

INSTRUCTIONS FOR ASSEMBLY,
OPERATION, AND INSTALLATION OF
CITIZEN-SHIP TYPE MTK "27"
PRINTED CIRCUIT RECEIVER KIT

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INDEX FOR RECEIVER INSTRUCTIONS

1. DESCRIPTION OF RECEIVER.
2. NOTES AND CAUTIONS
3. ASSEMBLY OF RECEIVER.
4. GENERAL REQUIREMENTS.
5. MOUNTING.
 - 5.1 "Crash-proof" mounting.
 - 5.2 Rubber bands to hold down.
 - 5.3 Horizontal mounting on sponge rubber.
 - 5.4 Access required to top of receiver.
 - 5.5 Battery location (for balance).
 - 5.6 Antenna lead to be kept separate from other leads.
6. BATTERY VOLTAGES REQUIRED
 - 6.1 "A" Batteries.
 - 6.2 "B" Batteries.
7. SOURCES OF BATTERIES.
8. WIRING THE RECEIVER
 - 8.1 Connecting and mounting of batteries.
 - 8.2 Wiring from diagram using plug.
 - 8.3 Need of Double Pole Single Throw Switch.
 - 8.4 Jacks.
9. ANTENNAE
 - 9.1 Selection of antenna.
 - 9.2 Lead-in from antenna.
10. TUNING AND ADJUSTING
 - 10.1 Simplicity of necessary tuning.
 - 10.2 Identification of coils used in tuning.
 - 10.3 Adjustment of coils used in tuning.
 - 10.4 Additional adjustment of coils.
 - 10.5 Interaction of T & S coils.
 - 10.6 Action of meter leads on S coil.
 - 10.7 Tube and relay idling currents.
 - 10.8 Check S setting before flying.
11. RELAY OPERATION
 - 11.1 Current settings of relay.
 - 11.2 Checking relay action with potentiometer
12. BATTERY LIFE
 - 12.1 Measuring voltages.
 - 12.2 End use of "A" battery.
 - 12.3 Decline and end use of "B" battery.
13. TESTING AND FLYING
 - 13.1 Use of escapement as indicator.
 - 13.2 Skipping of escapement.
 - 13.3 Recheck with motor running.
 - 13.4 Ignition interference.
14. FINAL GOOD WISHES

WARRANTY

BILL OF MATERIAL

DRAWINGS

INSTRUCTIONS FOR CITIZEN-SHIP

MTK "27" RECEIVER KIT

1.0 DESCRIPTION OF RECEIVER:

Your CITIZEN-SHIP Type MTK "27" is a miniaturized, Transistorized, super-sensitive receiver kit for use on the "examination free" 27.255 mc band in conjunction with CITIZEN-SHIP Transmitters FL, FLX, and LC. A printed circuit chassis is utilized which enables a modeler without elaborate test equipment to assemble his own receiver.

The use of the subminiature 1AG4 tube plus a transistor amplifier gives performance heretofore never achieved.

- (1) Sensitivity increased four times.
- (2) Greatly reduced battery power.
- (3) Five times increase in relay current change.
- (4) Instantaneous response - excellent for pulsing.
- (5) Highest reliability.
- (6) Transparent protective cover.
- (7) Weight only 2 ounces.

2.0 NOTES AND CAUTIONS:

1. Study all parts and corresponding drawings to familiarize yourself with the unit before assembly.
2. The top of the set is plain bakelite. The bottom has the copper circuit.
3. We do not recommend the use of a soldering iron of over 37-1/2 watts. This should preferably be an iron with a small 1/8" tip.
4. Care must be taken not to overheat and loosen the printed wiring from the base while soldering.
5. Take extreme care to make good soldered connections the first time.
6. **USE NOTHING BUT ROSIN CORE SOLDER** as furnished in kit. Anything else is corrosive and will impair the performance of the set.
7. Test receiver before mounting permanently.

