Instruction Manual

Science Fair®

GLOBE PATROL

CAT. NO. 28-205

CUSTOM MANUFACTURED IN JAPAN FOR

RADIO SHACK A DIVISION OF TANDY CORPORATION

FORT WORTH, TEXAS 76102

CONTENTS

INTRODUCTION

Your SCIENCE FAIR™ Globe Patrol short wave receiver is a four-band, three transistor receiver which can tune stations all the way from the AM broadcast band to thirty Megahertz.

You can listen to amateur stations, foreign broadcast stations, ships at sea, aircraft, and many other exciting radio services, just by switching bands with a simple turn of a knob. This compact transistorized receiver has a main tuning dial and a bandspread dial, RF gain circuit, a choice of earphone or speaker output, and front panel band selection.

FEATURES

Continuous AM reception from 550 KHz to 30 MHz in four bands (Standard AM broadcast plus three short-wave bands).

BANDSPREAD tuning on all four bands (on the broadcast band it is used for fine tuning).

BAND Switch on front panel

REGENERATION control for increasing the sensitivity to weak signals

All solid-state for instant reception (no warmup time required).

Front panel jack for earphone

External connection for antenna and ground

Built-in 2-1/2 inch PM speaker

A. C. Adaptor jack

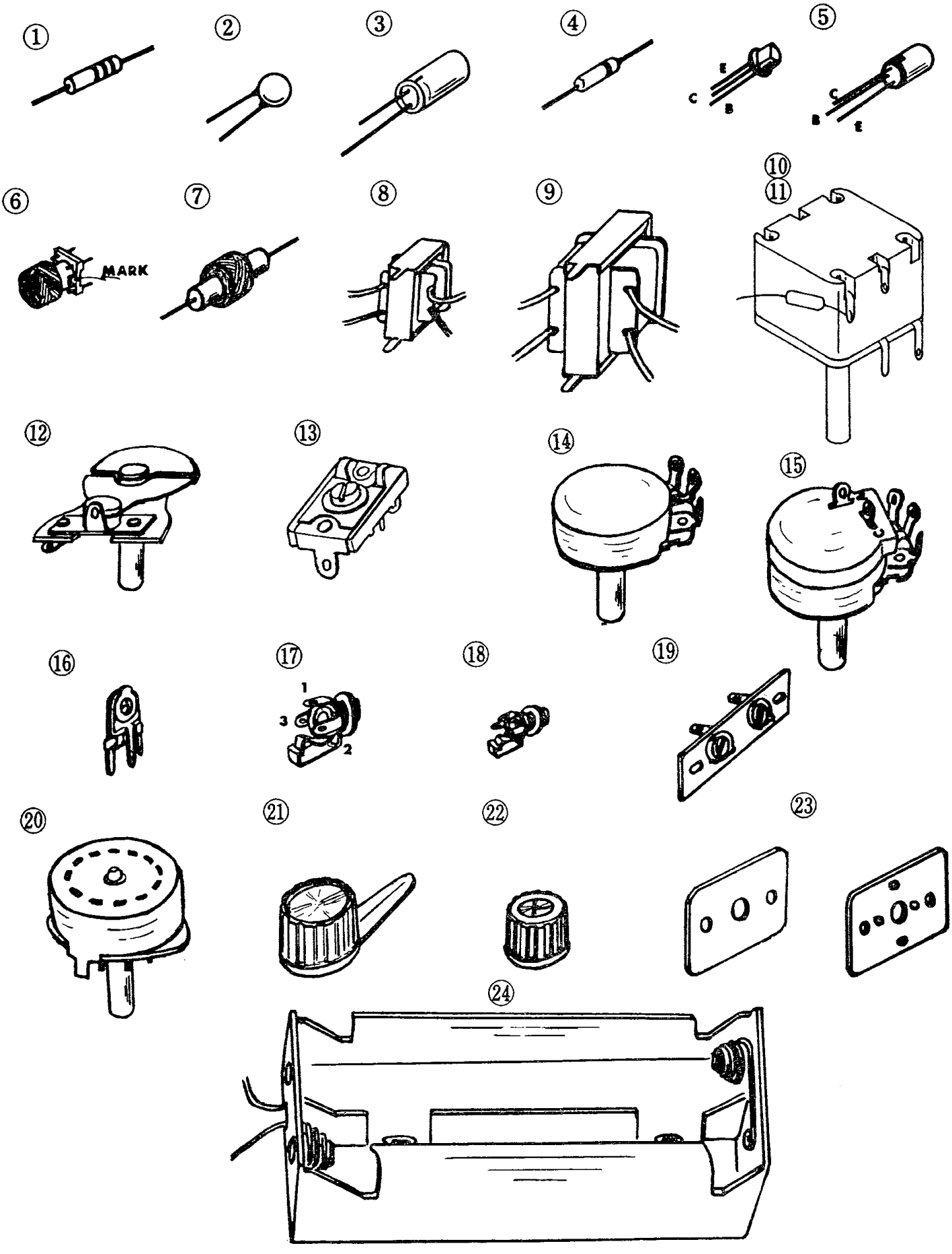
NOTE: Please read the Kit Construction Guide before proceeding.
It contains valuable information on unpacking, parts identification, tools, soldering and step-by-step instructions.

PARTS LIST

The numbers in parentheses are keyed to the numbers on the parts drawings.

	Part No.	Description
		Resistors, 1/8 Watt
(1)	R1, R4	33kΩ (Orange-orange-orange)
	R2	12kΩ (Brown-red-orange)
	R3, R10	100Ω (Brown-black-brown)
	R5	10kΩ (Brown-black-orange)
	R6	560Ω (Green-blue-brown)
	R7	5.6kΩ (Green-blue-red)
	R8	3.3kΩ (Orange-orange-red)
	R9	220Ω (Red-red-brown)
		Capacitors
(2)	C1, C2, C5, C10	0.005μF Disc
	C3	0.01μF Disc
	C4	0.02μF Disc
(3)	C6, C7, C8, C9	33μF Electrolytic
	C11, C12	220μF Electrolytic
	C13	3pF Disc
	C14, C15	5pF Disc
(11)	C16	140pF, Soldered to VC1
		Diode and Transistors
(4)	D1	1N60 Diode (Audio Detector)
(5)	Q1	2SC394 Silicon Transistor
	Q2	2SB54 Germanium Transistor
	Q3	2SB56 Germanium Transistor
		Coils and Transformers
(6)	L1	D Band Coil (Black)
	L2	C Band Coil (Green)
	L3	B Band Coil (Red)
	L4	A Band Coil (White)
(7)	RFC	3mH RF Choke Coil
(8)	T1	Coupling Transformer
(9)	T2	Output Transformer

	Part No.	Description
		Other Parts
(10)	VCla	245pF Variable Capacitor (Ganged)
(11)	VC1b	245pF Variable Capacitor (Ganged) with C 16 140pF polystyrene capacitor
(12)	VC2	12pF Variable Capacitor
(13)	VC3	30pF Trimmer
(14)	VR1	5K Variable Resistor
(15)	VR2	10K Variable Resistor
(16)	VR3	5K Semi-fixed Resistor
	SP	2½"(63mm) Speaker
(17)	J1	Earphone Jack
(18)	J2	Adaptor Jack
(19)		ANT. GND. Terminal
(20)	SW1	Band Switch
	Quantity	
(21)	2	Knobs, Large
(22)	3	Knobs, Small
	1	Printed Circuit Board
	1	Front Panel (Pre-mounted)
	1	Plastic Case
	1	Back Board
(23)	2	Adaptor Jack and Trimmer Boards
(24)	1	Plastic Battery Case
	1	Earphone
	2	Screws, 2.6×5mm
	6	Screws, 3×10 m m
	2	Screws, 3×15 m m
	2	Screws, 2×10 m m
	4	Screws, 3×5 m m (Self tap)
	5	Screws, 3×8 m m (Self tap)
	12	Nuts, 3 m m
	2	Nuts, 2 m m
		Wires and Tube
		Coil of Solder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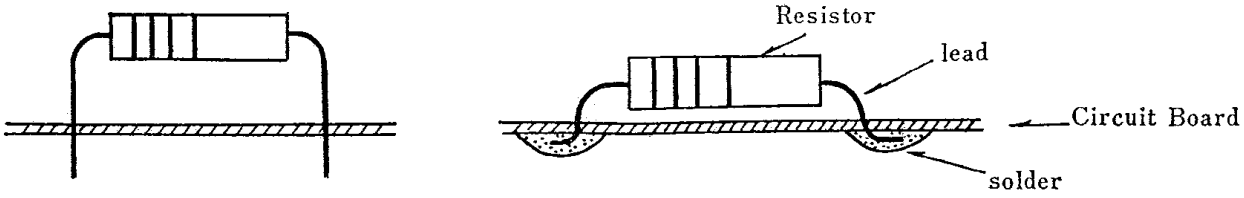
STEP-BY-STEP ASSEMBLY

The circuit board will be wired in the following steps. Be very careful in soldering not to use too much solder and short adjacent foils together.



DETAIL-1

START

Install each resistor to the circuit board in the following steps.

( )R1 33KΩ (orange-orange-orange)

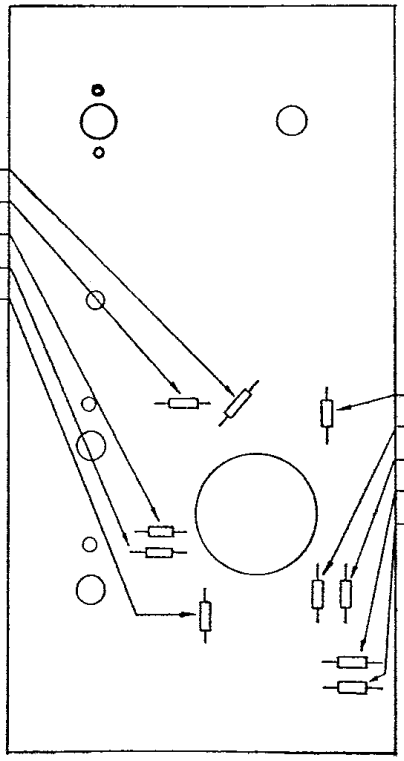
( )R2 12KΩ (brown-red-orange)

( )R4 33KΩ (orange-orange-orange)

( )R5 10KΩ (brown-black-orange)

( )R6 560 Ω (green-blue-brown)

( )Solder all leads to the foil side of the circuit board. Do not fill the other holes with solder. After soldering clip off the excess lead lengths.



CONTINUE

( )R3 100Ω (brown-black-brown)

( )R7 5.6KΩ (green-blue-red)

( )R10 100Ω (brown-black-brown)

( )R8 3.3KΩ (orange-orange-red)

( )R9 220Ω (red-red-brown)

( )Solder all leads and clip off the excess lead lengths.

GO TO FIGURE-2

FIGURE-1

When attaching the electrolytic capacitors, be sure they are mounted with proper polarity. The negative leads are identified by a minus (—) sign on the capacitor next to the negative lead, and the connection on the board can be checked with pictorial diagram. FIGURE 2.

START

The capacitors will be installed on the circuit board in the following steps.

( )C12 220μf electrolytic. Be sure that the correct polarity is observed.

( )C11 220μf electrolytic. Observe polarity.

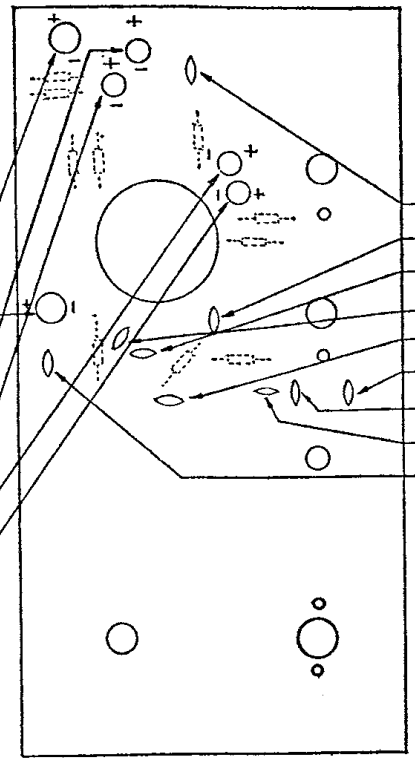
( )C9 33μf electrolytic. Observe polarity.

