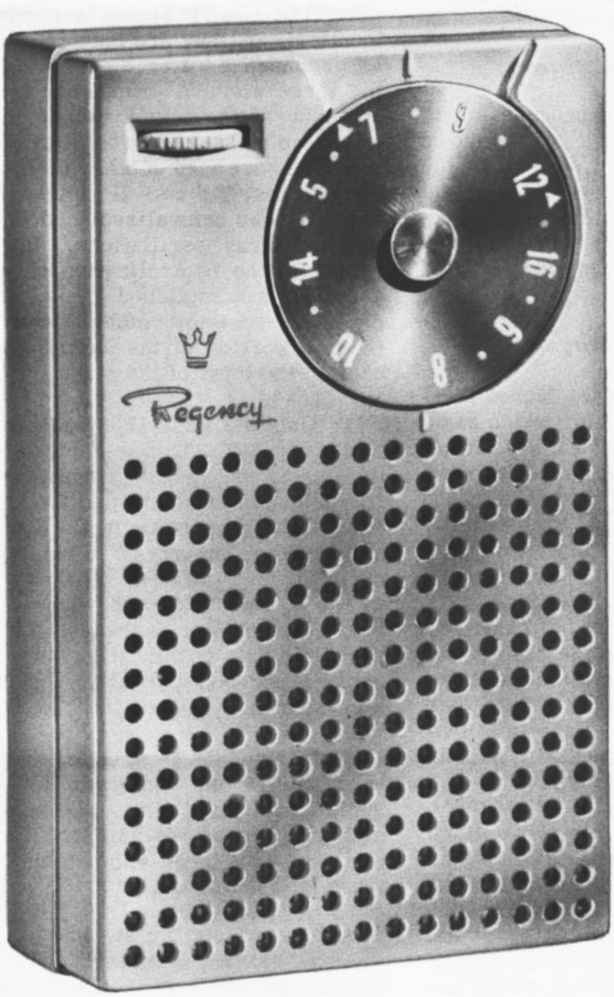
Regency Radio



TR-1

THE FIRST TRANSISTOR RADIO RECEIVER

TECHNICAL DATA AND SERVICE NOTES

REGENCY DIV. I.D.E.A. INC.
7900 Pendleton Pike, Indianapolis 26, Ind.

25 CENTS

Regency

The advent of the use of transistors in commercial radio equipment for sale to the general public has been predicted many times since the announcement of this interesting device several years ago. While many laboratory and military receiver models have been announced and illustrated in the technical press over this period, the first unit to be placed on the market in quantity, and at a price below $50 is the Regency TR-1 Pocket Radio Receiver described in this brochure.

This accomplishment has been made possible by close cooperation between the Regency Division of I. D. E. A., Inc. of Indianapolis, Ind. and Texas Instruments Inc. of Dallas, Texas whose unique transistor production techniques made possible mass production, at a reasonable cost.

The TR-1 is equivalent in circuit functions and performance to the familiar five tube, battery type, superheterodyne receiver since its tubes are replaced (stage by stage) by four transistors and a diode detector.

The transistors employed are of the NPN, germanium, grown junction type and three special designs are used for the converter, IF and audio stages. Grounded emitter circuits are employed in all stages. The general similarity to vacuum tube type receivers will be noted from a study of the schematic wiring diagram of Fig. 7.

A DESCRIPTION OF THE REGENCY MODEL TR-1 POCKET RADIO

General Features

This receiver has been completely transistorized; in addition, it has been miniaturized to the point where it truly is a pocket-sized radio receiver. The dimensions of 5 inches by 3 inches by 1 1/4 inches are small enough so that the receiver conveniently fits into the pocket of a man's shirt. The size of the receiver can be judged from the fact that the picture on the cover of this folder shows its actual size. The receiver complete with battery weighs only 12 ounces. The case is made of polystyrene plastic and is available in a variety of colors.

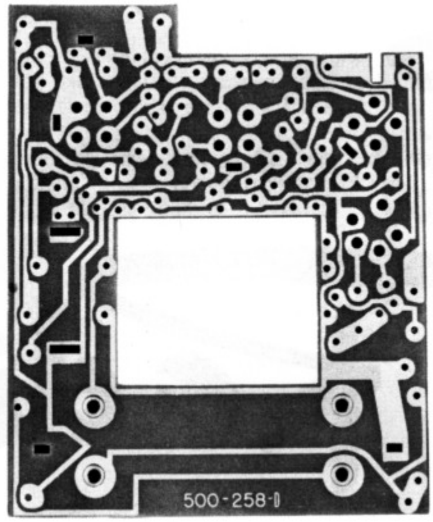


Fig. 1. Printed-Circuit Board Used in the Regency Model TR-1.

