GRID LEAKS

R/C DATA SERVICE

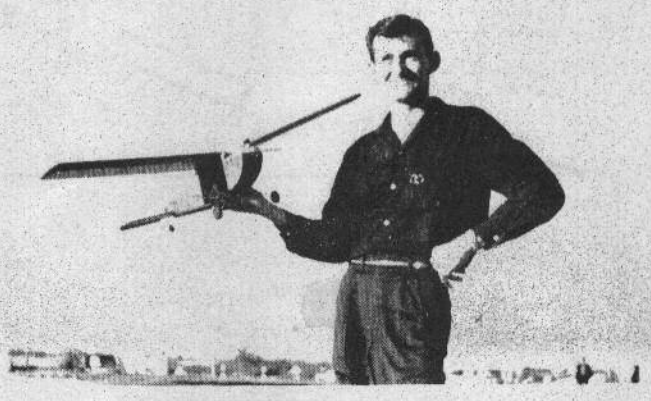
VOLUME 1 NUMBER 5

JULY AUGUST 1958

PUBLISHED BI-MONTHLY AT HIGGINSVILLE, MO.

Galloping Ghost in a "Small" Hog

DON MEADOR SHOWS YOU HOW



Small R/C planes have always given me a thrill and I have had a desire to build such a plane equipped with rudder, elevator, and motor control for some time.

It was in December of 1956 that I switched over to the WAG TTPW system and naturally to larger planes. I have flown several different planes equipped with the WAG TTPW system and found that the Smog Hog delivers the best performance in all maneuvers for rudder, elevator and motor control. In view of this, I decided that a half scale version of the Smog Hog would be ideal for the Galloping Ghost system and so the Small Hog was born.

My Small Hog is powered by a Jim Walker .065 Spitfire with exhaust valve and clapper. I used a Controllaire SM-1 receiver because I had one on hand and because of its ability to follow rapid pulses. It is also very compact and very light weight. I used the installation shown in Grid Leaks Volume 1, Number 3, for the Mighty Midget motor to drive both rudder and elevator. 1/8 inch doweling was used for the torque rod rather than 1/16 inch wire in order to eliminate electrical noise so as not to interfere with the operation of the receiver. This is shown in a diagram.

The Small Hog is in the 1/2A class and of course weight and space are very important factors. The plane is entirely covered with silk to give it additional strength. This is dyed red silk and finished with clear Aerogloss dope. The ship is exactly one half the size of the Smog Hog and weighs in at 22 ounces fully equiped ready to fly.

In view of the weight factor, four pencells was all I could carry to drive the Mighty Midget motor. As such the Stick-Trol Pulser pulses too fast with three volts on the Mighty Midget and therefore there had to be slight modification made in the pulser. The pulser is adequate for 4½ volts but I simply couldn't pack the 4½ volts.

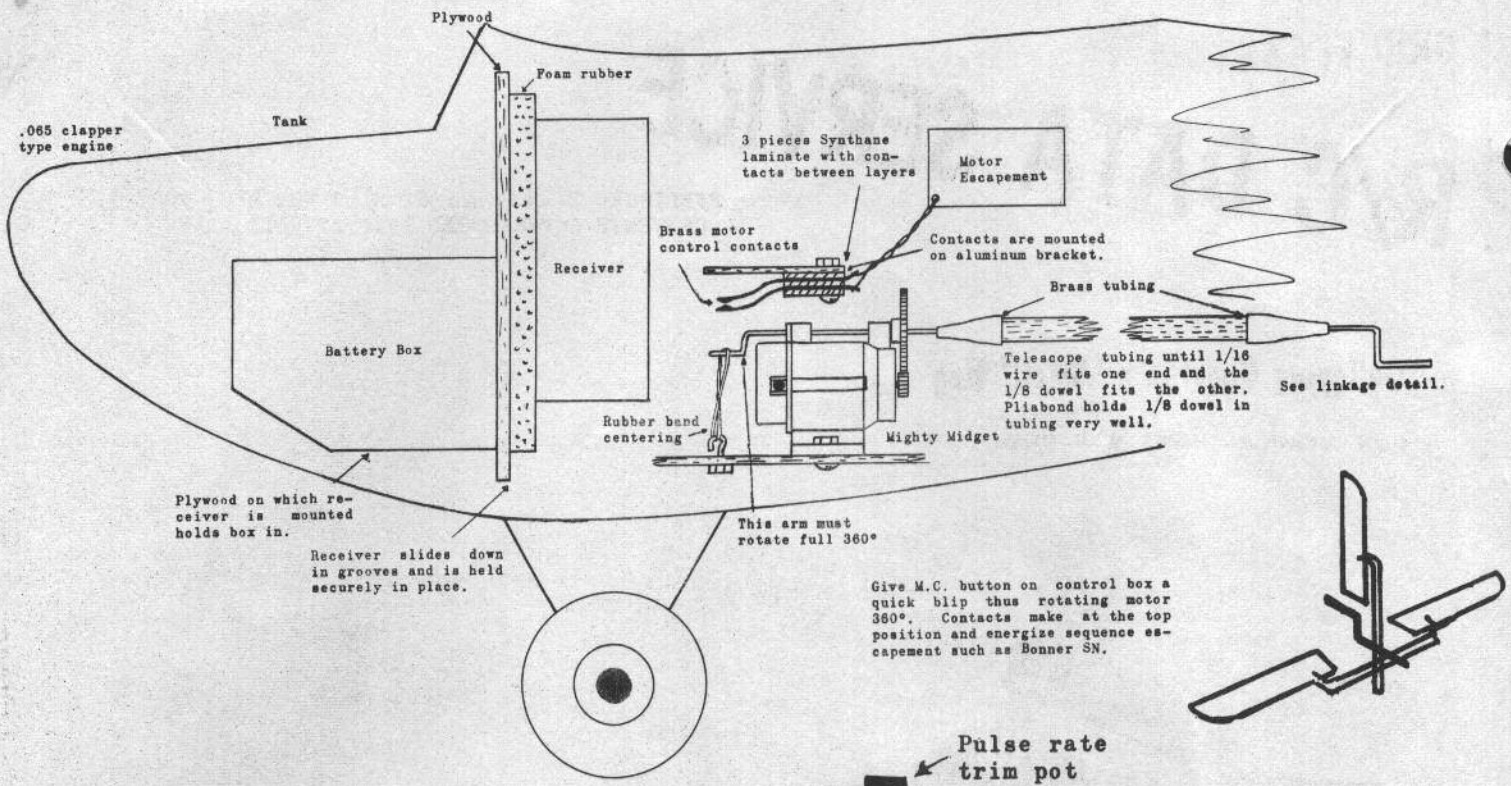
In order to receive adequate up elevator on only three volts the pulses have to be slowed down. This does not affect the filght of the plane since the only time you use slow pulses is in full up position (an arc of 270 degrees). You will either be looping or doing true spins and so forth.

The only changes that are necessary to make in the pulser are to change R2 and R7 from 15K to 25K and R3 and R6 must be changed from 330K to 530K. If you are flying a larger plane that will carry 4½ volts these changes are not required.

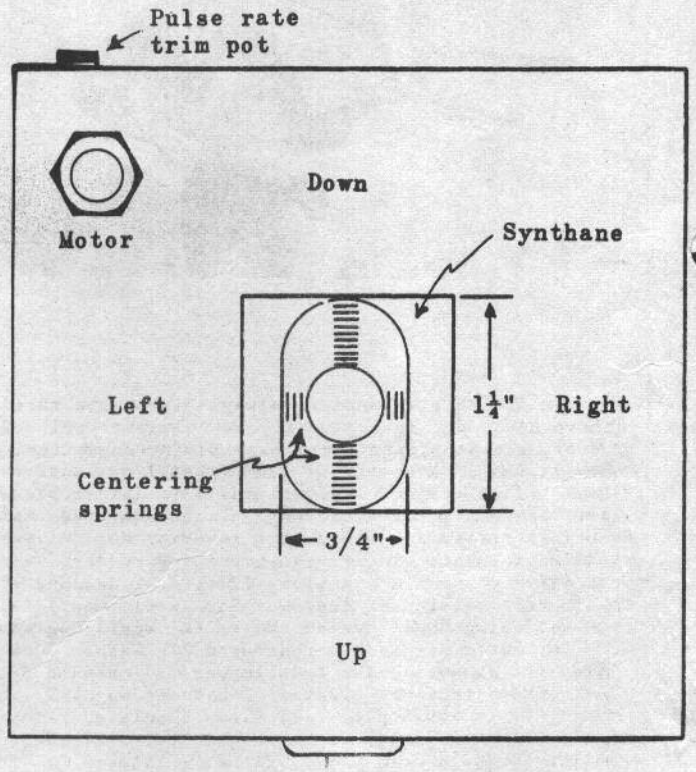
NOTE:
It is most important that when you mount the multi-vibrator in your transmitter case to be sure it is well shielded and far enough away from the RF portion of the transmitter so that there is no interaction. If it is too close the RF will cause the pulses to speed up.

The control box, as you know, is very important because with it you get your simultaneous operation. I found it desirable to reduce the full travel of the stick from 1-1/4 to 3/4 full travel right and left. Up and down must be full travel of the stick which is 1-1/4 inches. By setting the control box up in this manner you eliminate any over control in the rudder which also has effect on the elevator action. The limiting of the rudder throw to 3/4 inches eliminates alot of the elevator and rudder interaction noticed in GG systems. Note the diagram.

The motor control that I used is very simple. No stops are provided on the motor. All that is necessary is a set of contacts on the top of the crank travel located near enough to the Mighty Midget motor crank so that when the motor rotates a full 360 degrees contact is made and this in turn energizes a Bonner escapement.



Give M.C. button on control box a quick blip thus rotating motor 360°. Contacts make at the top position and energize sequence escapement such as Bonner SN.

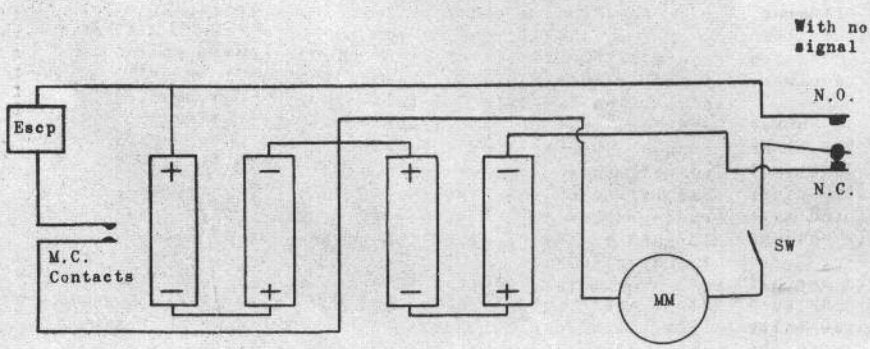


which actuates the motor control. This is quick blip--only one complete revolution of the motor is needed. Note the wiring diagram and also the rough drawing of the installation

In view of the fact that the pulser consists of electrical components which have to be closely matched, rather than trying to find these parts and match them myself I found that the kit as supplied was easily assembled and very successful in operation.