3.0 ASSEMBLY OF MTK "27" RECEIVER:

- 3.1 Follow Figure 5 closely and insert resistors (parts illustrated in Figure 6) in proper holes. Pull parts flush with the base, bend leads over sharply and in the direction that the widest portion of the printed wiring runs from the hole. Cut leads approximately 1/8" from bend.
Insert capacitors (disc shaped parts shown marked 10, 10, 15, 470, 2000, 4700, and 4700; rectangular part shown marked 820 and cylindrical part with brown and green stripes shown marked 1.5 MMFD). Pull the leads through the base so that the component fits closely to the base but do not break or strain the parts in so doing. Bend and cut leads the same as for resistors.
- 3.2 Solder all resistors and capacitors in place being careful not to solder holes that have not been used, and be sure not to let the solder flow from one printed wire to another. Use care.
- 3.3 Push tube leads through respective holes as shown (Figure 5) with the two leads only near the red dot through one hole. Position tube as shown in top view and also flush down to the base along its length. Bend tube leads over, cut to 1/8" length, and solder to printed wiring. Use provided solid tinned copper wire and form a short piece around tube at rear. Pull ends through holes as shown and solder to printed wiring. This wire is only a hold-down to secure the tube.
- 3.4 Screw the relay to the base using 3/48 screw and #3 lockwasher. Cut two small pieces from the solid tinned copper wire to be used as relay coil leads. Insert these through the base from the bottom and solder each to the relay coil terminal directly above. Bend leads over, cut to 1/8" and solder to printed wiring.
- 3.5 Push T & S coils in proper holes, keeping each pressed firmly against and in a vertical position to the base, and solder the protruding prongs to the printed wiring. (Figure 1, Figure 2 and Figure 5). These two coils are identical.
- 3.6 Push quench coil in proper holes (can be identified in Figure 1, Figure 2 and Figure 5), and solder the three prongs protruding through the base to the printed wiring. The ends of the prongs on the T & S and quench coil may be clipped off slightly after soldering.
- 3.7 The encircled numbers from 1 to 6 on the board are eyelet holes to which the colored leads must be soldered as follows:
 1. Brown - antenna
 2. White
 3. Black
 4. Red
 5. Orange
 6. Green

Also spot solder each eyelet to the printed wiring at this time. Solder the yellow lead to the bottom center relay terminal (normally open contact). Solder the blue lead to the

top center relay terminal (normally closed contact). Strip leads back 3/16" before soldering to eyelets and terminals or to the plug. (See Figure 4). Bring all leads except antenna to point X in order that the cover may be installed properly. Antenna wire extends from base on opposite side (point Y).

- 3.8 The transistor must be mounted in only the direction shown (Figure 5) with the spaced single lead toward the quench coil. Push leads through the proper holes leaving the bottom of the transistor approximately 1/4" above the bakelite board with the end leads perfectly vertical and the center lead at a slight angle. Do not bend leads over. Solder the three leads to printed wiring carefully. Clip off excess. For better protection of the transistor against heat when soldering it is recommended each lead be held with needle nosed pliers between the transistor and the solder joint when soldering.

- 3.8a Transistor with red dot replaces type with spaced lead. Red dot end is equivalent to spaced lead end.

- 3.9 Check all solder joints again.

- 3.10 See Paragraph 8.2 for wiring of plug.

4.0

GENERAL REQUIREMENTS:

The MTK Receiver must be tuned by the modeler after assembly. This requires the use of a milliammeter that will read from 0 to 1 or 1.5 milliamperes. (See enclosed Brochure describing special CITIZEN-SHIP test meter.) In addition a meter to read 0 to 5 milliamperes is also helpful to check relay current. This second meter is not a necessity.

5.0

MOUNTING:

The acetate protective cover must be attached to the receiver board with the enclosed self-tapping screws. All tuning except the relay adjustment can be done with the cover installed.

- 5.1 The "crash-proof" mounting (Figure 2) is the method of mounting the set so that the components are stressed to best resist the shock of a crash. In Figure 2 the receiver is shown glued directly to the sponge rubber at the ends only where there is no printed wiring. If you wish to glue the receiver to the sponge more securely, place a spot of glue in the center of the circuit board so that it will anchor to the sponge there also. Do not glue the entire printed circuit board to the sponge as this makes very difficult any repairs to the receiver that might ever be necessary.

A 3/16 to 1/4" thick balsa sheet relieved to fit the soldered back of the receiver may be glued between the receiver and sponge to provide some additional support for the receiver base.

- 5.2 Rubber bands from the plywood mount around the receiver at each end can be used in place of the glue which allows the receiver to be more readily removed.

- 5.3 Although the vertical mounting is probably preferable the receiver can also be mounted on sponge rubber in a horizontal position.

- 5.4 Since it is necessary to tune the receiver after installation it is recommended that an access space be provided on top of the fuselage. The easiest solution is to have the space under the center of the wing open. After tuning, the wing may be put in place.