Technical Features

The assembly process starts with the printed-circuit board shown in Fig. 1. This board serves as the chassis of the receiver. All of the components are mounted on the board, and all connections are soldered simultaneously in one dipping operation.

Converter Stage

The antenna in the Model TR-1 is in the form of a coil which has a ferrite core providing a tuned circuit of high Q. Hand capacitance has very little detuning effect on this coil, and the receiver is not exceptionally directional; these are two good features in a portable receiver of such a small size. A low-impedance winding on the antenna coil couples the received signal to the base of the converter transistor. Like the three other transistor stages in the receiver, the converter stage is biased in such a way that the input impedance is low (about 500 ohms).

The oscillator injection voltage is derived from a tuned circuit which is inductively coupled to a coil in the collector circuit. The entire converter stage is similar in operation to the vacuum-tube converter circuit shown in Fig. 2, a circuit which has been used in conventional receivers.

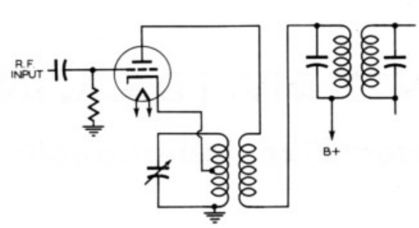


Fig 2. Equivalent Vacuum-Tube Converter Circuit.

As in any superheterodyne receiver, the IF transformer accepts the proper frequency from among the multitude of frequencies in the output circuit of the converter and passes this frequency to the first IF stage.

IF Stages

The IF transformers used in this receiver are of the tuned-primary, untuned-secondary type; and they resonate at 262 kc. The secondaries are wound with very few turns so that proper matching to the low input impedances of the IF transistors is obtained. The primary of each transformer is paralleled by a capacitor of fixed value, and variable tuning is accomplished with the threaded iron core.

The two IF stages are almost identical, and they are both connected as grounded-emitter circuits. Since the three-element transistor is the analogue of the triode vacuum tube, and since triodes must be neutralized when they are used at other than audio frequencies, the two IF transistors must also be neturalized in order to prevent stray oscillations. In this receiver, the neutralization of each stage is accomplished by a series capacitor-resistor combination which feeds a portion of the output signal back to the input of the stage.

Only the first IF stage is controlled by AVC. This is derived from the output of the diode detector, is filtered, and is then supplied to the base of the transistor in the first IF stage. When the received signal increases, the negative AVC voltage which is fed back to the base of the first IF transistor increases and reduces the gain of this stage. The opposite condition prevails when the signal strength decreases.

The second IF stage derives its base bias from the emitter of the audio output transistor. The bias resistor in the output-emitter lead is bypassed by a large value of capacitance in order to stabilize the voltage across the resistor. This voltage is further bypassed by an .05-mfd capacitor and is fed to the low side of the secondary of transformer T2. A resistor in the emitter lead of each of the IF transistors develops a voltage which biases the emitter properly.

The diode-detector stage, in which the manufacturer uses either a Raytheon CK706A or a Tungsol TS117 crystal diode, is connected directly to the volume control. The low resistance (1,000 ohms) of this control is necessary for a proper impedance match to the input of the audio transistor.

Output Stage

The output transistor is connected in a grounded-emitter circuit, and bias for the emitter is obtained by a series resistor. Bias for the base is obtained by a voltage divider from the positive line. These two bias arrangements assure that variations in ambient temperature and in battery voltage will not adversely affect the operation of this transistor. The collector impedance of this transistor is approximately 10,000 ohms, a value considerably lower than that which is characteristic of most transistors of this general type.

The output transformer matches the 10,000-ohm impedance of the output transistor to the 12- to 15-ohm impedance of the speaker. The speaker, which is only 2 3/4 inches in diameter, provides reasonable fidelity and volume for so small a unit. A hearing-aid type of earphone is available as accessory equipment for the Model TR-1, and the earphone plug can be inserted into a small jack on the side of the receiver. The speaker is silenced when this plug is inserted into the jack.