Due to weather conditions here the Small Hog at present has about two hours successful flying time to its credit.

My Smog Hog, now retired, has about twenty hours successful flying time or about 200 flights to its credit. For a lot of fun the Small Hog will give it to you. Just think of it a 1/2A ship with rudder, motor and elevator--and proportional rudder and elevator at that.



The quick blip system is used for motor control. With no signal the relay is pulled in leaving the top contact open, so hook one side of the M.C. circuit to the normally open contact and the other side of the circuit to ground on the batteries.

DEVELOP A PREFLIGHT COUNTDOWN

A MUST FOR MISSILES AND RC PLANES!

Off and On **Full On** **Full Off**

It was a beautiful Saturday morning. We were watching Jerry Tucker of Higginsville, Missouri ready his little .049 Gimlet (MAN October 1956) for its first radio control flight.

The weather was perfect. Almost calm conditions prevailed while up over head a few lazy clouds stood guard.

This was to be a maiden flight so a number of preliminary checks had to be made before a trip to the flying site some miles away need to be made. A large open space in back of the house would do for the preliminary checks since there might have to be return trips to the bench it was decided to do as many checks at home as possible.

First the test glide--into the wind. This proved smooth and only a few minor weight and incidence shifts were required. Jerry had been careful to follow the designers instructions and had made his center of gravity location come out where the designer had stipulated.

Down and side thrust had been put on the engine as specified, too, but these would have to be readjusted later under actual flight conditions. Now it was time to determine the reliability of the radio and the installation of the actuator to make sure it followed letter perfect.

First came a range check to determine of the receiver was operating correctly. The receiver had been checked on the bench but a range check was in order.

With a helper and a pre-determined set of signals the check was made. Jerry, with the plane, would hold his arm up and circle for full on. When he held his arm out away from the body this was signal for full off. Up and down meant on and off signals--about at half second intervals. While the foregoing aren't the only signals that may be developed a system of such a type will save the throat and avoid any misunderstanding of what is desired. This was all part of the countdown.

In any set of signals it is imperative that both parties are quite clear on what is desired. For instance if full on signal is given it is important that full on be held until another wig wag is sent. Nothing is more exasperating than trying to tune a receiver to a non-existent signal!

Tuning checks were begun at about 10 yards. A Field Strength Meter was set up near the transmitter to indicate that transmitter was performing. When you KNOW your transmitter is putting out you can pin point troubles much more quickly.

With the meter plugged in Jerry proceeded out with the plane. A check was made at spaced intervals. Tuning becomes narrower the further away you get. It is not a good policy to make a check right at the transmitter and then go all the way out for another. Rather stop every 50 yards or so and check. Always tune to the center of the current change--tune for maximum needle deflection and get right to the center of it.

Range check was continued until 400 yards had been reached. This is considered an acceptable minimum range. Everything was fine so the countdown continued.

(It should be mentioned here that all of the batteries were brand new and so no voltage checks were made except when installation was made. If the batteries have been in use make the checking of the voltage UNDER LOAD a part of the countdown. On filaments this means with filaments on, the B batteries must be conducting at their maximum current, and the actuating device should be drawing full current. It is important that FULL ON checks be made since with no load voltages can be very misleading.)

Now one more check on the countdown before the trip to the flying site. This was to be with the motor running.

This is one check which is often overlooked particularly in new planes. In Jerry's case it was wise since without motor running everything was fine--apparently.

The power Jerry used was the Cox .049 Space Bug--a hot performer.

Starting was easy. Now on with the radio receiver and transmitter and key. Control surface or surfaces MUST operate just as they do with motor not running. In Jerry's case it was necessary to reposition the receiver and balance the prop to cure vibration difficulties.

Now we were ready to go to the field. Had these checks been made only at the field countless trips back to the work bench would have to be made. Jerry was now ready to concentrate mostly on flying.

Now the countdown was getting closer to the zero hour.

At the field here was the procedure. Battery voltages were checked--A, B and servo.

Range was checked again by means of the signals to make sure the trip had not shifted the tuning of the receiver.

All installation was checked for plugs connections, servos, keepers, escapement, rudder, fuel system, and engine.

Alignment of wing stab. Check the rubber bands holding down stab and wing.

Try the engine and make sure you have all the controls.

And there you have it--as you become more proficient the countdown will become second nature. But it is wise to remember that even experts paste check lists in their tool boxes to make sure they do not slip up. One slip and a lot of fun can be ruined.

To make sure your launching is a success make your countdown to the zero hour as thorough as you know how. Then you can concentrate on the fun of flying and quit wondering "What's gone wrong?".

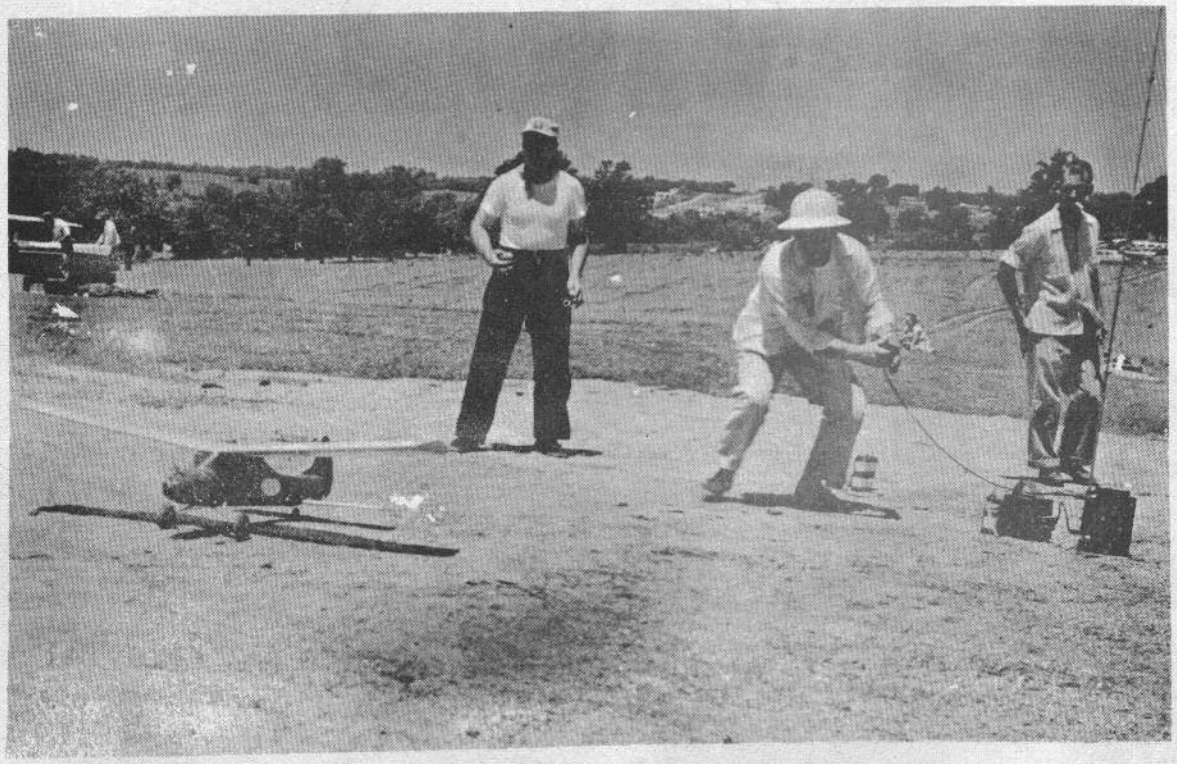
From the May issue of the East Bay Radio Controllers Carrier comes a check which these club members paste in their tool boxes. It would be wise for you to follow their example.

I BATTERY VOLTAGE: A____ B____ Servo____ _____
II HOW IS RANGE: _____
III AIRCRAFT INSPECTION: Inspect fuselage and all surfaces for warps, breaks, ets. _____
IV EQUIPMENT INSTALLATION: Check and secure all plugs, connections, servos, keepers, escapements, fuel system, and engine. _____
V ASSEMBLED AIRCRAFT: Check alignment of wing, stab, bands, controls (neutral) _____
VI TURN UP ENGINE: Check throttle speeds and ALL controls _____

DO NOT FLY UNTIL CHECK IS COMPLETE.
COVER ENGINE, WING AND STAB BANDS TO PROTECT FROM SUN.

FLY LIKE THE PROS!

By Al Divem and Ted Straightin



Body english helps--sometimes!

EDITOR'S NOTE: It is strictly with tongue in cheek that we bring you a series of articles written by some of the top experts of R/C throughout the country. Just see how many of the names you will recognize. These words of wisdom will be found ONLY in Grid Leaks. No other publication cares to make such a statement.
Just wait for the next issue for another in thi[illegible]eopener series.

Anyone can recognize an R/C beginner. Every flight is a dream. Troubles just don't exist. It's obvious that the equipment instructions are being observed instead of ignored. Is this kind of success breeding loneliness for you? Is consistency such a problem that you can't even remember your last flyaway? Are you discouraged at not being a bonafide member of the Down Elevator Club? If so, you can't expect to make "expert" and share the brotherhood of crying in your beer with the boys.

You're destined to boredom and isolation unless you take prompt and decisive action--the old ways must go! And here's a setup to solve all your problems. With it erratic flying is a snap; in fact, it will be hard to prevent! And no matter what the model does, the control stick will indicate that you are the cause--now you can have proof positive to gain acceptance with the boys. No one can dispute your qualifications--no one can claim you cheated by accidental mishaps. Every flight can qualify as a controlled crash!

In the air, your "receiver" is really a subminiature dual WAG transmitter, utilizing pendulum operated pots in the multivibrator circuits to trigger the ground unit so as to produce proportional movement of the control stick. Packaged with printed circuitry and utilizing a transistorized power converter, the "receiver" looks like the real thing, including pulsing relays.

Since a properly trimmed freeflight model flies too smoothly, a clever actuator installation is used to provide simulation of a sloppily flown flight pattern. The heart of this is an aneroid unit which, whenever altitude exceeds a preset limit, provides full down elevator; also, a timer included to apply up elevator and return to neutral after a preset time interval. Variation of the timing cycle permits adjustment to obtain loops, dives, etc. You can live as dangerously as you wish!