( )C8 33μf electrolytic. Observe polarity.

( )C7 33μf electrolytic. Observe polarity.

( )C6 33μf electrolytic. Observe polarity.

( )Solder all leads and clip off the excess lead lengths.



CONTINUE

( )C10 .005μf disc. ceramic.

( )C5 .005μf disc. ceramic.

( )C2 .005μf disc. ceramic.

( )C4 .02 μf disc. ceramic.

( )C1 .005μf disc. ceramic.

( )C13 3pf disc. ceramic.

( )C14 5pf disc. ceramic.

( )C15 5pf disc. ceramic.

( )C3 .01μf disc. ceramic.

( )Solder all leads and clip off the excess lead lengths.

GO TO FIGURE-3

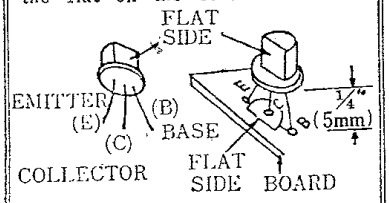
FIGURE-2

START

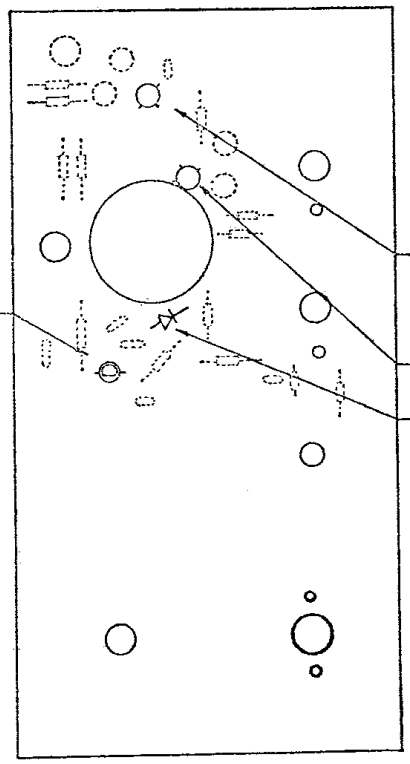
The transistors and diode will be installed on the circuit board in the following steps: solder the leads after each transistor is installed; then clip off the excess lead lengths.

( )Q1 2SC394. (silicon transistor)

Install the transistor in the following manner as shown. Position the flat side of the transistor with the outline of the flat on the circuit board.

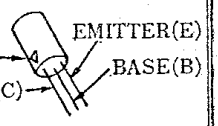


Then insert the transistor leads into correct holes which are indicated by E, C, and B. Mount each transistor about 1/4" (5mm) above the circuit board.



CONTINUE

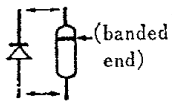
( )Q3 2SB56. Position the transistor as shown to identify its leads:



Note that the collector lead is identified by a mark on the case.

( )Q2 2SB54. Mount as above.

( )D1 IN60—



Diode mounts as shown.

The positive side is the end with the black band.

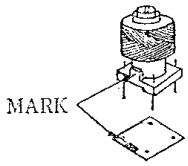
GO TO FIGURE-4

FIGURE-3

START

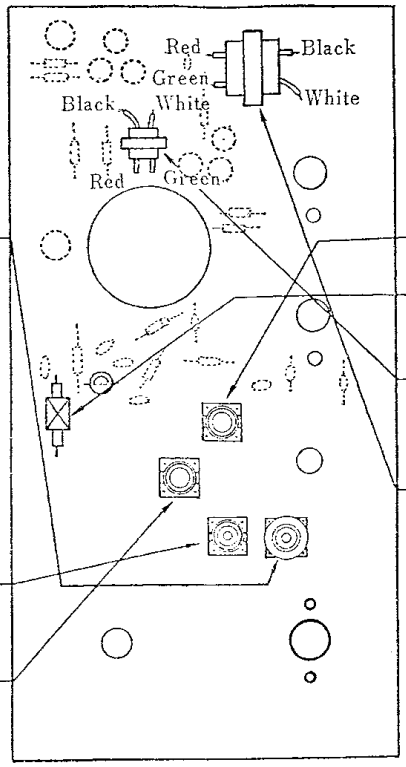
Transformers and coils will be installed on the circuit board in the following steps. Solder the leads after each component is installed.

( )L1 D-band coil black mark (universal winding)
Install the coils in the following manner, as shown.
Position the coil with its mark as shown.



( )L2 C-band coil green mark (solenoid winding)
Mount as above.

( )L3 B-band coil red mark (solenoid winding)
Mount as above.



CONTINUE

( )L4 A-band coil white mark (solenoid winding)
Mount as above.

( )RFC 3mH RF choke.

( )T1 Coupling transformer. (small transformer)
Mount the coupling transformer on the circuit board at T1.
Position the colored wires as indicated.
Bend the tabs of the transformer under the board and solder for a rigid mounting.

( )T2 Output transformer.
Mount as above.

GO TO FIGURE-5

FIGURE-4

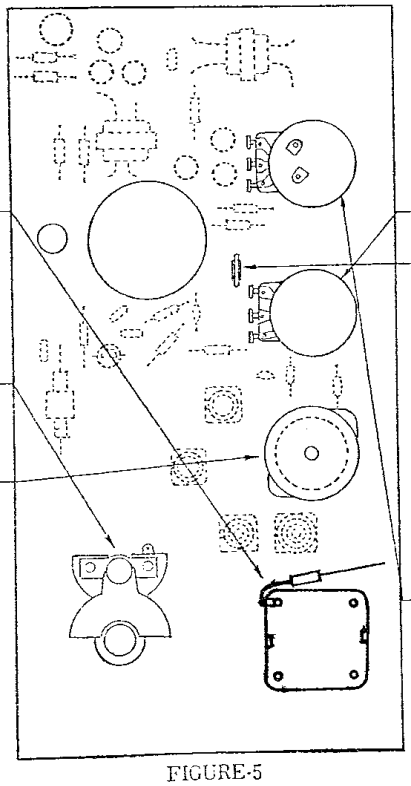
START

The variable capacitors, band select switch and variable resistor will be installed on the circuit board in the following steps.

( )VC1 Main tuning V.C.
Mount the variable capacitor from the lettered side of the circuit board. The two 2.6×5㎜ screws are inserted from the foil side to hold.

( )VC2 Band-spread V.C.
Mount the bandspread V.C. on the circuit board at VC2.

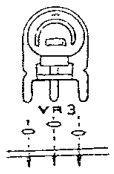
( )SW1 Band select switch
Mount the band switch SW1 from the lettered side of the board with the lugs going through the holes.
Then the lugs are soldered to the foil side.



CONTINUE

( )VR1 5KΩ regeneration control
The variable resistor VR1 is mounted from the lettered side of the board at VR1.

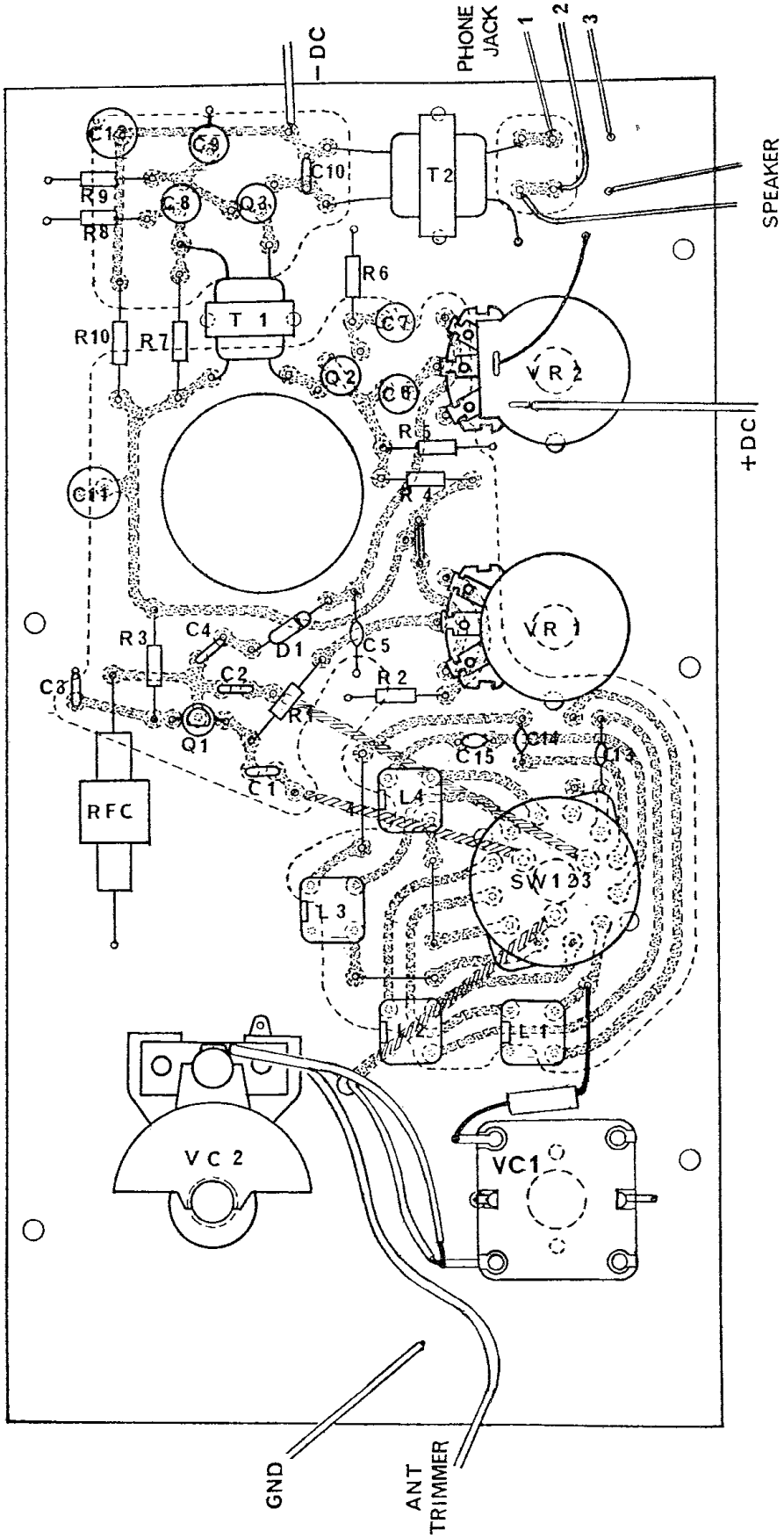
( )VR3 5KΩ semi-fixed resistor.
Mount the semi-fixed resistor from the lettered side of the circuit boad. The lugs are bend to the foil side.



( )VR2 10KΩ Volume control with Switch Mount the volume control on the board at VR2.