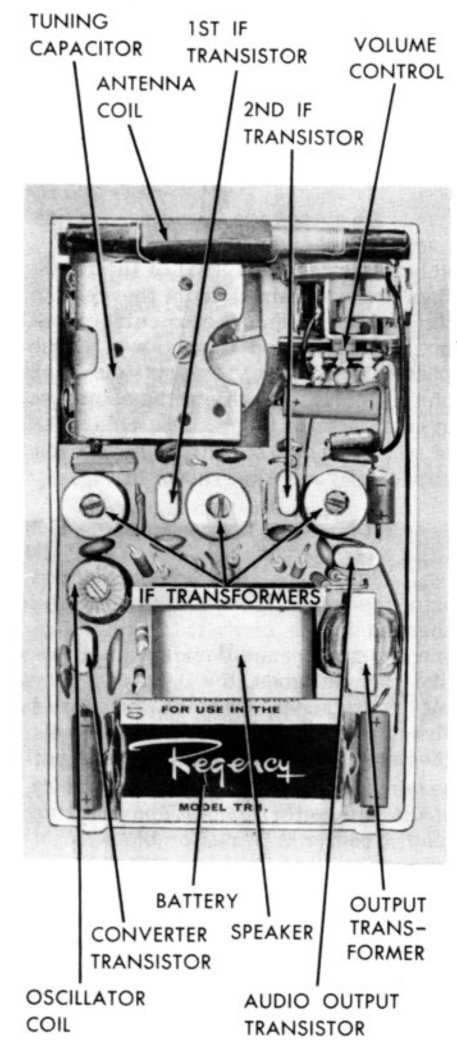


Fig. 3. Rear View of Regency Model TR-1 Showing Layout of Components.

Power Supply

The entire power requirements for this receiver are fulfilled by one hearing-aid battery that provides 22.5 volts. The current drain from this battery is only 4 ma when a local station is being received, and the life expectancy of the battery is rated at 20 to 30 hours depending upon frequency and duration of use.

One important fact to remember is that it is physically possible to reverse the battery when inserting it into the clips. Warnings are given about this in the literature accompanying the receiver and inside the receiver case. The transistors will not be harmed by a reversal of battery polarity; but the electrolytic capacitor connected between the positive battery lead and ground will be damaged if the battery is reversed.

A photograph of the receiver shown in Fig. 3 has been included to give a general idea of the way the components have been mounted. Note in particular the small size of the IF transformers, audio output transformer, and the tuning capacitor. The use of these miniature components together with the use of transistors instead of tubes contribute to the compactness of the receiver.

Battery

Since there is no filament drain in an "all-transistor" radio set, the battery drain is much lower than in other battery operated receivers using tubes. While a special replacement battery is available through Regency dealers, any of the following batteries (22 1/2 volt rating) may be used:

Burgess Y15 or U15
Eveready 412 or 412E
General Dry 612
Mallory RM412R
NEDA 215
Olin O915
RCA VSO84
Ray-O-Vac 516
Sears Roebuck 8212
Sonotone 312
Zenith 212

Since the neutralization of the IF amplifier stages is somewhat dependent upon the operating voltage, the set will become more regenerative as the battery voltage is reduced due to battery exhaustion. The battery will need replacement when oscillation occurs (12 to 14 volts).

Earphone Reception

A distinctive feature of the design of this receiver is the provision for private earphone reception made possible by the development of a low impedance earphone which replaces the loudspeaker moving coil when a minature plug is inserted into a diminutive jack accessible through a hole in the side of the case. This silences the speaker and allows the user to hear radio programs under conditions of high ambient noise or situations in which operation of the speaker is not desirable.

Servicing and Component Replacement

To assist the service technician the schematic diagram, trouble chart and parts list have been placed on the facing pages (6 & 7). In ordering replacement parts from the factory always give part number and name or description of the part.

Unless the service technician is experienced in the repair of printed circuit equipment, removal and replacement of components should not be attempted (see notes on printed circuit repair on page 8).

SERVICING THE REGENCY MODEL TR-1

The introduction of the first transistor radio presents to the service technician new problems such as:

1. Will the printed wiring board need repairing?

2. How can transistors be tested?

3. Does normal servicing procedure apply to this receiver?

Because of the extremely small size of the receiver and because of the use of transistors, the technician is in "strange territory" as soon as he opens the case. A look at the back of the Regency Model TR-1 (with the cover removed) will reveal that the components are very closely spaced and that apparently no wiring points are accessible. With this article, we hope to present to the service technician a method of trouble shooting this receiver with the least expenditure of time and effort as well as methods of repair and replacement of components with the least possibility of damage to the delicate miniature components.