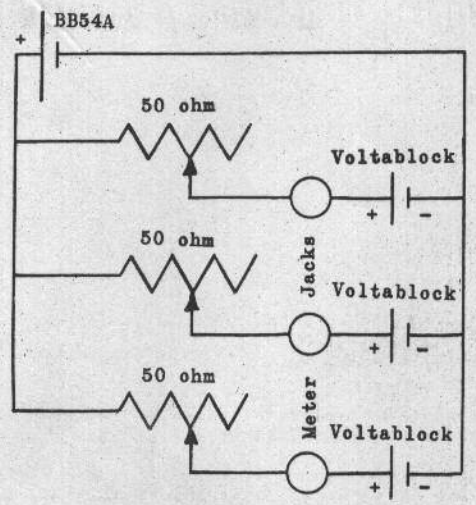
Also a part of the airborne actuator installation is a compass steering unit which switches the rudder control as necessary to maintain an approximate preset heading (according to wind tion). By adjustment of this unit flights may be made upwind occasionally (to show that you sometimes do learn how to fly correctly) or downwind for that fairly regular "flyaway" that keeps you in good company.

On the ground, your "transmitter" is really a standard dual WAG receiver hidden in the big box or perhaps in one of the latest hand held jobs which combine transmitter and control box. In either case, the signals received are used to drive servos which move the control stick exactly as the model flies. An important feature is the normal WAG jittering of the servos which shakes your hands just enough to complete the expert's illusion of studied nervousness. Now the chain is complete, if you remember to have a few pat alibis ready for the first mishap--no expert would be without half a dozen excuses for any predicament!

SHORT CIRCUITS

A REGULAR FEATURE OF GRID LEAKS. THIS PAGE PRESENTS SHORT NOTES OF IMPROVEMENTS DEVELOPED BY OUR READERS. SEND US YOUR BRAIN CHILD!

CHARGING VOLTABLOCKS



"CG's pee-wee Voltablocks are a swell deal for R/C work that's for sure. But, and there is always a but to consider, one must be different with these units and first read the instructions supplied for proper use and recharging. Otherwise you had better stick with your dry type cells.

"If you follow the instructions as given you will obtain long life and swell performance within the ratings as given. The charger circuit shown in the instructions might be more complicated than the average modeler would want to get involved in. We here at Essco have a simpler method to recharge these V0 cells with only a few cents worth of equipment required.

"Most modelers already have a BB54 2 volt cell in their possesion for use in glow plug heating or as a primary source for their transmitters. So we simply suggest that you hook the V0 cell to the 2 volt unit with a 50 ohm 2-4 watt pot in series to regulate charge rates.

"The stable voltage of a fully charge BB54 will give you the required constant current required to correctly recharge the V0 cells. We suggest that a 0-100 milliammeter be wired into the circuit to correctly set the required charge rate or provide a closed circuit meter jack in the circuit.

"If more than one cell is to be recharged at one time simply use a separate 50 ohm pot and meter jack for each cell and connect each cell across the BB54. Of course you should observe correct polarity or your cells will be destroyed.

"If dual units are to be recharged (two in series in a single package) you will have to go to a higher voltage. Use two BB54's in series or an NT6 for three cells connected. The current required to recharge a V0.500 would be approximately 760 mils or less than 1 amp. This drain is just a trickle from a fully charged BB54 cell."

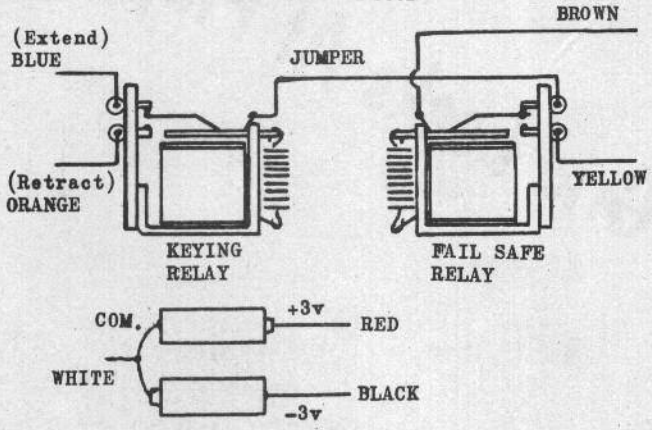
Our thanks to Irv Megeff for the foregoing information.

MARCYTONE ON 50 MC

From Pete Bliss comes the following word on the MarcyTone: "Six perfect flights on my 50 mc MarcyTone yesterday. Never missed a "Beep"--real pleased. Receiver was an exact copy except I used 1AG4 detector and had an 18 turn #30 wire CTC LSM tank coil. I also put a 10 mf from B plus to ground since I wanted to use it on only 22½ volts of B.

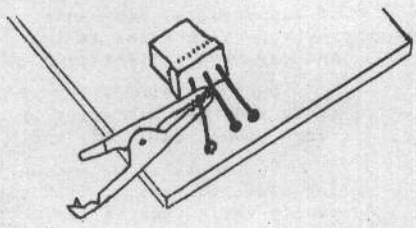
"A 6007 works equally well but a 30 volt battery should be used. It will only work down to 18 volts so a 22½ volt battery is marginal."

BONNER SERVOES FOR WAG DUAL



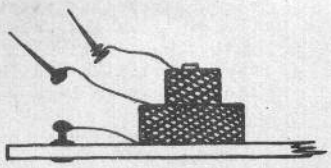
Bonner Servos may be used with the Walt Good Dual Proportional system so that the fail safe relay drives the servo back to neutral, not depending upon any spring return. Very light centering may be used. This information is forwarded to us thanks to Howard Bonner.

SOLDERING TRANSISTORS



Soldering in transistors into circuits can be exasperating. Most articles state "Use a pliers to grasp the lead between the body of the transistor and the joint to be soldered to avoid heat damage." Most of us are alone in the workshop and have only the normal complement of hands and yet we must solder in these little beasts. Here is a method evolved which becomes a third hand. Use a minigator clip in between the body and the joint to be soldered. This quite effectively helps dissipate the heat and keep the transistor from harm.

COMMANDER KINKS

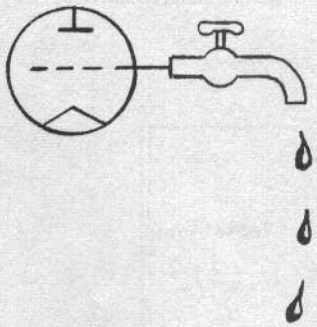


"The one source of difficulty for Commander Receivers is quench coil lead joints with good continuity. If these leads are wrapped around pins and soldered with a gravity ball of solder and the pins soldered into eyelets as standoffs this, we have found, pays off."

This excellent suggestion from Ellis Sigmon of Everett, Washington is worthy of consideration. Another idea of Sig's is below.

"On the Commander Transmitter, light is on but no signal is getting out as indicated by FSM. Cure--Rubber antenna grommet subject to cutting and grounding through at the hole in the case. Replace with one extruded fibre washer above and one below in place of the grommet. Pliabond to the case."

Grid Leaks At Play



THANKS!

In the five issue history of Grid Leaks we've never enjoyed a response as we had from the last issue. Thanks very much. It's heartwarming to get such a confirmation that the basic idea of an experimenter's magazine is sound.

R/C itself is so fast breaking with so many new developments cropping up that our plans must change from issue to issue to keep abreast. You'll recall we mentioned in the last issue that we would have a transistorized Tech Two. We shelved that temporarily in favor of something far more exciting.

KAMM AND COSTLOW'S ALL TRANSISTOR TR 4-5

We were favored a few weekends ago by a visit from Mr. and Mrs. Don Kamm and Red Costlow of Minneapolis, Minnesota. With them they brought an all transistorized audio receiver and invited us to wring it out. This is a small audio job and it requires only 4.5 volts. Don and Red have aptly tagged it the TR 4.5.

During their visit we ground checked it using a CG Audio Transmitter since this was handy and had batteries ready to go. Any good Audio Transmitter having a 300 to 400 cps range, 100% modulated, would produce the same results.

On the bench we had an idle of 2 mils. Remember this is on 4½ volts of batteries--nothing else required. With signal this walloped the special relay with a 40 mil current for a really satisfying wallop. When you think of this in terms of the fact that many receivers now in use draw at least 100 ma filament on two pencells and have to have B batteries, too, some of the awe inspiring facts of the TR 4.5 hit you with a wallop.

We took it out to range check. To make it really hard we removed the antenna completely from the receiver! And then proceeded to walk out 500--1000--2000--and 3000 feet and nary a miss. This was over a slight rise in the ground and line of sight was lost. We had to have a middle man to give us the signals for transmitter on and off. Then we took the test board and put it on the ground! And it kept on working. Enthused? Pretty mild a word.

So--instead of having your mouths water we rushed the TR 4.5 through for this issue. We feel this represents another important publication break through and scores another first for GL.

MONTHLY?

Many of you have requested Grid Leaks go monthly. This would be nice but we have not yet achieved that stature. Grid Leaks is still largely a labor of love, existing solely on subscriptions and sales. And these, while beyond expectations, are not yet up to where monthly publication is warranted. Couple that with only twenty-four hours in a day and other responsibilities and there is little choice. We feel it's better to leave you wishing for it oftener than to have you say--Oh here again so soon!

IN THE WORKS

We've previewed an exciting 12 volt power converter for transmitters which is fabulous in performance. This one is by Don Kamm too. We're looking for satisfactory commercial cores to give you do-it-yourselfers the know how to make your own. This is scheduled in a forthcoming issue.

A collection of different types of modulators satisfactory reed use have been made and will be featured in a future issue.

So for now we'll leave you. The weather's right for flying and boating and we hope you are getting your share of satisfaction. If we've helped in a small way that's what we're here for.

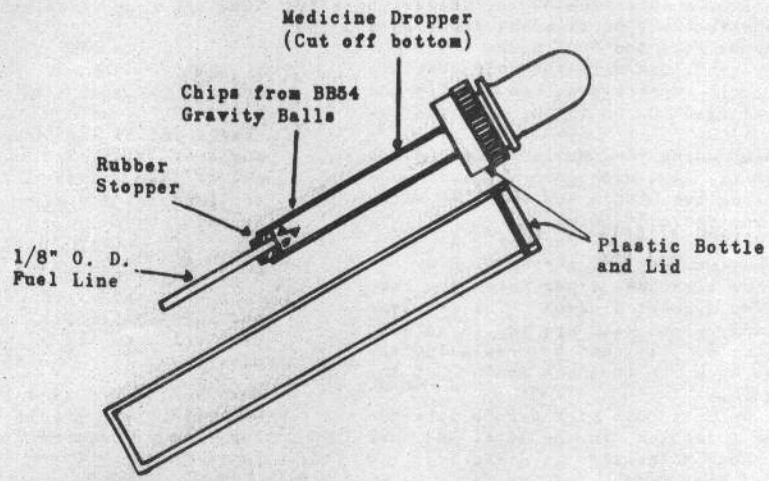
Yours sincerely,

Paul F. Runge

EDITOR-PUBLISHER

Notes on Wet Cell Care

THESE JOBS SAVE MONEY IN THE LONG RUN



The use of rechargeable batteries is a must for the serious R/C boat fan. Not only do they pack a lot of punch, but they can be recharged hundreds of times for an economy of operation not easily found elsewhere.

The NT6 which was the old boat standby has largely disappeared. The NT6 was supposedly rechargeable, but many of them gave trouble and refused to take charges or to hold charges.