GO TO WIRING

FIGURE-5


– DC
PHONE JACK
1
2
3
SPEAKER
+ DC
C12
C9
C10
T2
R9
C8
Q3
R8
R6
T1
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R7
C7
VR2
Q2
C6
R5
C11
R4
VR1
C4
D1
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C3
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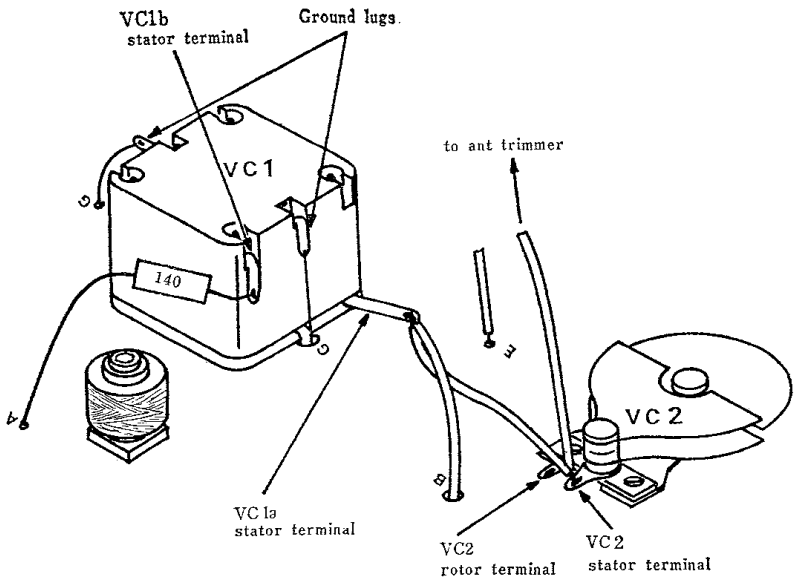
ANT TRIMMER



DETAIL-2

WIRING

Do wiring in the following steps. Use thicker yellow wire unless indicated. Alphabets and numbers are printed on PCB so that wiring may be done easier. Wires supplied are uncut, and therefore they should be cut to required lengths and each end of them should be stripped about 1/4″ (5mm)

( ) Connect stripped wires to Ground lugs of the main tuning capacitor and to the point G holes, and solder. See Detail-2.

( ) Connect the lead from the polystyrene capacitor (C16) coming from VC1b stator terminal to point A hole. See Detail 2.

( ) Connect a 2½″ (65mm) wire to the stator terminal of bandspread capacitor VC2 Do not solder. See Detail 2.

( ) Connect the wire coming from VC2 stator terminal to VC1a stator terminal. Do not solder now, but do in next step. See Detail 2.

( ) Connect a 4″ (100mm) wire to VC1a stator terminal and solder.

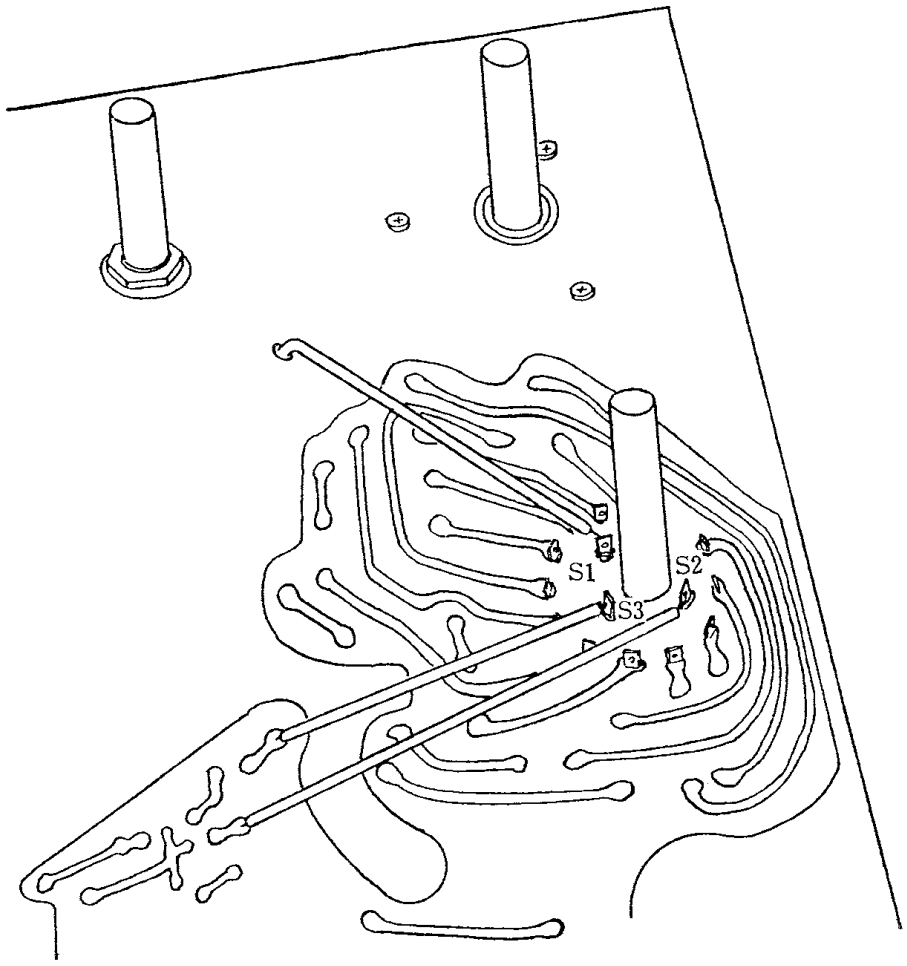
( ) Connect the other end of the 4″ (100mm) wire through the point B hole to the S1 lug on the foil side and solder. See Details 2 and 3.

( ) Connect a 10″ (250mm) wire to VC2 stator terminal and solder.

( ) Insert a 10″ (250mm) wire (thicker wire) through E hole from the lettered side and solder on the foil side.

( ) Connect a 2½″ (65mm) wire from S2 lug on the foil side to the foil side of C2 0.005μF, and solder. See Detail 3.

( ) Connect a 1-3/4″ (45mm) wire from S3 lug to the foil side of C1 0.005μF, and solder. See Detail 3.



DETAIL- 3

( ) Connect a stripped wire from the earth lug (rotor terminal) of bandspread VC2 to the point 1 hole and solder. See Detail 2.

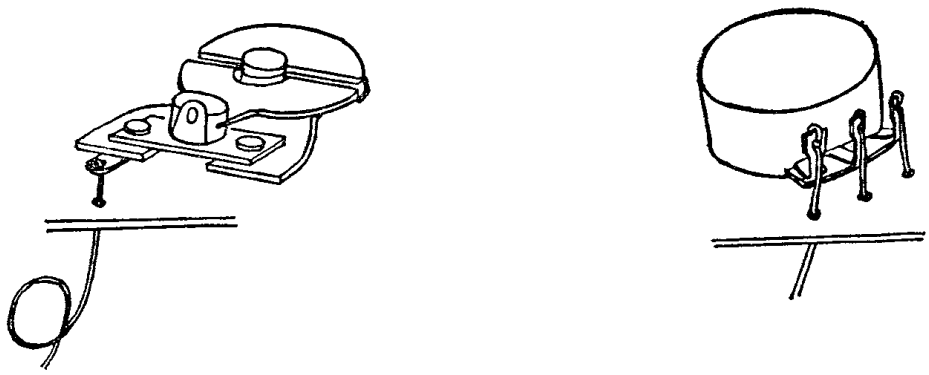
Note: It may often be difficult to do wiring if you cut the wire at the required length from the first. It would, therefore, be better to insert a long wire from the foil side through the hole and solder to the lug first and then cut it at about 1/8″ (3 mm) length on the foil side, bend it and solder. See Detail 4.

( ) Mount a 1″ (25mm) bare wire on the line 2 jumper and solder. Mount this jumper wire as you would a resistor, flush with the board.

( ) In a like manner, a 1″ (25mm) bare wire on the line 3 jumper and solder.

( ) In a like manner, a 1″ (25mm) bare wire on the line 4 jumper and solder.

( ) Connect a bare wire from each of the 3 lugs of the regeneration control VR1 5KΩ to the points 5, 6 & 7 respectively, and solder. See Detail 4.



DETAIL-4

( ) In a like manner, connect a bare wire from volume control VR2 to the points 8, 9 & 10, and solder.

( ) Connect a bare wire from one SW lug of VR2 to the point 11 on PCB, and solder. See Detail 7.

( ) Solder the green lead of coupling transformer T1 to the point 12 on PCB.

( ) In a like manner, the red lead of T1 to point 13.

( ) In a like manner, the white lead of T1 to the point 14.

( ) In a like manner, the black lead of T1 to the point 15.

( ) Solder the green lead of output transformer T2 to the point 16.

( ) In a like manner, the red lead of T2 to the point 17.

( ) In a like manner, the white lead of T2 to the point 18.

( ) In a like manner, the black lead of T2 to the point 19.

( ) Cut each of the thin black and yellow wires in half.

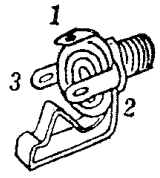
( ) Connect each of the black wires to points 20 and 21, one to point 20 and the other to point 21.

( ) Connect each of the yellow wires to points 22 and 23, one to point 22 and the other to point 23.

( ) Solder a thin white wire to the point 24.

( ) Twist together the black, yellow and white wires coming from points 21, 23 and 24.

( ) Solder the yellow wire coming from the point 23 to the lug 1 of earphone jack. See Detail 5.



DETAIL-5

( ) Solder the white wire coming from the point 24 to the lug 2 of earphone jack.

( ) Solder the black wire coming from the point 21 to the lug 3 of earphone jack.

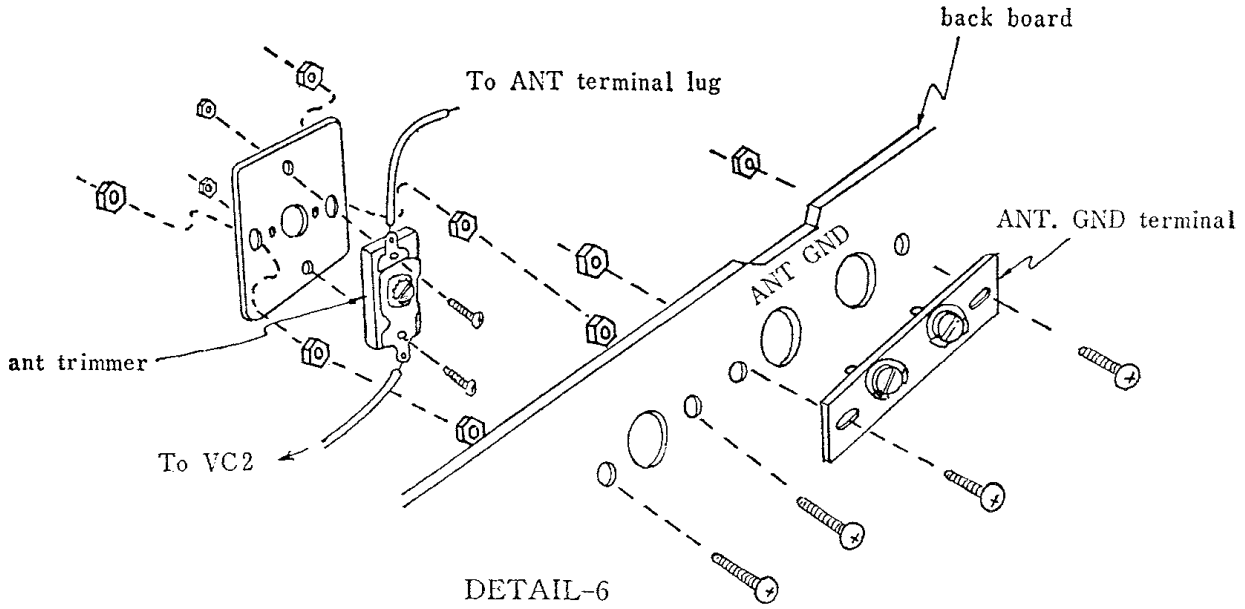
( ) Twist together black and yellow wires coming from points 20 and 22.

( ) Solder the black wire coming from the point 20 to one terminal of speaker.

( ) Solder the yellow wire coming from the point 22 to the other terminal of speaker.

The back board of the cabient will be installed with ANT and GND terminals and antenna trimmer in the following steps.

