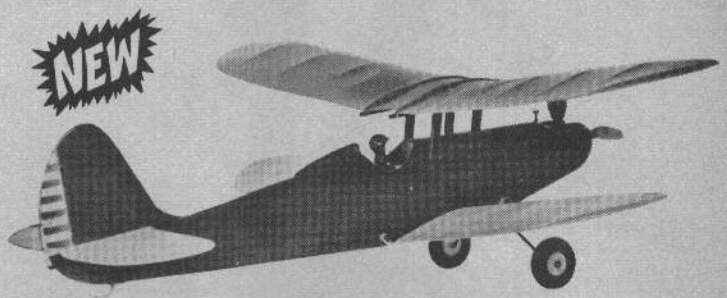
Not shown with this equipment are the necessary connectors. If any were to be specified, nine out of ten modelers would have other ideas about their arrangement. If any connectors are used (some modelers prefer to solder all inter-connecting leads) be sure they are reliable and your connections are sound with no wire strains on the solder joints. Ace R/C has a varied selection of connectors suitable for this system.

Battery power supply requirements will vary according to the rudder servo selection, shown in Figure 11. Pulsing servo motor requires a larger ampere-hour capacity supply for reliable operation than does a feed-back servo. A good general rule is to have at least a two-hour operating capability on board the model. The battery arrangements noted have this capacity.

(To be continued)

NOTE: NEW ITEMS LISTED ON THESE PAGES ARE AVAILABLE OR WILL SOON BE AVAILABLE AT YOUR HOBBY DEALERS. OR YOU CAN ORDER DIRECT FROM ACE R/C —BOX 301 HIGGINSVILLE, MISSOURI. IN CANADA — ACADEMY MODELS, 955 ROSELAWN, TORONTO 19, ONTARIO.





ECKTRONICS BI-HAWK BIPE KIT

From Ecktronics comes word of a cute ½A biplane for R/C. Designed for rudder only operation, and for use with the relayless or small Ecktronics Relayer receiver, this semi-scale job is sure to be a crowd pleaser from an appearance standpoint, and win many flying friends with its flight characteristics.

Kit features the same high quality balsa wood and die cutting as found in the other Ecktronics airplane kits, and in spite of its two wings, is a cinch to build.

The Bi-Hawk has a 30 inch top wing span and a 20 inch lower wing, designed for .049 engine. Kit includes all hardware including wheels, less pilot and liquids.

For sport and fun flying the Bi-Hawk is an easy assembly job that will provide maximum hours of enjoyment.

No. 13A22—Ecktronics Bi-Hawk $6.95

OMEGA MAGNETIC REED RELAY SWITCH

A reliable reed type magnetic switch designed for the R/C fan at a reasonable price! Made by Omega of Racine, Wisconsin, these devices are seeing increasing use in R/C where a resistive type of switching action is required. May be used in circuits where Hamlin or other items of this nature are specified.

Omega's AR500 is completely assembled, comes with coil resistance of 500 ohms, designed for a pull in of 2.5 to 4.5 volts, and a 10 mil max pull in. Vibration can be withstood in excess of 35Gs. SPST X action.

Unit is small size and weight is 4.5 grams. May be mounted vertically on PC board, also may be mounted horizontally but one lead will need extension. Contacts are rated for 2,500,000 switchings at ½ ampere resistive load.

No. 30A14—Omega Reed Relay Switch AR 500 $3.75

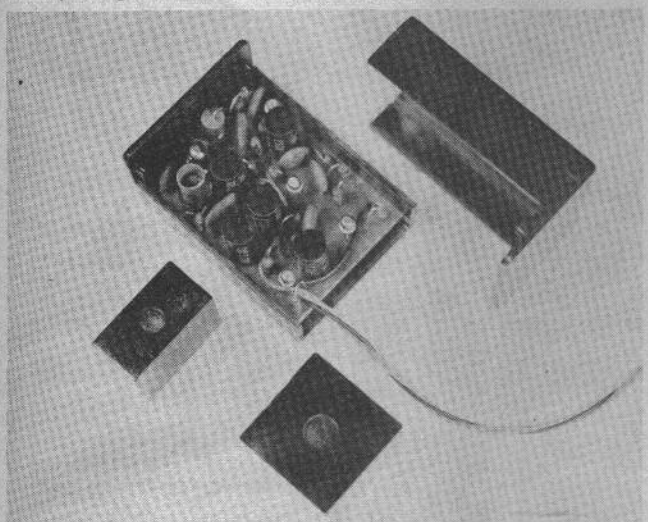
MARCY RELAY FEEDBACK CONVERSION KIT

For relay proportional users, Ace R/C now announces that the conversion kit to allow any relay type of receiver to be used with the Marcy Feedback servo, is now ready. This kit provides all the reliability of feedback systems, with considerable additional torque; drain only when surfaces are being moved; no flopping; and will work with almost any relay type of pulsed receiver proportional system.