Battery Replacement

As with any piece of battery-operated equipment, the first suspect when the receiver is inoperative is the battery. A voltage check of the battery is easy when the rear cover of the receiver is removed, since the battery clips are readily accessible. This measurement should be made with the receiver turned on and should read more than 15 volts. Any reading below this value indicates a defective battery which should be replaced.

Since it is usually not known whether the battery deteriorated through normal usage or through a defect in the receiver, an ohmmeter check should be made across the battery clips before a new battery is installed but after the old one is removed.

Meter Precautions

It is important to point out at this time that some service ohmmeters utilize circuitry which necessitates an other-than-normal battery polarity inside the meter. With meters of this type, the red test lead has a negative potential and the black lead has a positive potential. The technician should investigate his meter to determine its polarity. This can easily be done by connecting a voltmeter across the ohmmeter test prods. When measuring circuits which are critical with regard to polarity (such as those containing electrolytic capacitors), the technician should keep in mind the polarity of the meter leads and should connect them accordingly. The positive lead, whether it is red or black, should be connected to the positive lead of the electrolytic capacitor. The transsistors in this receiver would not be ruined if an ohmmeter were to be connected into the circuit in the reversed polarity, but the electrolytic capacitors would give incorrect readings because they would be measured backwards. It is also imperative not to use an ohms range which utilizes a battery of more than three volts (or two cells), because the transistors can be ruined if too much voltage is applied to them.

The resistance between the battery clips (with the battery removed and the receiver turned on) should be between 6K and 15K ohms for a normal receiver, as read by an ohmmeter with an internal battery of not more than three volts. A reading lower than 6K ohms will usually indicate a defective receiver which should be checked before the new battery is installed.

Checking Battery Current

Probably the easiest method of checking a receiver which has a low B+ resistance reading is to measure the battery current. This can be done very easily by holding the battery vertically with the negative terminal resting on the negative clip. The negative lead of a milliammeter is attached to the positive battery clip, and then the positive meter lead is touched to the positive terminal of the battery. Normal battery current should be between 3.5 and 4.8 milliamperes.

Trouble Shooting

The new battery can be inserted into the clips if the reading of the battery current is within the normal range. If the dead battery were the only trouble, the receiver should operate satisfactorily; however, there will presumably be many cases in which a new battery will not return the receiver to operating condition. For these receivers, a troubleshooting procedure is outlined in Chart I. This chart covers the basic methods of isolating and identifying the causes of the most common troubles.

Oscillations

There is one receiver condition which is not fully covered in Chart I. This is the condition wherein the receiver is oscillating and normal reception is impossible. As in most battery-operated receivers, the battery in the Model TR-1 is bypassed with an electrolytic capacitor C17 in order to present a low-impedance circuit for signal currents. Consult the schematic in Fig. 7 for the location of these components in the circuit. If this capacitor were to develop an open circuit, there would be a considerable amount of feedback along the B+ line to all stages; and the receiver would have general oscillations over the entire tuning range. A similar condition of general oscillations will exist when and if capacitor C9 develops an open circuit. Since C9 bypasses the audio voltages on the AVC line, its failure will allow the gain of the IF stages to vary at an audio rate; and oscillations will result.

An electrolytic capacitor of almost any value can be used to check an electrolytic capacitor that is suspected as being open. This can be accomplished by momentarily bridging the external capacitor across the suspected one while the receiver is turned on. The capacitor polarity should be observed when making this check.

Failure of capacitor C19 in the audio stage will cause a complete loss of audio output. An open condition in capacitor C21 will cause extreme degeneration in the audio stage. This will in turn cause the output of the receiver to be weak and distorted, and some IF oscillation will be encountered.

The information in Chart I lists most of the possible troubles in this receiver. Actually, the replacement of the battery and the electrolytic capacitors is expected to constitute the great majority of service operations in the field.

Circuit Checks

At first glance, it may seem that no points are available for voltage or resistance checks of the circuit. Actually, the top end of each resistor in the receiver provides an important circuit point at which to make measurements. All but three of the transistor elements can be measured very easily from the rear, and those three (the collectors of X2, X3, and X4) could be checked by using some ingenuity. The transistors in this receiver use the basing illustrated in Fig. 4; and X2, X3, and X4 are mounted so that their collector leads are toward the outer edges of the circuit board. A small wire probe could be attached to the conventional meter probe and could be bent to reach under the transistor in order to touch the collector lead.