( ) Install ANT and GND terminals on the back board from outside with 3x10 mm screws and nuts. See Detail 6.



DETAIL-6

( ) Install the antenna trimmer on the trimmer board with 2x10 mm screw and nuts. These screw and nuts are found in the plastic bag with the trimmer, and are very small. See Detail 6.

( ) Install the trimmer board on the back board from inside with 3x15 mm screws and nuts. See Detail 6.

( ) Install adaptor jack on adaptor jack board with the nut and washer supplied with the jack.

( ) Install adaptor jack board on back board with 3x10 mm screws and nuts.

( ) Install battery case on the back board with 3x10 mm screws and nuts. Install so that the red and black wires will be next to the adaptor jack—install so that when the back board is put on the case the battery holder will clear the tuning capacitor.

( ) Solder red wire of battery case to lug 2 of adaptor jack as shown in Detail 5.

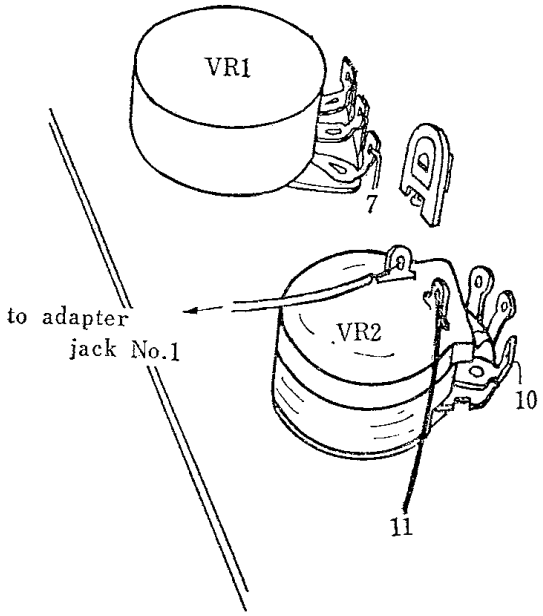
( ) Connect black wire of battery case to lug 3 of adaptor jack but do not solder.

( ) Solder one end of 7″ (180mm) black wire to lug 3 of adaptor jack together with the above wire and the other end to point 25 on PCB.

( ) Solder one end of 6″ (150mm) red wire to lug 1 of adaptor jack and the other end to switch lug of VR2. See Detail 7.

( ) Insert the yellow wire coming from VC2 stator terminal and the black wire from point E through the tube provided.

( ) Solder the black wire coming from the point E to the GND terminal of ANT. input board from inside.



DETAIL-7

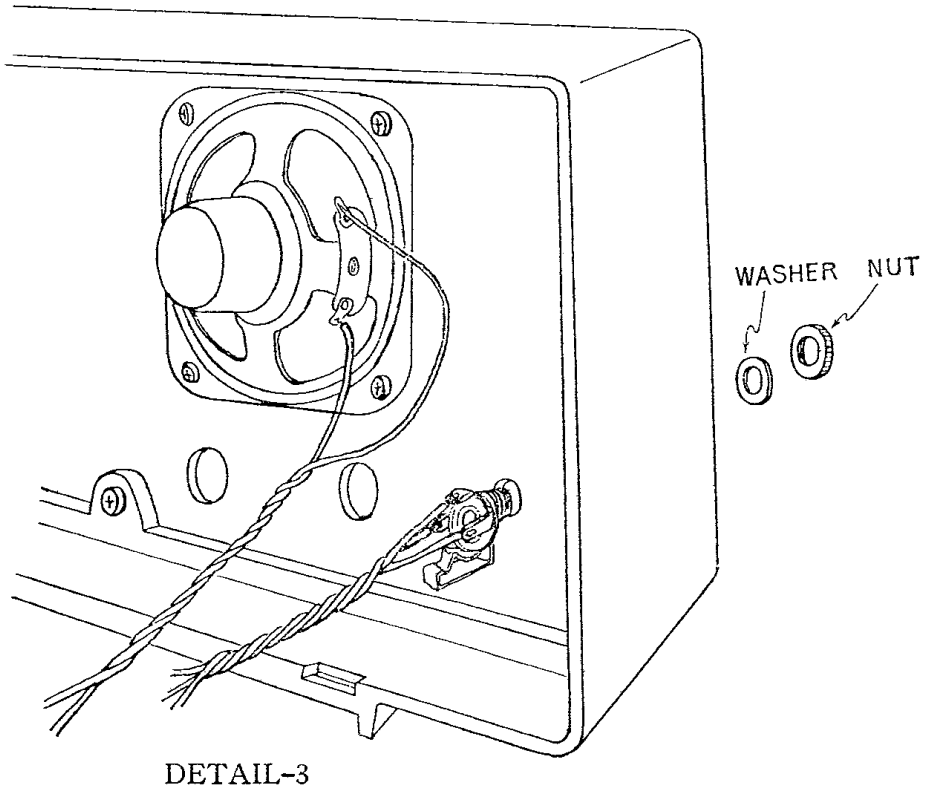
( ) Solder the yellow wire coming from VC2 to one lug of the antenna trimmer.

( ) Connect the other lug of the antenna trimmer and the ANT terminal with a wire and solder.

FINAL ASSEMBLY

( ) Install the speaker on the front pannel with 3×5 m/m self-tap screws. See **Detail 8.**

( ) Install the earphone jack on the front pannel. See Detail 8.



DETAIL-3

( ) Install the PCB in place.

Note: Bandspread should be kept at fully counter-clockwise.

( ) Turn the shaft of the mein tuning capacitor fully counter-clockwise, and fix the large knob with clear plastic indicator pointing to the 9 o'clock direction. Make sure that the indicator line points to the 3 o'clock direction when the knob is turned fully clockwise.

( ) Install on the bandspread shaft a knob with clear plastic indicator pointing to the dial O. Make sure that the indicator points to the dial 10 when the knob is turned fully clockwise.

( ) Install the band switch knob in place and see that the white indicator line points to Band A when it is turned fully counter-clockwise. Make sure that the knob indicates A, B, C, and D of the band when it is turned.

( ) Install the regeneration knob in place and see that the white indicator line comes to the top when the knob is turned and stopped in the middle.

( ) In a like manner, install the volume knob in place.

( ) Install the back board. It can be set easily if you push it trying to open the top and bottom of the cabinet.

ADJUSTMENT & OPERATION

( ) Insert 4 1.5 V "C" cell dry batteries (Radio Shack Cat No. 23-467 or 23-581) in battery case in proper direction.

( ) Connect ANT line to ANT terminal.

( ) Use GND line in case of necessity.

( ) Turn the volume control knob fully clockwise to turn the set on.

( ) Turning the regeneration control knob clockwise, check if the set oscillates on A, B and C bands except D band. In case it does not oscillate on each band, adjust VR3. The adjustment of VR3 should be done in the following steps.

( ) Set the band switch at the band where it is most difficult to get oscillation.

( ) Turn the main tuning knob clockwise and set it at about 3/4 turn position.

( ) Turn the regeneration control knob clockwise and set it about 3/4 turn position.

( ) Turn the VR3 with screw driver and set it at the position where oscillation happens. (It is easier to get oscillation if you turn it counter-clockwise looking from the VR1 side.)

For regeneration alignment, it is necessary to adjust VR1, VR3 and ANT trimmer. Antenna trimmer is for adjusting antenna input load. If it is turned fully clockwise, input increases and sensitivity rises, but oscillation becomes hard to occur. In case of regenerative receiver, the sensitivity is the best just before oscillation and lowers

unless oscillation happens even if antenna input was increased. In case you use the ANT wire, the sensitivity is the best at the position where the ANT trimmer was rotated about 1 turn counter-clockwise from the point turned fully clockwise.

( ) If oscillation does not happen after you have adjusted VR3, check it if antenna trimmer is not turned too much clockwise.

Since the oscillation point changes a little at each station you receive, you have to try to receive a station at the best sensitivity adjusting the regeneration control knob to set to the point just before oscillation. If the band spread knob is set at the dial 10, the main tuning dial becomes the direct reading (the dial indicates exact frequency), and you can receive a station rotating the main tuning knob looking at the dial. And when you have received a signal, turn the bandspread to get the best sensitivity. The short wave broadcast is not transmitted at every frequency but only within the limited frequency range according to the international agreement. In case of the short wave broadcast, therefore, it is the point that you try to receive a station in the limited frequency. SW broadcast is largely affected by the time and season, and sometimes it becomes impossible to receive a station if the time is wrong. In general, due to the conditions of ionosphere the reception is good at night at low frequency, but at high frequency it is better in the daytime.

NOTE: To save on batteries use the AC adaptor, Radio Shack Cat. No. 12-702, available from your dealer.

IF YOU HAVE TROUBLE

If the radio does not work properly after assembly the following steps should help you to locate and correct the error.

1. Recheck all the wiring. It is a good idea to have someone else check your work. Someone who is not familiar with the kit may notice something you have overlooked.
2. 90% of the kits returned for repair do not work properly due to poor connections and soldering.
3. Check to see that all transistors have been installed with thin leads connected to proper holes on the circuit board.
4. Check to be sure the correct part is installed in the circuit as shown in the diagrams and called out in the instructions.
5. Check for bits of solder or wire that may be lodged in the wiring.
6. If you still cannot locate the problem check the voltage readings as shown on the chart below. All readings are with a VTVM and may vary ±20%.
7. The schematic and circuit description may help in indicating where to look for problems.

VOLTAGE CHART

Voltage checks can be made with a vacuum tube voltmeter (VTVM) or multitester at certain points in the circuit.

These readings are obtained at the transistor leads and are referred to ground (plus) potential.

Q1	2SC394	C	—0.01V	E—C	5.8V
	(NPN)	B	—5.0V	E—B	0.6V
		E	—5.8V		
Q2	2SB54	C	—5.2V	E—C	4.1V
	(PNP)	B	—1.2V	E—B	0.2V
		E	—1.0V		
Q3	2SB56	C	—5.4V	E—C	3.7V
	(PNP)	B	—1.9V	E—B	0.2V
		E	—1.7V		

EXTERNAL ANTENNA

This kit has been supplied with a 6 feet length of antenna wire, which should be adequate for local AM or short wave reception. For optimum reception an external antenna is recommended (Radio Shack No. 278-1373). To install external antenna, see Fig 7.

Following installation of the antenna use a slot screwdriver to adjust the trimmer capacitor, located on the back panel, to one turn counter-clockwise from maximum clockwise position.

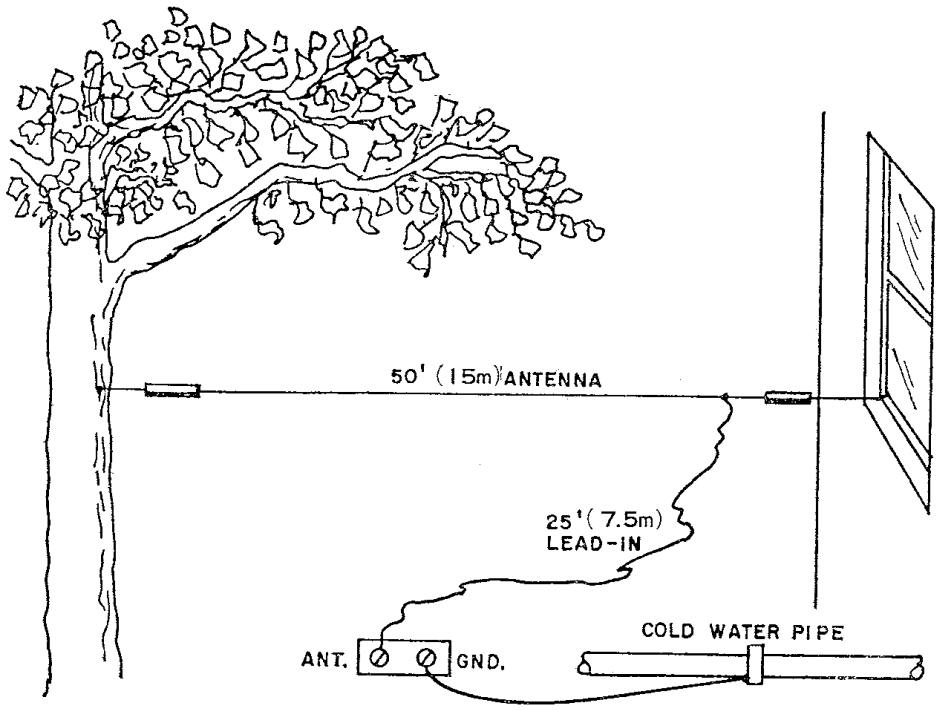


Figure 7 External Antenna for Globe Patrol Receiver

OPERATIONAL USE

There are five operating controls on the Globe Patrol short wave receiver. Their functions and use are described below. There is also a phone jack for earphone listening when desired. See front panel view, Figure 8.