Complete with silicon diodes, three electrolytic P. I. caps, resistors and PC board. Complete unit measures 1 x 1 x ⅝ inches, and may be housed in small plastic box furnished. With instructions.

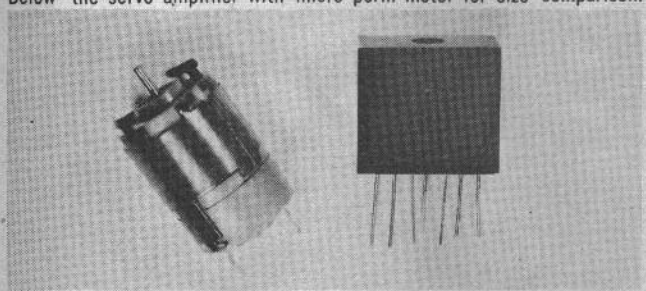
No. 14A59—Conversion Kit for Marcy FB servo for relay use $4.95

FROM RAMECO PRODUCTS of Huntington Station, New York, comes word of several new items to be added to their line. Manufacturers of the Rameco Audio Filters which have been finding an increasing use, are expanding their line and jobbing more of it through jobbers.



This photograph shows the new Rameco Receiver and two dummy module cases. Large case holds 4 Rameco filters, same case also is used for the two channel filter/switching circuit. Small case is used for two channel filter or single channel filter/switching circuit.

Below the servo amplifier with micro perm motor for size comparison.



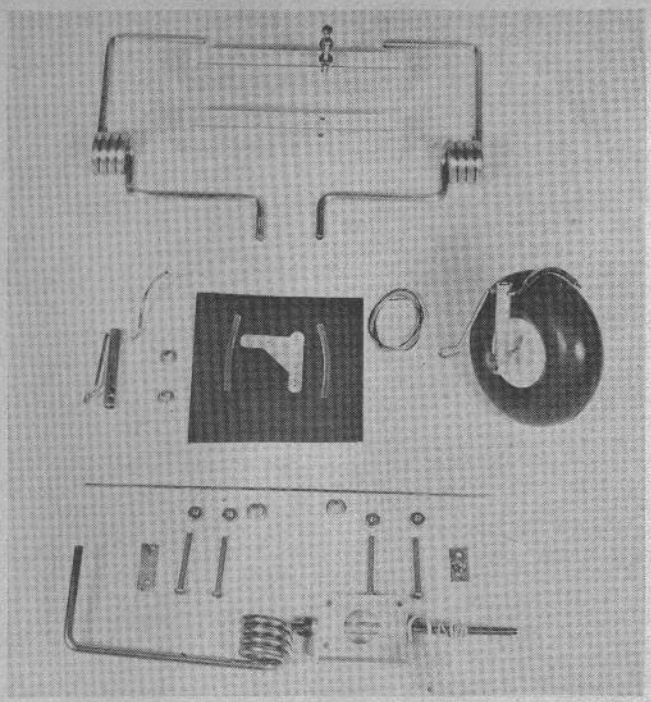
SERVO AMPLIFIER IN MODULE FORM. Case size is .840 X .440 .750 high. (inches). Will drive Mighty Midget, Bonner, Microperm 2000. ect. Max current 300 MA. Requires simple 6V source (no taps). May be driven by filters or reeds. No current flows when both inputs are accidentally turned on. SN is provided but can also be used for trim only. 10 leads protude on .1 grid spacing. Price **$10.95.**

SWITCHING STAGE W/FILTER. Module same size as above. Comes in 3 types. One provides negative output for use with above amplifier or with any servo amplifier requiring neg. signal. One with positive output for amplifiers requiring pos. signal and one for driving a relay (external). Filter is built-in. Two of these are normally required for use with an amplifier. **$5.95.**

