GRID LEAKS

VOLUME I NUMBER 2

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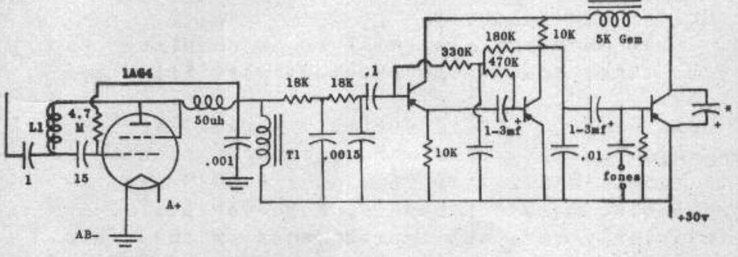
R/C DATA SERVICE

PUBLISHED BI-MONTHLY AT HIGGINSVILLE, MO.

SHORT CIRCUITS

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

TRANSISTORIZED AUDIO RECEIVER



The above circuit is one being flown very successfully by Max Boal of Kansas City, Missouri. It was developed by Walt Brockman an electronics engineer.

It is an audio receiver requiring 100% modulated signal but the beautiful part of it is that any one of five different transistors seem to work well in the circuit. The ones tested were the CK722, 2N191, 2N192, 2N188, and 2N188A.

L1 is 36 turns of #32 on 1/4" CTC red dot core form. T1 is an audio choke with a UTC SS05 or a half of a UTC SS03 suggested. Max says there are some surplus audio transformers on the market which have a DC resistance of 3K to 4K and he finds these also work well besides being much lower in price.

The capacitor marked X at the transistor on the final stage will need to be varied from .25 to 1 mf at 50V. .25 is for fast pulsing. .4 will be found good for averages and 1 mf is for high rise on signal but will not pulse.

The circuit is temperature compensated and reliable in operation.

CHANGING WAG PULSER RATE

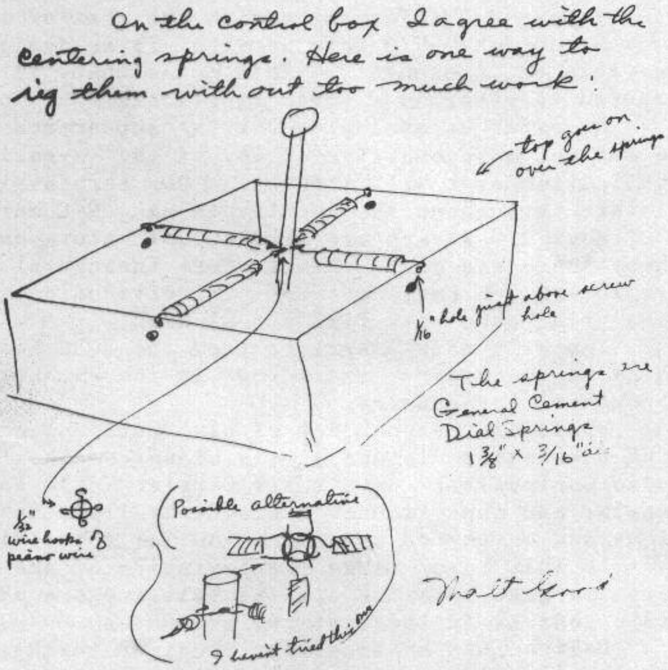
Some of the pulsers for the WAG TTPW system are reported operating at too high a pulse rate and can not be slowed down to the required 2 cps. In the event that any of our readers have encountered this difficulty it may be quite simply cured by changing part number 6 from a 100K to 330K. This will appreciably slow down the pulse rate and be adjustable within the ranges as required and as stated in the original article.

PULSING THE DELTRON R109

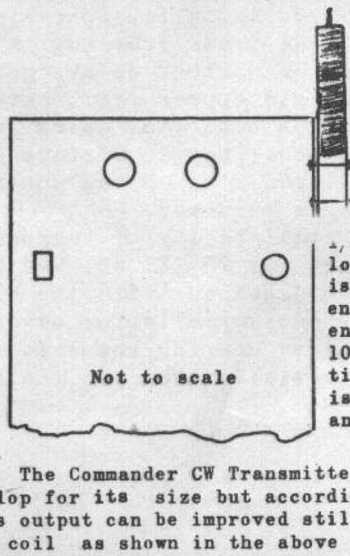
When the Deltron R109 All Transistor receiver first appeared it offered many fine features, only 1 22½ volt battery required, weight with battery could be as low as 3 ounces, current change was from ½ to 4 ma on signal -- and the escapement boys were happy. Not so with the proportional boys who found receiver would not follow the pulsing. From Howard McEntee now comes the news that it CAN be pulsed. Simply adjust relay to pull in at 2½ ma, and it will go from 3-15 pulses per second--should make it fine for both pulse width and rate.

SPRING LOADED CONTROL BOX

From Walt Good comes the sketch which shows how centering springs may easily be added to the WAG Dual control box or Stick-trol in this issue.



LOADING COIL FOR COMMANDER



1/2" diameter plastic rod 6" long is bolted to side. It is wound with 65 turns of 24 enamel wire closewound. One end connects to transmitter 10 mmf, other end to 3' section music wire antenna. Rod is drilled for press fit on antenna.

The Commander CW Transmitter packs a considerable wallop for its size but according to one of our readers this output can be improved still more by use of a loading coil as shown in the above sketch. Unfortunately, we do not have the name of the sender since the letter was unsigned. We do know it originated in New Mexico. Thanks Mr. Anonymous Contributor.

GRID LEAKS

THE MAGAZINE DEVOTED EXCLUSIVELY TO RADIO CONTROL

HIGGINSVILLE, MO.

Dear Subscriber:

Here is the second issue of Grid Leaks coming your way. The reaction to Volume One, Number One has been most heartwarming. Comments range from "Congratulations", to "It's wonderful", "Enjoyed it", all the way to "Grid Leaks is a dud, I have seen better high school papers". The most lavish praise was from a beginner who said the R/C Glossary was worth fifty dollars to him.

We need your circuits, we need your kinks, we need your diagrams. Won't you share your your latest R/C information with the rest of the Grid Leaks readers?

Grid Leaks--R/C Data Service is so designed that each article will be as complete as possible on one sheet. This means that it may be taken apart and each article filed and grouped together in a three ring loose leaf notebook.

We offer no apologies for the appearance of Grid Leaks. It is strictly a Data Service. We are not a competitor of any of the magazines which go into far more coverage than this publication ever will attempt. Our purpose is to have a sharing of knowledge by R/C experimenters throughout the country to make R/C more reliable, more dependable, more versatile.

Most R/C flyers are also experimenters and invariably work out improvements on their own. Where there are clubs this is done through club publications or in club meetings. Many R/Cers are loners or small groups of individuals not having access to clubs and this is where we hope Grid Leaks will fill a real need.

You will note reprints from the DCRC Newsletter. It will be our policy to share anything we consider outstanding in the exchanges that we have with many of the club papers throughout the country.

While on the subject of club publications, we can heartily recommend these to you. The DCRC Newsletter is one of the oldest. The Larks in Los Angeles publish one, the East Bay Radio Controllers have their Carrier, the San Leandro Channel Masters have their Channel Chatter and the Pioneer Radio Controllers have their Modulator. All are excellent publications and worthy of consideration for the serious R/C fan.

As this issue marks the beginning of the new year for radio control, we are going to attempt to gaze into the crystal ball and see which way the transistor bug is going to jump in radio control in the next twelve months.

Deltron has an excellent receiver in their R109 which uses only one 22½ volt battery and requires an audio tone of approximately 500 to 600 cycles per second.

B & S has or will shortly announce a hybrid type using vacuum tube and a power converter, but requiring only three volts for operation.

Which direction the transistor bug is going to jump, whether we are going to completely eliminate A batteries or whether we are going to completely eliminate B batteries seems to be the big choice. It would appear from where we sit that the most economical approach would be the elimination of the B batteries using power converters.

Experiments are under way in various sections of the country for good power converters, simpler and lower priced. B & S has one at $15.95 in three models which will produce either 30, 45, or 67½ volts as required.

In view of the availability of inexpensive Nicads known as the CG [illegible] tablock in .25, .5, and .8 ampere hours at $1.75, $1.95, and $4.95 respectively, it would appear that the most economical flying could be had with the elimination of the relatively expensive B batteries going to the Nickle Cadmium cells for power.

We would appreciate hearing comments from you stating your opinions.

Also ideas for articles that you would like to see would be appreciated.

Yours sincerely,

Paul

Paul F. Runge

Editor

HERE NOW!--Inexpensive Rechargeable Batteries

THREE SIZES SUIT RC NEEDS

Many R/C fans have longed for a rechargeable A battery that was also reasonable in price and also was not so relatively fussy as to charge and discharge rates. But until recently that dream has been beyond the average R/Cer's pocketbook.