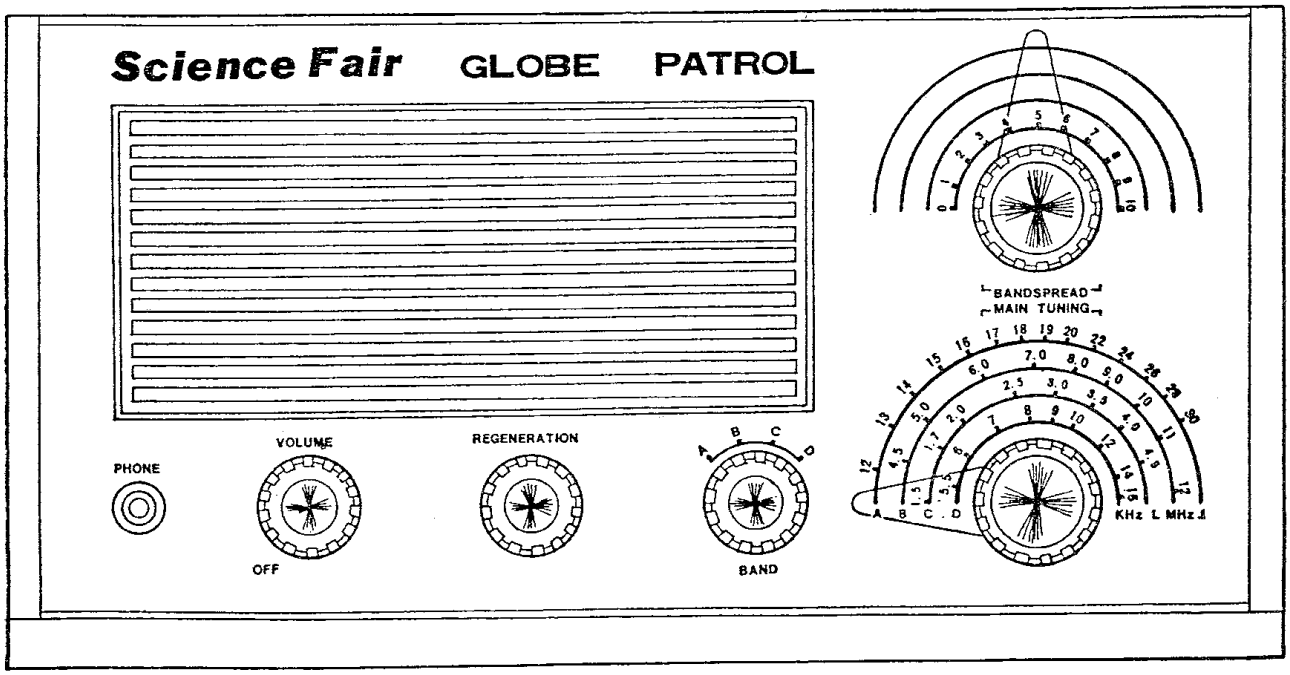


Figure 8 Globe Patrol Short Wave Receiver

OPERATING PROCEDURES

When you first operate your receiver, it is recommended that you first tune in the Standard AM Broadcast Band (Band D). This band will be the easiest to tune and the stations will be familiar to you. You will probably notice that you can receive many stations that you had not listened to before. When tuning, use the BANDSPREAD control as a fine tuning control. This will enable you to separate close stations and get a sharp and clear signal.

TUNING THE BROADCAST BAND

To operate the Globe Patrol short wave receiver on the AM Broadcast Band, perform the following steps:

1. Turn the OFF-VOLUME control clockwise to turn on the switch. This radio does not require any warm-up time.
2. Set the BAND switch to the band D. (for Broadcast Band). The white line on the knob is the pointer.
3. Turn the MAIN TUNING dial in either direction until a station is heard. The broadcast band frequencies are marked on the black dial.
4. Set the REGENERATION control to the point where the signal is strongest without much background noise. Background noise may sound like static or hissing.
5. Set the OFF-VOLUME control to the level desired.
6. Adjust the BANDSPREAD dial for the clearest signal. It may be necessary to separate stations that are close together. This can be done easily by fine tuning.
7. Readjust the OFF-VOLUME control if necessary.

MAIN TUNING DIAL

The main tuning control is a variable capacitor which is varied to produce resonance at the various transmitting frequencies of the band in use. This control is used to locate a station and is very sensitive. It is used for tuning most standard broadcast stations and for scanning the short wave bands. The BANDSPREAD dial can be used to spread out a small area of the MAIN TUNING dial over the whole BANDSPREAD dial, and fine tuning can be accomplished. This tuning dial has four calibrated frequency ranges, each in a different color to make it easy to use. The bands and color-coding are listed in the table below.

BAND	FREQUENCY CALIBRATION	COLOR
A	12 MHz to 30 MHz	Blue
B	4.5 MHz to 12 MHz	Red
C	1.5 MHz to 4.5 MHz	Green
D	550 KHz to 1600 KHz	Black

BANDSPREAD DIAL

The BANDSPREAD control is also a variable capacitor which is used for fine tuning of the station after an approximate dial location has been set on the MAIN TUNING dial.

REGENERATION

This control is used to adjust the RF sensitivity on all bands. When weak signals are received, advance the control clockwise until peak audio output is obtained. For strong signals adjust the control counterclockwise for best operation. If REGENERATION control is set too high, overloading will occur, resulting in oscillation and loss of audio output.

BAND SWITCH

This control is used to select the desired band for listening. The letters A, B, C, D above the control knob are the four switch positions which correspond to the letters A, B, C, D on the MAIN TUNING dial.

OFF-VOLUME

This control is a combination of switch and potentiometer (variable resistor). When turned fully counterclockwise, the switch is in the OFF position and the radio will not operate. Turning this control clockwise turns on the switch and provides volume control by increasing the volume as it is turned in the clockwise direction, and decreasing the volume as it is turned in the counterclockwise direction.

PHONE JACK

The PHONE jack is provided on the front panel for plugging in the earphone for private listening. When an earphone is used, the speaker is automatically disconnected and the radio cannot be heard except through the earphone.

TUNING Short Wave Stations

Tuning of short wave signals is a more precise operation. Short wave radio reception varies with many conditions that are beyond the control of your receiver and which may affect its performance. Examples of these conditions are atmospheric disturbances, barometric high's, and low's, lowering of the ionosphere at night-time, sun spots and radiation conditions, and daily and seasonal atmospheric variances. Short wave reception is also more dependent

on your own skill in tuning your receiver. Even with highly sophisticated receiving systems, reception is at time very poor or very good.

Sometimes "freak" conditions exist in the atmosphere which create good or excellent reception from long distances or directions that would not normally be expected, adding fun and excitement to your short wave listening. Some short wave services such as amateur radio service, do not operate on fixed frequencies, and can be heard at any time within the various bands. For this reason, when tuning short wave stations, there is more dial scanning required to find stations, and especially when the transmitting station is crystal controlled, the frequency limits within which the station can be heard are narrower and tuning must be more precise. The steps required to tune short wave stations can be summarized as follows:

1. With the receiver turned on, select the band you wish to scan by setting the BAND switch to A, B or C.
2. Set the BANDSPREAD control to the high end. The index on the knob should be at 10. Observe the dial corresponding to the band selected.
3. Slowly rotate the MAIN TUNING control across the entire dial, and repeat up and down the dial as often as necessary. This process is called dial scanning, and when your skill improves, it may be done more rapidly. You may hear clicks and squeals, and sometimes code, voice or music. When you hear the clicks, this is usually a station which you are rapidly passing over. Go back and try to zero in on the click and it may become a voice or other signal. Squeals are somewhat similar. They are caused by the mixing of signals from two or more stations, and tuning down on them may produce a station.
4. When you have located a station and have tuned in as sharply as possible with the MAIN TUNING control, use the BANDSPREAD control to separate stations and to fine-tune the desired station.
5. The continuous wave (CW) code stations which you may receive while dial scanning, can be made to sound higher or lower in pitch (frequency) by use of the BANDSPREAD control.

WHERE TO LISTEN

The four bands on the Globe Patrol short wave receiver provide coverage for many interesting world-wide radio services that can be monitored day and night. The services covered by each of the bands are described briefly here. When you are familiar with the use of the receiver, you will be able to find stations more easily and to be able to locate your favorite stations and radio services at regular times, and you will be able to scan the dials for new stations with more success.

BAND A

Band A includes Amateur Stations, International Short Wave Stations, Military Stations, and Standard Time Signals.

20 METER BAND—Frequency Range: 14.0 MHz to 14.350 MHz. Amateur

This band is normally used for distances of 600 to 3000 miles, but has occasional openings of up to 7000 miles. The CW portion is from 14.0 MHz to 14.2 MHz. In the United States, the phone band is from 14.2 MHz to 14.350 MHz. Peak distances are usually at sunrise and sunset. This is primarily a daylight band with night-time activity limited to the late spring, summer and early fall months.

19 METER BAND—Frequeucy Range: 15.1 MHz to 15.45 MHz. ISW

Signals over extreme distances are heard after sunrise and throughout the daylight hours. Some night reception is possible during the summer months.

16 METER BAND—Frequency Range: 17.7 MHz to 17.9 MHz. ISW

Signals at this end of the Radio Frequency spectrum are significantly subject to changes in sunspot activity. The generally accepted theory is that, as the number of sunspots increase, the higher frequencies are received over longer distances. Therefore, at the peak of the solar cycle, this band should offer wonderful possibilities of daylight DX (long range reception). (Note: The solar cycle peak occurs at eleven year intervals. The last peak occurred in 1969-70)

15 METER BAND—Frequency Range: 21.0 MHz to 21.450 MHz. Amateur

Normal distances that can be expected from this band are from 800 to 4000 miles with occasional openings of up to 8000 miles. This is a daylight band with peak distances occurring during the daylight up to sunset. Summer time produces a combination of long distance and short distance "skip". During winter evenings the band is usually dead with signals limited to "line of sight" signals, sometimes referred to as "ground waves". The U.S. phone portion of this band is 21.250 MHz to 21.450 MHz.

14 METER BAND—Frequency Range: 21.450 MHz to 21.7 MHz. ISW

Signals in this band are subject to changes in sunspot activity. At times this band will have stronger signals than the 16 meter band due to a buildup of ionospheric return from frequencies higher than 21 MHz. Many international stations are now moving into the 14 meter band in anticipation of better sunspot conditions.

10 METER BAND—Frequency Range: 28.0 MHz to 29.7 MHz. Amateur

The CW portion of this band is from 28.0 MHz to 28.5 MHz; the U.S. phone portion is 28.5 MHz to 29.7 MHz. Normal distance ranges from 1000 to 5000 miles with occasional openings of up to 10,000 miles or better. Summer time produces a phenomenon commonly referred to as "short skip" with intermediate distances of 200 to 800 miles. During winter evenings the band is normally closed with ground wave signals limited to 25 to 50 miles. During this period the waves act in a similar manner to VHF (very high frequencies) or television frequencies.