SAME AS FOREGOING but contains 2 filters and switches. Case is same height but twice area (.840 X .840 X 750). **$10.50.**

FRONT END (RECEIVER). This has been improved over our old one. A limiter has been added before the emitter-follower output stage to provide constant audio level to filters. Will be housed in plastic box used by RCS of England, 1-13/16 X 1-5/16 X 1. Requires 6V. Note that all items run off 6V source and entire system is designed to use one source. Nicads would allow receivers, amplifiers and motors to all run from one supply. No taps or separate bias needed. **$24.95.**

FILTERS—SMTF AND SMTF-T are retained and are now available in all 10 channels. All others have been dropped and 2 new versions of the potted type are being introduced. One will be a 2-channel in the smaller module case, .840 X .440 X .750 inches. The other a 4-channel in the larger case. **$5.50 and $9.80 respectively.**



BLACKWELL ACCESSORY PRICE REDUCTIONS

Blackwell Coil Landing Gear Kit. This contains all of the parts shown in the top part of the photo—steel mounting plate, mahogany mount blocks and wheel eyelets and nuts and bolts, as well as two coil gears. Wheel not included.

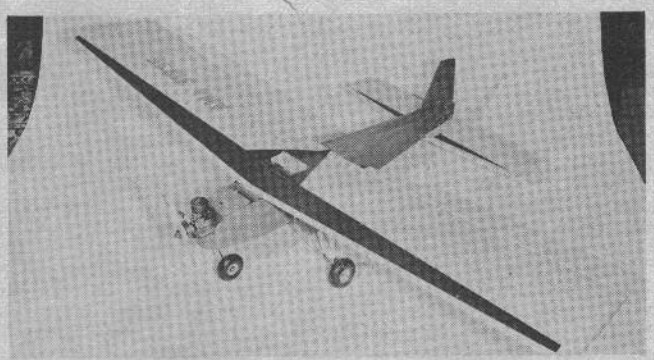
No. 25A13—BLG No. 1, Now reduced to $2.19

Blackwell brake is drag type external brake. Center photo shows simplicity of the unit. Very dependable and easily worked.

No. 25A15—BB #1, now reduced to $2.39

Blackwell nose gear is a really tough steerable job. Adjustable as to length. Features machined aluminum casting mount. Shown in bottom of photo. Highly prefabbed, less wheel.

No. 25A14—RCNB1, New price $3.49



BLACKWELL RANGER PLANE

Good news! Blackwell Manufacturing has announced that the **RANGER S1 OW** is again in production and will be available to the modelling public.

The S1OW was quite a popular favorite of a few years ago, but had to be temporarily withdrawn. It is a shoulder wing job with 600 square inches of area. Features 63 inch span, and is ideal for 4, 6, or 8 channel multi jobs. Has been a consistent contest performer.

The new Ranger features completely die cut balsa wood which is separated and lends itself to quick assembly. Clean lines with a reduced frontal area.

A beefed up ship, it is designed for violent maneuvering if desired.

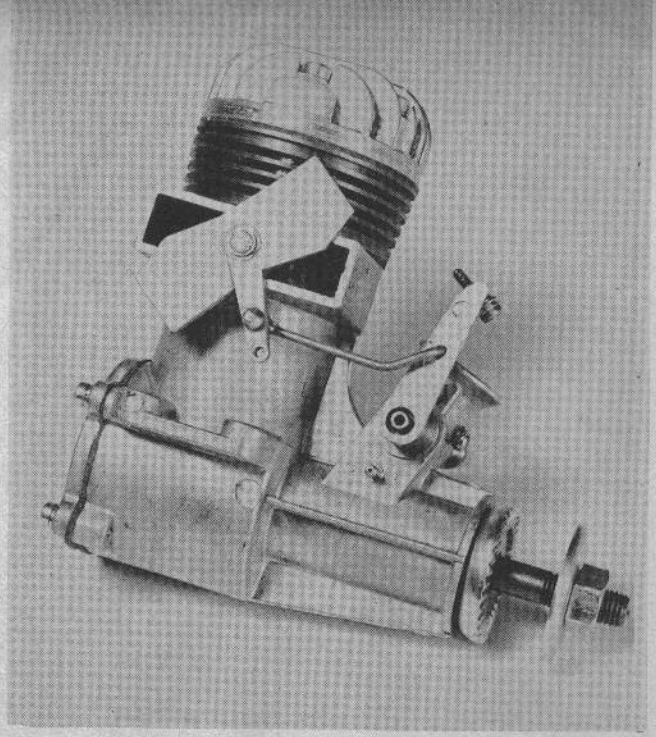
Full size plans, include installation hints for cascaded escapements and servos for multi. Kit includes steerable nosewheel by Blackwell, and the plans show how to modify the trailing edge for full span ailerons. No liquids or covering included.