Good news, however! The CG Voltablock Nickle Cadmium batteries appeared on the R/C market late in 1957. These are of the button type and also the flat type. Available in three different sizes they appear ideal for R/C and unlike other rechargeable cells of this type are indefinite in their life in a discharged condition.

They are also not erratic as to taking charge and discharge cycles as some of the less expensive lead acid cells of the Magnalux or the Rulag type.

These cells, while marketed under the CG Electronics trademark, are the Saft Nicads and have been extensively tested and have been found suitable for both filament and actuator use in units up to and including the WAG Dual system. As a matter of fact, a number of the units were being used in the DCRC area with exceptional success.

They are hermetically sealed with a nickle cadmium centered plate. The button type are smaller than a silver dollar and offer unlimited possibilities as to R/C use.

We will discuss the characteristics of the three types separately. The VO.250 has a voltage rating of 1.2 volts, has a capacity of 250 milliampere hours and needs to be recharged at 5 to 25 mils. Trickle charge rate is 2 to 5 mils. Cell voltage during the charge is 1.4 volts. Maximum peak discharge current that this cell will allow is 5 amperes. The VO.250 weighs .5 ounces, is .1875 inches thick and is 1.375 in diameter. Price is $1.75.

The VO.500 has a capacity of 500 mah, a voltage of 1.2 volts, charging current is from 1 to 49 mils, trickle charging rate 5 to 10 mils, cell voltage during charge is 1.4 volts. Maximum peak discharge current is 7.5 ampere hours. The VO.500 weighs .75 ounces, is .3125 thick and 1.375 inches in diameter. Price is $1.95.

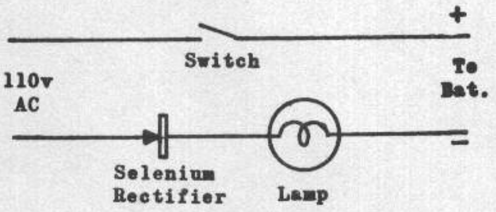
The VO.8 has a capacity of .8 ampere hour, voltage is 1.2 volts, mechanical specifications are three inches long including two screw terminals, 1-7/16 inches wide and 5/16 inches thick. The weight is 1.5 ounces. No charge and discharge information is definitely available from CG on this yet but will be very shortly. Price is $4.95.

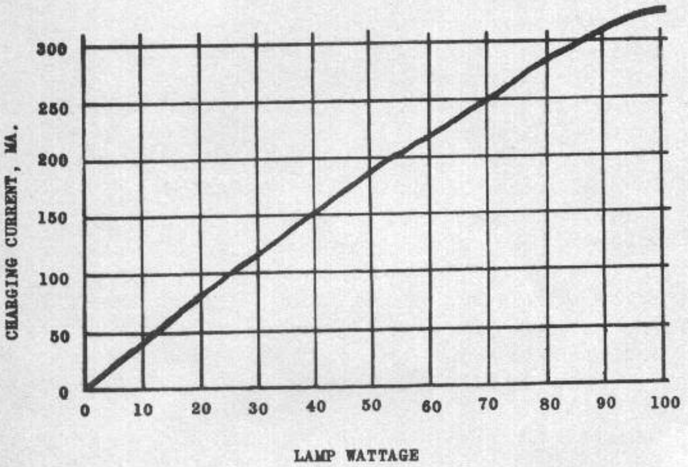
As they are supplied the cells come in a discharged condition. If the cell is to be maintained at a full charge a trickle charge rate can be used indefinitely. Just glancing at the charge rates for the VO.250 and the VO.500 a guess would be that a trickle charge rate for the VO.800 would be in the order of 8 to 15 mils.

Probably the most frequently replaced batteries in any R/C installation are the A and the actuating batteries. The shelf life of pencells is such that by the time of purchase a battery can go down rather rapidly and deteriorate much more quickly than is desirable. Where very low filament drains are to be had with some of the transistorized equipment, the .250 ampere hour would do a very respectable job. If the filament drain for instance were only 13 mils as with the 6007 detector in the transistor amplifier. This would be good for almost twenty hours of operation.

Under actuating conditions and where greater life is desirable, of course, the VO.800 furnishes the ultimate. So you just pays your money and take your choice.

In the November, 1957 DCRC Newsletter there appeared a simplified charger by Bill Grogan for these cells as well as the other cells of this type such as Silvercels.





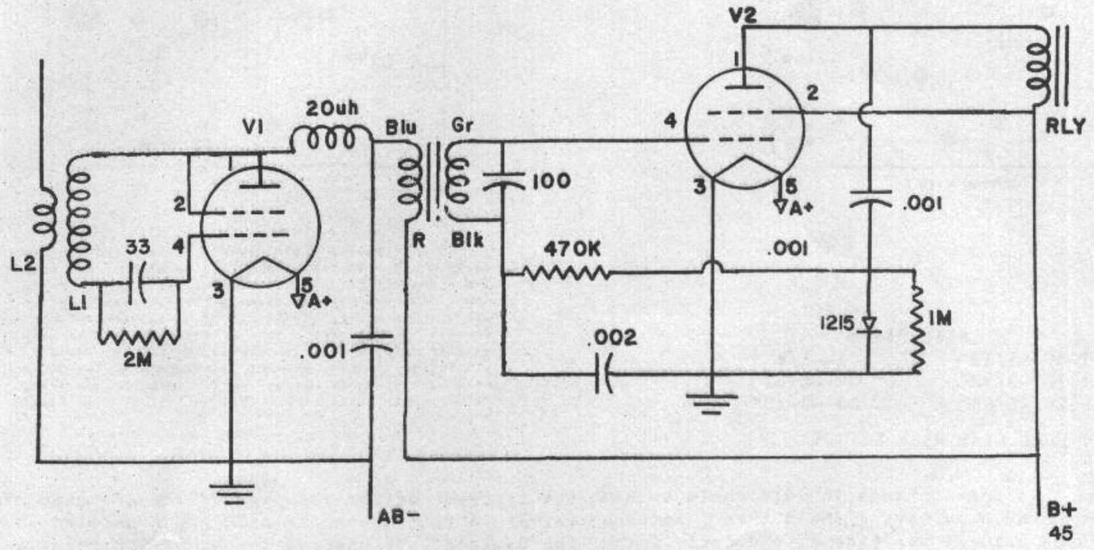
Above chart gives lamp wattage required to get a desired rate of charger. Simply select wattage nearest rate desired.

Investigation of various type of chargers in the DCRC area indicated that a constant current inexpensive charger would enable an even more wide spread use of rechargeable cells. The following circuit and information is presented. The Rectifier is a standard television type of 300 to 500 ma currently available from Electronic Wholesalers. The lamp is mounted in a porcelain socket and the wattage size is chosen to give the required charge current. For example, to charge a Saft cell, Type 1 - VO.8 or up to six in series a 75 watt lamp may be used with a charge rate of 275 mils for 2 hours and 40 minutes followed by a 15 watt lamp with a charge rate of 60 mils for 5 hours. Because of the high voltage source a constant current is ensured and any number of cells up to six in series may be charged with very little change in the charge rate. The chart below will give you the different charging current that may be had by inserting a different wattage lamp.

Care must be used in the use of this charger, however, to avoid touching the contacts inasmuch as there is no isolating transformer between this and the 110 volt AC. This could give quite a nasty shock particularly if this were used on a concrete floor of a basement.

CONVERTING THE TECH TWO TO 27

NO SENSITIVITY ADJUSTMENT, CURRENT RISE, TEMPERATURE STABLE



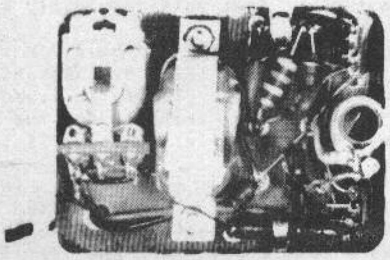
When Howard McEntee published the circuit for the Tech Two in the 1957 Air Trails Model Annual there was an assurance given that a 27¼ megacycle version would be forthcoming. It was awaited with a great deal of interest. However, the development of the 27¼ version has been delayed in publication. In view of this fact as well as the fact that there seems to be such a tremendous amount of interest in the 27¼ MC version, we tackled it to see what could be done.

The tackling was spurred by a special transformer commercially wound for us by Jaidinger Manufacturing Company, manufacturers of the Little Gem relay. This gave uniform results in our testing the 50 mc version and we felt would do the job on 27¼.

A glance at the circuit shows that it is quite simple using a superregen detector, transformer coupled to a relay tube. The feed back circuit is used on V2 which picks up some of the audio this tube amplifies, rectified it, and applies it to the grid. The heart of the receiver is the special transformer. The receiver operates by virtue of the hiss produced by V1. The hiss is high frequency but quite audible. You can hear it with a pair of head phones across the secondary of the transformer. This is stepped up by the 1 to 4 ratio. V2 amplifies this hiss, picks it up off of the plate circuit, goes through the diode rectifier and turns it into DC. The result is negative and this holds the grid of V2 through the secondary of the transformer. V2 is biased to a low plate current with no signal and relay remains open. An incoming signal will stop the hiss from V1; V2 will lose its bias and plate current rises closing the relay.