- 5.5 The receiver and batteries must be mounted to give proper balance to the plane. Batteries should be mounted forward of the receiver. It is convenient to mount them on the front of the plywood board if vertical mounting is used.

- 5.6 For best results the antenna wire should not be wound in and around other wiring leads.

6.0

BATTERY VOLTAGES REQUIRED ARE:

"A" or filament 1-1/2 Volts.

"B" or plate and transistor 45 Volts (See Par. 6.2).

- 6.1 "A" battery should be either 1 or 2 pen cells. (With plus terminals wired together). The total filament current is 40 M.A.

- 6.2 "B" battery must be made up of two 22-1/2 Volt cells connected to make 45 Volts. One of the 22-1/2 Volt cells operates the transistor. Burgess type U15 or Eveready type 412 are recommended although Burgess type Y15 or Eveready type 505 may be used with good luck and at a lighter weight.

7.0

SOURCES OF BATTERIES:

Many hobby shops carry a complete line of batteries for Radio Control. If not available there, pen cells may be obtained in any Drug or Hardware Store. The "B" or hearing aid batteries may be obtained from radio parts jobbers or hearing aid distributors and in some radio parts stores.

8.0

WIRING THE RECEIVER:

- 8.1 All batteries must be wired with polarity exactly as shown in wiring diagram (Fig. 4). Make special note that the -A lead is completely separate from the -B battery lead. It is recommended that the one or two pen cells for filament supply and two other pen cells for the escapement be mounted in battery boxes for ready changeability. The two 22-1/2 Volt "B" batteries may be mounted in battery boxes also or leads may be soldered directly to them.

- 8.2 Figure 4 shows the wiring diagram of the batteries, escapement, and receiver with the color of leads identified. Also a recommended arrangement of leads is shown for the plug and socket included with the set. Our test fixtures will be wired for this arrangement of leads in case the set is sent in for service with plug attached. It should be obvious that the socket has the same wiring arrangement as the plug. CAUTION: Do not wire socket according to numbers, but by color matching socket wires with plug wires.

- 8.3 The wiring diagram (Figure 4) shows a Double Pole Single Throw Switch to open the filament power and simultaneously shut off any current flowing through the transistor.

- 8.4 Although the wiring diagram (Figure 4) shows two closed circuit jacks which will accept

phone plugs, neither is a necessity for the hook-up in your model. These are a convenience for inserting a meter to check the receiver. A meter plugged into jack #1 (Figure 3A) reads the current flowing in the tube, and a meter in jack #2 (Figure 3B) reads the sum total of the tube current and the relay current. If jacks are not desired a meter can also be inserted by simply opening a lead.

9.0

ANTENNAE:

- 9.1 Several arrangements of antennae are possible. A stiff steel wire about 18" long may be cemented vertically at any convenient point and the antenna lead from the receiver soldered directly to this. A wire may be stretched from the receiver to the top of the rudder fin. The longer the antenna the more pick-up of signal is obtained, but the receiver will operate farther than the control is useful with only an 18" vertical antenna and its associated lead-in for an approximate total of 24".
- 9.2 Leave some slack in the antenna lead-in to the receiver, but do not wind this lead in and around other wiring as range might be reduced.

10.0

TUNING AND ADJUSTING:

