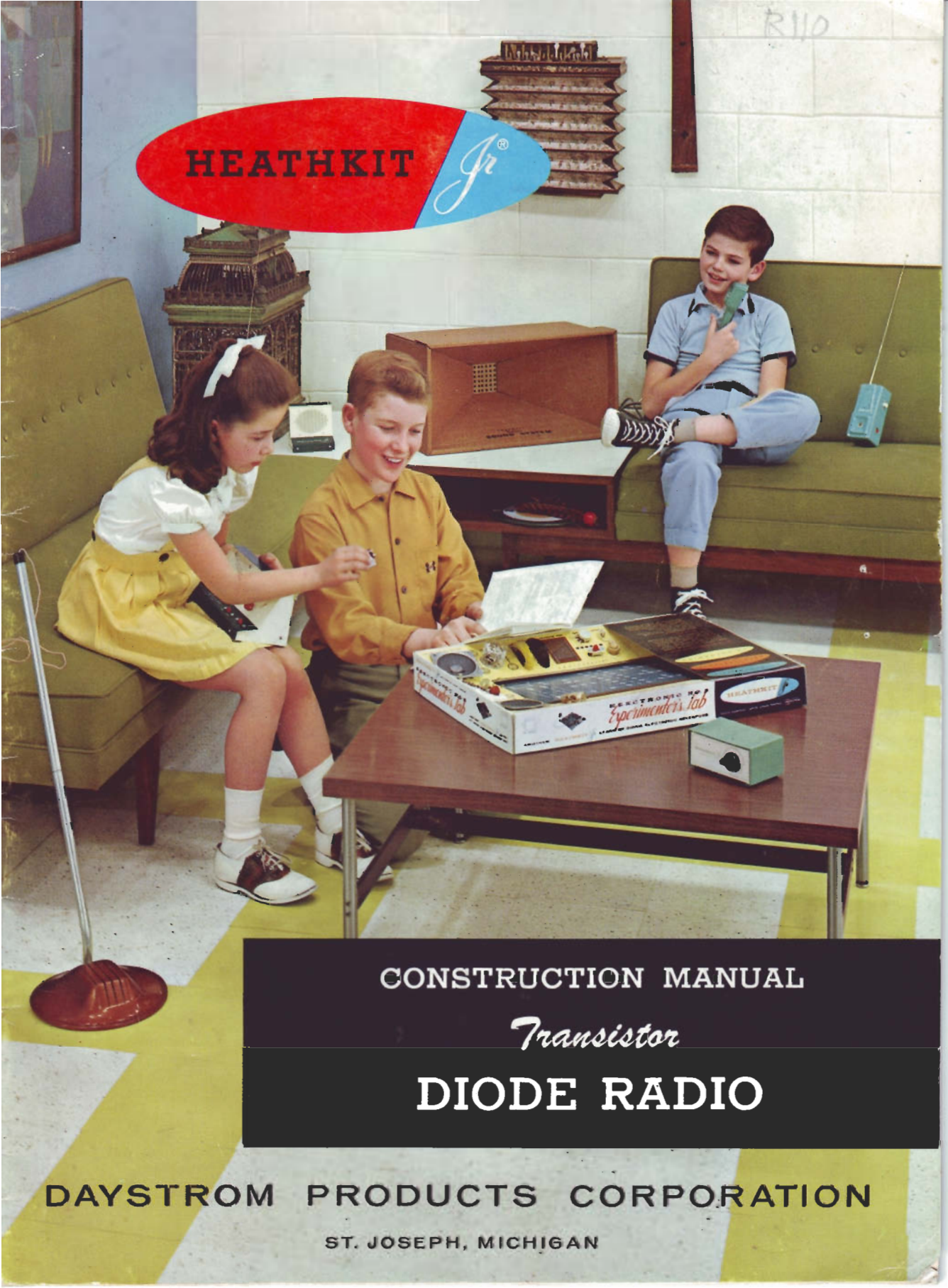


CONSTRUCTION MANUAL

Transistor

DIODE RADIO

DAYSTROM PRODUCTS CORPORATION

ST. JOSEPH, MICHIGAN

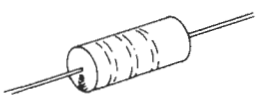
Assembling and Using Your HEATHKIT Jr® TRANSISTOR-DIODE RADIO

MODEL R-110

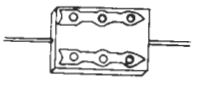
DESCRIPTION

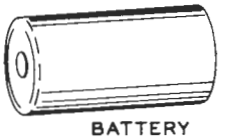
The HEATHKIT JR® Transistor-Diode Radio will pick up radio stations just like your regular home radio does. You will also be able to learn how the radio works.

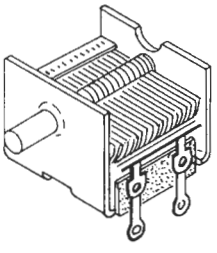
This radio uses a coil, two capacitors, a crystal diode, a transistor, a resistor, a battery, an earphone and an antenna. Each of these parts has a different job. (The words that are underlined are explained on Pages 14 through 17.)