In designing the unit for best operation on 27¼ mc, a choice had to be made on the tubes to be used. Since the 1AG4 was in short supply at the time of the design, as well as increased in price, we looked around. A new tube had appeared in the R/C field in late 1957. This was the Amperex 6007. Walt Good had tested it in the TTPW receiver and found it worked as well or better than the 1AG4 with no circuit changes. So it seemed natural to change the tank circuit to one used by the WAG Dual. This was 34 turns of #32 on a CTC LSM red dot core form.

Tests were made and indications were that this was the answer for the front end, with the exception that for this circuit, link coupling would likely have to be increased. The original circuit used only 1 turn of #24 plastic insulated wire in the center of the coil on 50.

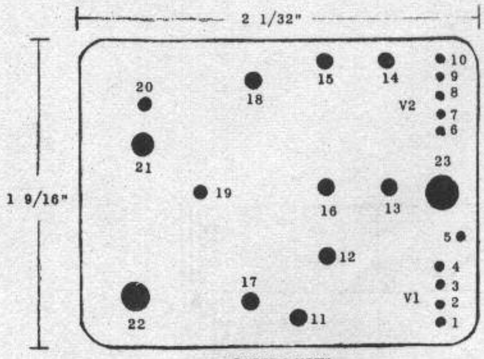


While the finished package is small, wiring is relatively easy if the sequence of building suggested in the article is followed.

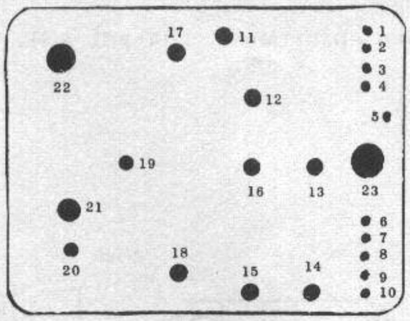
In looking about for a tube for the second stage, a number of reliable relay tubes for other circuits were tried with mediocre results. The 1AG4, CK526, CK5672--all wanted to work and did to a degree, but the combined idle of the two tubes was too high. The Sonotone Co., manufacturers of hearing aids had sent us some of the tubes they make in our endeavor to always find new items. These were tried and things looked up! But good!

With the P4-R Sonotone tube here were the results. Combined idle was on the order of .8 to 1 ma depending on antenna coupling and other factors. On signal from a weak transmitter this jumped up to 3 to 4 ma really clacking the relay in heftily.

With this tube combination, we had a fabulously low filament drain. The 6007 uses 13 ma., while the P4-R draws only 32 ma. This is a total of 45, or 35 less than if two 1AG4 tubes had been used.



BOTTOM VIEW



TOP VIEW

The January, 1958 issue of American Modeler shows another approach to a 27¼ version of the Tech Two. However, since that original article was written, Raytheon has announced price increases of the CK533 to a net of $3.95 and $5.85 for the CK5854. In view of this fact, this article was left as originally written since in checks in various parts of the country, the component listings and the tubes used have given excellent performance besides being relatively inexpensive. Net on the 6007 is $1.95 and on the P-4R is $2.95.

Hole Sizes	
1-10--1/16"	21--1/8"
11-18--3/32"	22--5/32"
19,20--5/64"	23--3/16"

FULL SIZE BASE LAYOUT

It was found that some change in idle could be had as well as current change by moving the 5 turn antenna coupling coil to the grid or top side of the coil form. Coupled very tightly this gave the best results.

Acceptance of pulsing was tried. It was found that receiver would accept quite fast pulsing cleanly without lags.

Begin construction by cutting the base for the receiver. The base is cut out of 1/16" Synthane base material to the dimensions shown. The full sized base layout can be used as a drilling template for the holes. 3/32" eyelets should be placed into holes #11 through #16.

Before actual construction of the receiver is begun the location of holes should be marked on the top of the plastic box used to house the receiver. The receiver base can be used as a template to mark and drill holes in the box. The base should be placed inside one lid of the box with the top side of the base against the box. After wiring is completed the tubes are mounted on the outside of the box so slots must be cut in the top of the box for the flea clips. Holes should be drilled for the coil and relay mounting holes 23 and 21 respectively. These will be used to hold the receiver to the inside of the box. Drill holes to pass the receiver hook up cable at 22 and antenna lead at 5. Drill a 3/32" hole above 19 which is used to mount the tube hold down strap. Drill 5/32" holes in the box above 17 and 18 which are used to mount the transformer. This will allow the heads of the transformer mounting bolts to seat in the top of the plastic case.

Parts may now be mounted on the receiver base. Insert the flea clips into holes 1 through 4 and 6 through 10 from the top side of the base. Mount the relay in holes 20 and 21 and the tank coil in hole 23 on the bottom of the base. The transformer is mounted with a small aluminum strap held by 2/56 nuts and bolts in holes 17 and 18. The primary or small coil of the transformer is placed towards V1 side of the base.

Wiring is simple and only a few precautions need to be observed. The base has been layed out to keep all leads as short as possible. Placement of parts should be kept in a neat arrangement. Eyelets should not be soldered until all leads are in place. Eyelets 12, 13 and 15 are ground or AB- and should be connected to each other. The filaments of V1 and V2 should be wired first. Connect flea clips 4 and 6 to eyelets 13. Connect flea clip 8 to flea clip 2 and run a length of hook up wire from flea clip 2 out through hole 22. This wire will be the A+ lead of the receiver. The AB- lead of the receiver is run through hole 22 and connected to eyelet 12. The B+ lead is connected to one of the relay coil terminals and also run out through hole 22. The red lead of the transformer is connected to this same terminal on the relay. Connect the 20 uhy RFC from flea clip 1 to eyelet 11. The blue lead of the transformer is also connected to eyelet 11. A .001 mfd capacitor connects from eyelet 11 to eyelet 12. The green lead from the transformer connects to eyelet 16. The .002 mfd capacitor connects from eyelet 16 to 15. A 470K resistor goes between eyelet 14 and 16. The 1 meg resistor connects between eyelets 13 and 14 and the diode goes between eyelets 14 and 15 with the cathode or insulated lead in eyelet 15. A .001 mfd capacitor connects from eyelet 14 to flea clip 10. The tank coil should be wired by connecting the bottom end of lug nearest the base to flea clip 1. The other lug of the coil is connected to flea clip 3 by a 2 meg resistor and 33 mmf capacitor connected in parallel. One end of the 5 turn link coil connects to eyelet 13 and the other is run out through hole 5 on the base and connects to the antenna. The 100 mmf capacitor can now be connected from eyelet 16 to flea clip 7. The black of the transformer also connects to flea clip 7. Flea clip 9 connects to the B+ lug of the relay coil and flea clip 10 connects to the other relay coil lug. The receiver is now wired and ready to be tested.

Initial testing should be done before the receiver is installed in the plastic case. Plug the 6007 (V1) into flea clips 1, 2, 3, and 4. The tube has five leads but the two leads adjacent to the red dot on the tube are both inserted into flea clip 1. Connect the receiver to the batteries and place a 0-5 ma milliammeter in series with the B+ lead. The 6007 should draw about .3 to .4 ma. Turn on the transmitter and tune the slug in the coil until a slight drop in current is obtained. Now plug the P4-R (V2) into flea clips 6 through 10 with the red dot on the tube adjacent to flea clip 10. The receiver should now idle at about .8 to 1 ma. When the transmitter is keyed the current should rise to about 3-4 ma.

We invite you to experiment with this circuit. We believe that after you do you will find yourself liking your Tech 27 Receiver.

NOTE -- Insulated end of 1215 diode is the cathode end. V1--6007, V2--P4-R, L1--34 turns #32 magnet wire on CTC LSM coil form, red dot core, L2--5 turns of #24 plastic insulation, Relay--Gem 5K standard.

TRANSISTORIZED COMMANDER RECEIVER

FEATURES 4 MA CURRENT RISE, CW OPERATION,

Current rise receivers are sought after by the R/C fraternity with good justification. They feature non-fussy relay settings with the high current change. Vibration troubles are virtually non-existent since tension may be set tight enough to avoid it. For escapement flyers they offer the utmost in economy since they are in low idle most of the time drawing heavy current only upon receipt of signal.

This popularity is particularly evidenced by the popularity of such receivers as the Lorenz Two Tuber, Hill THT, Tech Two, and others.

For pulse work a current rise offers no particular current economy since the receivers are on virtually 50% of the time and relay adjustment consideration aside it matters little if the current through the relay rises or drops.

The Commander Receiver as originally developed is a current drop receiver and while the current drop is quite respectable as far as hard tubers go, many builders express the wish that a current rise receiver with similar dependability and reliability could be developed.