- 10.1 There follows very detailed, step-by-step instructions of the complete adjusting procedure. After these are completed and understood, only one adjustment need ever be made regularly. This adjustment is described in Par. 10.8. A complete schematic diagram (Fig. 7) of the receiver set, batteries, and escapement is also included for the modeler who wishes to better understand the receiver's operation.
- 10.2 Looking at the top of the receiver identify T & S coils (Figures 1, 2, 5). The T coil adjusts the tuning and the S coil adjusts the sensitivity.
- 10.3 If the receiver is properly connected including the antenna, and the switch turned on the plate current of the tube only as read by the meter plugged into jack #1 (Figure 4) may be anywhere between 0.2 M.A. and 0.7 M.A. See Figure 3A. Turn out (counterclockwise) the slug marked S until the meter reads a steady maximum. Then turn out two or three additional turns. (CAUTION: The following adjustments must be made with a non-metallic screw driver such as fiber or bakelite.)
Turn slug of quench coil (identify quench coil Figures 1, 2, 5,) in or out to find the lowest tube plate current reading or valley - i.e., a definite minimum as slug is rotated in or out. This is the most sensitive quench coil setting.
Turn on the CITIZEN-SHIP "27" Transmitter with the antenna plugged in and press the operate button. Rotate slug T in and out until plate current drops. Tune slug T for lowest value of tube plate current that shows a definite valley - i.e., goes through a minimum as the slug is turned in and out.
- 10.4 Next turn in (clockwise) slug S with the transmitter off until the tube plate current falls. Back off the screw until the plate current remains steady at its highest value. This is the most sensitive setting but with no factor of safety. When flying the slug S should be set from 1/8 to 1/2 turn safe from this most sensitive setting. Backing off the slug too far reduces range.
- 10.5 It is possible that if the sensitivity control S is set too close, adjusting the tuning slug T may make the tube plate current go down and stay down. No minimum valley could be found under this condition. Simply turn out the slug S and proceed as above.
- 10.6 The varying length of leads used on your meter may affect the sensitivity adjustment S. Make any final S adjustment with the meter removed using the escapement as an indicator. As tube plate current goes down transistor current goes up and the relay pulls in, operating the escapement.
- 10.7 After the tube plate current is operating properly (Off signal value 0.55 M.A. to 0.7 M.A.) and (On signal value 0.2 to 0.4)(Figure 3A) the relay or transistor current will be 0 - 0.1 off signal and approximately 3 M.A. on signal. (Fig. 3B). Check with meter in jack #2 (Figure 4).
- 10.8 At least once before each day of flying the S slug should be checked and properly set approximately 1/4 turn safe. This is very important.

11.0

RELAY OPERATION:

- 11.1 Since the current change through the relay is very great (0 - 3 M.A.) the relay setting is non-critical. The relay is properly set at the factory to pull in at 1.5 M.A. (actuate the escapement) and drop out at 1.0 M.A. (release the escapement). A slight correction in the spring tension is the only adjustment that might ever need to be made.
- 11.2 These values of relay pull-in and drop-out can be easily checked by wiring a 100,000 ohm potentiometer or volume control in series with the plus 22-1/2 Volt green lead (Figure 4). Either send a signal or turn in slug S until relay current jumps up. Then turn potentiometer shaft to insert resistance which decreases current and the value may be observed at which the escapement operates - i.e., relay contacts open and close.

12.0

BATTERY LIFE:

- 12.1 To properly know the voltage of your batteries, it is desirable to have multimeter that will read 1-1/2, 22-1/2, and 45 Volts for the receiver and 135 Volts for the Transmitter. All voltages must be read with some load being placed on them such as the set being turned on. This meter, also including a 1-1/2 milliamp scale, is available and especially designed for this application. (See CITIZEN-SHIP Test Meter in enclosed Brochure).
- 12.2 "A" batteries should be replaced at 1.1 volts with the set turned on.

- 12.3 The "B" batteries (B1 and B2)(Figure 4) can be used down to 17 Volts each if they run down uniformly. Do not use one new cell and one old cell together unless the new cell is used in the B-2 position. Having the voltage of B-1 appreciably higher than B-2 causes the relay idle current to increase with no signal from transmitter. This could cause the relay to hold in and not release when transmitter signal is shut off.
- 13.0 TESTING AND FLYING:
- 13.1 The above instructions have described not only how to make the radio receiver operate properly, but have mentioned the action of the escapement as a means of telling when the relay properly operates.
- 13.2 If the above instructions have been carefully followed and the transmitter operating properly (See transmitter instructions) every time the operate button on the transmitter is pushed, the escapement should operate ONCE only. Check that the relay current is increasing as described in Par. 11.1. If this action is correct, check the relay setting and finally see that the escapement itself is not skipping or sticking.
- 13.3 All these checks should be repeated on the ground WITH THE MOTOR RUNNING. If the receiver is not suspended freely enough, vibration may make the relay chatter, or even vibrate the escapement and cause it to operate. Carefully check the T & S coil slugs to see whether they may have a tendency to rotate up or down from excessive vibration. (THIS IS IMPORTANT). If this happens either mount the receiver more loosely or put a drop of model airplane cement at the edge of the slugs and coil form. Be sure not to fill the screw driver slot with glue.
- 13.4 Practically all models are now using glow or diesel engines, but if ignition is used it may have the same effect as sending a signal from the transmitter, i. e., drive the tube plate current DOWN and operate the relay and escapement. A suppressor resistor of about 10,000 ohms in the spark plug lead will generally fix this, but it may be necessary to isolate the ignition system from the receiver.
- 14.0 IF ALL THE ABOVE CHECKS OUT, GO AHEAD AND FLY. HAVE FUN !