No. 13A21—Blackwell Ranger $15.95

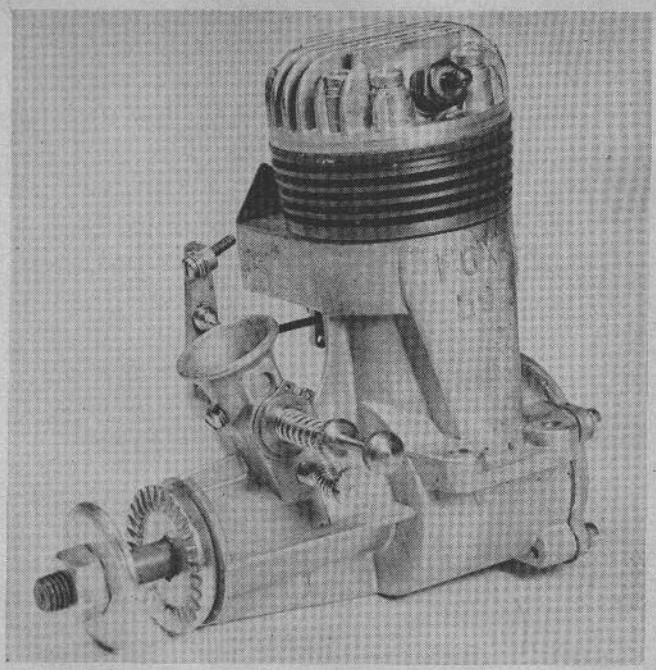
FLIGHT LINE VARI-CLAMP

An indispensable building tool for all modellers. Spring is of the finest spring steel available, heat treated after forming. Adjustable tension. Adjustable closing. Reverse and or turn wood jaws to assure parallel closing on parts being held. Wood jaws slide easily to any desired position and stay in place. Variation of pressure and angle unlimited.

No. 36A90—Vari-Clamp. Packaged 3 for $1.00



New carburetion design affords steady running without leaning out, plus diving ability, throttle closed, no/flooding. (11-12T rpm, 12-6.)



Offset plug design shields plug element from the by-pass gasses, enables engine to accept hot-fuel mixes without cooling off at lower speeds.

THE FOX .59

By DUKE FOX . . . Since 1947 a steadfast clan of big engine lovers have stuck to the 59, a powerplant with a special individuality. Now there's a new one.

THE FOX 59 IS THE LARGEST R/C motor currently available for multi-ships. At 11½ ounces, it weighs slightly less than the Veco 45, slightly more than the OS 49, and can be readily installed in models which have been powered by other motors. About the biggest problem is in adapting the throttle-control arm to the righthand side.

The first observation in flying the motor is how quickly the plane comes off. The airplane does not seem to travel much faster in a straight-away or dive, but when you pull it up in a vertical climb or vertical maneuver, the motor does not bog down, but continues to run at almost maximum speed and thus pulls the plane through. The reason, of course, is that the motor does have more displacement and more power, yet the carburetion and design is such that the motor does not readily pick up a great amount of revs. This is a definite asset for those who like to perform a deliberate, precise maneuver, but may not be so desirable for those who like the long, shallow dives with spectacular pullouts.

The second thing you will notice is that the motor runs steadily from the beginning to the end of the flight without any leaning out tendencies toward the end of the flight, or changing speed during maneuvers. The reason for this is a completely redesigned carburetor system which changes from the venturi control flow of the earlier series to a design where the full suction of the crankcase draws the fuel, and the fuel is metered under this full suction. In order to accomplish a smooth transition, adjustable high speed and low speed jets are provided with a fixed intermediate jet. As the throttle is closed, the high-speed jet is actually closed for the first 25% of the throttle travel, and the intermediate and low-speed feed through the second 50%, and the final 25% is fed only by the low-speed jet. The advantage of this is that the model can be dived straight down with the throttle closed and there is no loading up or flooding out.