The Commander is based on Howard McEntee's Simple Single, which was published in Air Trails a few years ago. Thousands of satisfied users attest to the ease of construction, ease of adjustment, and reliable fun that may be had with this simple hard tuber.

Research led in the direction of finding a simple way to convert to a current rise and yet retain the good features of this dependable receiver.

Transistors seemed to be the answer and so research and development was done using a variety of transistors. A number of circuits were cut and tried.

The schematic shown below is the result. It is relatively un-fussy as far as temperature is concerned (temperatures above 110° and 115° are to be avoided since they may cause some trouble).

The Raytheon CK721, CK722, and Philco A02 and T0037 were all tried with equal success. These are all NPN transistors. Others of this type of manufacture will likely also perform equally well.

Features of the receiver are as follows. First stage--3S4--idles at .6 of a mil. Upon receipt of signal this drops to .4 ma or lower. This in turn triggers the transistor in the relay stage from 0 to 4-4½ mils depending upon the transistor used. The relay really clacks in with this kind of current.

Sensitivity setting is still important as it is with any hard tuber. There are no exceptions to this except the Tech Two which utilizes an entirely different operation principle. (See elsewhere in this issue and January 1958 American Modeler.)

Conversion of existing units is relatively simple. Only two extra components and a transistor are required to achieve a current rise receiver.

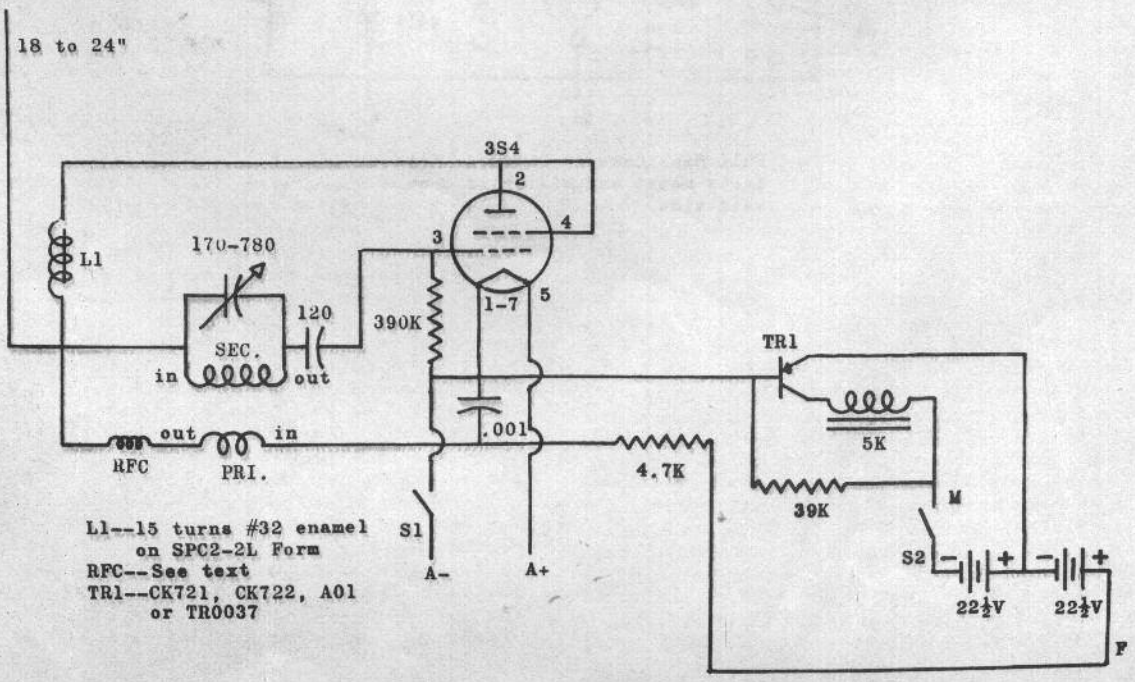
To begin the conversion it will be necessary first to drill three additional holes in the base. Remove the 3S4. The holes are shown as X, Y, Z on the base layout. These are 3/32 diameter holes and after they are drilled 3/32 diameter by 3/32 length eyelets are sunk.

Remove the red wire from relay lead R1. Next remove the .001 bypass capacitor and the inside primary lead from relay lug R2. Care must be used here to avoid tearing up the .001 and breaking off the lead of the quench coil. It can be done but use caution.

Place the removed leads of the .001 bypass and the inside lead of the primary in eyelet X. Do not solder. Place a 4.7K resistor, color code yellow, purple, red, between eyelets X and Y. Solder at X. Place the red hook up wire into eyelet Y and solder. You are now ready to insert the transistor.

When soldering a transistor into a circuit it is always wise to use some type of heat deflection to keep from damaging the transistor itself. A pliers may be used which will require the assistance of a helper. It has also been found that a mini gator clip, which can be placed in rather close quarters, inserted between the joint to be soldered and transistor itself will quite readily conduct heat away from the transistor. We recommend the mini gator approach.

Insert the center lead of the transistor which is



L1--15 turns #32 enamel on SPC2-2L Form
RFC--See text
TR1--CK721, CK722, A01 or TR0037

the base into lug R2 of the relay. Do not solder as yet since some adjustment may be necessary. Insert a white or contrasting hook up wire from any that are in use into lug R1 of the relay. Do not solder. Heat eyelet 4 and insert a 39K resistor. Bring the other end of this resistor to lead R1 and solder. Now bring the lead from the red dot which is the emitter to eyelet 4 and apply heat from underneath on eyelet 4. Insert with a pliers into the eyelet.

Bring the lead from the blank side of the transistor to eyelet Z and insert a length of green or other contrasting hook up wire not in use into this eyelet. Solder. This completes the wiring of your receiver.

You are now ready for a check. Insert 0-5 milliammeter at point M on the schematic. With padder 180-780 screwed down all the way and with an 18 to 24 inch antenna in place, this should read between 2 and 3 ma. Unscrew padder with an insulated screwdriver until you reach the point where it just drops to 0. Greatest sensitivity will be had with the transistor drawing just a slight bit of current.

Now keying your transmitter, tune the slug tuning coil until a rise in current is had to 4 to 4.5 ma.

Meter may also be inserted into the first stage for finer check on the sensitivity setting. This will be at point F on the schematic. Meter here may be a 0-1 ma. With padder screwed down tight this stage should read approximately .4 ma and when padder is unscrewed should jump to approximately .6 or slightly more.

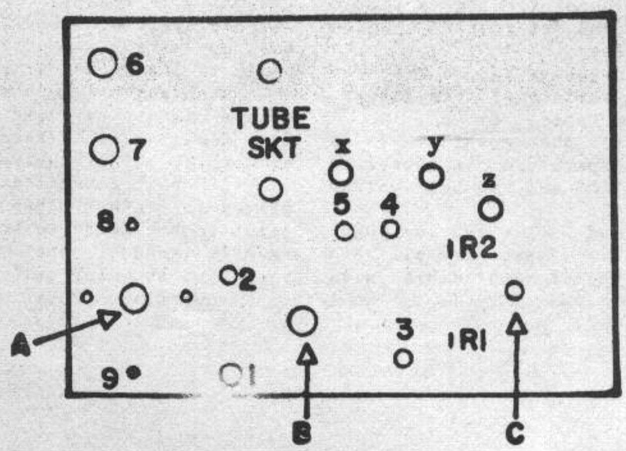
Upon receipt of signal when tuned in properly this stage should drop to .4 ma or less.

The two switches S1 and S2 may be a DPST slide or toggle.

Other tubes of lower filament drain may be used but the 3S4 has been proven dependable. With the availability of rechargeable CG Voltablock cells of low cost, the 100 ma filament drain pose no problem whatever.

There you have it, a current rise with the addition of only two components and one transistor to your present Commander Receiver. Let us know how you come out. This circuit should lend itself for adaption to other single hard tube receivers.

NOTE: At the decreased idle of first stage it may be necessary to change RFC to one of 20 to 50 uhy for better range.

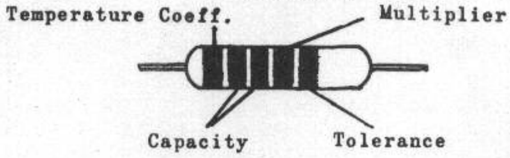


Full Size Chassis Layout. All parts mount and wiring is on this side.