WARRANTY

The parts of your CITIZEN-SHIP MTK "27" radio control kit are warranted to be free from defects as shipped. The tube will not be replaced because of an open filament because each tube is tested before shipment. The transistor has also been tested and known to be operating and we cannot guarantee it against damage by incorrect voltages or overheating in soldering. Since the assembly, construction, and successful operation of the assembled set are the responsibilities of the builder, the warranty does not cover incorrect assembly or bad workmanship. A minimum of \$2.50 plus parts will be charged for any set returned for the purpose of being put in operating condition. The printed circuit board cannot be repaired if it is damaged.

CITIZEN-SHIP RADIO CORPORATION 820 EAST 64th STREET INDIANAPOLIS 20, INDIANA

BILL OF MATERIAL AND PARTS PRICE LIST FOR MTK "27" RECEIVER

1	1AG4 Tube	\$ 5.00	1PNP Transistor	2.00
1	Gem Relay	4.25	1 Quench Coil	2.25
1	T Coil	1.00	1 S Coil	1.00
1	Plug for Wire Cable	1.00	1 Rubber Shield for Plug	.50
1	Socket for Plug	.50	Wire - one foot each of 8 colors	.75
1	Screw - 3/48 x 1/4 BHMS	.05	1 Lockwasher #3	.05
1	Plastic Cover	1.00	Solder	
1	Tinned Copper Wire		1 Instruction Sheet	
1	Decal		1 Citizen-Ship Brochure	
1	Chassis (base) complete with eyelets			\$ 4.00
1	Mica Capacitor - 22A 820 MMFD \pm or $-$ 10%			.75
2	Ceramic Disc Capacitor - 4700 MMFD GMC .593 diameter			.25 ea.
2	Ceramic Disc Capacitor - 10 MMFD \pm or $-$ 20% 1/4" diameter			.25 ea.
1	Ceramic Disc Capacitor - 2000 MMFD GMC .390 diameter			.25
1	Ceramic Disc Capacitor - 470 MMFD \pm or $-$ 20% 3/8" diameter			.25
1	Ceramic Disc Capacitor - 15 MMFD \pm or $-$ 10% 1/4" diameter			.25
1	Gimmick Capacitor - 1.5 MMFD \pm or $-$ 20%			.25
1	BTS Resistor - 100,000 ohm \pm or $-$ 20%			.18
1	BTS Resistor - 100,000 ohm \pm or $-$ 10%			.25
1	BTS Resistor - 22 megohm \pm or $-$ 20%			.18
1	BTS Resistor - 39,000 ohm \pm or $-$ 10%			.25
4	Screws for Plastic Cover - #2 x 3/16 RHMS self-tapping			.10