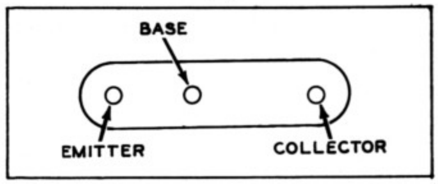


Fig. 4. Basing Diagram for the Transistors Used in the Regency Model TR-1 Receiver.

The voltage readings of an average receiver are shown on the schematic diagram. All of the readings were obtained from the rear of the receiver, and the receiver was not disassembled in any way. The photograph in Fig. 5 identifies each of the points at which these measurements were taken. The polarities of the leads of the electrolytic capacitors are also shown in Fig. 5.

Checking Transistors

The transistors are soldered onto the circuit board and must be checked in the circuit. Transistors are low-impedance devices; and unlike vacuum tubes, the input and output resistances can be measured directly with an ohmmeter. When checking the transistors, care must be taken to ensure the correct polarity of the ohmmeter leads. The positive lead, whether it is red or black, must be connected to the base terminal for these transistors which are of the NPN type. The negative lead is then used to measure resistance at the emitter and collector terminals.

The transistor is a nonlinear device; therefore, different types of ohmmeters will give different values of resistance between the terminals

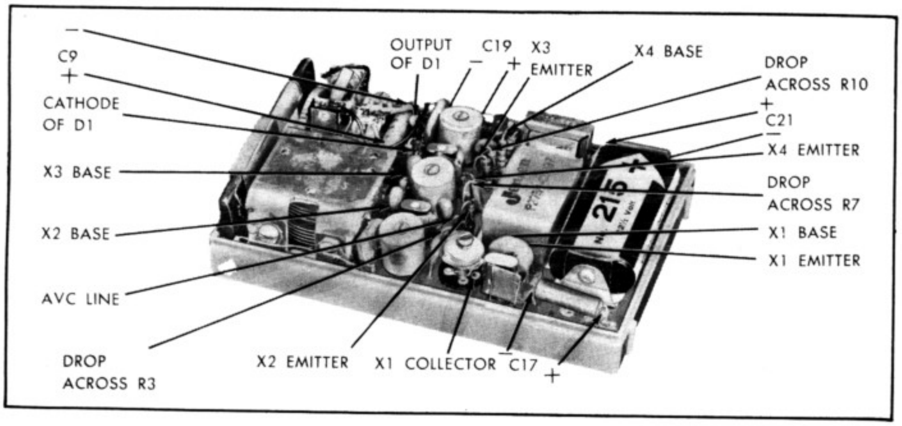


Fig. 5. Photograph Showing the Measuring Points in the Circuits of the Regency Model TR-1 Receiver.

of the transistor. The reading given by any one ohmmeter will depend upon the circuit in that meter, the range that is selected, and the voltage of the internal battery. Ohmmeters using an internal battery of 1.5 or 3 volts and having a 10-ohm midscale range will give the following resistance values:

Base to emitter — 2 to 10 ohms,

Base to collector — 5 to 200 ohms.

The junction transistor is a very stable device having exceptionally long life. Mishandling, mechanical damage, or application of improper voltages are the usual causes of transistor failure. Improper voltage and resistance measurements which are encountered at the transistor leads are in all probability the result of a fault in a component other than the transistor. Before any component (especially the transistor) is changed, the entire associated circuit should be checked thoroughly to determine which component is faulty.

Component Replacement

The replacement of small components such as resistors and capacitors can be accomplished without disassembling the receiver. The leads of a faulty capacitor can be cut close to the body of the component, thus leaving leads long enough to solder to the new component. Faulty resistors can be crushed with a pair of pliers and the resistive material can be removed, again leaving leads long enough to solder to the new components. Access to the wiring side of the circuit board is not necessary for these replacements. A small 20- to 25-watt soldering iron is recommended for any repairs that have to be done. Repairs on the wiring board itself should not be attempted unless the technician has some general knowledge of printed-wiring repairs. See page 8.