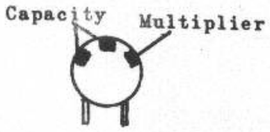
Color Code Primer

FOR THE BEGINNER

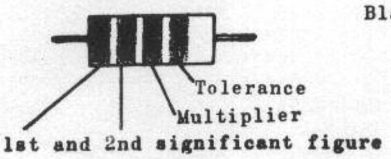
TUBULAR CERAMIC CAPACITOR



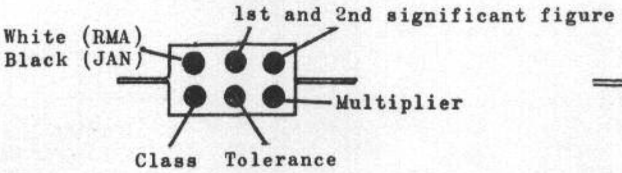
DISC CERAMIC CAPACITOR



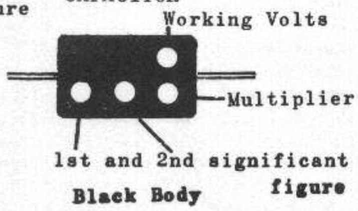
RESISTOR



MICA CAPACITOR



MOLDED PAPER CAPACITOR



Following the policy begun last issue with the R/C Glossary, we hope to show the beginner through some technicalities of electronics. This issue presents a discussion on resistors and capacitors.

The Glossary took care of symbols. This article is intended to cover the color coding which is very easy to the experienced but confusing to the beginner.

Standard color code of resistors and capacitors provides all the necessary information required to properly identify them. You will find below a chart shich gives the numerical values and the zeroes or multipliers assigned to the colors used. By referring to the drawings you will see how this color code may be used to help you identify the value of a given capacitor or resistor. The illustration shows the axial lead resistors, ceramic capacitors, disc ceramic capacitors, molded mica capacitors and molded paper capacitors.

By applying the color code as follows we will identify a resistor. We have a resistor that has the following four bands on it -- red, red, yellow, silver. A reference to the chart below shows that red is 2 and the second figure would be 2 and this would be multiplied by four zeroes. This is then a 220,000 ohm resistor. With silver this is 10% tolerance. The tolerance figure means that this resistor may be either 22,000 ohms over 220,000 ohms or 22,000 ohms less.

The fourth color band on resistors determines the tolerance ratings as listed on the chart. Gold = 5%, silver = 10%. If there is no fourth band this indicates a 20% tolerance rating.

A bit of practice with various resistors will soon get you on to the determination of values. Refer to the color code for the numerical of the first two figures and the zeroes are then multipliers assigned to the colors used.

The physical size of carbon resistors is determined by their wattage rating. The resistors most commonly used in R/C are 1/4, 1/3, 1/2 and 1 watt. Larger resistors are generally used only when required in power supplies or other applications where there is apt to be higher power requirements.

The same general procedure for identifying resistors is followed in using color coded ceramic and mica capacitors. By and large most capacitors now contain a printed lettering for the value they designate. One important point to remember is that in identification a capacitor in the higher ranges may be identified one of two ways. A .001 mfd may be also identified as a 1,000 mmfd or a 1K mmfd. These are exactly the same values. The same holds true for a .005 mfd and a 5,000 mmfd or a 5K mmfd.

Generally in R/C the 10% or 20% values are acceptable in most of the applications except in the RF stages. In these, closer tolerances are advised, in many instances 5% resistors and silver mica capacitors which have closer tolerance and also a tendency for slightest drift are required. In some instances temperature compensated capacitors are required.

If you will remember the rule of thumb that in any stage where radio frequencies are present very close tolerances are required you will avoid many headaches. The broad tolerances that audio applications accept are not always acceptable in radio frequency stages.

Pin up this chart over your work bench and it will provide you a quick identification of that unknown value resistor or capacitor.

Color	First Figure	Second Figure	Multiplier
Black	0	0	None
Brown	1	1	0
Red	2	2	00
Orange	3	3	,000
Yellow	4	4	0,000
Green	5	5	00,000
Blue	6	6	000,000
Violet	7	7	0,000,000
Gray	8	8	00,000,000
White	9	9	000,000,000

Silver 10% Gold 5% No Band 20%

Transistorized Pulser

BY LT. COL. H. M. BOURGEOIS

The Transistor Pulser is designed to replace the tube pulser in the WAG Dual Proportional Control System Transmitter. Primarily it reduces B battery drain and eliminates the A battery. In addition it reduces the size and weight of the transmitter and control box. The transistors are Raytheon CK722's which are low in cost and readily obtained. This transistor pulser has been successfully used by members of the DCRC under field conditions of varying temperatures and humidity. The pulser is simple to build and not critical as to layout. It works with any two CK722 transistors, however, slight imbalance may be noted when different manufacturing numbers are used. This number is printed on the bottom of the CK722 and indicates the "batch" or run number. Be sure when selecting two transistors for the pulser that this number is the same.

The pulser works well with 5% resistors and capacitors. The values R4 and R5 are not critical, but for pulsing balance they should be matched as closely as possible. Similarly the capacitors C1 and C2 should be matched. The capacitor C3 across the relay coil is important as it prevents the relay coil "kick", on field collapse, from damaging the transistor T2.

The pot R7 controls pulse rate and once set will not vary with voltage change. After once finding this value a fixed resistor could be substituted for the pot. The resistor R1 controls relay current and the 6200 ohm value will give a maximum relay current of about 3 ma. Higher relay currents can be obtained by decreasing this value.

The resistor R3 is important, as it balances the relay resistance against the value of R2. If erratic operation or unusual changes of pulse rate occur when the control pot R6 is moved to its extreme position, then R3 must be increased or decreased slightly. Once balanced, voltage changes will not effect the circuit. It was only found necessary to change the value of R3 when relays of 5000 ohm resistance was substituted for the 8000 ohm resistance.

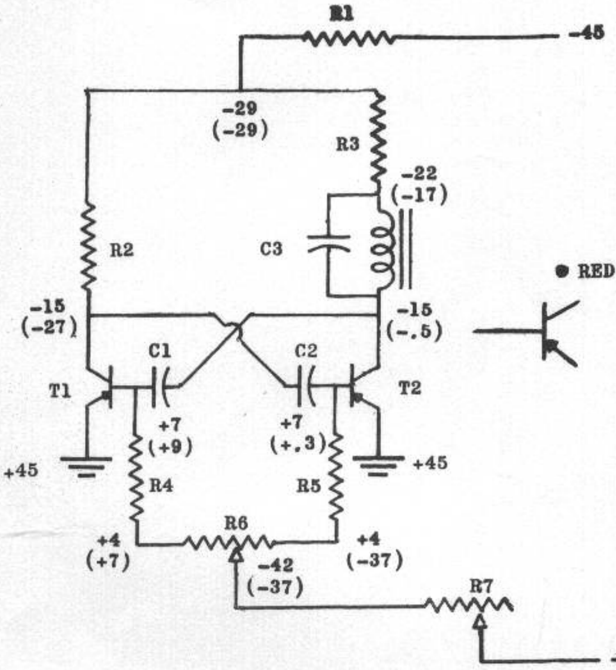
The layout suggested in Figures 1 and 2 works well and is easily constructed. It is suggested that short leads be used between the board and the control pot R6. Therefore the whole pulser could be built into the control box and only the relay leads and battery leads run to the transmitter.

The voltages shown on the diagram are typical when measured with a Heathkit VTVM, and may vary slightly. The voltages in the brackets are with the control pot R6 in the extreme position. Total pulser drain is 3 ma. in the neutral position, and 4 ma. in the full control position. Relay current is 3 ma. maximum and 0.2 ma minimum. The relay is adjusted to pull in at 1.8 ma. and open at 1.5 ma. This provides a good margin of safety. Once adjusted the pulser is stable in operation from 47 volts down to 35 volts.

The values of C1 and C2 generally control the pulse rate of the pulser. Capacitors of .15 mfd will give the proper pulse rate for the WAG Dual, with the pot R7 varying the rate between 2 pulses per second to 8 pulses per second. Increasing this value of C1-C2 will slow the rate, while reducing the value will increase the rate. With the values of components given the relay will stop pulsing on the full control positions. This is desirable when the control surfaces must be jammed against the stops in the airplane. If some pulsing of the relay is desired when the control is against the stop, then R1 must be decreased in value.

The mounting board is a 2" x 3" sheet of Synthane 1/16" thick. Flea clips are used to mount the transistors, and eyelets are used for the solder connections.

This is with submini parts. Size will need to be increased if conventional low priced parts are used.



R1--6.2K
R2--10K
R3--2.7K

R4, R5--36K match
R6--1 Meg linear
R7--100K linear
T1, T2--CK722

RLY--8K Sigma 4F
C1, C2--.15 match
C3--.25

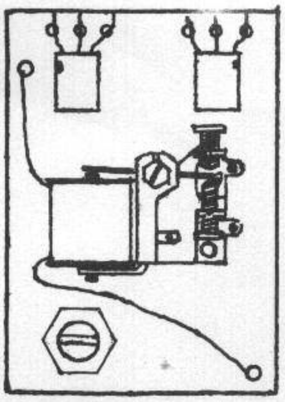
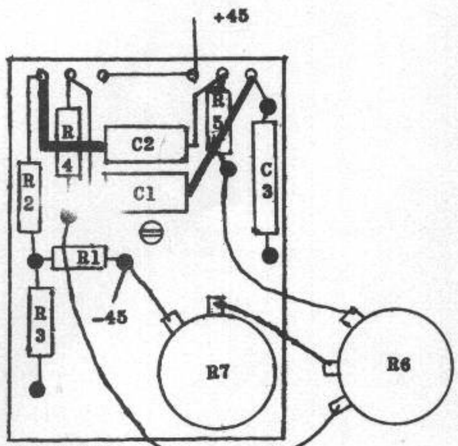


Figure 1



● eyelets
○ flea clips

Figure 2

SIMPLE DUAL PROPORTIONAL WITH STICK-TROL

BY BERNARD FOX

Since Dr. Walter A. Good successfully designed and operated his now very familiar TTPW control system there has been a flurry of excitement concerning ideas intended to duplicate its performance at a lower cost to the R/C modeller. Of all these systems none has generated as much interest or been as successful as the popularly known Galloping Ghost system. It offers a relatively inexpensive and effective form of simultaneous, proportional rudder and elevator control.