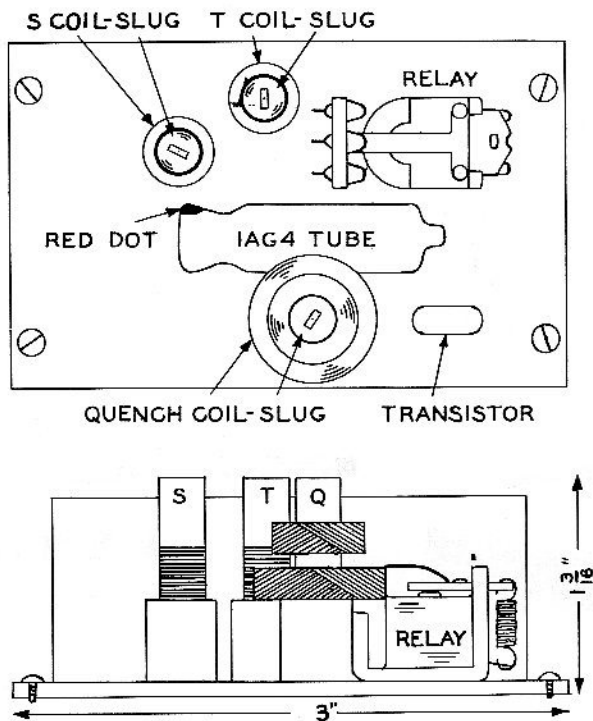


Fig 1

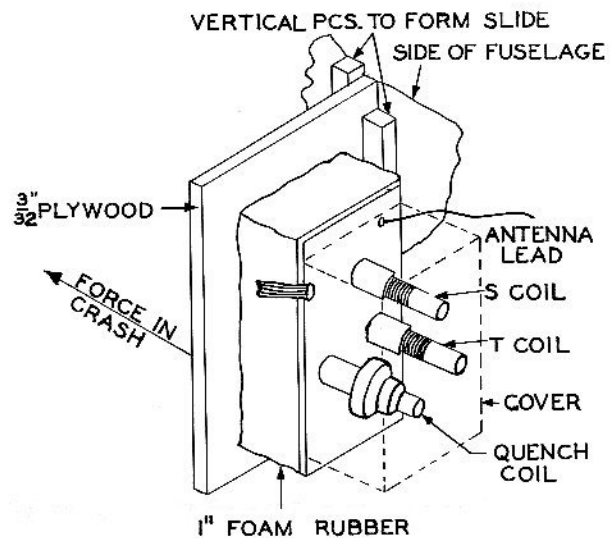


Fig 2

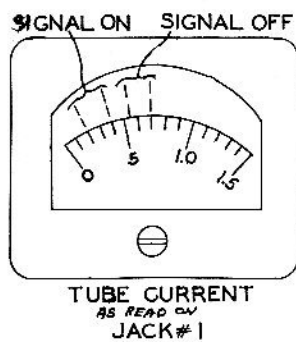


Fig 3A

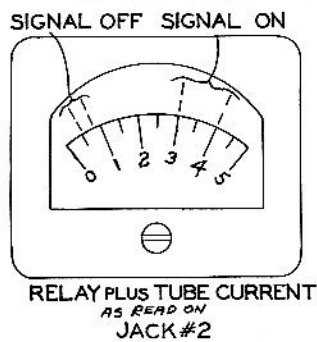


Fig 3B