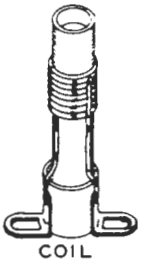

RESISTOR

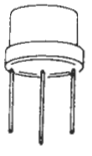

CRYSTAL DIODE


CAPACITOR


BATTERY


TUNING CAPACITOR


COIL


TRANSISTOR

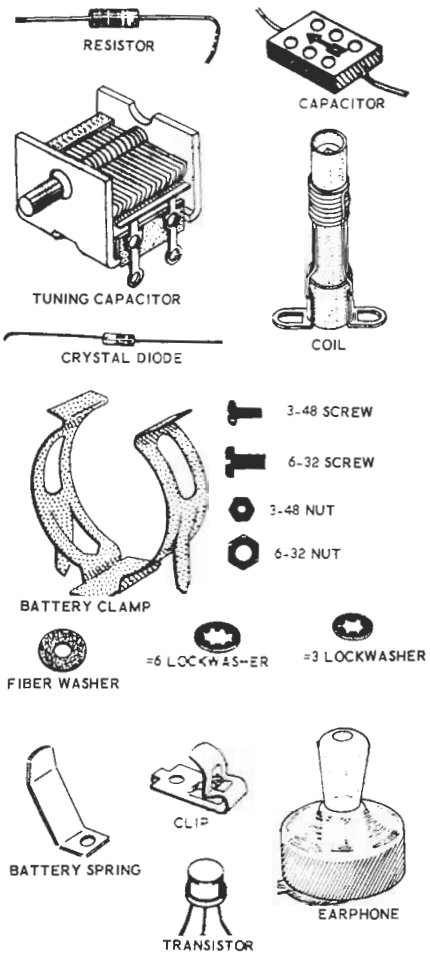

EARPHONE

3/23/62

PARTS LIST

Take the parts out of the box and check them with the Parts List. The pictures on the Parts List will help you to find each part.

PART NO.	NAME	QUANTITY
1-73	8200 Ω resistor (gray-red-red)	1
20-62	Capacitor	1
26-67	Tuning capacitor	1
40-315	Coil	1
56-8	Crystal diode	1
208-2	Battery clamp	1
250-7	6-32 x 3/16" screw	1
250-49	3-48 screw	17
250-56	6-32 screw	2
252-1	3-48 nut	17
252-3	6-32 nut	1
253-1	Fiber washer	2
254-1	#6 lockwasher	1
254-7	#3 lockwasher	13
258-6	Battery spring	2
260-30	Clip	2
344-1	Black wire	10 ft.
344-1	Yellow wire	50 ft.
1401-36	Earphone	1
417-35	Transistor	1
462-24	Knob	1
85-31F368	Circuit board	1
263-7	Felt feet	4
90-M196	Cabinet	1
203-M203F414	Front panel	1
490-5	Nut starter	1
490-25	Screwdriver	1
595-340	Manual	1



ASSEMBLY NOTES

The resistor is marked with colored bands. The colors for the resistor are given in the Parts List and in the step where the resistor is used.

All of the connections in this kit are made on a circuit board. To make a connection, wrap the wire around the screw and then tighten the nut.

When you connect a wire to a screw, wrap the wire around the screw in the same direction that you turn the nut to make it tight.

A plastic nut starter is included to help you start the nuts on the screws. The nut is placed into the end of the starter. The large end is for the 6-32 nuts and the small end is for the 3-48 nuts. See the drawing below.

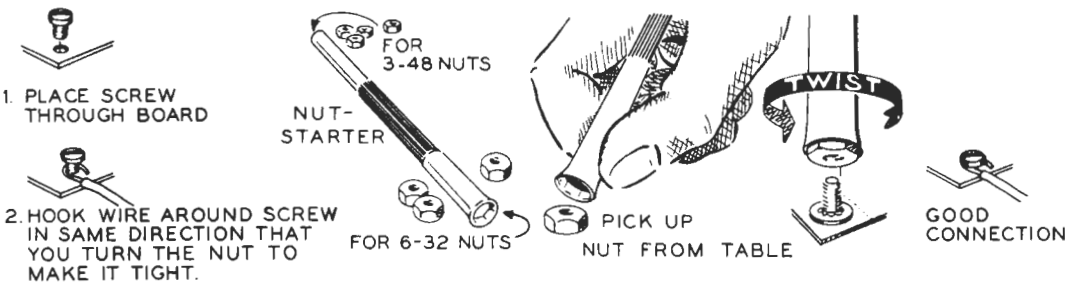


Figure 1

STEP-BY-STEP ASSEMBLY

The numbers just before each of the following steps match the numbers on the Figures. The letters on the Figures point out the screws mentioned in the steps. The printed side of the circuit board will be called the top side.

See Figure 2 on Page 4 for the following steps.

(✓) Check off each step as it is finished. This will help you to find your place if your work is interrupted.