BAND B

Band B includes Amateur Stations, International Short Wave Stations, Aircraft, Maritime Mobile, Military Stations, and Standard Time Signals.

60 METER BAND—Frequency Range: 4.75 MHz to 5.06 MHz. ISW

This is primarily a domestic band broadcasting to local listeners. However, it is often possible to receive such signals at considerable distances. The 60-meter region is designated as the "Tropical Band" since many of the stations using it are located in South and Central America. On occasion, the central and southern parts of Africa are also heard. Best reception on this band is during the winter months in the early evening.

49 METER BAND—Frequency Range: 5.95 MHz to 6.2 MHz. ISW

The behavior of this band is somewhat similar to the 60-meter band. However, it is occupied by very strong international broadcasting stations and, for this reason, may at times be more consistent.

41 METER BAND—Frequency Range: 7.1MHz to 7.3 MHz. ISW

A shared band that will, at times, have interference from other services. Amateur radio stations will be heard occasionally between 7 MHz and 7.3 MHz with voice signals between 7.2 MHz and 7.3 MHz.

During the evening hours, strong international broadcasting stations almost completely take over this band.

40 METER BAND—Frequency Range: 7.0 MHz to 7.3 MHz. Amateur

This band is good for distances of 150 to 2000 miles. As with the lower frequencies, the distance increases during the dark hours with occasional openings up to 5000 miles.

31 METER BAND—Frequency Range: 9.2 MHz to 9.7 MHz. ISW

This band offers the greatest coverage of all. Primarily a night-time band, it offers some daylight listening as well. It also holds up well during the winter evenings, making it one of the best all-round bands in the spectrum.

25 METER BAND—Frequency Range: 11.7 MHz to 11.975 MHz. ISW

The daylight reception is somewhat improved over the lower frequencies. Evening reception is possible at certain times of the year but not as regularly as on the lower bands.

BAND C

Band C includes one or two stations at the high end of the standard AM broadcast band (between 1500 and 1600 KHz), the 160-meter amateur band, the 80–75 meter amateur band, international short wave stations, ship-to-shore radiotelephone, aircraft, maritime mobile service (large ships), military stations, and standard time signals.

80–75 METER BAND—Frequency Range: 3.5 MHz to 4 MHz

This band, normally used for distances of 50 to 500 miles, has occasional openings of up to 3000 miles at night. CW is from 3.5 MHz to 3.8 MHz; phone is from 3.8 MHz to 4 MHz.

BAND D

Band D covers the standard AM broadcast band from 550 KHz to 1600 KHz. Below 550 KHz a few long range code communication stations may also be heard, but are not likely to be intelligible because of their use of high speed transmission devices.

WHAT TO LISTEN FOR

Listening on your Globe Patrol short wave receiver can be a most enjoyable and exciting hobby. You can roam the world from your armchair, listening to exciting news and events as they are happening. Many foreign broadcasts are in English, and amateur stations operate in over 100 countries around the world. You can listen to radio operations from fishing fleets, pleasure craft, rescue operations, and weather broadcasts. Some of the radio services you can hear on your Globe Patrol receiver are listed below.

Amateur Radio
International Short Wave Broadcasting
Ship-to-Shore Mobile Radio Telephone
Aircraft Radio Service
Military Radio Stations
Maritime Mobile Radio Service
Standard Time Signals—WWV and CHU
Citizens Radio Service

International broadcasting offers the most varied entertainment of all the services you will listen to on short wave. Many governments operate powerful short wave transmitters (e.g. the U. S. Government's Voice of America) to keep the world informed of activities within their countries. Many countries also license commercial short wave stations and, in fact, many regions of the world conduct most of their daily broadcasting on short wave instead of on the standard broadcast band. For specific stations and frequencies, you can obtain lists of stations in book and radio stores.

FREQUENCY CONVERSION

Communication receivers are calibrated in Megahertz, or for the Broadcast Band, in Kilohertz, which mean millions of cycles or thousands of cycles, respectively. Wavelengths, however, are measured in meters. The distance that a wave covers in meters, before the next radio wave starts is the wavelength. The number of cycles that occur in one second for each meter that the wave travels, is the frequency and may be expressed in cycles (Hertz), hundreds, thousands, or millions.

Many stations, particularly international short wave broadcasting stations, announce their frequency in meters. Amateur operators refer to amateur bands in meters. Kilohertz may be converted to meters by using this simple formula:

$$\frac{300,000}{\text{Frequency in Kilohertz}} = \text{Wavelength in meters}$$

Example:

$$\frac{300,000}{1500\ \text{KHz}} = 200\ \text{meters}$$

Megahertz may be converted to meters by the following formula:

$$\frac{300}{\text{Frequency in Megahertz}} = \text{Wavelength in meters}$$

Example:

$$\frac{300}{7.1\ \text{MHz}} = 42.5\ \text{meters}$$

The conversion from meters to Megahertz (or Kilohertz) uses the same formula:

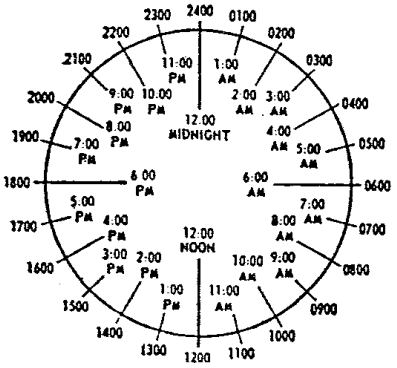
Example:

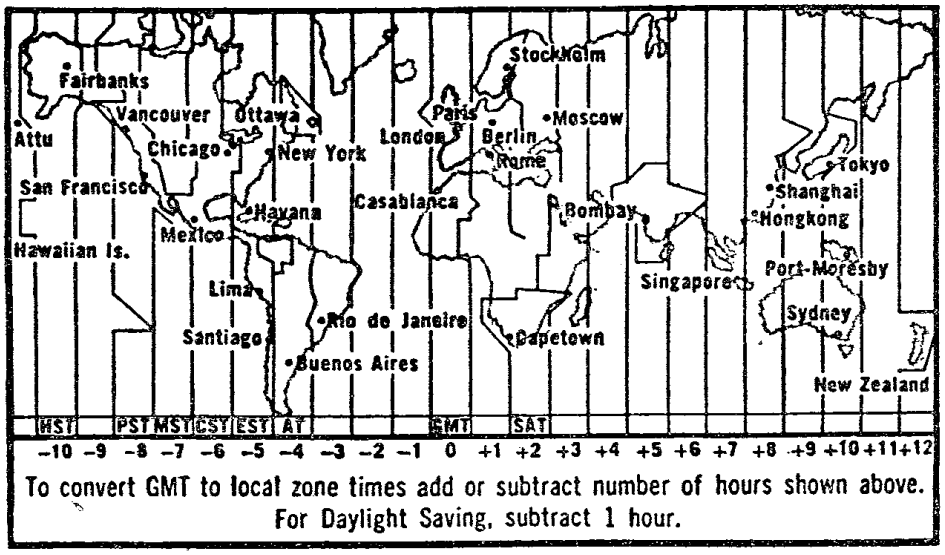
$$\frac{300}{42.25\ \text{meters}} = 7.1\ \text{Megahertz}$$

TIME CONVERSION

A 24-hour clock is used to tell communication time. One AM is 0100; four AM is 0400; Noon is 1200; 3:30 PM is 1530; 8:45 PM is 2045. This simple method precludes any confusion between AM and PM. (See chart below.)

GMT (Greenwich Mean Time—the time at Greenwich Observatory, England) is the basis for telling time in International Broadcasting. To convert from GMT to local time or any other time zone, add or subtract the hours shown on the INTERNATIONAL TIME MAP below.





Example: 2300 GMT is 1800 EST (Eastern Standard Time). This is equivalent to 11:00 PM in London, England, 6:00 PM New York is 7:00 AM in Tokyo (The next day).

THEORY OF OPERATION

OVERALL CIRCUIT

The Globe Patrol short wave receiver is a regenerative circuit with three transistor stages, a detector stage, an antenna input circuit, an output, and a power supply. The receiver is constructed of basic and rugged circuits for dependable operation, but by the use of well-engineered design principles, gives high performance despite its relatively simple construction. The electronic principles upon which the receiver is designed, are described stage-by-stage in the following paragraphs.

ANTENNA TUNING CIRCUIT

The antenna tuning circuit need not create undue concern for complexity, for in reality, it consists of four simple circuits arranged so that only one of them will be used at a time, just by switching the BAND switch. To understand its operation, consider the circuit of only one band, band D for instance. This is the broadcast band whose limits are 550 KHz to 1600 KHz.

If the other three band coil were not in the circuit, the simple tuning circuit for the broadcast band would be as shown in Figure 9. In this simplified circuit, the signal from the antenna is coupled into the tuning circuit through 30 pF capacitor VC 3. A condition of resonance is produced in the inductive-capacitive (LC) tuning circuit. The tuning circuit consists of the MAIN TUNING capacitors VCIa and VCIb in parallel with the primary winding of the band D coil. The series combination of the variable BANDSPREAD capacitor VC2 provides a small amount of additional capacitance which is used for fine tuning over small areas of selected bands.

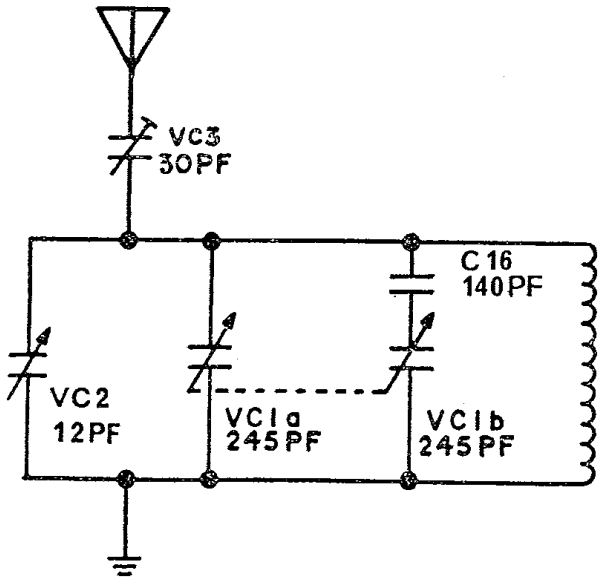


Figure 9 Tuning Circuit for Broadcast Band, Simplified

For the short wave bands, VC1b section of variable capacitor is not needed (total capacitance of this with C16 equals 89pF). When you switch the band switch to A, B or C eliminates this section from the circuit. The simplified tuning circuit for the short wave bands would be as shown in Figure 10.

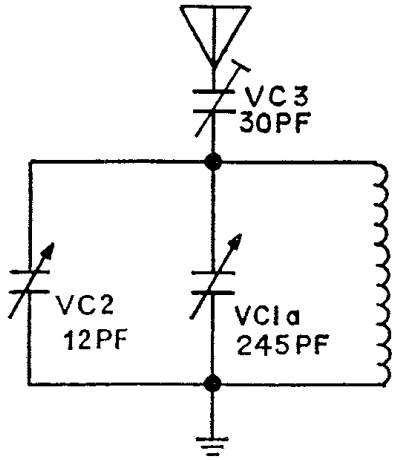


Figure 10 Tuning Circuit for Short Wave Bands, Simplfied

RADIO FREQUENCY (RF) AMPLIFIER

Transistor Q1 is an RF amplifier. It is a grounded emitter circuit in which the amplified output is taken from the collector. When the transistor goes into conduction by correct adjustment of the bias with the REGENERATION control, a small portion of the output is coupled back through 0.005μF capacitor C2 to the tickler coil. This starts and sustains oscillation at the frequency of resonance as selected by the tuning controls. The tuned signal is coupled to the base of the transistor through 0.005μF capacitor C1. The bias circuit, which controls the amount of voltage on the base of the transistor and thus controls its operating point, consists of resistors R1, R2, and variable resistor VR1, which is the REGENERATION control. The amplified collector output voltage is also controlled at -6V by action of the RF choke, which is part of the detector circuit. A simplified diagram of the RF amplifier circuit is shown in Figure 11.