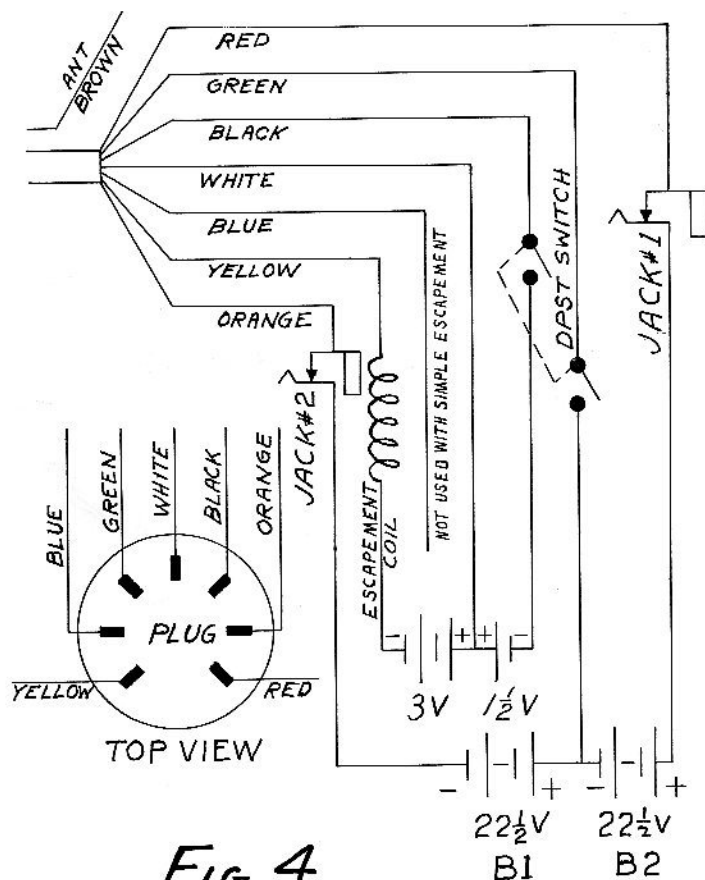


Fig 4

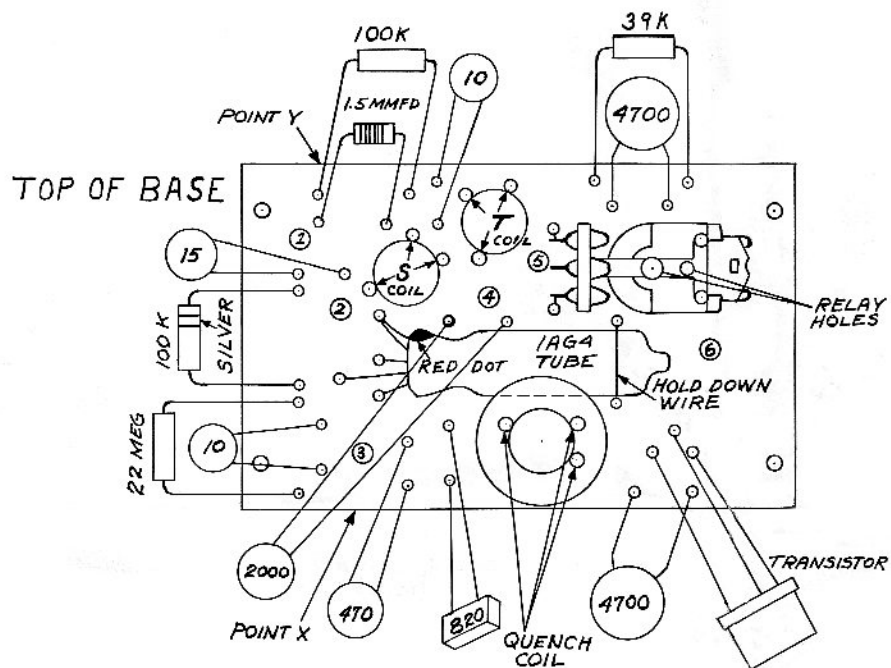


Fig 5

RESISTOR CODE

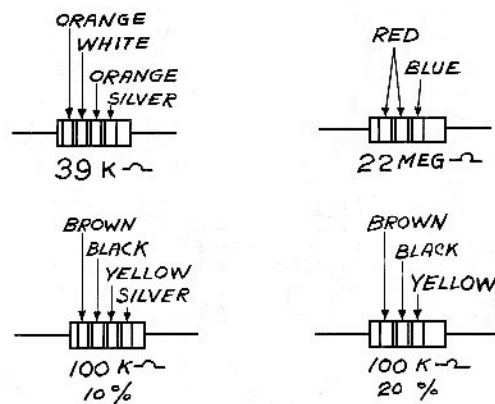


Fig 6

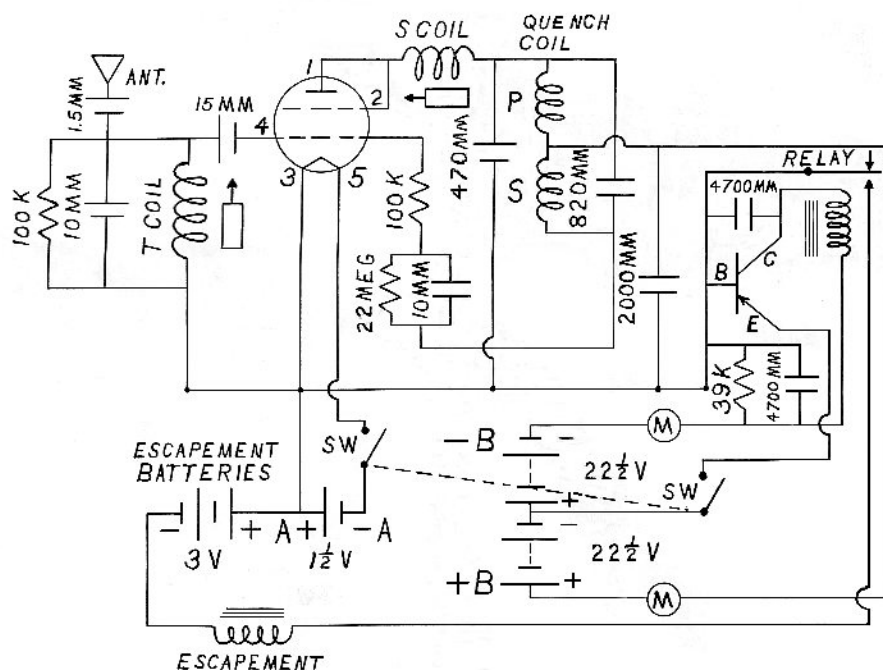


Fig 7