Disassembly of Receiver

The larger components, including the transistors, will have to be unsoldered before they can be removed from the board. To do this, the circuit board must be disassembled from the chassis. Disassembly should proceed as follows:

1. Rotate the tuning dial to the extreme counterclockwise position.

2. Loosen the knurled screw in the center of the dial, and remove the screw and dial.

3. Loosen and remove the one flat-head screw.

4. Remove the chassis from the receiver case.

5. Straighten the twisted lugs at three corners of the circuit board.

6. Unsolder the connections to the stator of the tuning capacitor and to the twisted lug projecting from the chassis.

7. Move the circuit board to a right-angle position with the chassis.

Alignment

The alignment of this receiver is very simple. Signal injection is accomplished by connecting the signal generator to a loop formed of several turns of wire and situated close to the antenna coil of the receiver. Set the generator to 262 kilocycles with 400-cycle modulation, and reduce the output to as low a value as is usable. Connect an output meter (with a .1-volt scale) across the voice-coil connections. (The high side of the voice coil is easily accessible at the spring of the phone jack.) Set the volume control in the receiver to maximum. Adjust each of the cores of the IF transformers for maximum indication on the output meter. Set the receiver dial to its maximum counterclockwise position, tune the generator to 535 kilocycles, and adjust the core of the oscillator coil for maximum output. Tune the generator to 1630 kilocycles, set the receiver dial to its maximum clockwise position and adjust the oscillator trimmer capacitor for maximum output. Repeat these last two adjustments alternately until no further improvement can be made. Then tune the generator to 1500 kilocycles, tune in this signal with the receiver dial, and adjust the antenna trimmer capacitor for maximum output. Turn the receiver dial to the high-frequency end, and determine whether or not the range extends to 1630 kilocycles. If not, the oscillator trimmer capacitor must be readjusted, and the alignment at 1500 kc must be repeated.

Transistor Replacement

The neutralizing circuit of the IF stages requires a resistor in series with the capacitor to balance internal coupling of the transistor. This is not critical in value and a single value suffices for all production units. The capacitor requires selection to take care of the spread of effective capacitance encountered.

Consequently, the transistors in the IF amplifier stages have been divided into several classifications according to their internal capacitances. The neutralizing capacitors C10 and C14 are selected during manufacture to neutralize effectively the specific internal capacitances of the transistors used.

To eliminate the confusion which could arise from this situation, the manufacturer has color-coded each transistor for internal capacity. **Each IF service replacement transistor is supplied with its proper neutralizing capacitor. The neutralizing capacitor (either C10 or C14) must be replaced when X2 or X3 are changed, unless the new one is of the same value as the old.**

Since the Regency TR-1 transistor receiver has been on the market only a short time, the special components are not yet available through parts distributors. Distribution of these components is planned by the manufacturer for a future date. Until such distribution has been made, the service technician should contact the manufacturer for information regarding the contemplated plan for factory service at a fixed price before attempting any component replacement; or the faulty receiver should be returned to the manufacturer for service.

CHART I

TROUBLE-SHOOTING PROCEDURE FOR THE REGENCY MODEL TR-1 RECEIVER

DEAD RECEIVER

A. Absolutely No Output.

1. Remove the battery and turn on the switch. Measure the resistance between the battery clips. (Make sure the positive meter lead is on the positive clip.) If the resistance is:

   a. Approximately 10K ohms, the B+ circuit is normal.

   b. Less than 2500 ohms, check the leads of capacitors C17 and C21, and make sure that they are not touching the battery clips or the frame of the output transformer. Check for a shorted condition in either C17 or C21. Measure the resistances from the top ends of R3 and R7 to ground. These should be 2200 ohms more than the reading across the battery clips.

   c. Infinity, check for an open switch.

2. Turn the volume control to maximum, and insert the battery. If a click or noise is heard from the speaker, check X4 by shorting its base to the frame of the output transformer. The audio stage is operating if a click is heard. If no click or noise is heard, proceed as follows:

   a. Check for an open or shorted jack. Indicative readings can be obtained by measuring the resistance from the fixed contact of the jack to ground. These readings are:

      0 ohms — Shorted jack.
      2 ohms — Normal.
      15 ohms — Jack is open, or the ground between the wiring board and chassis is open.

   b. Check for an open condition in the speaker or in the output transformer.

   c. Voltage at the base of X4 (about +2 volts normal).

   d. Voltage at the emitter of X4 (should measure approximately .15 volt less than the base voltage).

3. Check capacitor C19 by paralleling it with a capacitor known to be good.

4. Measure the voltage at the output of the diode D1 (should be approximately +.1 volt).

   a. If voltage is zero, check the resistance to ground with the positive meter lead on the output. This resistance should measure between 20 and 100 ohms. If the resistance is zero, check for a shorted condition in the diode circuit. If the resistance is 200 ohms or greater, check for an open in the diode circuit or for an open diode.

   b. If voltage is negative when the receiver is tuned to a station, move the tuning dial so that no station is received. The negative voltage should decrease.

   c. If voltage is negative by one volt or more and does not drop when the receiver is tuned off the station, the receiver is oscillating. Proceed to the section entitled "Oscillating Receiver."