Construction of the motor: Crankcase is a one-piece die-casting incorporating a half-cylinder; i.e., up to and including the exhaust stack in the manner of the K&B. The case has a cast-in main bearing. 9/16" diameter x 1⅝" long, provided with an oil groove. The bearing material is bearing bronze. One interesting feature is that the mounting lugs are not on the centerline of the thrust, but are 3/16 of an inch above it. This requires a shim when the motor is installed in a model not designed for it. The theory in back of the high lugs is that the motor is mounted closer to its center of gravity and transmits less torsional vibration into the airplane.

The cylinder head is 1⅝ inch diameter and unique in that it has very deep cooling fins and a plug that is offset on the side. The offset design of the plug completely shields the element from the by-pass gases. and accounts for the capabilities of the motor to accept hot fuel mixes without cooling off at low speed. Under normal operating conditions, you will almost never have to worry about the plug cooling off.

The cylinder is made from hard steel and, unlike earlier 59's, the lower portion dropping in the case is of a substantial well-section, and should have no distortion problems or breakage problems. The latest piston is a result of several months' development. The original piston produced from a die-casting proved to be very short-lived and, in general, was less than we expected. The current piston almost can be said to be made of glass, in that it has over 20% silicone. The result is a material that is virtually wear-proof, has an expansion co-efficient substantially less than most aluminum alloys, and should virtually last forever.

In factory tests, pistons have been fitted close in the manner of a lapped piston, and have run for several hours with no rings whatever, with no discernible wear. The wrist-pin is made of hardened steel and is tubular in design. It is a free-floating fit in the piston and rod. The connecting rod, unlike the earlier rod, is now machined from bar stock, and is of generous proportions. The crankshaft is 9/16 inch diameter main, and 7/32 diameter pin. The shaft is hardened steel. The aluminum piston is fitted with two narrow rings. The rings are a perfect circle design and meet the wall all the way around, and are quite hard.

The throttle body is machined from brass, and is fitted into a honed hole in the crankcase casting. The operating arm is pressed on, and connects to the exhaust valve by means of a rather frail-looking wire link. Unlike the earlier of this series, the 59's are now provided with an adjustable high-speed and low-speed position stop. The parts carefully made and fitted, and should give several seasons of trouble-free operation.

Another point of interest is that the Fox 59 is probably the only R/C motor which will use hot fuel to advantage. The manufacturer recommends Missile Mist and the motor can be run on Blast for more power without any sacrifice of the engine's idle capabilities. The motor idles exceptionally slow, and by careful adjustments a 59 that is well broken in and fitted with a recommended 12-6 prop can be adjusted to idle at a reliable 3500 rpm.

No power curves have been run; however, it appears that the peak power output comes in the 11- to 12-thousand rpm range. With a 12-inch-diameter, 6-inch-pitch Top Flite wood propeller, the motor would run at approximately 11,000 rpm on Missile Mist.

It is interesting that at full throttle a two-cyle motor is horribly inefficient. However, at partial throttle, a two-cycle motor can be amazingly economical. You will find that if you install your 59 in a airplane previously powered with a 45, that if you consistently fly the 59 throttled down to approximately 45 output, you will get better fuel mileage than with the 45. On the other hand, if you run it at full throttle, your fuel mileage will drop about 20%.

Readers Write!

GOOD THINKING

• It's well known that the FCC limits Citizens Band transmitters to 5 watts maximum power to the last stage of amplification. Since most model transmitters run between ¼ watt and 1 watt, the question that invariably arises is, "How far can a model be controlled with such a weak signal." Always in search of a better answer to a good question, we have found on the front pages of our newspapers these thought-provoking facts.

The Mariner was 36,000,000 miles from Earth while telemetering useful information about Venus to us. It was more than 54,000,000 miles from Earth before it finally went out of range. Seven thousand Earths set side by side touching each other wouldn't be enough to join a gap of that size. Although the government chose not to operate on the Citizens Band (they must have heard some nasty rumor about interference) the transmitter which set this phenomenal distance record radiated a whopping signal of 3 watts!

Now it's understood that the receiver, antenna and power supply were of specialized design. However, I don't believe the receiver was as sensitive as one might imagine since it would most likely pick up a lot of unwanted electrical noise. It would appear then that this outstanding range should be attributed to a superior antenna, a rock stable power supply and ultra-fine tuning—all of equal importance.