An improved 6 volt 4 ampere hour battery has appeared however, and from preliminary field reports this holds a lot of promise. While constructed of plastic and the plastic looks fragile, it seems to withstand the abuse a battery of this type must take.

It is imported by both Aristo and International Models and is designated simply the 6-4.

A few tricks of the trade will help make the use of storage batteries a lot easier particularly for the newcomer.

All batteries of this type come "dry-charged". This simply means they come dry and are ready to be filled and charged and put into immediate use.

To fill them an electrolyte solution of 1.265 specific gravity must be procured. Some of the electrolyte available hasn't proved too satisfactory. But from the Minneapolis area, Red Costlow reports the Delco type sold by GM dealers just fits the bill and seems to give the batteries new pep and new life.

To facilitate filling Red drills a 1/32" hole right beside the filling hole. This allows enough air to escape to prevent the bothersome bubbling so common when filling small batteries of this type.

The large size plastic bottles used for Elmer's Glue All, when empty, provide excellent bottles to hold the electrolyte and also provide an excellent filling device. Lacking this a K & B Glue Gun can be pressed into service to fill them.

While the charging rate indicates the batteries will take up to .4 amps or 400 ma on charge, experience seems to dictate a much slower charge rate. Red uses a Voltablock charger which accepts different size light bulbs to fix the charging rate. While experimentation is called for by the individual, a 60 watt bulb does an excellent job when charging two of the 6-4 batteries in parallel.

When charged slowly the batteries do not have the tendency to overheat or to bubble so badly. Of course, longer charging times are indicated, but this is generally no problem since an overnight charge is generally sufficient.

Motor cycle shops have available small hygrometers which are excellent for checking the batteries, but one may also be made relatively inexpensively.

Red Costlow and Don Kamm made the unit shown at the top of the page. It consists of a medicine dropper, the bottom of which has been filed off. In this is inserted a rubber stopper. Into this a hole is drilled so that the smallest size fuel line carried by your hobby dealer can be press fitted.

The secret of the hygrometer lies in the specific gravity indicators. These are the ones taken from an old BB54 or BB54A. These may be chipped up and several hygrometers made with one set of balls. This will indicate the condition of the battery.

If all three of the balls ride at the top of the electrolyte when it is sucked in, battery is in fully charged condition. If only two of them ride high and one of them fails to rise, battery is 1/3 down. If one is up and two down, battery is 2/3 down and if all three fail to rise battery is dead.

The hygrometer is excellent to check batteries both while being charged and also check in the field to see how the battery is holding up.

To make the unit acid proof, Red and Don found a small bottle with plastic lid to house the hygrometer. A hole drilled into the top for a press fit allows the rubber part of the hygrometer to remain in air, while the acid is kept inside the bo[illegible] to keep from damaging clothes or items in the tool box.

On some of the 6-4 batteries, it has been found they are reluctant to accept an initial charge. If this happens they should be completely discharged and charging cycle started again.

Take care of your batteries and they'll take care of you. If you don't plan to use them for a month or so, it is well to charge them once every two weeks, just to make sure they stay up. As a rule it is harmful to charge a lead acid battery in a discharged state.

Learn how to use your wet cells. Their future looms larger in R/C all the time. 6 and 12 volt DC power converters are on the immediate horizon. With these little jobs you can have inexpensive sources for power for your transmitters.

The future of the storage cell in R/C has just begun.

LETTERS

MISCELLANY

"We wish to take this opportunity to congratulate you on Grid Leaks and to say "It is just what the doctor ordered".

"We noticed someone's comment in Grid Leaks about the Mullard DL66. We have used this tube for a number of years and find it to be a good superregen tube as good as the 1AG4 but not as good as the 6007. However, we have had no trouble with the DL66 filament going out, due to jarring in crackups like the 6007 does.

"We have had very good luck with the old obsolete Raytheon CK503AX tube. It superregens beautifully and was the best tube we had used up until the 6007 was introduced. (33 ma filament)

"We have also been using the Mullard DL68 as an output tube in place of the 1AG4 with good results. We have a tone receiver using two DL66's and one DL68 which gives us the low filament drain of 55 ma.

DL66--Filament 15 ma--Maximum cathode current 1 ma.
DL68--Filament 25 ma--Maximum cathode current 2.3 ma.

"We wonder if anyone else has experienced the same trouble with the Tech Two 27 that I have? The receiver when new works beautifully. But with age the on current starts regressing downward. I found by replacing the transformer that I was back in business again but the same thing happened again.

"Now as you know, mu metal has high permability due to the alignment of the molecules in the metal and that if the alignment of these molecules is disturbed the permability of the metal goes down. This seems to be my trouble. If so I can only contribute this to one thing --D.C. current through the primary. Now if my theory is true the one sure cure for this trouble is to A.C. couple to the primary of the transformer. I expect to replace the transformer and try A.C. coupling in the near future to confirm or disprove my theory.

"The Tech Two 27 has great potentials--out of this world range, wonderful current change, and small size. For those who do not want fast pulse (escapement, etc.) the current change can be made fantastic--.4 ma to 3 ma with the real low idling current working to their advantage."

Jim Conklin
Owensboro, Kentucky

Jim, your fine letter with its many worthwhile comments is very deeply appreciated. We are glad to get the run down that you had on the DL66 and DL68. They have confirmed our own tests that we made here. We feel the DL66 is in between the 1AG4 and 6007.

It could be that the trouble on the high mu you mentioned is it. Wonder if anyone has experienced anything of this nature and has any effective cures. We would be most interested in having you keep in touch with GL readers on your A.C. coupling.

Delighted that your Tech Two 27 is working out so well for you. Thanks again for sharing your ideas with us.

GG GOING GOOD

"Just received issue number 4 of Grid Leaks and think its a real "gasser". Each issue seems to get better than the previous one. My only complaint is that it isn't published monthly.

"The guys in my group, about six of us, fly with the pulse system and all of us are either flying or getting ready to fly planes with the "Galloping Ghost" system. I'm flying a L.W. Trainer with G.G. that, quote from a flying buddy, "Makes you feel like hopping over it instead of ducking down when it makes a low level pass". Of course we've had our share of Hair Raising Splashes but expect them with this kind of flying. I have more fun with the G.G. so my Smog Hog with 5 channel Schmidt is collecting dust in my workshop.

"On the Short Circuits page you have info on License Renewal but it comes a little too late for me. My license expired on April 17, 1958 so I sent in my renewal on form 505 in the middle of February to the Detroit office and I've received no work or license from them. Meanwhile my license has expired. What do I do now?

"I've thought of a few suggestions for Grid Leaks but with each new issue some one beats me to them so I'll just say keep those pulse articles coming."

Norman Delaney
East Liverpool, Ohio

Thanks for your kind comments. Also glad to hear that you boys are getting a terrific charge out of the GG system. We have been accused of being too much pro-pulse here at GL and we are delighted to hear that in other sections of the country pulse is gaining increasing favor.

About the only thing we know to advise on your expired license is just to pretend you didn't have one and use Form 505 and then sit back and wait patiently. Some regional offices will act promptly on these and others act more slowly.

When you get a good idea be sure to share it with us. We will be looking forward to hearing from you again.

WAG-MARCY COMBO?

"Many thanks to you for sending the copy of Grid Leaks containing the information on the MarcyTone system. It looks like a very practical method of getting multi-channel operation.

"I am definitely going to experiment with a hybrid receiver with this and the TTPW combined. One problem with this idea is coupling the transistor relay stage to the voltage amplifier of Good's receiver. Since the transistor has a low input impedance, it would load the voltage amplifier too much probably.

"The drawing of the Mighty Midget motor servo is included. This is a very simple but efficient modification. The centering idea of course is the biggest contribution here. I find that masking tape cut on a taper makes a fine drum. The tapered drum gives a non-linear return force permitting more force to be transmitted to the surface. If a more detailed explanation on any part is desired, I would be glad to furnish it."

Jim Martin
Maryville, Tennessee

We will be most interested in hearing how your hybrid receiver comes out, Jim. It occurs to us that this merging of the WAG TTPW and the MarcyTone might be done right immediately following th detector tube. There is a considerable mis-match there but it is the vacuum tube that doesn't seem to particularly care about the mis-match. Thanks very much for the drawings for the Mighty Midget servo for use in the WAG TTPW system and it will be appearing in the next issue of GL.

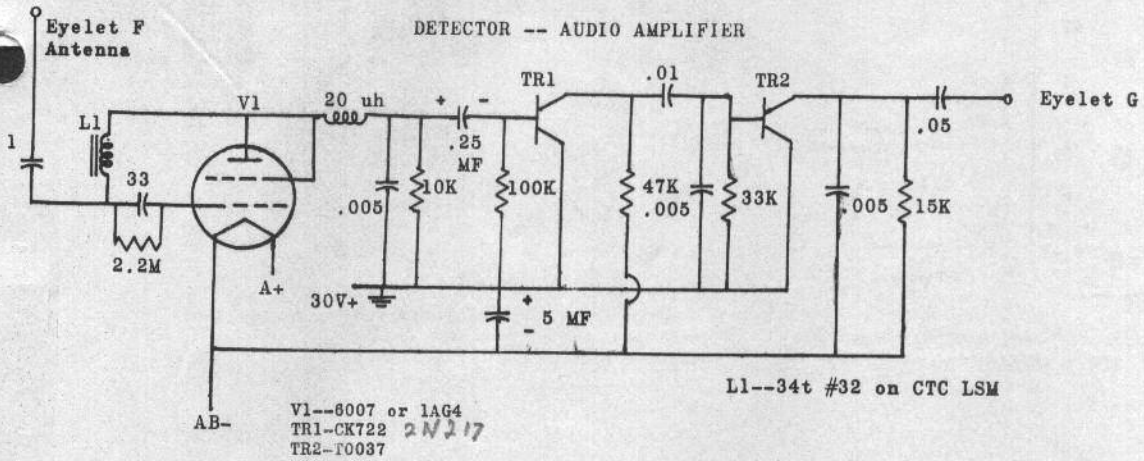
TIP FROM HONG KONG

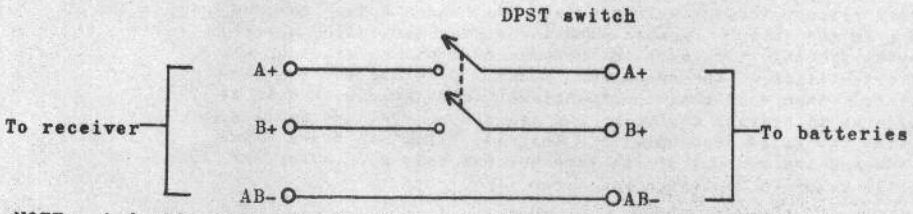
"Perhaps your pulser boys would like to know that Tri-ang in England has a double pole sensitive relay. It has two armatures and two sets of contact within a single coil. It can be wired to reverse the polarity of battery. It can also be adjusted so that one set of contacts closes at a lower current and the other on a higher current. Regretfully it is heavier than others. It can be had for about $3.90 from mail order houses in England.