5. Make voltage and resistance measurements in the IF stages.

B. Noise But No Signal.

1. Check the local oscillator in the receiver as follows: Tune another receiver to any station above 850 kc. On the receiver being serviced, rock the dial above and below a setting that is approximately 262 kc below the frequency of the station being received by the other receiver. If the local oscillator in the receiver being serviced is operating, a whistle will be heard from the other receiver as the radiation from the oscillator beats with the station frequency.

   a. If the oscillator is dead, proceed as follows:

      (1) Check the voltage at the base of X1. This should be between 3 and 10 volts.

      (2) Check the voltage at the emitter of X1. This voltage should be within .1 volt of the base voltage.

      (3) Check the voltage at the top end of R3. This should be measured from the B+ line, and it should be between .6 volt and 2 volts.

      (4) If any of the voltages measured in the three preceding steps are incorrect, check for an open oscillator-coil primary or an open first IF transformer.

      (5) Check resistances of:

         (a) The high side of the antenna coupling coil to ground (should be less than 1 ohm).

         (b) The secondary of the oscillator coil (should be approximately 10 ohms).

         (c) Stator of oscillator section of the tuning capacitor to ground (should be infinity).

WEAK OR DISTORTED OUTPUT

1. Turn volume control to maximum. Check capacitors C19 and C21 by paralleling a good capacitor across each.

2. Perform step 5 under section entitled "Dead Receiver."

3. Measure voltages at:

   a. Base of X4 (should be approximately +2 volts).

   b. Emitter of X4 (should be approximately .15 volt less than the base voltage).

   c. Emitter of X3 (should be approximately .15 volt less than the voltage at the emitter of X4).

   d. Top end of R11 (should be approximately -.5 volt when receiving a signal of average strength).

   e. AVC line (should be from approximately 0 volts with signal to .5 volt with no signal).

   f. Emitter of X2 (should be approximately .15 volt less than the AVC line).

4. Check the alignment of the receiver.

OSCILLATING RECEIVER

1. Measure the battery voltage. If it is below 15 volts, the battery should be replaced.

2. Check the local oscillator as in step 1 under the section entitled "Noise But No Signal."

3. Check capacitors C17, C9, and C21 by paralleling a good capacitor across each.

4. Check ground connection between wiring board and chassis. This connection is the twisted lug near the negative battery clip and is the only lug which has been soldered to the board. Measure between an IF transformer can and the metal chassis. These readings are:

   0 ohms — Normal.

   15 ohms — Ground lead is open.

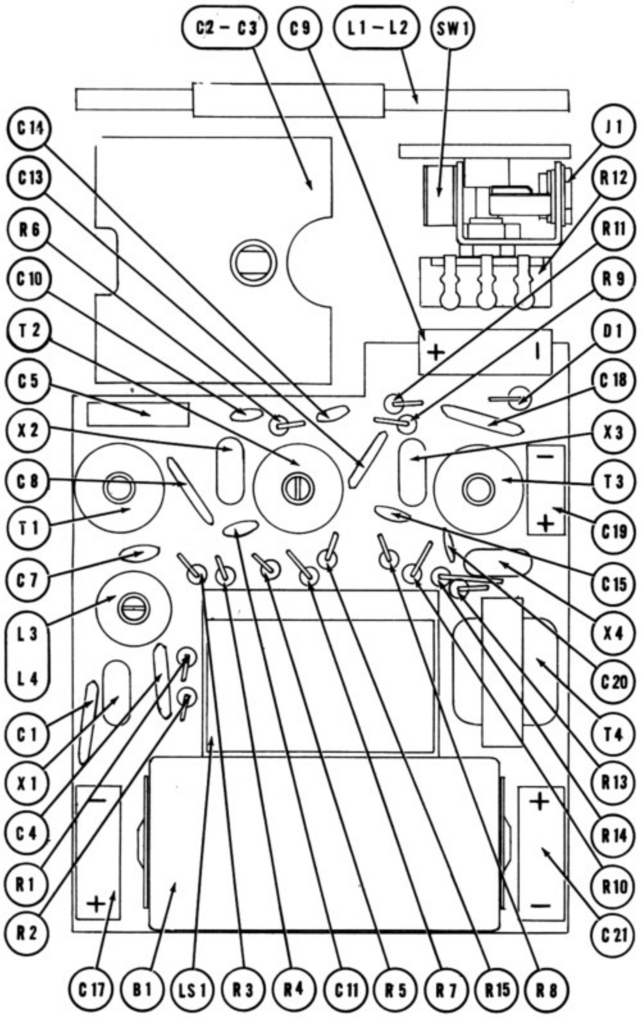


Fig. 6. Top Chassis Components in Regency Model TR-1.