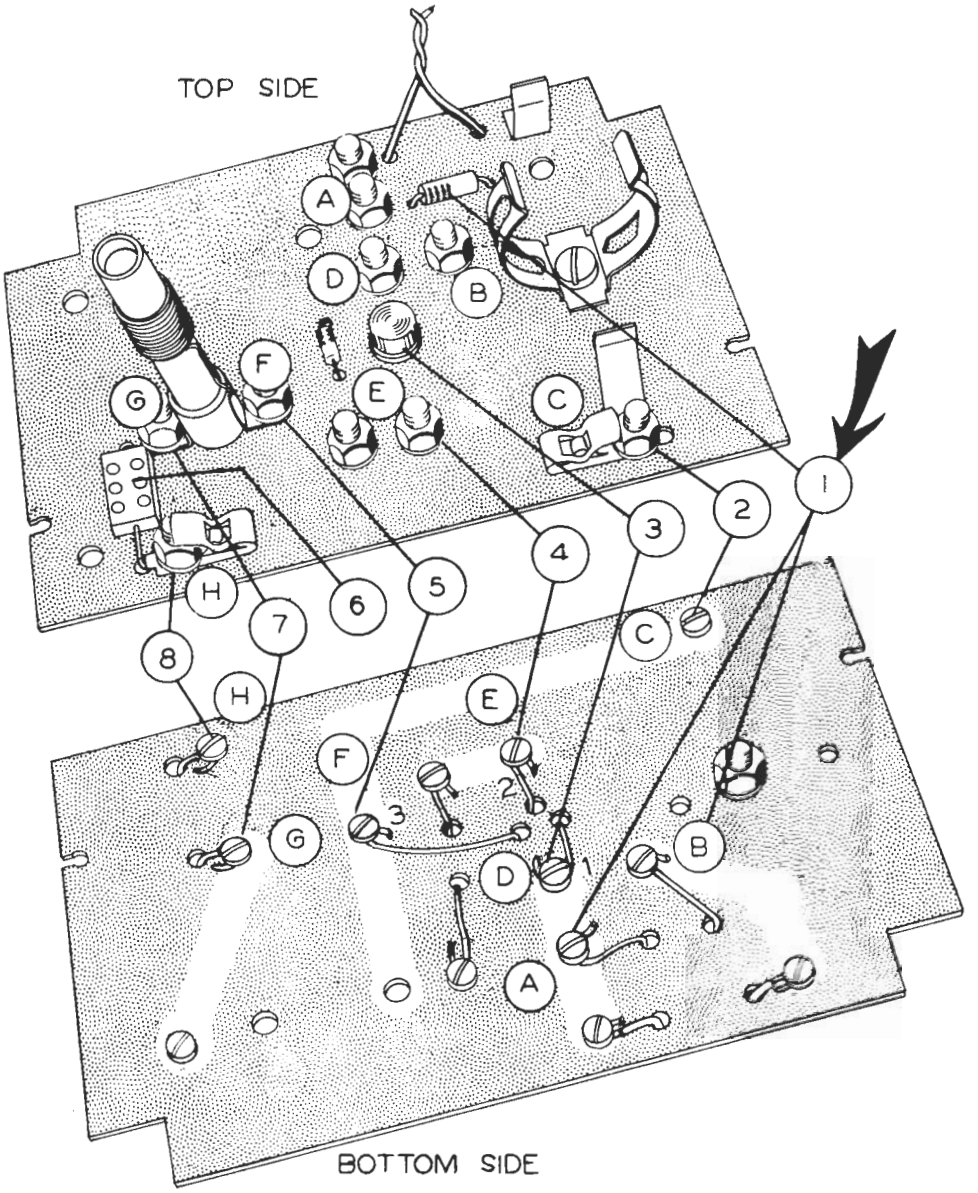


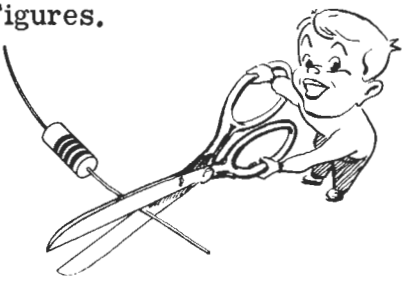
Figure 2

3-48 SCREW #3 LOCKWASHER 3-48 NUT

( ) Find the circuit board and compare it to Figure 2.

Before using any screws, lockwashers or nuts, match them up with the LIFE SIZE drawings which are below the Figures.

The wires on the ends of the resistor, capacitor and crystal diode are longer than necessary to make the connections called for. The wire can be cut to the right length with an OLD pair of scissors.



1. ( ) Place the wires of the 8200 Ω (gray-red-red) resistor through the circuit board from the top. Fasten one wire of this resistor at Ⓐ and the other wire at Ⓑ with 3-48 screws, #3 lockwashers and 3-48 nuts. See Figure 1 on Page 3.

2. ( ) Place a 3-48 screw through a clip and then through a battery spring. Mount this clip and battery spring at Ⓒ. Fasten the screw with a #3 lockwasher and a 3-48 nut.

3. ( ) Place the wires of the transistor through the circuit board from the top. The wires form a triangle pattern where they are connected to the transistor body. This pattern matches the three transistor wire holes in the circuit board. Fasten transistor wire #1 at Ⓓ with a 3-48 screw, #3 lockwasher and 3-48 nut.

4. ( ) Fasten transistor wire #2 at Ⓔ with a 3-48 screw, #3 lockwasher and 3-48 nut.

5. ( ) Place a 3-48 screw through one of the mounting holes at the bottom of the coil. Fasten this screw at Ⓕ with a #3 lockwasher and a 3-48 nut. Use this screw to fasten transistor wire #3.

6. ( ) Place the wires of the capacitor through the circuit board.

7. ( ) Fasten the other side of the coil at Ⓖ with a 3-48 screw, #3 lockwasher and 3-48 nut. Use the screw at Ⓖ to fasten one wire of the capacitor.

8. ( ) Place a 3-48 screw through the other clip. Place this clip at Ⓗ and fasten the screw with a #3 lockwasher and 3-48 nut. Use the screw at Ⓗ to fasten the other wire of the capacitor.