K. Y. Cheang
Hong Kong, China

Good to hear from Hong Kong, Mr. Cheang, and appreciate very much your sharing this tip with our world wide readers.

MaRCytone 6 Channel Sytem

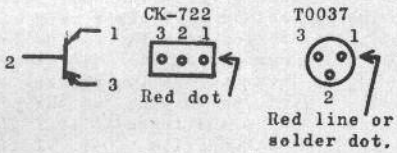




NOTE: A double pole single throw ON-OFF switch must be used with the receiver as shown to prevent the transistors from draining current from the batteries. A single pole switch in the common AB- lead to the receiver will not work since it will only turn off the filament to the 6007 tube and will not isolate the transistors from the batteries.

TRANSISTORS BASE DIAGRAMS
BOTTOM VIEW

1 Collector
2 Base
3 Emitter



Great interest was created in the MarcyTone system as presented in GL Volume 1, Number 4. Reports have come in of many scratch builders who have proceeded to build the multi version in 3, 4, 5 and 6 channel rigs and are highly pleased.

In order to assist other builders in making six channel units, GL this issue presents the 6 channel lay-out.

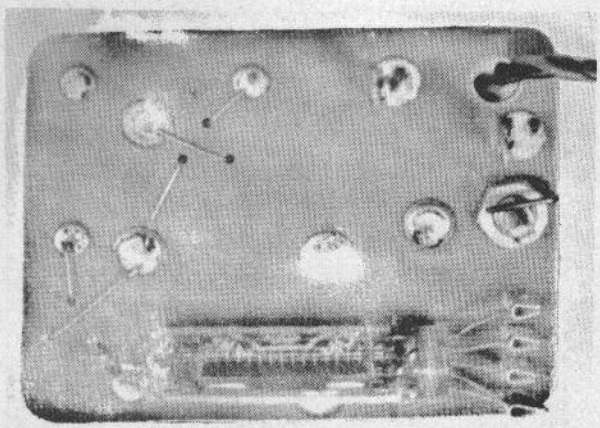
It was felt in designing this unit advisable to make two separate units--the first being the basic detector and audio amplifier stages, to this then could be added as many channels as desired. The two units can be piggy backed quite easily for small installation considering the type of control achieved.

Construction of the 6 channel rig is quite straight forward but it is NOT for the tyro in Radio Control.

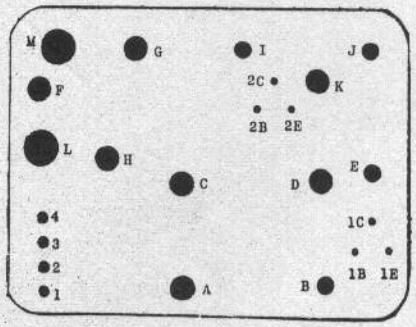
The Philco T0037 characteristics were changed by Philco with the result that the first transistor audio amplifier gave trouble in some of the initial sets. This can be completely cured by using a CK722 or better still an RCA 2N217. The rest of the T0037's should be checked to make sure that we have high gain with as little leakage as possible. This may be done quite simply in a transistor checker. Plans for such a checker as developed by Marcy will be in a forthcoming issue of GL.

In the single channel version better results will be had if the .001 coupling condenser and 22K resistor in the filter stage are changed to .005 and 10K respectively. This gives more drive and better range.

The glowing reports of those who have their Marcy units in successful operation are increasing. The unit is even finding applications on 50 mc as detailed elsewhere in this issue in Short Circuits.



NOTE: Only the detector AF schematic is shown. For the relay filter circuits refer to GL Volume 1, Number 4.



T0037 Base

Bottom View

1 Collector
2 Base
3 Emitter

Component side of base.
Tube is on opposite side
Full Size.

Begin assembly by mounting flea clips 1 through 4 in the four 1/16 inch holes provided. Mount the tuning coil at location L on the base. Proceed with the wiring and follow closely the connection chart and base layout drawing. Be sure to observe correct polarity on the electrolytic capacitors and proper orientation of the transistor leads. Refer to the transistor base drawing for the latter point. When soldering the transistor leads hold each lead as it is soldered with a long nose pliers to prevent damaging the transistor by overheating. Make all jumper wires on the base with the solid hook up wire. The red, black and brown flexible wires are used for battery leads and are run out of the base through hole M. After wiring has been completed the detector is ready to be tested and tuned.

Plug the 6007 tube into the flea clips, the two leads adjacent to the red dot on the side of the tube into flea clip 1, and the other three leads into the remaining clips in order.

Connect an 18 inch length of wire to the antenna lug F on the base. Connect the three battery leads to the batteries; red to B+, black to AB- and brown to A+. There are several different methods of tuning the detector. One method is to use a 0-5 ma meter and the other method utilizes a pair of headsets. If you prefer to tune with a meter, connect the meter in series with the red B+ lead to the detector. With no signal from the transmitter, the idling current of the detector should be about 2 to 2.5 ma. Turn the transmitter on and tune the slug in the tuning coil until a slight rise in current is noted on the meter. Now press one of the buttons on the control box and the current should drop slightly with an audio signal from the transmitter. The detector is now tuned to the transmitter frequency. If you prefer to tune with a pair of headsets, connect the headsets from B- to the output lug G on the base. With no signal from the transmitter, a hiss or rushing sound should be heard in the headset. Turn the transmitter on and tune the slug in the tuning coil until the noise in the headset disappears. Now press one of the buttons on the control box and an audio tone should be heard in the headset. The detector is now tuned and no further adjustments are necessary.

If desired, the detector-audio amplifier may be housed in the small plastic case included.

COMPONENT	CONNECTS FROM	TO
Jumper	Flea clip 4	Eyelet H
Jumper	Flea clip 1	Bottom Coil Lug
Jumper	Eyelet J	Eyelet H
Jumper	Eyelet C	Eyelet D
33 mmf and 2.2 meg resistor	Flea Clip 3	Top Coil Lug
1 mmf capacitor	Eyelet F	Top Coil Lug
20 uhy RFC	Flea Clip 1	Eyelet A
10K resistor	Eyelet A	Eyelet C
.005 capacitor	Eyelet A	Eyelet C
.25 mf electrolytic	Eyelet A (+)	Eyelet B (-)
100K resistor	Eyelet B	Eyelet D
47K resistor	Eyelet E	Eyelet J
.01 capacitor	Eyelet E	Eyelet K
TR1 Collector	Through 1C	Eyelet E
TR1 Base	Through 1B	Eyelet B
TR1 Emitter	Through 1E	Eyelet D
33K resistor	Eyelet D	Eyelet K
.005 capacitor	Eyelet D	Eyelet K
15K resistor	Eyelet I	Eyelet J
.005 capacitor	Eyelet I	Eyelet J
5 mf electrolytic	Eyelet D (+)	Eyelet H (-)
TR2 Collector	Through 2C	Eyelet I
TR2 Base	Through 2B	Eyelet K
TR2 Emitter	Through 2E	Eyelet D
.05 capacitor	Eyelet I	Eyelet G
Red battery lead	----------	Eyelet C
Black battery lead	----------	Eyelet H
Brown battery lead	----------	Flea Clip 2

PARTS LIST

Quan.	Description
	RESISTORS
1	10K
1	15K
1	33K
1	47K
1	100K
1	2.2 meg
	CAPACITORS
1	1 mmf
1	33 mmf
3	.005 mfd
1	.01 mfd
1	.05 mfd
1	.25 mfd electrolytic
1	5 mfd electrolytic
	CHOKES
1	20 RFC

Quan.	Description
	COILS
1	Detector coil, 34 turns #32 on [illegible] 1/4" form
	TUBES & TRANSISTORS
1	6007 tube
2	T0037 transistors
	WIRE
1	12" length solid
1	12" length flexible red, black, brown
	MISCELLANEOUS
1	Detector-Audio amplifier base
1	Plastic case
4	Flea clips

MARCYTONE FILTER-RELAY DECKS

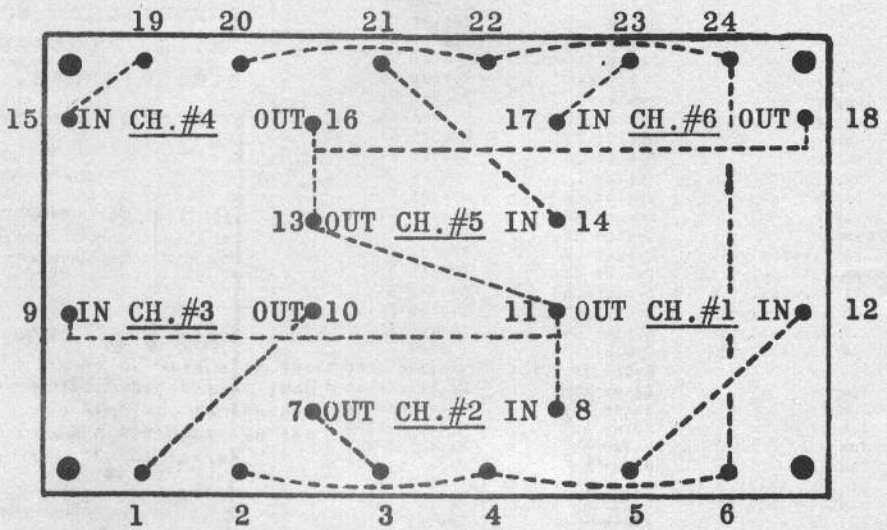
COIL DECK ASSEMBLY

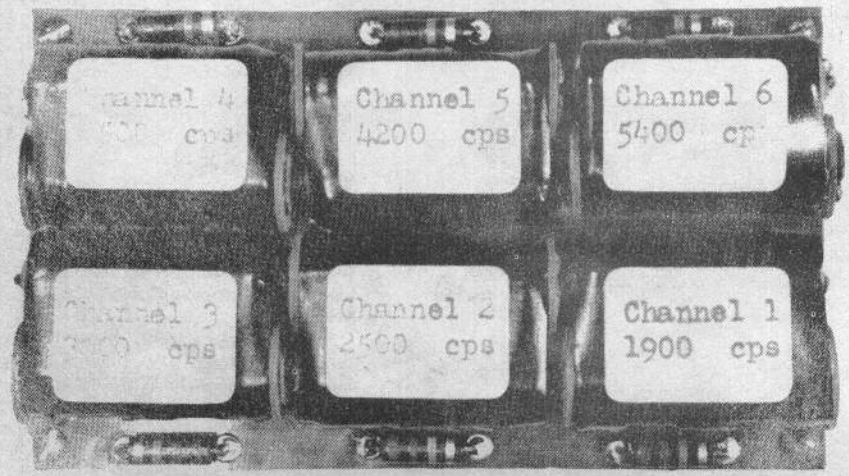
Begin assembly of the coil deck by placing the six audio filters into their respective positions on the base. Follow the coil deck connection chart and base layout drawing closely. The filter coils have been assembled with the .5 capacitor connected across them. Each filter is marked with channel number and frequency. The inside leads on the filters have been coded red for identification. Follow the instructions closely making sure the inside and outside leads of each filter are placed into the proper eyelets as indicated on the layout drawing and connection chart. The filters fit rather closely on the base and soldering should be done after all the filters have been placed on the base. After the filters are mounted, the coupling resistors for each channel should be connected and jumpers run to appropriate eyelets as indicated. Jumper wires on the base should be made with the solid hook up wire provided. The coil deck may now be placed aside and construction on the relay deck begun.