Within our own club no other idea exposed to the group ever promoted so much individual activity and thinking as did this system. Within days countless forms of actuators, auxiliary control devices etc. seemed to appear out of nowhere. What is more there are still several modifications being considered that have not as yet been explored.

In using this system it is important to provide a satisfactory means of coding the transmitted CW signal. This can be done primarily by either a mechanical or electrical means. The latter seems to be the simplest, cheapest and most logical means of controlling the transmitter signal rate and width. Dr. Good's multi-vibrator pulser circuit as used in his TTPW system seemed to be the best bet and has been generally adopted by Galloping Ghost fans.

Inasmuch as the system uses pulse width for the rudder and pulse rate for the elevator, it is essential that we have a pulse rate change of from three cycles to above twelve cycles for the best performance. With the original circuit this was not possible since the average rate of the pulser was too fast and it was impossible to obtain the proper pulser relay action in forming the transmitter pulse width.

These problems were changed after considerable experimentation and research. John Worth's article, which appeared in Flying Models magazine for September, 1957, page 10, gave several useful kinks. Our version is somewhat still more modified and the two objections to the original circuit are quite definitely cured. The pulser as shown will slow up to the required 3 cps up elevator but will speed up to 15-20 cps for down. This greater rate change, when used with the elevator trim circuit as shown, is highly satisfactory.

The problem of securing proper pulser relay action in forming pulse width was solved by examining the pulse produced with an oscilloscope. This readily showed the square wave multi-vibrator output applied to the pulser relay was malformed as a result of the inductive kick through the relay coil. The conventional .1 mfd and 10K suppressor across the relay was ineffective in reducing this.

By using a diode suppressor across the relay in place of the suppressor network the pulse comes out square waved again.

The diode used is superior to others that we have tested since it gives optimum suppression with best output. A Sigma 4F relay is recommended for ease of adjustment although a 41F may also be used but it requires much greater care in adjustment.

The final pulser circuit as shown is used with an Ace R/C Good TTPW Control Box with a 100K 60 degree potentiometer being substituted for one of the 1 meg potentiometers. This setup makes a very satisfactory method of controlling this simplified dual proportional system.

Figure 1 shows the complete schematic for the electronic circuitry and Figure 2 may be added to this circuit if desired to provide rudder trim. This idea comes from Howard McEntee's Compact pulser appearing in Air Trails-Hobbies for Young Men of October, 1955.

Control box may be modified for trim control by cutting a slot 1/4 x 1 and mounting the trim pot for elevator on an aluminum bracket so that a nylon gear protrudes for trim as shown in the photograph. This is an 80 tooth nylon gear which provides an adequate grip.

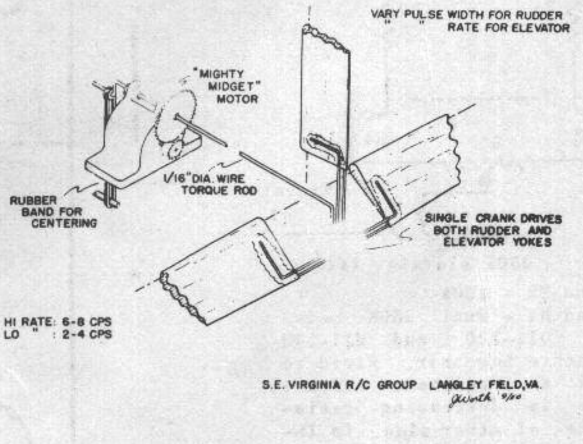
Construction is straightforward and the schematic should be followed. A small aluminum chassis is used to contain the components for the pulser. This is placed inside the transmitter cabinet. An additional A and B battery are also required.

Full size dimensions are shown as well as a wiring photograph which should enable any person to duplicate the unit. One word of caution: If key is in B minus relay may be grounded to transmitter chassis. If it is on the B plus side the relay must be insulated from the chassis since this would be a dead short across B plus.

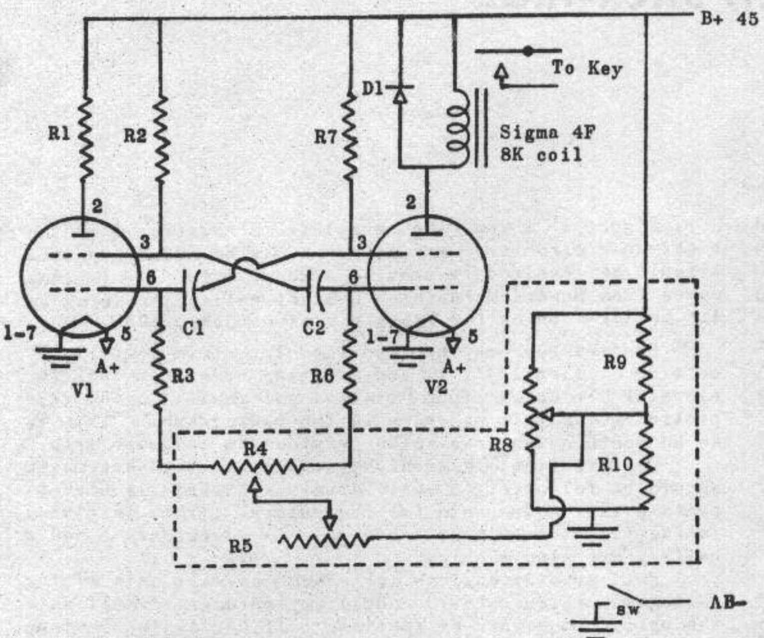
The filament switch is placed in AB minus since there would be a drain across it if it were in A plus.

An illustration is shown on how a conventional Mighty Midget is used. Here in Vestal there are combinations that vary widely from the simplest as developed by the Southeastern Virginia R/C group as illustrated to what we consider the best of all, the Robot Junior. This is completely ready to go, the mechanical drive arrangement makes it convenient to install and also we believe makes the maximum use of the power available from the Mighty Midget and does not require any reworking of the motor at all.

Don't let the extreme simplicity of the Stick-Trol fool you. With the Stick-Trol all tendency for galloping has been cured if the minimum pulse is kept above three cps. Very smooth flight characteristics may be had. Motor control may also be added by the use of any pulse omission detector on the receiver. This circuit is quite simple and if there is enough interest, Grid Leaks will publish such a circuit.



Linkage with Mighty Midget Motor working both rudder and elevator. Robot Jr. may also be used.

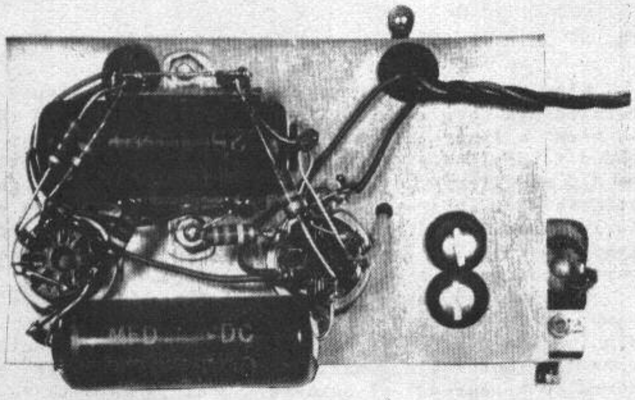


The parts contained in the dotted box are enclosed in the special WAG TTPW box using the 60 degree one meg and 100K pots.

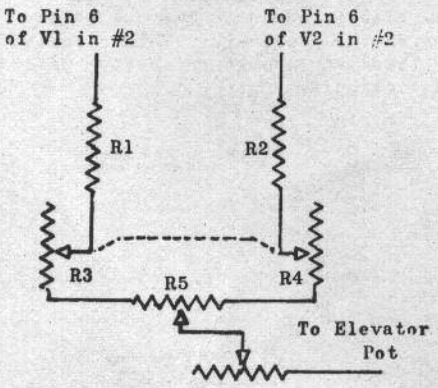
R1 - 8.2K
R2 and R7 - 15K 5%
R3 and R6 - 330K 5%
R4 - 1 meg 60° AB pot (Rudder Control)
R5 - 250K pot (linear volume control type, elevator trim)
R8 - 100K 60° AB pot (elevator control)
R9 - 120K
R10 - 15K
C1 and C2 - .25 mfd
V1 and V2 - 3V4
D1 - Federal 1T1 diode

Figure 1

Use of this pulser with your present transmitter and receiver will give you dual proportional control simply. May be audio or CW equipment. Receiver must be kind which will follow the fast pulsing.