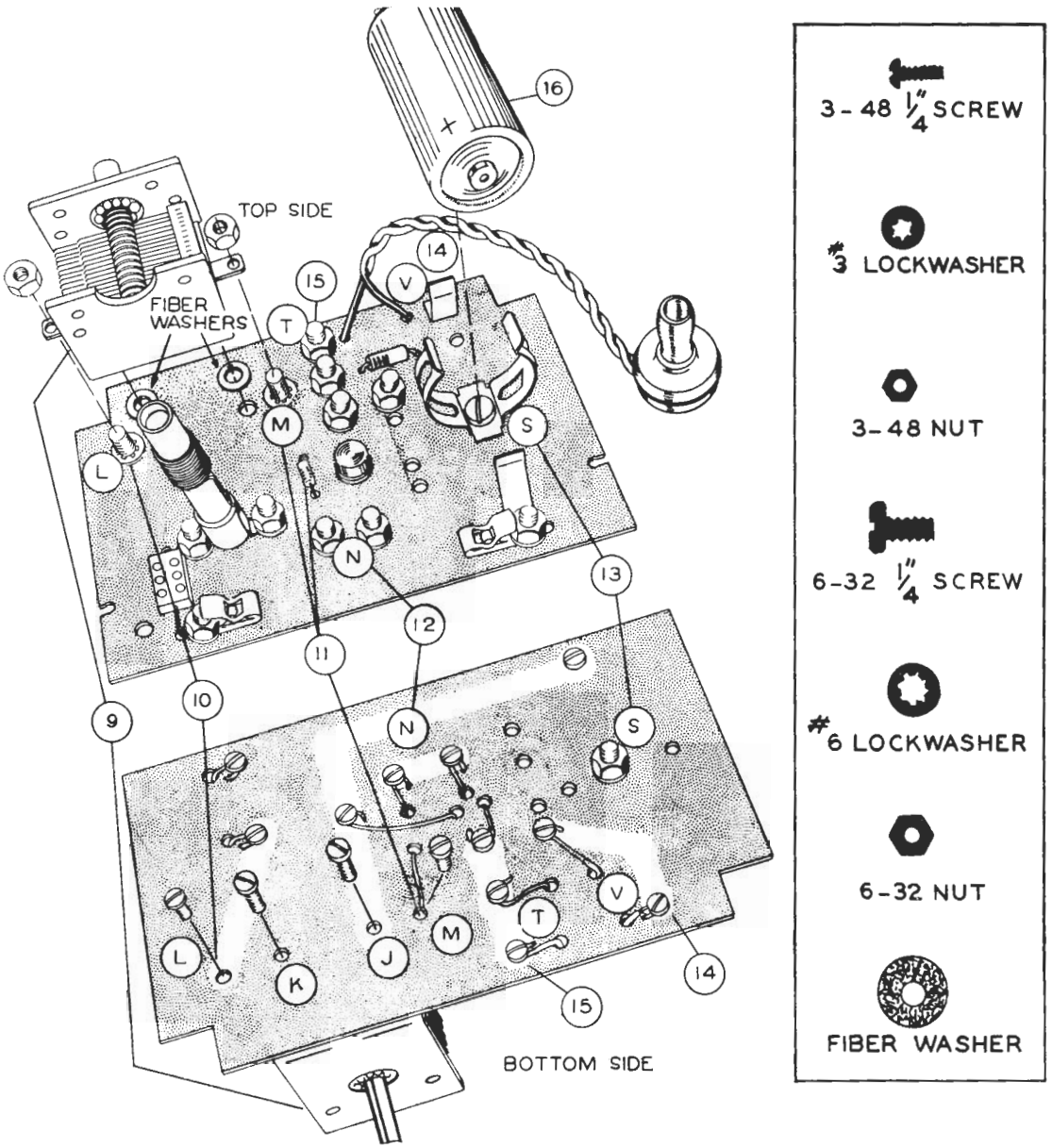

TOP SIDE
FIBER WASHERS
BOTTOM SIDE
3-48 1/4 SCREW
#3 LOCKWASHER
3-48 NUT
6-32 1/4 SCREW
#6 LOCKWASHER
6-32 NUT
FIBER WASHER

Figure 3

See Figure 3 for the following steps.

(9) ( ) Bend the lugs on both sides of the tuning capacitor as shown in Figure 4. Now mount the tuning capacitor with two 6-32 screws and two fiber washers at (K) and (J). The shaft of the tuning capacitor should point away from the coil. Turn the shaft until the tuning capacitor is closed as shown in Figure 3.

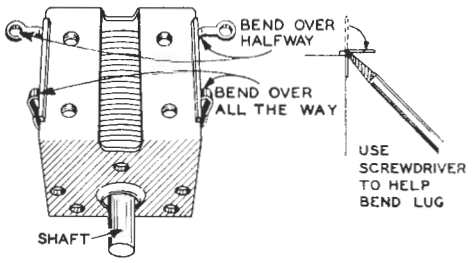


Figure 4

(10) ( ) Fasten the tuning capacitor lug at (L) on the circuit board with a 3-48 screw, #3 lockwasher and 3-48 nut.

(11) ( ) Fasten the tuning capacitor lug at (M) on the circuit board with a 3-48 screw, #3 lockwasher and 3-48 nut. Also use the screw at (M) to fasten the positive (+) crystal diode wire. (The + wire is the one coming from the end of the diode body that is nearest the color band.)

(12) ( ) Fasten the other wire of the crystal diode at (N) with a 3-48 screw, #3 lockwasher and 3-48 nut.

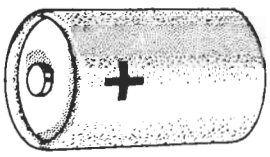
(13) ( ) Mount the battery clamp at (S) with the 6-32 x 3/16" screw, #6 lockwasher and 6-32 nut.

(14) ( ) Place a 3-48 screw through the other battery spring and then through the circuit board at (V). Fasten this screw with a #3 lockwasher and a 3-48 nut. Use the screw at (V) to fasten one of the twisted earphone wires.

(15) ( ) Fasten the other earphone wire at (T) with a 3-48 screw, #3 lockwasher and 3-48 nut.

(16) ( ) Snap a new size C flashlight battery into the battery clamp. The positive (+) end of the battery should be toward the + markings on the circuit board. The "button" end of the battery is positive.

You can get the battery from your local hardware store or drug store. The battery for the R-110 is a size C, 1-1/2 volt flashlight battery.



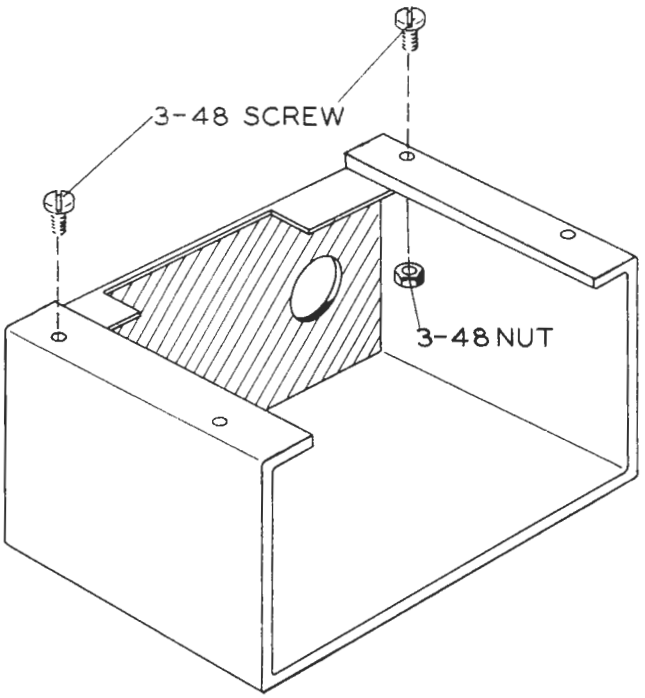


Figure 5

See Figure 5 for the following step.