FILTER CHASSIS

COMPONENT	CONNECTS FROM	TO
Filter 1	Eyelet 11	Eyelet 12
Filter 2	Eyelet 7	Eyelet 8
Filter 3	Eyelet 9	Eyelet 10
Filter 4	Eyelet 15	Eyelet 16
Filter 5	Eyelet 13	Eyelet 14
Filter 6	Eyelet 17	Eyelet 18
22k resistor	Eyelet 1	Eyelet 2
22k resistor	Eyelet 3	Eyelet 4
22k resistor	Eyelet 5	Eyelet 6
10k resistor	Eyelet 19	Eyelet 20
10k resistor	Eyelet 21	Eyelet 22
10k resistor	Eyelet 23	Eyelet 24
Jumper	Eyelet 9	Eyelet 11
Jumper	Eyelet 11	Eyelet 8
Jumper	Eyelet 11	Eyelet 13
Jumper	Eyelet 13	Eyelet 16
Jumper	Eyelet 16	Eyelet 18
Jumper	Eyelet 2	Eyelet 4
Jumper	Eyelet 4	Eyelet 6
Jumper	Eyelet 6	Eyelet 24
Jumper	Eyelet 24	Eyelet 22
Jumper	Eyelet 22	Eyelet 20
Jumper	Eyelet 1	Eyelet 10
Jumper	Eyelet 7	Eyelet 3
Jumper	Eyelet 12	Eyelet 5
Jumper	Eyelet 17	Eyelet 23
Jumper	Eyelet 14	Eyelet 21
Jumper	Eyelet 15	Eyelet 19

This side of the filter deck is the side on which the filters and resistors are mounted. Consult instructions and photos for details. Dotted lines are jumpers on opposite side of base.





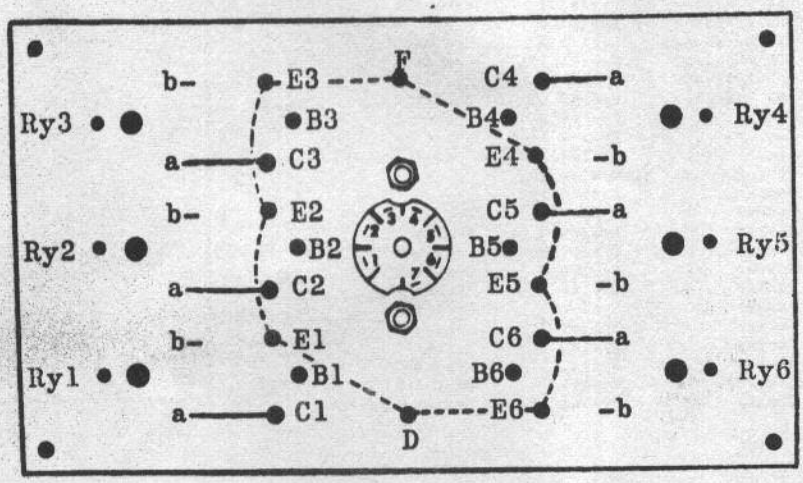
RELAY DECK ASSEMBLY

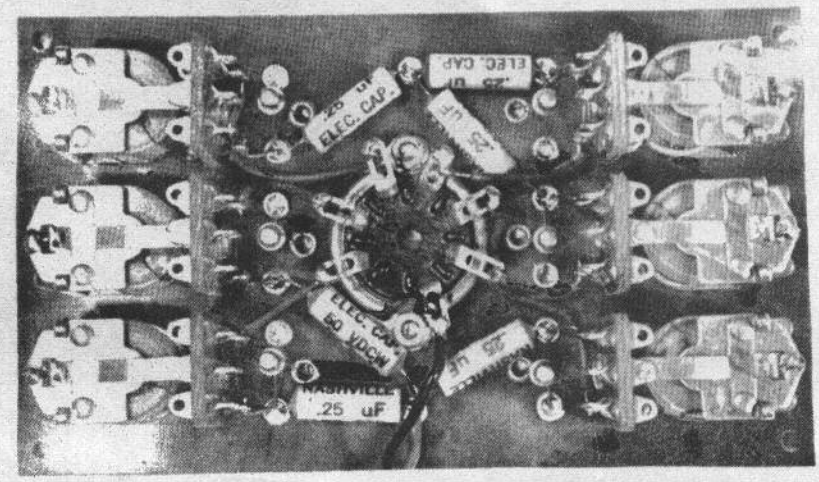
Begin assembly of the relay deck by referring to its layout drawing and then mount the seven pin socket on the base with two 2/56 bolts and nuts. Before the relays are mounted on the base they should be connected to a battery in series with a pot and meter and adjusted to pull in with a current of 2 ma. Mount the six relays in their places with the 3/48 bolts and begin wiring. When wiring, follow the layout drawing and connection chart closely making sure to observe correct polarity of the electrolytic capacitors and proper orientation of the transistor leads. Refer to the transistor base drawing for clarification of the latter point. When soldering the transistor leads, hold each lead with a long nose pliers as it is soldered to prevent damaging the transistor by overheating. All jumpers on the relay deck should be made with the solid hook up wire provided. After wiring of the relay deck has been completed, the two decks may be wired together.

RELAY CHASSIS

COMPONENT	CONNECTS FROM	TO
Jumper	Relay 1a	Eyelet C1
Jumper	Relay 2a	Eyelet C2
Jumper	Relay 3a	Eyelet C3
Jumper	Relay 4a	Eyelet C4
Jumper	Relay 5a	Eyelet C5
Jumper	Relay 6a	Eyelet C6
Jumper	Eyelet D	Eyelet E1
Jumper	Eyelet E1	Eyelet E2
Jumper	Eyelet E2	Eyelet E3
Jumper	Eyelet E3	Eyelet F
Jumper	Eyelet F	Eyelet E4
Jumper	Eyelet E4	Eyelet E5
Jumper	Eyelet E5	Eyelet E6
Jumper	Eyelet E6	Eyelet D
.25 electrolytic	Eyelet C1	Eyelet D
.25 electrolytic	Eyelet C2	Eyelet D
.25 electrolytic	Eyelet C6	Eyelet D
.25 electrolytic	Eyelet C3	Eyelet F
.25 electrolytic	Eyelet C4	Eyelet F
.25 electrolytic	Eyelet C5	Eyelet F
Jumper	Relay 1b	Meter socket 1
Jumper	Relay 2b	Meter socket 2
Jumper	Relay 3b	Meter socket 3
Jumper	Relay 4b	Meter socket 4
Jumper	Relay 5b	Meter socket 5
Jumper	Relay 6b	Meter socket 6
At this point solder all servo wires to the relay contact lugs before soldering transistors in place.		
TR1 Collector	----------	Eyelet C1
TR1 Base	----------	Eyelet B1
TR1 Emitter	----------	Eyelet E1
TR2 Collector	----------	Eyelet C2
TR2 Base	----------	Eyelet B2
TR2 Emitter	----------	Eyelet E2
TR3 Collector	----------	Eyelet C3
TR3 Base	----------	Eyelet B3
TR3 Emitter	----------	Eyelet E3
TR4 Collector	----------	Eyelet C4
TR4 Base	----------	Eyelet B4
TR4 Emitter	----------	Eyelet E4
TR5 Collector	----------	Eyelet C5
TR5 Base	----------	Eyelet B5
TR5 Emitter	----------	Eyelet E5
TR6 Collector	----------	Eyelet C6
TR6 Base	----------	Eyelet B6
TR6 Emitter	----------	Eyelet E6

This side of the relay base is the side on which relays mount. Mount 7 prong socket so that lugs are on this side. Consult instructions and photos for additional details. Dotted lines are jumpers on opposite side of base.





FINAL WIRING AND ASSEMBLY

Connect one end of the 12 inch green flexible wire to eyelet 4 on the coil deck. This lead will be used to feed the six relay stages from the detector and audio amplifier portion of the receiver. Connect one end of the 12 inch black flexible wire to pin seven of the seven pin meter socket on the relay deck. Connect one end of the 12 inch red flexible wire to eyelet D on the relay deck. These two leads will be used to connect the filter-relay section to the B battery. Connect a 3 inch length of the white flexible wire from eyelet 5 on the coil deck to eyelet B1 on the relay deck. Connect a 2½ inch length of white flexible wire from eyelet 3 on the coil deck to eyelet B2 on the relay deck. Connect a 3 inch length of white flexible wire from eyelet 1 on the coil deck to eyelet B3 on the relay deck. Connect a 3 inch length of white flexible wire from eyelet 19 on the coil deck to eyelet B4 on the relay deck. Connect a 2½ inch length of white flexible wire from eyelet 21 on the coil deck to eyelet B5 on the relay deck. Connect a 3 inch length of white flexible wire from eyelet 23 on the coil deck to eyelet B6 on the relay deck. Connect a 2 inch length of white flexible wire from eyelet 16 on the coil deck to eyelet F on the relay deck. This completes the wiring of the filter relay section.

Connect all seven pins of the seven pin plug together. This plug is used as a shorting plug for the meter socket when the meter is not in use.

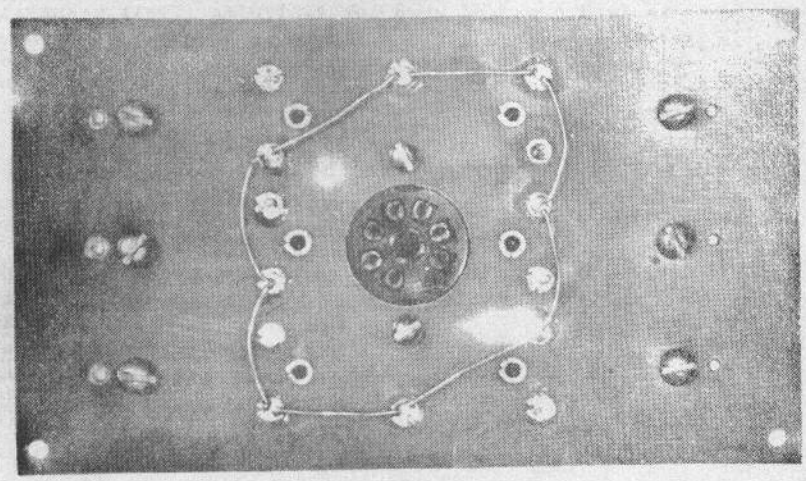
The coil and relay decks should now be bolted together. Insert the 3/48 x 1 inch bolts through the 1/8 inch corner holes on the coil deck and place the four spacers over the bolts. Thread the 3/48 bolts into the 3/32 inch corner holes on the relay deck. The unit is now ready to be tested.