Using the drawing below, mount your components. To assist in wiring study the photograph. A simple point to point wiring is used and all of the component leads are as short as possible.



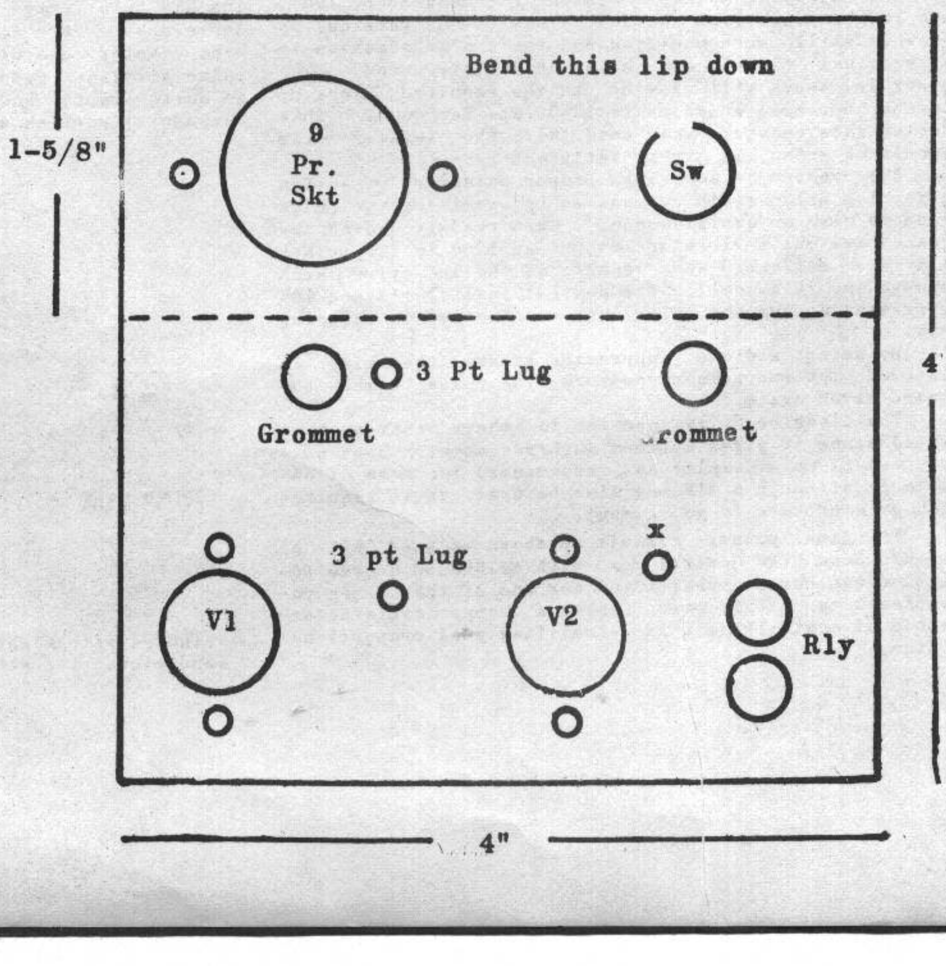
250K elevator trim

R1 and R2 - 150K
R3 and R4 - Dual 250K pots. IRC Q11-130 and M11-130 attached together. Wired so that as resistance of one side is decreasing resistance of other side is increasing. Mounted on side of control box adjusted by knob.
R5 - 1 meg 60° A-B pot. (Rudder control)

Figure 2

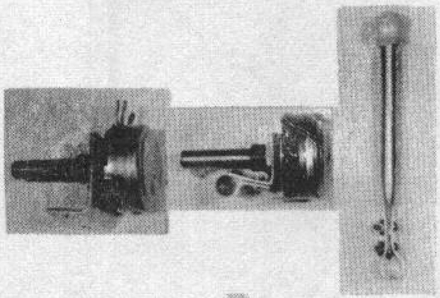
CHASSIS LAYOUT--MAKE OF 1/32" ALUMINUM

All wiring is done on this side. Mount sockets so tubes are beneath and lugs are on this side. Using grommets mount the relay on opposite side and bring relay lead wire thru hole x. The tie lugs mount on this side. Chassis is mounted by using the hardware of the 9 prong socket and the switch. Holes are cut in transmitter box to correspond to front lip of pulser chassis.

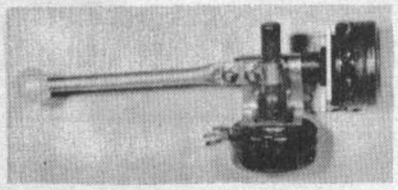


Make Your Own Control Box

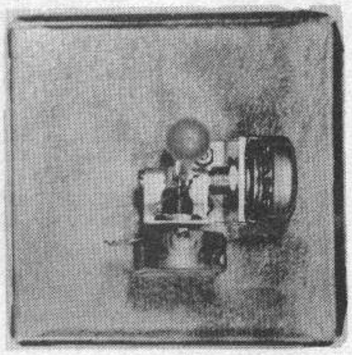
DESIGNED FOR STICKTROL PULSER



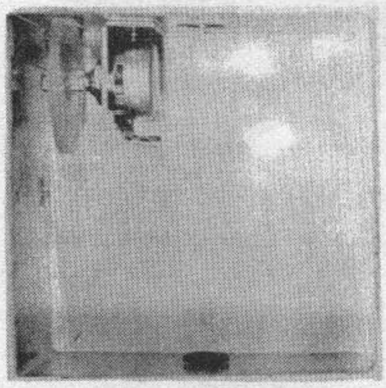
A



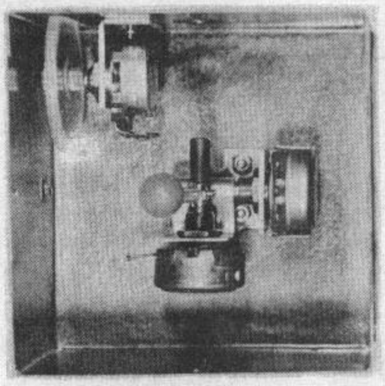
B



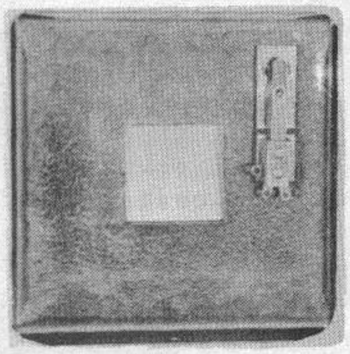
C



D



E



F

If you are starting your Stick-Trol control box from scratch, you will first need a box which measures 4 x 4 and is 2-1/4 inches deep. Opposite are a one half size template for this for the convenience of your metal worker. If the box is to be made of aluminum it should be made of 1/16" thick material. Out of other metal it may be made of metal 1/32" thick. Any tin shop can make this box for you with minimum trouble.

The hardware brackets and handle are shown full size. Consult the drawings themselves for the size of metal to use.

Begin assembling the control box by mounting the bottom pot in the L shaped bracket. This will need to be the 100K, which is your elevator pot. Mount the one meg 60 degree pot on the special shaft bracket as shown in the center of the photo A. Mount the special handle bracket onto the control handle using 2/56 x 1/4 inch bolts and nuts. The handle after having been flattened and drilled may be considerably beefed up by soldering where the brass splits. Considerable more beef may be added by filling the tube with solder. This is done by holding a large soldering iron along the brass tubing and running solder in from the bottom to the top.

Heat from your soldering iron is used to position the plastic ball. Continue assembly by mounting the one meg pot on the shaft of the 100K pot using two #2 self tap screws as shown in photo B. Now mount this sub-assembly on the bottom cover using two 4/40 x 1/4 inch bolts and nuts. Please note that under one of the nuts a cable clamp will need to be placed to hold the eight wire plastic cable in position.

Take the shell of the box and mount the 250K trim pot on the bracket. Force fit the 80 tooth nylon gear onto the shaft of this pot and then mount. It may be necessary to use shim stock in some instances for a tight fit. Mount this bracket so that the 80 tooth gear protrudes through the slot in trim control. Use two 4/40 x 1/4 bolts and nuts. The grommet for the cable mounts in the shell as shown in photo D.