( ) Find the cabinet and fasten it to the front panel as shown in Figure 5. Use 3-48 screws and 3-48 nuts.

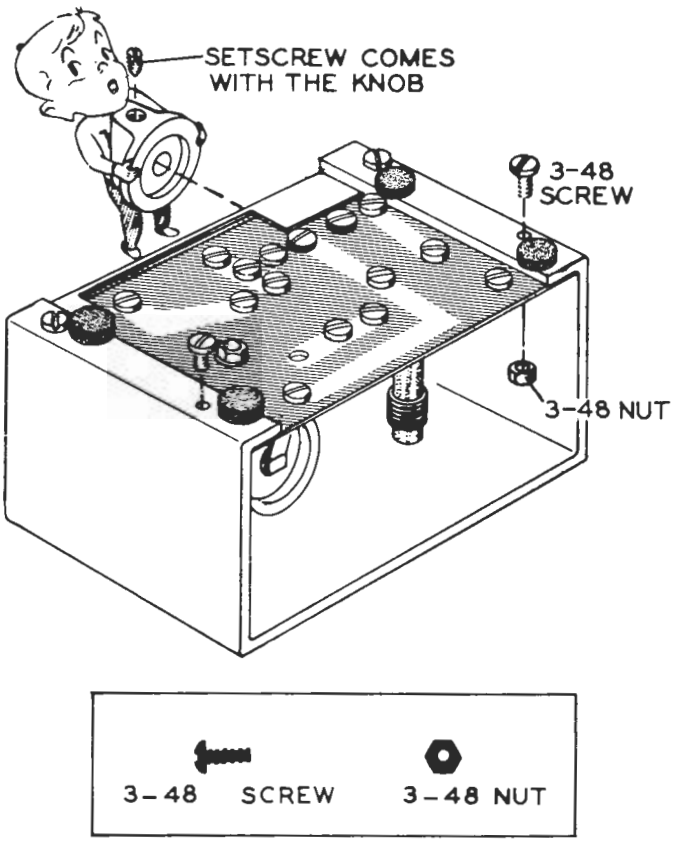


Figure 6

See Figure 6 for the following steps.

( ) Place the circuit board inside of the cabinet as shown. The twisted earphone leads should come from the rear of the cabinet and the tuning capacitor shaft should pass through the hole in the front panel.

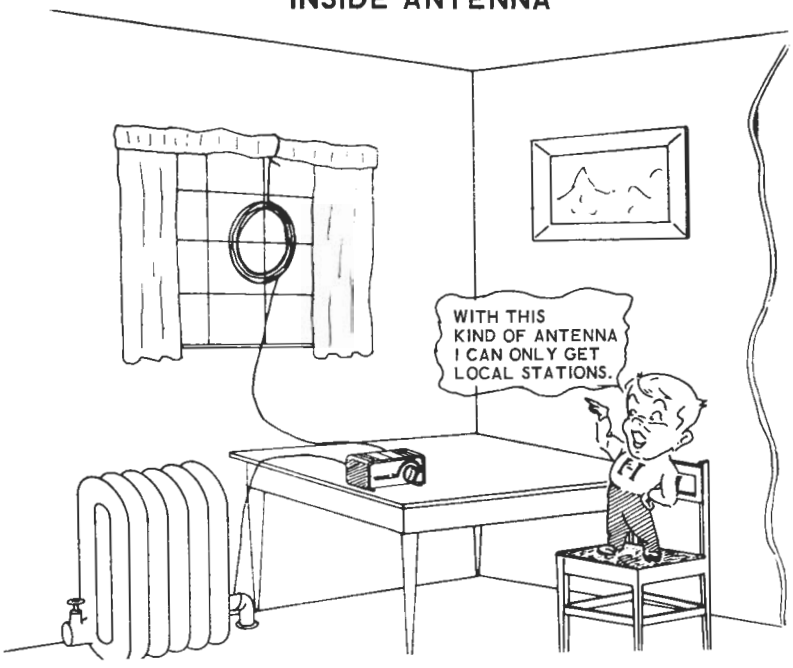
( ) Fasten the circuit board in place with 3-48 screws and 3-48 nut.

( ) Install felt feet.

( ) Place the knob on the tuning capacitor shaft. Position the knob so that its pointer line matches the left dial marking on the front panel when the tuning capacitor is closed. Now tighten the setscrew in the knob.

This completes the assembly of your Transistor-Diode Radio. Make sure that all screws are tight and that none of the wires on the bottom of the circuit board are touching each other.

INSIDE ANTENNA



HOW TO INSTA

Each radio receiver must have a good antenna. How big your antenna should be depends on where you live. If you live near strong stations, a small inside antenna would be best. Where all the stations are weak, an outside antenna would be best. Sometimes it is best to experiment with the different antennas to get the most clear stations.

Your antenna should always be as high above the ground as possible, even inside the house. The higher it is, the more stations it can receive.

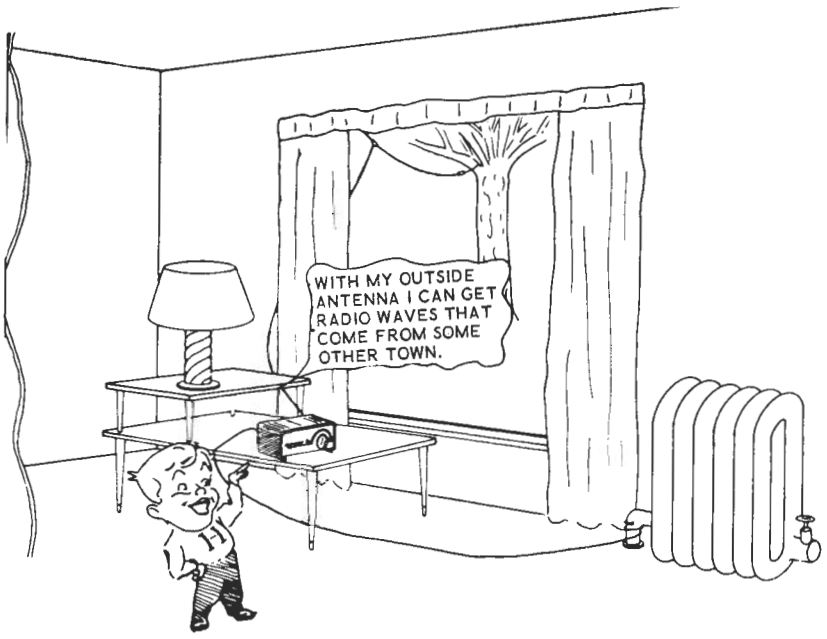
AN INSIDE ANTENNA

( ) Remove 1/2" of insulation from the end of one of the long wires. (The longer wire should receive more stations.)