Why don't we take some tips from the real experts of our field and keep a close check on our power supplies, use the recommended antenna lengths and tune as though we were auditioning for Carnegie Hall?—Ray Pisar, Misa, Ariz.

•

GYPSY MOTH—CONTINUED

• Saw the controversy over Bill Northrop's Gypsy Moth and I too recognized the errors in Vol. 3, No. 10. The matter is straightened out now so there is no use reviving it but I thought I'd send in a photo taken at the '61 Nats showing Mr. Northrop and his Moth (at least part of it). I believe he and a friend were breaking in that big Forester 99. I didn't get a chance to talk to Mr. Northrop as he was quite busy and I couldn't stay at the Nats very long to get acquainted with him or anyone. (I was only a spectator.)

While on the subject of photo's I would like to know what size etc. photo s you would like for printing in Grid Leaks, as from time to time I run into something interesting that you may wish to reproduce.—Robert Neulin, Hellertown, Pa.

Editor's Note—For best reproduction prints should be 4 x 5, or larger, such as 5 x 7 or 8 x 10, glossy with good contrast, and with a minimum of distracting objects in background.

•

ABOUT PRINTED CIRCUITS

• I noted in some issues fellows are using the chart-pac dots and crepe tape for printed circuits. I have experienced some trouble with etchant getting underneath this masking. I have found that the black plastic Scotch electrical tape to be better. It can be cut in strips or applied wide and the unwanted areas stripped off with an X-Acto knife. If dots are wanted, a dime-store paper punch is used. The circuits come out real clean and sharp.—E. L. Caustin, Torrance, Calif.

•

IT WAS ROUGH

• I tore up five planes before I got one to fly. The principle reason was unreliable equipment. This was discouraging to say the least. When MAN printed the Kraft single channel, I built both the receiver and transmitter and have not had equipment trouble since. Then I began to fly.

My first contest landed me a second place trophy in Class 1. The plane was a White Cloud with a Veco 19 engine, Kraft receiver, and a Micro 4 with a Hillcrest motor servo operating from 3 and 4 position. I then switched to Kraft 6 and learned to fly this in the same plane but with a Fox 40. This might seem ridiculous, but believe me that added power really saved several crashes because, when in trouble, I could always open the throttle and pop up-elevator. It would climb practically straight up for a couple of hundred feet. After I got the "hang" of multi flying, I built a Tauri with the same complementing equipment and engine. I did have the elevator servo set for a wide neutral which greatly improved the performance by being able to trim down after loops, etc. I give you all this information for I feel that your publication has helped me more than any other single thing.—Irwin H. Battle, Florence, Ala.

Publisher's Note—In his article "A Question of Reliability" in the January-February issue, the editor suggested that readers should send in their own experiences and tips on reliability practices. The following were selected from responses that were received.

"A QUESTION OF RELIABILITY"

• What was said in January-February GL is very true: most of the information about commercial gear is quite vague. Of course, the manufacturers may have their reasons.

I believe if one wants to enjoy this hobby he or (she) should try to read up on everything pertaining to Radio Control by authors of merit and experience. I know I had quite a time when I came to the field as a beginner.

My first transmitter and receiver were the Marcytone type. It wasn't the transmitter or receiver that caused all the commotion. It was a coil in the center of my antenna. Reading up on antennas for mobile work gave me the idea. I couldn't see how a piece of wire only 36 inches long for 27 mc could radiate as well as one a quarter-wave long.

Using a receiver with a S-Meter for indicating the signal strength, I adjusted the number of turns on the coil of the antenna for maximum signal strength. Using just the plain 36-in.-long antenna, the S Meter read just S9, but with the loading coil in the center of the antenna and the whole thing tuned to 27 mc. I got a reading of S9 + 6db. According to that reading, I increased my radiated power by four times without increaasing my input and never had any trouble with range. We are not using too much power to start with and the more you can help it to radiate the better the range.