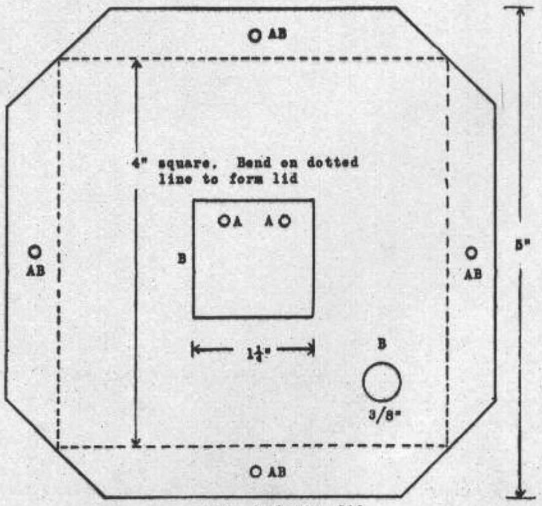
The extra holes provided in the cover are so that the pots may be trimmed without removing the cover.

Now mount the bottom cover on the shell of the box as shown in E.

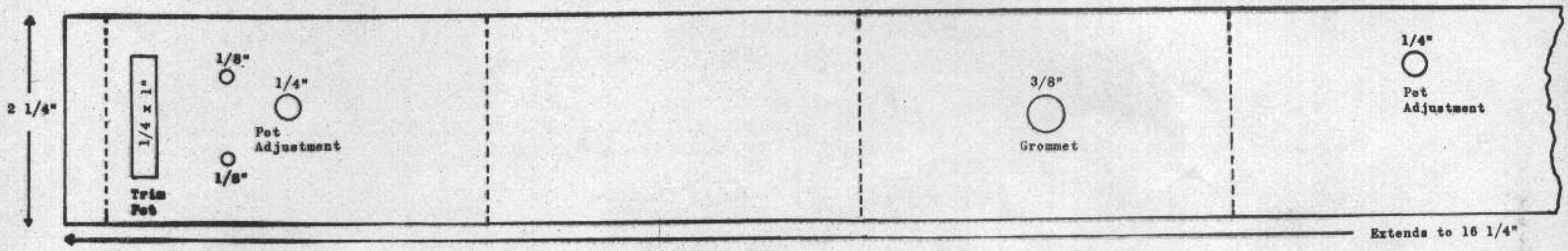
Mount the SPDT switch on the top cover as shown in F so that it will be in the upper left hand position of the control box as shown in the finished photograph. Now wiring may be begun. The SPDT switch is for your use in the event that you decide at a later date to add motor control to your Stick-Trol Pulser.

You may find it necessary to reverse the pot connection to obtain left and right or up and down.

NOTE: 60° pots must be used in this control box These have the resistance in a 60° range in the center of the 270° rotation.

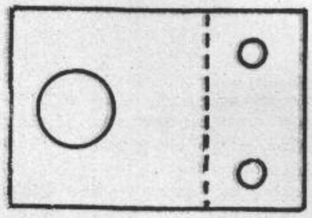


A--holes in bottom lid
B--holes in top lid

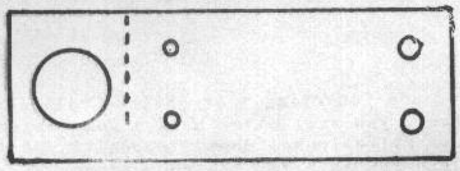


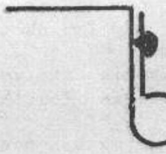
BOX AND LIDS
DETAIL 1/2 SIZE

NOTE: The covers are fastened to the box shell by eight #4 x 1/4 self tap sheet metal screws. The holes are not shown in the shell since it has been found to be desirable to mount the covers and then center punch the cover holes and drill the shell holes for accuracy.

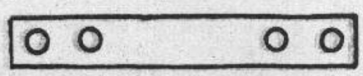


Pot bracket. Make 2 of 1/16" aluminum. Bend 90° on line.



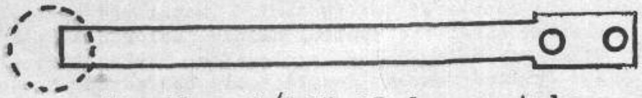


Secondary pot bracket Bend as shown at the left and fasten on sh[illegible] #2 self tap screws. 1/32" aluminum



Handle bracket. 1/32 aluminum. Bend as shown on right

STICK ASSEMBLY
PARTS FULL SIZE



Handle--3/16" OD brass tube. Flatten bottom and solder to strengthen. After bracket above is bent, mount on pot shaft using 2/56 x 1/4 bolts and nuts.

WAG Dual Receiver Tests With Simple Equipment

BY WALT GOOD

<u>Assumptions</u>:

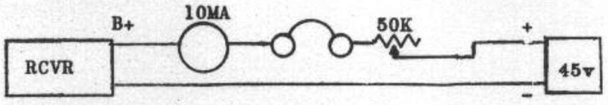
<u>Transmitter</u> - 1. Must be operating properly.
2. Use low power by disconnecting antenna or drop Osc-Amp voltage to 45V.

<u>Receiver</u> - 1. Is wired correctly? Have a friend check this.
2. Relays preset to work in 1.5 to 2.0 ma region. Armature must not touch pole piece even at 3.5 ma.
3. Batteries must measure 1.2 to 1.5V for filament and 42 to 49V for plate under load.

<u>Equipment</u> - Current meter 0-10 ma. Magnetic headphones. Voltmeter 0-100V. 50K pot.

<u>Test 1 - Check operation of Superregen</u>

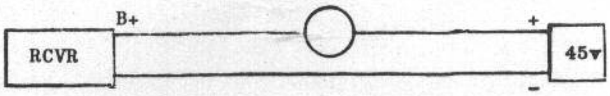
1. Superregen (1AG4), Amplifier (1AH4) in place, 2'-3' antenna on receiver, FS, Elevator and Rudder tubes removed.



2. Meter in B+ lead should read about 0.4 ma.
   a. Touch coil with finger. Current should go up to 0.6 ma.
   b. With transmitter sending UL (Up-Left) tune receiver for dip in current. Should dip from 0.4 ma to 0.3 ma. Block or hold relay(s) in position while sending UL if necessary.
   c. Magnetic type headphones placed in series with meter should give "rushing" noise with no signal and a smooth 500 cps tone with an UL signal.
   d. Using 50K pot, lower plate voltage until operation ceases; record voltage at which this happens. Try different tubes. An average 45V receiver should work down to 36V, and a 67V receiver to 55V.
3. If the currents of 2 a and b are not observed and if no noise or tone is heard then the superregen is probably not working. If so, take the following steps:
   a. Raise plate voltage to 67V and repeat 2 a b c d.
   b. <u>Increase</u> grid condenser (normally 10 to 15 mmf) and repeat until 2 a b c d are satisfactory.

<u>Test 2 - Check Fail Safe Relay</u>

1. Insert Superregen, Amplifier and Fail Safe tubes. Elevator and rudder tubes are removed.



2. Check the following conditions:

Transmitter	Off	Carrier (FS)	UL, UR, DL, DR
Receiver Current (FS) -	2.5 to 3.0 ma	3.5 to 4.0 ma	0.3 to 0.6 ma

It may be necessary to select tubes or readjust FS relay to obtain proper relay operation in the transmitter off condition.

3. If more than 0.3 to 0.6 ma current is obtained with DL or DR, then the superregen output may be low. If so, replace the superregen Grid condenser with condenser of 2 to 5 mmf smaller value and repeat 2.

<u>Test 3 - Check Rudder Relay</u>

1. Insert Superregen, Amplifier and Rudder Tubes. Elevator and Fail Safe tubes are removed.
2. Check the following conditions:

Transmitter -	Off	Carrier (FS)	UL	UR	DL	DR
Receiver Current (R) -	3.5 to 4.5 ma	3.5 to 4.5 ma	0.3 to 0.6 ma	3.5 to 4.5 ma	.3 to .6 ma	3.5 to 4.5 ma

<u>Test 4 - Check Elevator Relay</u>

1. Insert Superregen, Amplifier and Elevator Tubes. Remove rudder and fail safe tubes.
2. Check the following conditions:

Transmitter -	Off	Carrier (FS)	UL	UR	DL	DR
Receiver Current (E) -	3 to 4 ma	3.5 to 4 ma	.3 to .6 ma	.3 to .6 ma	3.5 to 4.5 ma	3.5 to 4.5 ma

<u>Test 5 - Check All Relays</u>

1. Insert all tubes.
2. Check the following conditions:

Transmitter -	Off	Carrier (FS)	UL	UR	DL	DR
Receiver Current (Total) -	9 ma	11 ma	.3 to .8 ma	.3 to .8 ma	4 ma	8 ma

Average Current 4 ma with neutral stick

<u>Test 6 - Distance Check</u>

1. Distance check at 1/4 mile at field.
2. Tuning range should be ± 1/4 turn or greater, no meter required.
3. Fly

P.S. Solder relay springs at both ends.
Place .02 mf condenser across Mighty Midget Motor brushes.

This article originally appeared in the November, 1957 issue of the DCRC Newsletter and is published by permission.