( ) Connect this wire to the ANTENNA clip.

( ) Run this wire as high as you can around the room. Sometimes, connecting the other end of this wire to a bedspring or metal lamp base gives very good results.

OUTSIDE ANTENNA



THE ANTENNA

( ) In strong signal areas: A loop antenna can be constructed. Wrap the 50 ft. length of wire into a loop, about 1 ft. in diameter. Connect the wire from one end of the loop to the ANTENNA clip. The loop can then be hung in the air with a piece of string.

NOTE: An inside antenna will not work well inside a steel building. Radio waves will not go through the steel.

One of the wires of a TV antenna often works well as your radio antenna.

AN OUTSIDE ANTENNA

( ) Remove 1/2" of insulation from one end of the long yellow wire. Connect this wire to the ANTENNA clip.

( ) Run this wire out the window and up as high as you can to a nearby tree or some other high object.

( ) See CAUTION note on Page 12.

GROUND - A ground connection is one that connects to the earth around your home. The ground connection can be made by connecting the ground wire to a metal stake driven into the earth. The ground wire can also be connected to an unpainted place on a radiator or water pipe since all water pipes connect to outside pipes buried in the ground.

Often, you may find that if the local stations are too strong, your receiver will work better when the ground is disconnected. The sound would get quieter and you would be able to tune in more stations. Experimenting will often show you how to get the best results.

CAUTION

1. Avoid installing your antenna close to power lines.
2. Do not let the antenna touch the ground, either directly or through some piece of metal.
3. Do not touch the antenna or receiver circuits during a thunderstorm, since it is possible for lightning to strike the antenna.

IN CASE OF DIFFICULTY

If the radio does not seem to operate properly, check these points:

A. See that the battery is fresh and that it is properly placed on the circuit board.

B. See that each wire under the circuit board is connected to the correct screw.

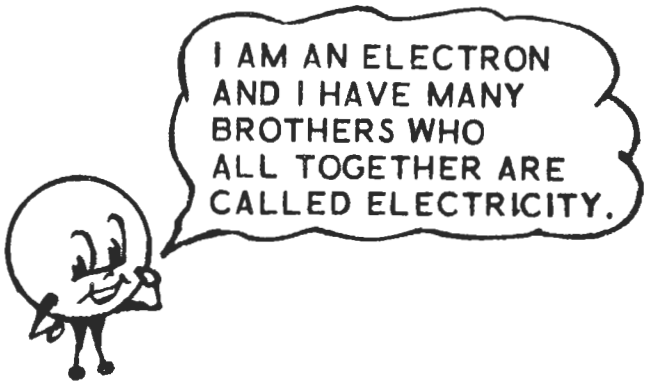
C. Make sure that all screws are tight and that none of the wires under the circuit board are touching each other.

D. Check the antenna connections.

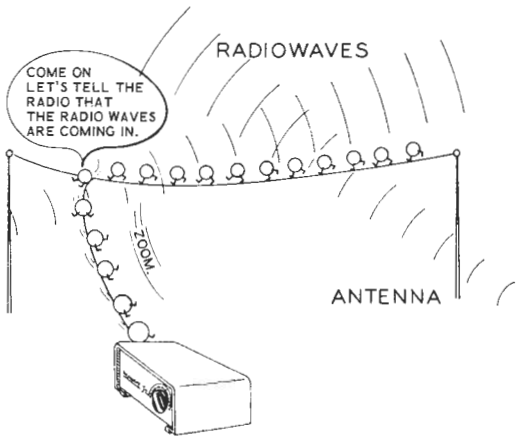
If the radio still does not operate properly, you might have it checked by a local amateur radio operator or radio repairman.

EXPLANATION OF ELECTRONIC PARTS

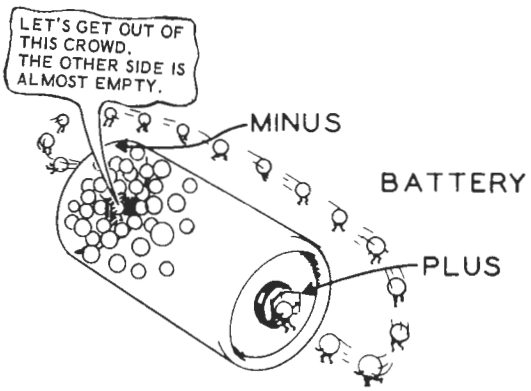
Because some of the words in this manual may be new to you, we suggest that you read the following explanations.



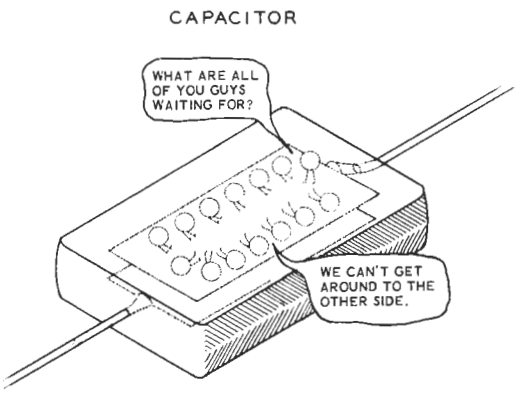
Antenna (an·ten'a) - An antenna is a wire or metal rod that is used to receive radio stations. The radio waves from a radio station go by the antenna and cause electrons to run into the radio receiver.