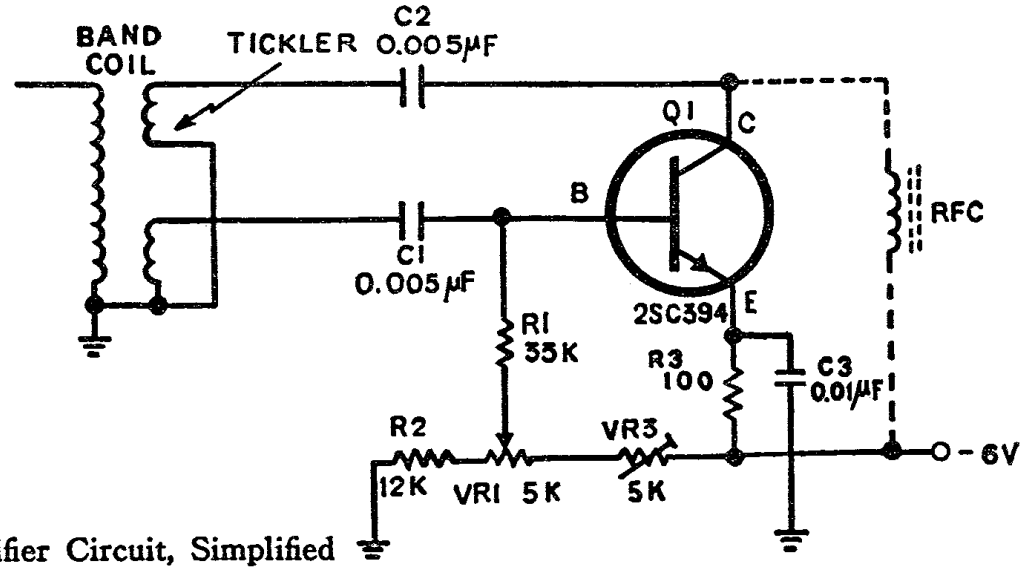


Figure 11 RF Amplifier Circuit, Simplified

DETECTOR CIRCUIT

The audio detector circuit illustrated in the simplified diagram of Figure 12 consists of a 3 mH RF chock, the 1N60 diode, and the 10 K variable resistor VR2, which is used to control the volume. The RF choke controls the output of the transistor Q1 collector at -6 volts and isolates the RF from the -6 volt DC source. The 1N60 diode is a point contact germanium diode which detects the audio and does not pass high frequency RF signal. The 10K variable resistor VR2 at the output of the detector circuit provides low-level volume control at the input to the first audio amplifier stage.

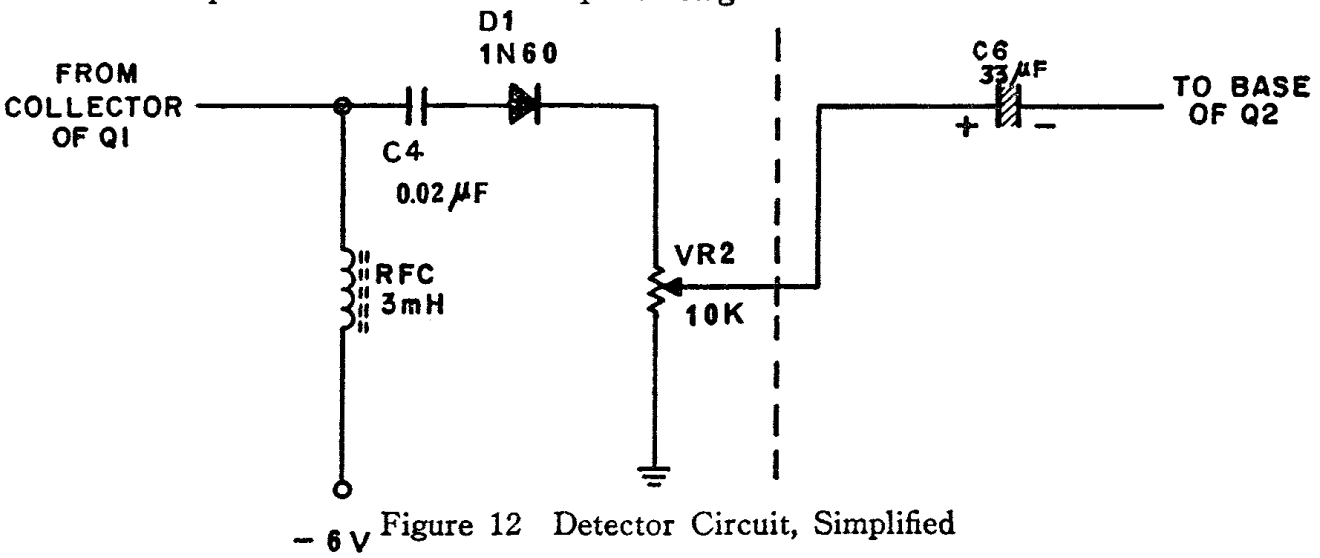


Figure 12 Detector Circuit, Simplified

FIRST AUDIO AMPLIFIER

The first audio amplifier amplifies the demodulated RF signal. It is a low level class A amplifier, whose input signal is taken at the 10 K variable resistor VR2 and coupled to the base of transistor Q2 (a medium gain 2SB54 PNP transistor) through 33μF coupling capacitor C 6. Resistors R 4 and R 5 determine the base-emitter bias for the transistor. Resistor R 6 is the emitter stabilizing resistor which is by-passed for RF by the 33μF capacitor C 7. The output signal is developed across coupling transformer T1, which acts as the collector load impedance. The collector voltage and the emitter current are kept relatively low to reduce the noise. Figure 13.

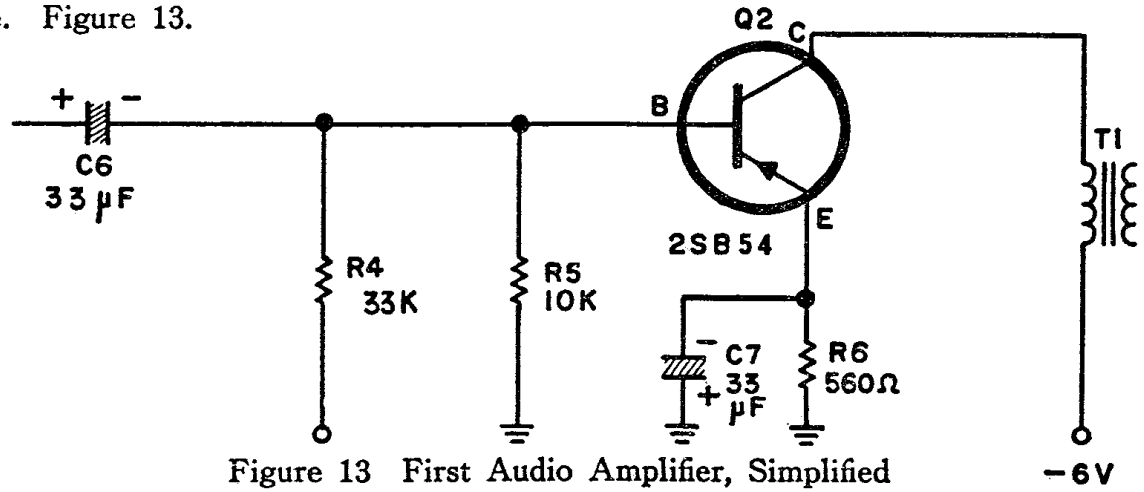


Figure 13 First Audio Amplifier, Simplified

POWER OUTPUT STAGE

This is a single-ended power amplifier circuit. Transformer coupling between the Q2 and Q3 transistor stages provides high power efficiency and matches the load of the first stage to the input of the second stage, giving high power gain. The secondary winding of transformer T1, coupled to the base of Q3 introduces the audio signal to the base and also acts as the base DC return path. The power output stage is a high gain 2SB56 transistor, transformer coupled to the PM speaker. Base-emitter bias is provided by resistors R 7 (5. 6 K) and R 8 (3. 3 K) respectively. Resistor R 9 is the emitter stabilizing resistor, by-passed by 33 μF capacitor C 9 for frequencies above the audio range. The 33 μF capacitor C 8 prevents loss of signal in the bias network. Transistor Q 3 collector output is coupled to the speaker by matching transformer T 2 whose primary is shunted by 0. 005 μF for high frequency attenuation and to protect against distortion in the speaker. See the simplified diagram, Figure 14.