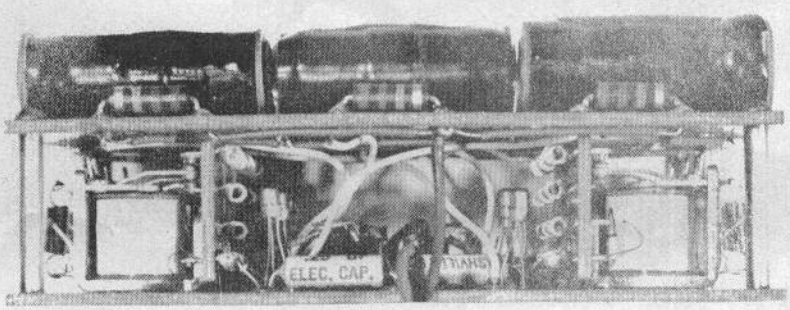
TESTING

Connect the detector-audio amplifier and filter-relay section to the batteries and tune the detector as explained in its instructions. Connect the green wire from eyelet 4 on the coil deck to eyelet G on the detector base. Plug the MarcyTester into the seven pin meter socket and rotate the selector switch through all six positions. The meter should indicate idling current of only slightly above zero on all six channels with no audio signal from the transmitter. If you do not have the MarcyTester any other 0-5 ma meter can be used by connecting its negative terminal to pin 7 of the meter socket and its positive terminal to any of pins 1 through 6, depending upon which channel you wish to meter. Turn the selector switch on the MarcyTester to channel 1, or connect the positive terminal of your meter to pin 1 of the meter socket. Press the channel 1 pushbutton on the transmitter control box and adjust the channel 1 frequency control slowly until the meter indicates maximum. If you get no indication on the meter, check the tuning procedure for the detector to make sure it is correctly tuned in. The maximum reading on the meter should be from 4 to 5 ma. Turn the selector switch on the MarcyTester to channel 2, or connect the positive terminal of your meter to pin 2 of the meter socket. Press the channel 2 pushbutton on the transmitter control box and adjust the channel 2 frequency control slowly until the meter reads maximum. Adjust the remaining channels using the same procedure. After the frequency controls on the control box have been adjusted, they may be covered with the control guards to prevent accidentally changing the settings. If everything works up to this point, the receiver should be ready for installation in the model.

PARTS LIST

Quan.	Description	Quan.	Description
	FILTERS		TRANSISTORS
6	Selective audio filters	6	T0037 Transistors
			Relays
	CAPACITORS	6	Gem 5K standard
6	.25 mfd electrolytics		WIRE
		1	18" length solid
	RESISTORS	1	18" length flexible white
3	22K		
3	10K	1	12" length flexible red, black and green
	HARDWARE		
2	2/56 x 1/4 bolts		MISCELLANEOUS
2	2/56 nuts	1	7 pin socket
4	3/48 x 1 bolts	1	7 pin plug
4	Spacers	1	Coil deck base
6	3/48 x 1/4 bolts	1	Relay deck base





Trade Notes

NEW ITEMS OF INTEREST

TR 4.5 Parts Package

The all transistor receiver--TR 4.5--shown elsewhere in this issue is sure to appeal to the advanced radio control enthusiast. It's many fine features, including reliable operation over wide temperature ranges, high current change, ultra economical operation, is sure to win many friends. To assist the advanced builder in making his unit a complete parts package is made available, along with instructions. All required components have been assembled and the total price is less than if parts were purchased individually. The package includes 3 CR60 transformers, special Gem relay, four transistors, including a specially hand selected and tested A01 to insure operation at 27¼ megacycles. L1 and L2 are completely wound. A special ferrite core RFC to insure small size is included. Ohmite 1/10th watt resistors and Goodall capacitors are used throughout. A special alumited case is also supplied to make a compact unit measuring 2 x 2 7/8 x 3/4". The price represents an important breakthrough for this type of equipment, being only $22.95. This also is the FIRST all transistor receiver kit available anywhere. It is not recommended for the beginner or the fan with limited radio experience. It will be available only from Ace R/C, by special arrangements with designers Don Kamm and Red Costlow. This is another Ace exclusive Designer Approved kit.

Special Compact Power Supply

Essco announces a special compact power supply to eliminate the expensive A and B batteries used to power most audiotone and multi-channel reed transmitters.

Output voltage is completely filtered and regulated to better than 1%, which is superior to even that obtained from heavy duty batteries.

Unit operates from a 2 volt wet cell and will also deliver the 1½ volts for the transmitter tube filaments.

One standard type fits the Bramco 5-8-10 channel transmitters, the Citizen-Ship MST-8 and Orbit 5-8 channel reed transmitters. Can also be used to power the Deltron T109 Tonemaster transmitter.

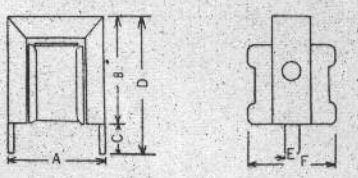
Power unit weighs approximately three pounds and is only slightly larger than the batteries it replaces. Compactness of unit allows space in the Bramco case for a BB54A wet cell. List price is $17.95. Electronic Specialty Supply Company.

New Gem Relay

Jaidinger Manufacturing Company, makers of the Gem relay which is so popular in R/C use, announces their new ER type relay. Configuration and weight are very similar to the standard Gem, but spring is of the type used on the old Price job. Pull in is 3.5 ma and drop out is 1.0 ma. This means it will probably find use only in transistorized circuits where an excess of current change is available. Coil is 5k.

The really newsy part about the new Gem ER, however, is its price. It will carry a consumer net tag of less than $2.50, which is very reasonable considering a general price rise in other electronic materials.

CR60--Transistor Transformer



With transistors finding an ever increasing use in R/C, the announcement from CalRad of their CR60 at a consumer net of $1.63 is good news. This imported job measures as follows A--1/2; B--9/16; C--1/8; D--11/16; E--1/16; F--9/16". Input is 20,000 ohms, output is 1,000 ohmes. The core is a heat treated permalloy. Winding coil is specially coated and a high vaccum impregnation is used to insure high resistance to moisture or chemical corrosion. Ace R/C.

PC BOARD FOR TRANSISTORIZED WAG RECEIVER

THE PLAY IS FROM HERZOG TO WINBY TO BERTRAND

Gerald Herzog's "Shrinking The WAG TTPW" which appeared in the December 1957 issue of the American Modeler created quite a bit of interest. It cut filament drain way down and had the possibility of using the system in much smaller planes.

In Grid Leaks Volume 1, Number 3 Douglas McMulkin's Printed Circuit boards were presented and much interest was evinced.

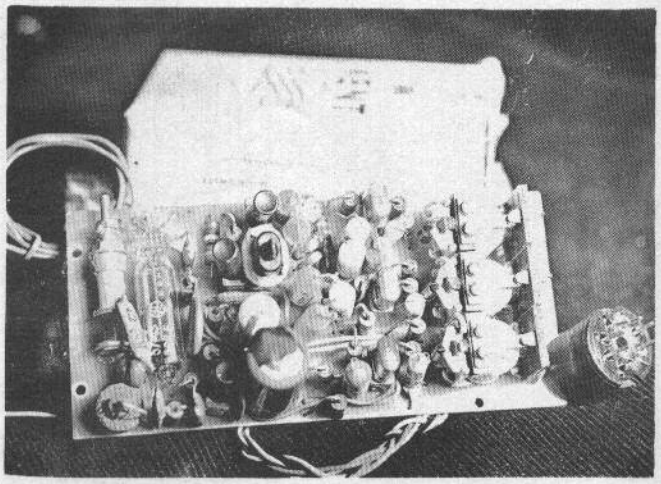
However some receivers did not perform up to snuff with the circuit as provided and Ivor Winby came to the rescue saying that C12 and C18 should be changed to 3mf instead of 10. This cured the tendency for the units to go nuts on fail safe without provocation. Also the removal of R10, R12, and R16 was recommended to provide a greater current change for added reliability.

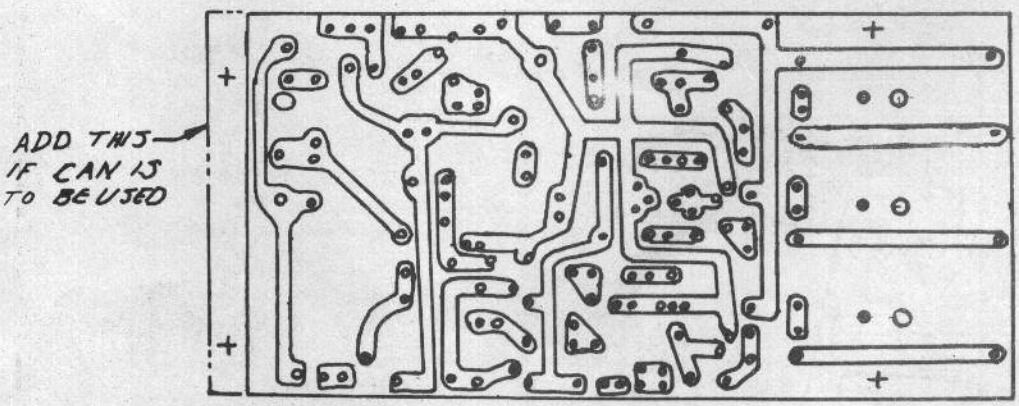
Bill Bertrand of Allen Park, Michigan took this revised version and came up with a beautifully engineered printed circuit board. A study of the drawings will show this is a beautifully laid out job and not complex.

The PC base is shown full size. It is recommended that Epoxi Fibre Glass base material be used. The base may be stripped using an Exacto type blade, or strips of 1/16" resist tape laid down and then etched in Ferric Chloride or Ammonium Persulphate. If more details on making printed circuit bases is desired why not write and request an article on it.

The parts placement drawings are self explanatory. A small aluminum base may be made to facilitate mounting.