Battery (bat'er·i) - A battery uses chemicals to make electricity. When a battery is connected to other electronic parts, it pushes an electric current through these parts. The current leaves the minus (-) end and comes back to the plus (+ button) end of the battery. The amount of push that the battery has is called its "voltage."

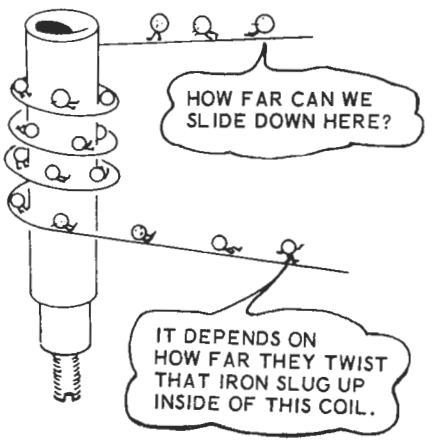


Capacitor (ka·pas'i·ter) - A capacitor is an electronic part that seems to like changes. As long as the changes in the flow of electricity are quick, they seem to pass right through the capacitor. If the electricity trys to flow in only one direction, it will pass through for just a little while. Even if the changes are too slow, they will not pass. In fact, if electricity flows in only one direction for very long, it will pile up on one side of the capacitor and stay there until there is a way for it to get back out.



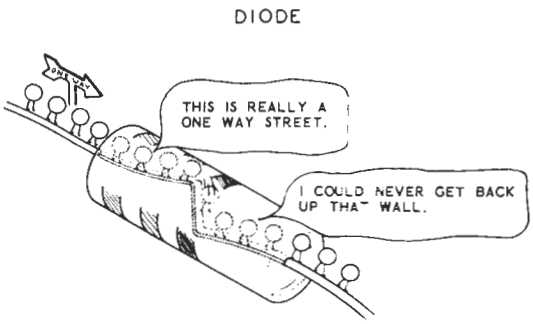
A capacitor is judged by the amount of electricity that can be piled up on it. It is measured in "farads," the same as a bucket's size is measured in gallons.

A "tuning capacitor" is simply one that can have the amount of electricity that it can store trimmed to the size that you want.

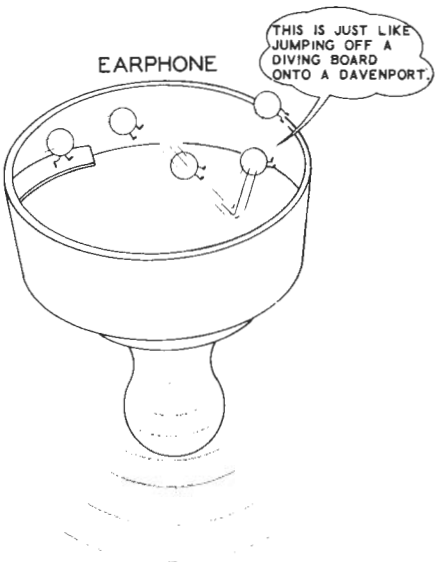


Coil (koil) - A coil is used to lengthen the path that the electricity must take. A coil is usually made of one long wire all wound up. The electrical size of a coil is stated in "henrys."

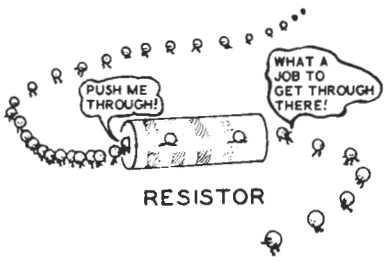
Crystal Diode (kris'tal di'od) - An electric current can go through the crystal diode in only one direction. It acts like a steep cliff to the electrons. They can only go down the cliff, they can't go up.



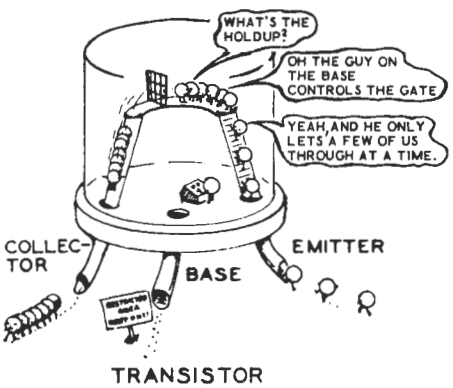
Earphone (er'fon') - All sounds are made from movements of air. When these movements of air push our eardrums, we hear sounds. The earphone takes electric currents and makes them push air back and forth. This makes the sounds we hear from the earphone.