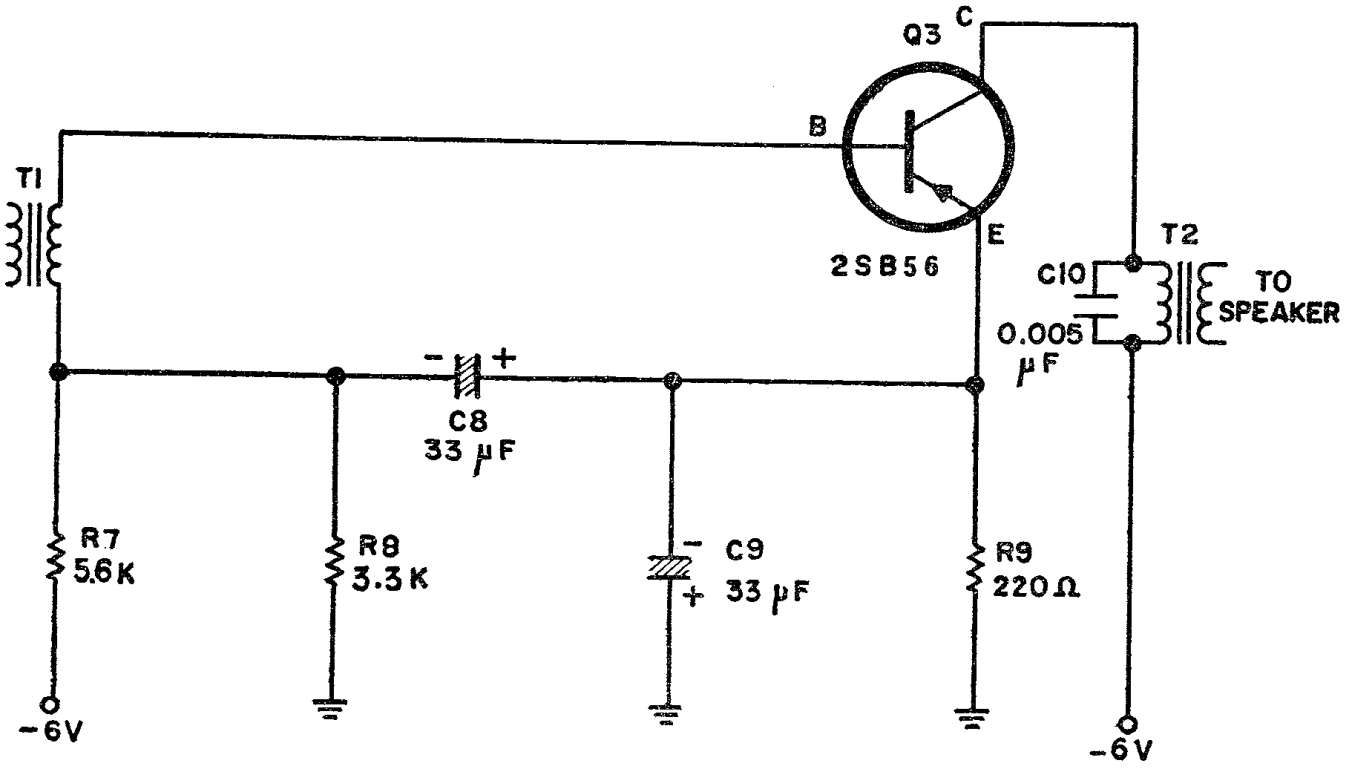
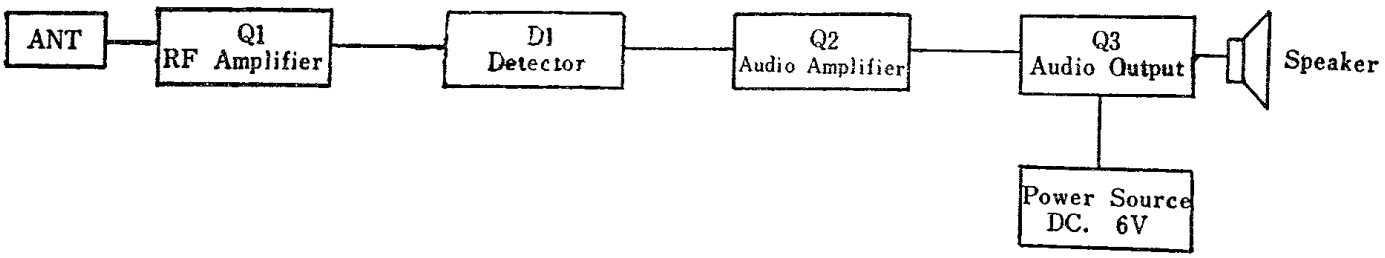
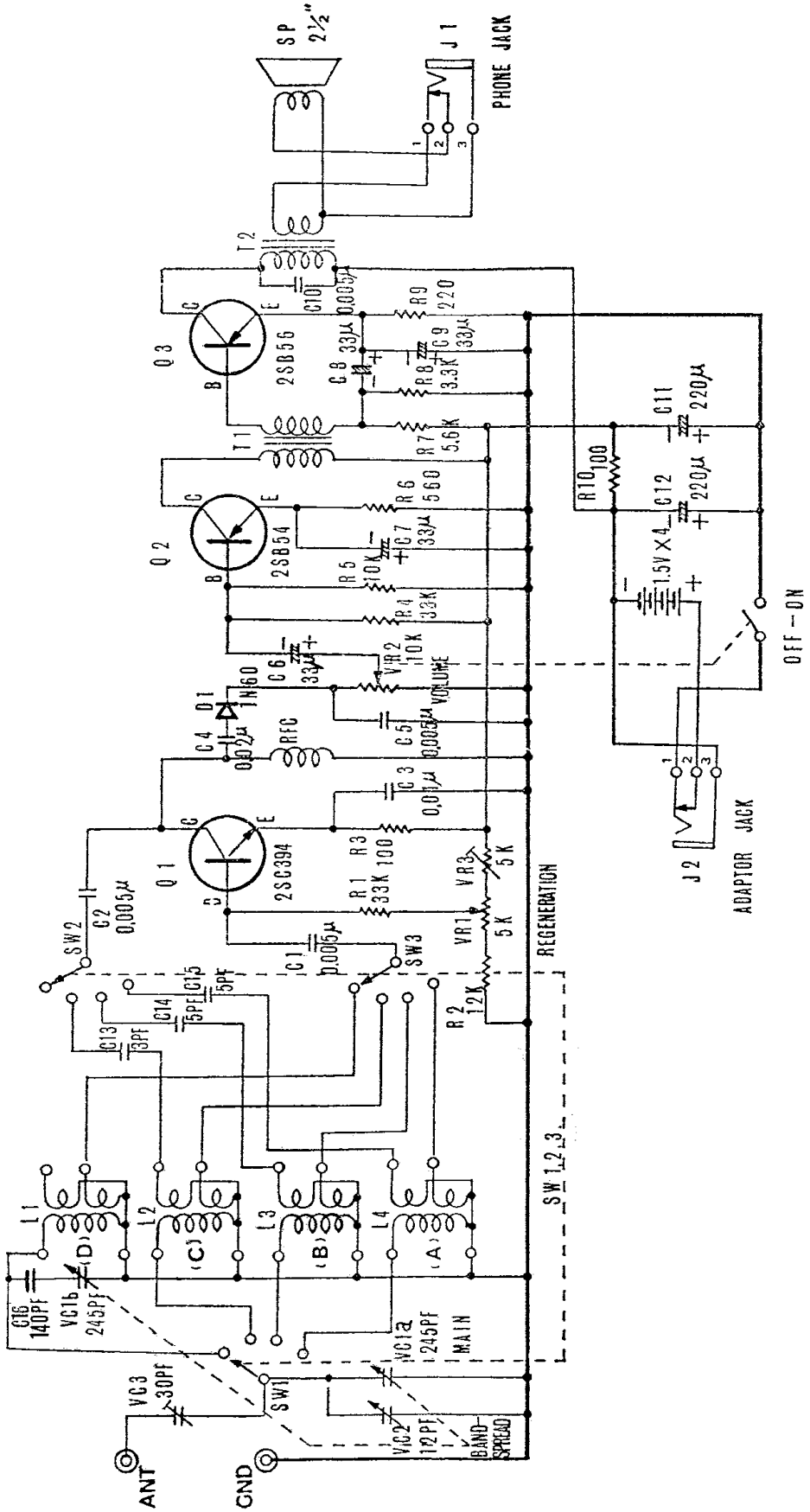


Figure 14 Power Output Stage, Simplified



BLOCK DIAGRAM


SP 2½"
J 1
PHONE JACK
T 2
Q 3
2SB56
C10 0.005μ
C8 33μ
C9 33μ
R8 3.3K
R9 220
T 1
R7 5.6K
C11 220μ
R10 100
C12 220μ
Q 2
2SB54
R6 560
C7 33μ
R5 10K
R4 33K
1.5V×4
OFF-ON
C6 33μ
VR2 10K VOLUME
D1 1N60
C5 0.005μ
C4 0.02μ
RFC
C3 0.01μ
J 2
ADAPTOR JACK
Q 1
2SC394
R1 33K
R3 100
VR3 5K
VR1 5K
R2 12K
SW2
C2 0.005μ
C1 0.005μ
SW3
REGENERATION
SW 1.2.3
C15 5PF
C14 5PF
C13 3PF
L1
L2
L3
L4
(D)
(C)
(B)
(A)
C16 140PF
VC1b 245PF
VC1a 245PF
MAIN
VC3 30PF
SW1
VC2 12PF
BAND SPREAD
ANT
GND

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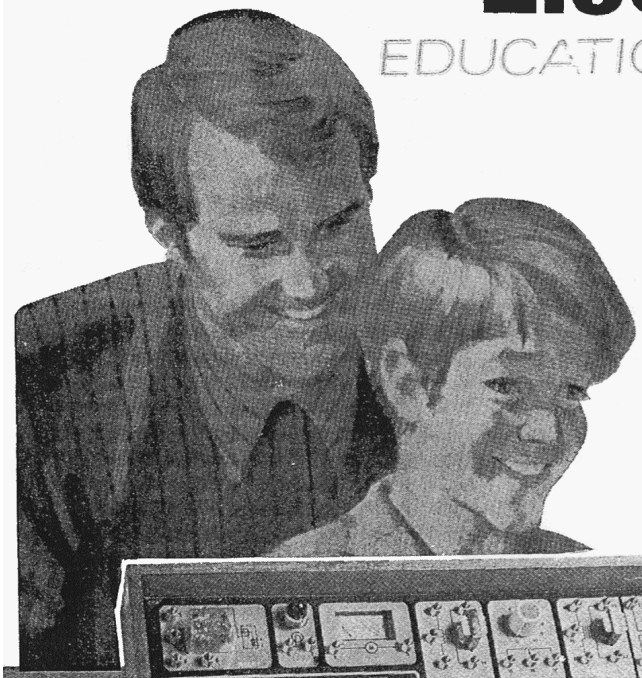

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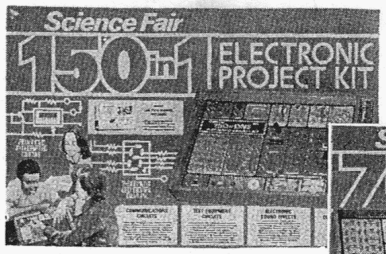

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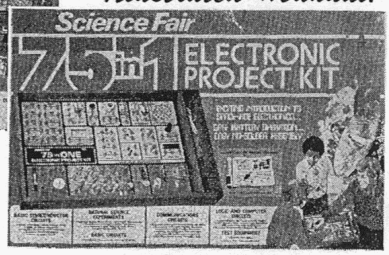
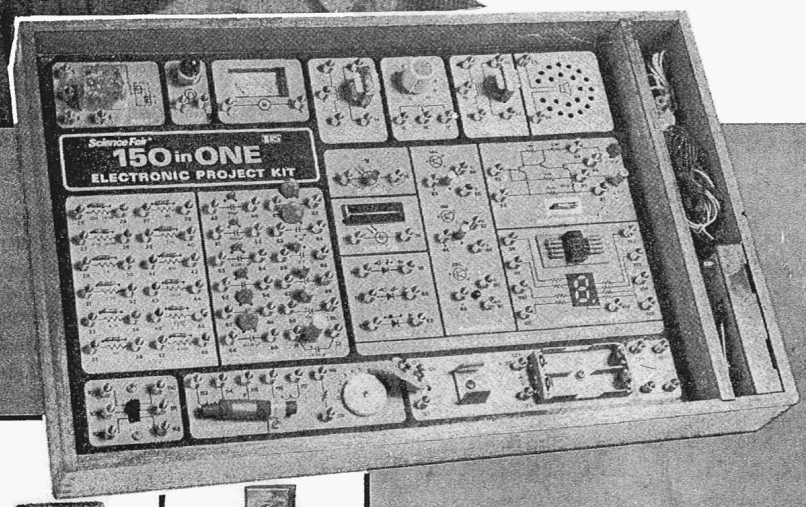


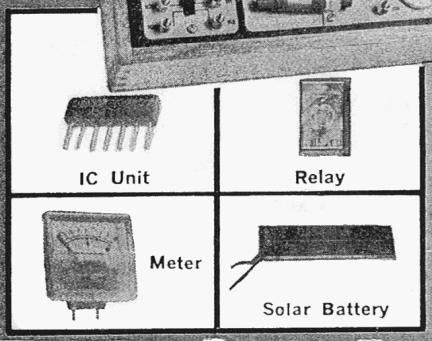
EDUCATIONAL MANUAL

Easy-to-Follow Complete With Instructions



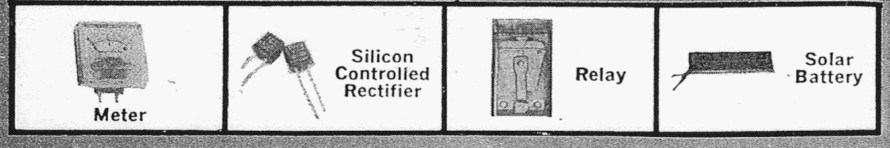
150-in-1

Build radios, amplifiers, code oscillators, computer circuits, and more! Learn both the "how" AND the "why" of functioning circuits! With plans for strobe light, lie detector, photometer, more! NO soldering, NO tools — spring connectors. 100% SAFE battery operation! Wood case. Cat. No. 28-248. Takes 2 "AA" cells, 23-468 and 1 9-Volt, 23-464.



75-in-1

Build alarms, radios, intercoms, computer & test equipment circuits, AM transmitter, perform solar experiments — 75 working projects in all! Solderless spring clips, SAFE battery operation. Cat. No. 28-247. Requires two "AA" cells, 23-468 and 1 9-Volt, 23-464.



Sturdy Wood Case!