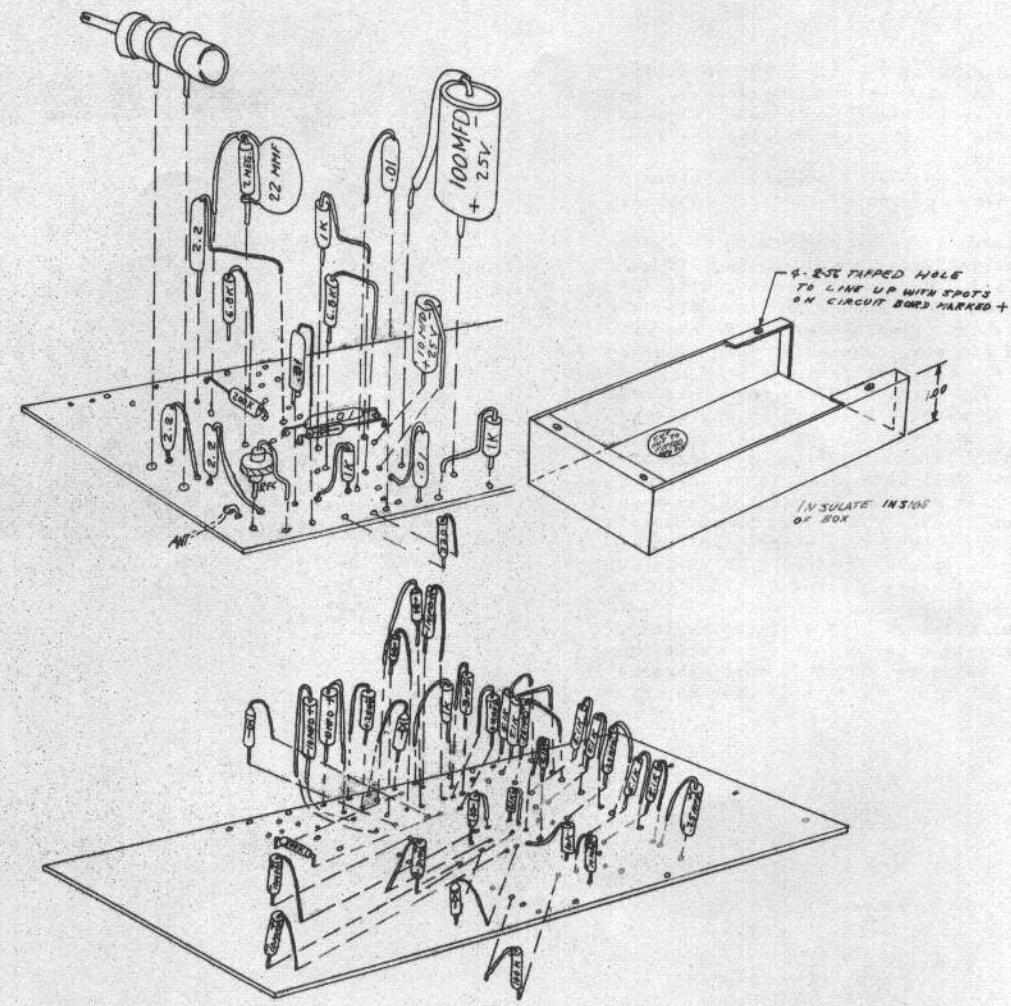
NOTE: (Instead of using two 50 mf 50 volt electrolytics, Bill used one 100 mf. This gives same capacitance in less space.)

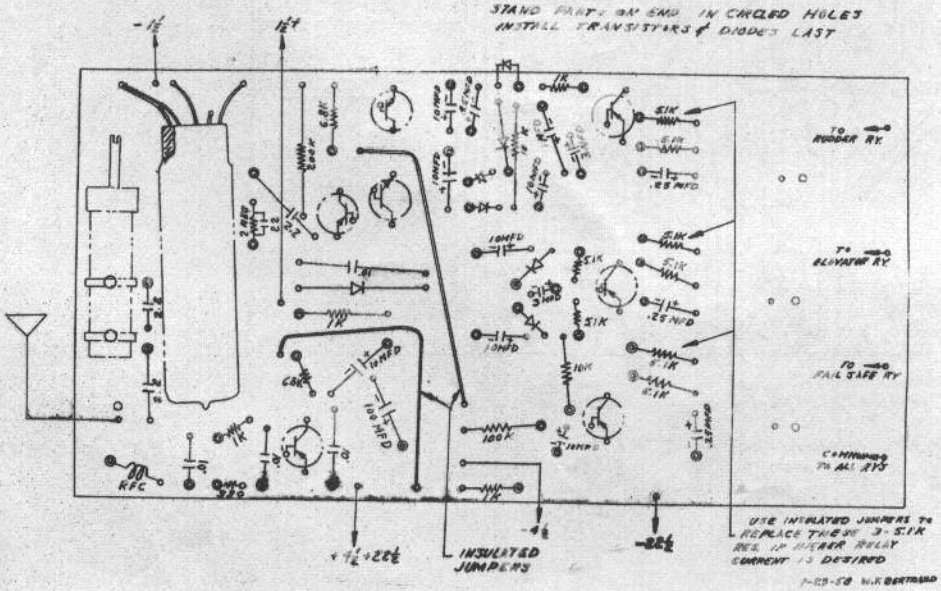




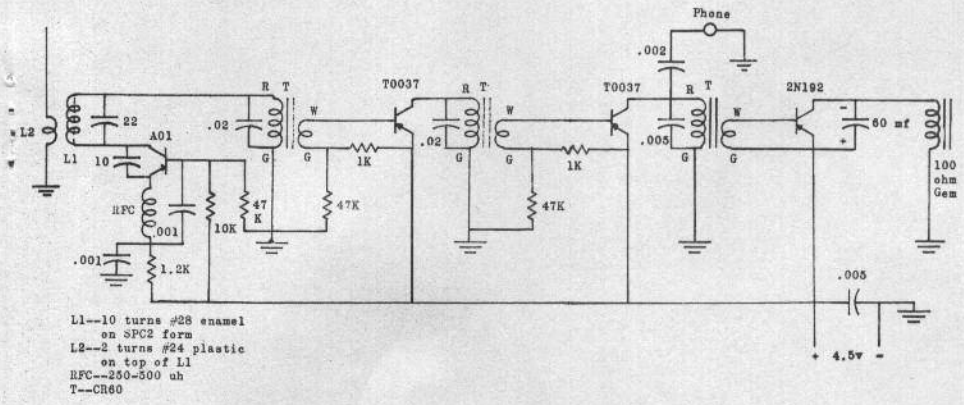
FULL SIZE VIEW
OF PRINTED SIDE
OF BOARD

1-29-58 W.F. BERTRAND

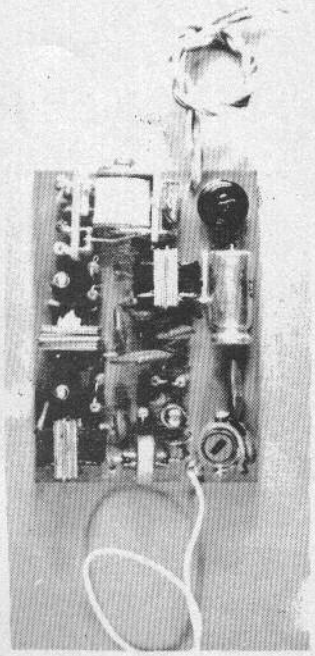

100MFD
22 MMF
4-8-32 TAPPED HOLE TO LINE UP WITH SPOTS ON CIRCUIT BOARD MARKED +
INSULATE INSIDE OF BOX


STAND PARTS ON END IN CIRCLED HOLES
INSTALL TRANSISTORS & DIODES LAST
TO RUDDER RY.
TO ELEVATOR RY.
TO FAIL SAFE RY
INSULATED JUMPERS
USE INSULATED JUMPERS TO REPLACE THESE 3-5.1K RES. IF RELAY CURRENT IS DESIRED

TR 4.5--Fabulous All Transistor Receiver



L1--10 turns #28 enamel on SPC2 form
L2--2 turns #24 plastic on top of L1
RFC--250-500 uh
T--CR60



Before you start assembling your receiver may we pass on some information and a few tips. The TR 4.5 is an all transistor receiver operating on 4½ volts! No expensive B batteries or converters. This is achieved through the use of a low resistance, high current relay. With no signal the receiver idles at approximately 10 mils. Carrier drops this to 2-3 mils and a 400-500 cycle tone produces a rise to 40 mils for really reliable relay operation.

The A01 detector used is equal to or exceeds tube detectors for sensitivity and eliminates the need for high plate voltages.

Probably the greatest pleasure we've had with the TR 4.5 is with temperature stability. The receiver responded perfectly from 15 degrees to 130 degrees Fahrenheit. How much lower in temperature it will go we do not know and we doubt if we'll be out to check this! Our final submini receiver weighed in at 1½ ounces and you should have no trouble at a little better than two ounces with no miniaturization.

In construction we can not stress enough proper handling of the transistors. Not using heat sinks when soldering in the transistors or wrong polarity will ruin them for sure. We use 3/16" lengths of spaghetti for "stand offs" on the transistors. This protects the leads and makes it easier to install them. Install the transistors last and only after you've carefully checked your wiring.

Tuning up is a simple matter. We prefer to use a crystal earphone but other methods are okay. Long meter leads are taboo!

Listen for the conventional rushing noise and with carrier on tune the slug until the hiss disappears. Key the audio and it should be loud and clear. After this step, range check and touch up the tuning with tone. Tune for the loudest tone. Most of the conventional tone transmitters of 100 percent modulation will operate the TR 4.5. In some instances the receiver may swamp within a couple of feet of the transmitter. Back off a few feet. When the TR 4.5 is at idle (no carrier) the relay may occasionally chatter. This is normal and will cease when the RF is on. A crystal earphone is also nice for trouble shooting. Merely touch a tip to various stages of the receiver and you can hear the hiss (or tone). With any high gain receiver any noise spikes caused by rubbing metal may cause interference and can be easily cured by bonding or insulating the offending parts. This will be in rare cases.

When the temperature rises so does the idle current. If you don't want fail safe action and operate in the warmer climates, set the relay to pull in above idle current. As the relays come they pull in at approximately 12 mils.

If you use a plastic case for the TR 4.5 you can mount four 100 ma Voltablocks in the cover for an integral power supply.

It is quite possible to make the TR 4.5 smaller. This is not recommended for the beginner. The prototype measures 5/8 x 1 1/2 x 1 7/8 in a can (smaller than a book of matches) and we pass on this information for those with patience and the need for smaller size and lighter weight. The frames of the CR60's are removed and the transformers fastened to the base with light buss wire passed over the laminations. Don't crowd them too closely or you will get interaction. The length of the SPC2 can be cut down to fit in tighter quarters. If you are really pressed for space try the CTC SPC1-4L. It is a lot smaller but more fragile. Finally, leaving off the can (or plastic case) and potting the receiver to foam rubber will save space and weight. This leaves the receiver unprotected and should be used as a last resort. By careful planning and good workmanship the TR 4.5 can be built to weigh 1½ ounces.

We feel the TR 4.5 will open many new phases of R/C. The 1/4A fan can now build an R/C ship well under 10 ounces (we have a Cox PeeWee job at 8½ ounces). The endurance man can really log time. With 500 ma Voltablocks, minimum duration would be over 12 hours. This would be with a continuous tone and the transmitter would give out first. On the average, you could expect about 20 hours! For just plain R/C we think you'll enjoy the economy and ease of operation of this receiver.

We wish to thank the Minneapolis and St. Paul R/C men for their encouragement and Ace Radio Control for their selection of components in the TR 4.5 kit.

Happy landings!