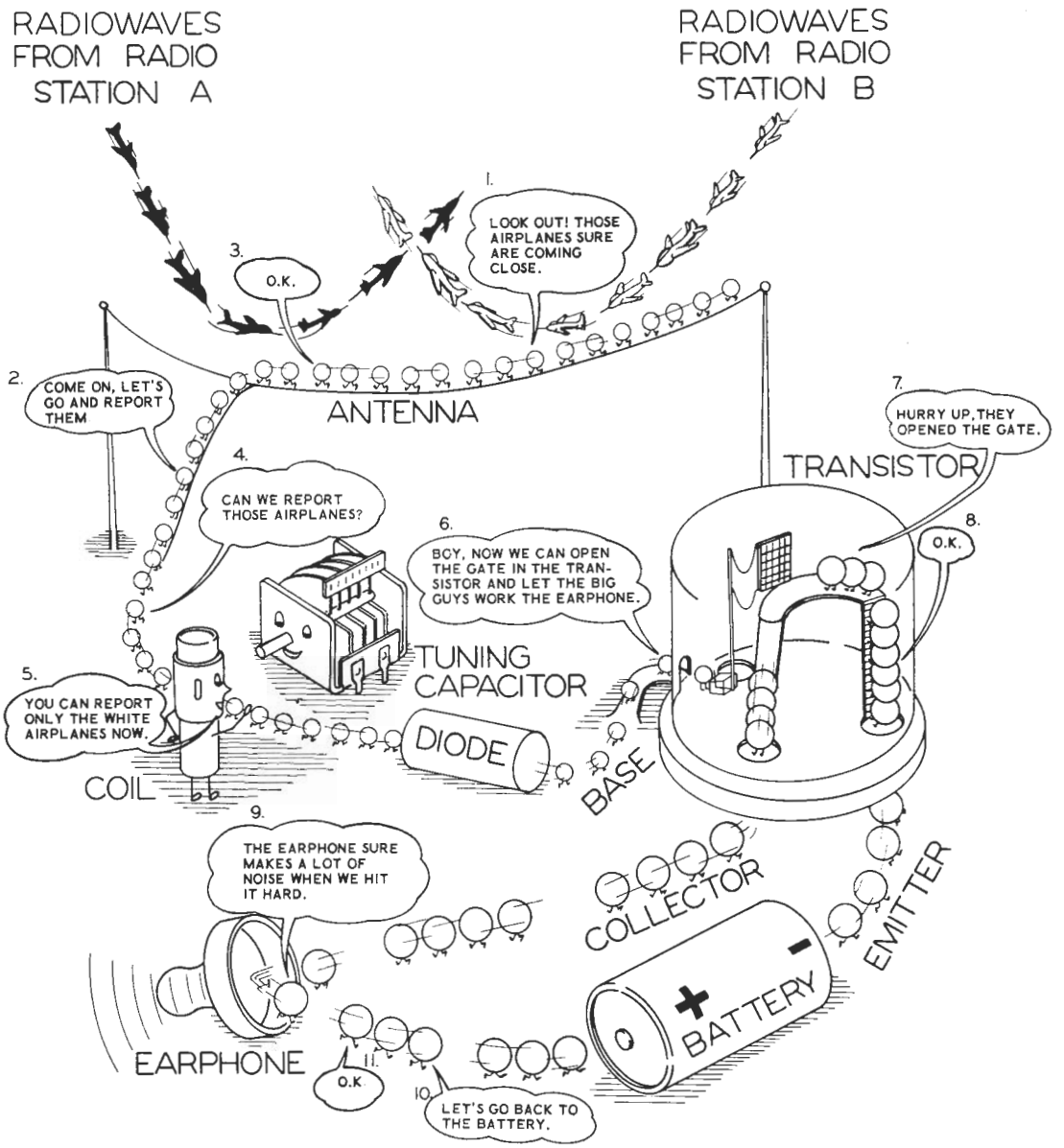
Resistor (re·zis'ter) - A resistor does not like to have electricity flowing through it, so it makes it as hard as it can for electricity to flow through it. We state the resistance in "ohms," and the higher the number of ohms the harder it is for the electricity to flow through the resistor.



Transistor (tran·zis'ter) - A transistor may be thought of as being like a gate. For example, one small man opening and closing a gate can either allow many men or only a few men to pass through. It depends on how far he opens the gate. He could even open and close the gate many times and make the men pass through in bunches. The same thing happens in a transistor. A little bit of electricity at one point on a transistor can control the amount of electricity passing through the transistor.



The three main parts of a transistor are the emitter, collector and base.


RADIOWAVES FROM RADIO STATION A
RADIOWAVES FROM RADIO STATION B
1.
LOOK OUT! THOSE AIRPLANES SURE ARE COMING CLOSE.
3.
O.K.
2.
COME ON, LET'S GO AND REPORT THEM
ANTENNA
7.
HURRY UP, THEY OPENED THE GATE.
TRANSISTOR
4.
CAN WE REPORT THOSE AIRPLANES?
6.
BOY, NOW WE CAN OPEN THE GATE IN THE TRANSISTOR AND LET THE BIG GUYS WORK THE EARPHONE.
8.
O.K.
TUNING CAPACITOR
5.
YOU CAN REPORT ONLY THE WHITE AIRPLANES NOW.
DIODE
BASE
COIL
9.
THE EARPHONE SURE MAKES A LOT OF NOISE WHEN WE HIT IT HARD.
COLLECTOR
EMITTER
BATTERY
EARPHONE
11.
O.K
10.
LET'S GO BACK TO THE BATTERY.

HOW YOUR TRANSISTOR DIODE RADIO WORKS

The antenna that is used with this radio picks up signals from several radio stations. These radio signals are sent to the tuning circuit formed by the coil and the tuning capacitor.

By turning the tuning capacitor you are able to choose only one of the radio signals. This radio signal is then sent to the crystal diode. The action of the crystal diode changes the radio signals to an audio signal (one that will work the earphone). This audio signal is then sent to the base of the transistor. The transistor makes the audio signal larger.

The audio signal is now large enough to work the earphone. The earphone changes the electrical audio signal into movements of air which can be heard.

HEATHKIT EDUCATIONAL SERIES

Has this Experimenters Kit sharpened your appetite to learn more about electronics? It it has, the Heath Company has an Educational Series that is just what you need. It teaches you the fundamentals of electronics, and at the same time it gives you the fun of kit building and experimenting. Besides this, you end up each book in the series with a useful electronic device, such as a meter, radio, intercom, etc. Write today for a free catalog that lists the kits in the Educational Series.

Write to: Heath Company, Benton Harbor, Michigan.

OTHER BOOKS TO READ

The books listed below contain information on basic electricity, electronics and on amateur radio theory, rules and practices.

Epstine, Sam and Beryl. The First Book of Electricity (found in the First Book Library For Boys And Girls, New York, Greystone Press).

Meyer, Jerome S. Picture Book of Electricity, New York, Lothrop, Lee and Shepard Co., Inc.

Stoddard, Edward. The Real Book of Electronics, New York, Garden City Books.

Yages, Raymond F. The Boy's Book of Communication, New York, Harper and Brothers.

ARRL Radio Amateur's Handbook (American Radio Relay League, West Hartford, Connecticut.)

SCHEMATIC DIAGRAM

These are the schematic symbols for the electronic parts that are used in this kit. After you learn what each symbol means, you can read the Schematic Diagram as easily as a carpenter can read a floor plan for a house.