My present plane is another Trainer, which gave me many enjoyable flights and is still flying. It has over 200 flights without any failures. The receiver is a Kraft single channel with a 30-volt battery instead of 22½. I changed the 4.7K resistor to 7.5K as the idle was a little high without carrier. The range is extremely good. The relay is a Tiny-Mite Gem. I increased the contact spacing to .008 and cut the spring in half. I set the relay up to pull in at 2 milliamperes and drop out at 1.6 milliamperes. I am using pulse with a Mighty Midget Motor and a tube pulser using 3V4's ala Mr. Good. I checked out the receiver under extreme heat and cold, by putting receiver in freezer for a hour and made up an oven from an old cardboard box using a 100-watt bulb. It was a great deal colder in the freezer than I would care to fly. I've flown the plane when it was 20 above zero.

I've heard so many fellows say, gee, it worked in the cellar, but not at the field. I can truthfully say I've never had any trouble after making a permanent installation in plane.

The actuator batteries give fairly good service, I averaged around 50 flights per change. My flying time is from 5 to 8 minutes a flight. That may have something to do with the good life of my batteries. I find that Eveready's give good service.

After a day of flying I just wipe the plane off and remove plugs for receiver and motor control. In arriving home I just hang up plane by the tail until I am ready to go for another day of flying. I believe that when everything is working properly there is no need to tinker and invite trouble.

My plane weighs 4¼ lbs. and has a wing loading of 22½ oz. per sq. ft. which is way over the limit, but it still flies very well, even in a 20 mph wind.

Here are a few tips that I find very good.

Instead of using Saran-wrap for holding tuning slug from turning, I put a small amount of Duco cement into the last few threads of the slug by rubbing the cement into the thread and, when dried, put into coil form. If it is not tight enough one can rub a little more cement into the thread to build it up. It has worked very well for me.

I find that a large toe-nail cutter does a much better job of cutting the wires projecting through on a printed circuit board than the conventional side cutters as the face of the toe-nail cutter is perfectly straight, therefore leaves no sharp edges sticking up.

Checking for noise suppression, I use 2-1 mfd condensers and a 10-ohm resistor directly across the Mighty Midget Motor. Without the suppression in the A.C. voltage, peaks are around 8 volts and on high rate for motor control it will go up to 30 volts. (Measured on a vacuum tube volt-meter.)

Now with the condensers and resistor connected directly across the Mighty Midget the normal rate and the voltage peaks are around 4 volts and on high rate it will only go as high as 8 volts. It seems to be the most effective type of suppression I've found, plus the spark suppression on the relay.—Jacob Garrecht, Stamford, Conn.

•

• Your last issue (January-February) was the most timely in the feature on reliability as written by Bill Winter. I wish that more RC beginners would pay attention to these articles. We would not lose so many potential good R/C men if they would try not to be so original in their initial ventures. I am safe in saying that reliability can extend to scores of hours and hundreds of flights if certain rules are followed in construction, check-out and maintenance of R/C equipment and airplanes. Our three-man group has racked up a fantastic record of air time in multi. Our total exceed 1000 flights aloft in the past 16 months. At an average of 15 minutes each time that would be 250 hours, or 200 to play it safe. The old "Mud Hen" has over 300; the Snapdragon 66 has 27 hours of air time, and the 690 has been up about 50 times.

We lost 14 guys in R/C in the past 2½ years—all due to poor workmanship, bad equipment, or not benefitting by our experience. Single-channel super-regen went down the drain here and if you go to Denver, the same thing goes; you have super-het or don't fly, and about all the air work is done on multi. Am predicting that single intermediate is about done unless some single-channel proportional, that really works, gets into the picture and gives really good elevator-rudder-engine when you want it. I don't believe you pulse a lot more in proportional than flying reeds on 10 channels; some of the final approaches in windy weather on reeds will really run a pile of signals between simultaneous on rudder-elevator and romping on engine to bring the model up to the strip.—Rob Blackwell, Blackwell Models Mfg. Co., Canon City, Colo.

GRID LEAKS

IN THIS ISSUE

Volume IV, Number 3—May-June 1963

PAUL RUNGE, Publisher—WILLIAM WINTER, Editor—WITTICH HOLLOWAY, Art Director—BOBBIE RUNGE, Secretary-Treasurer
Contributing Editors: Gordon Flenniken—Phil Kraft—Frank Schwartz—Dale Springsted—John Worth

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

SEC. 34.66 P. L. & R.
U. S. POSTAGE
PAID
Permit No. 27
Columbia, Missouri

TO

8-64
C A DESS JR
4002 MONITOR DR
HAMPTON VA