PARTS LIST.

CAPACITORS

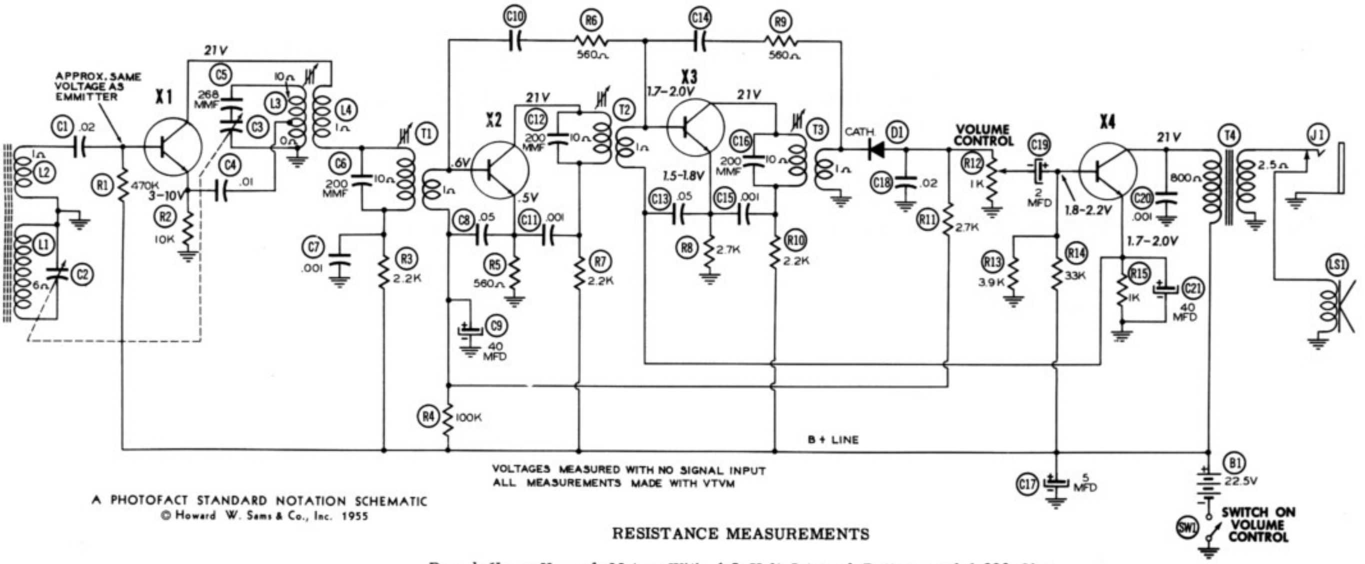
Symbol No.	Part No.	Description	Type
C1, C18	20-075-23	.02 Mfd 9/16" Dia. -20 + 80%	Disc Ceramic
C4	20-075-22	.01 Mfd 9/16" Dia. -20 + 80%	Disc Ceramic
C5	100-771	268 Mmfd 2%	Silver Mica
C7, C11, C15, C20	20-075-21	.001 Mfd 1/4" Dia. G. M. V.	Disc Ceramic
C8, C13	100-772-1	.05 Mfd 9/16" Square -20 + 80%	Disc Ceramic
C9, C21	300-473-2	40 Mfd / 3 Volt	Electrolytic
C17	300-473-3	5 Mfd / 25 Volt	Electrolytic
C19	300-473-1	2 Mfd / 3 Volt	Electrolytic

RESISTORS

Symbol No.	Description
R1	470 K 1/4 Watt - 20% Carbon
R2	10 K 1/4 Watt - 20% Carbon
R3, R7, R10	2.2 K 1/4 Watt - 20% Carbon
R4	100 K 1/4 Watt - 10% Carbon
R5, R6, R9	560 Ohm 1/4 Watt - 10% Carbon
R8, R11	2.7 K 1/4 Watt - 10% Carbon
R13	3.9 K 1/4 Watt - 10% Carbon
R14	33 K 1/4 Watt - 10% Carbon
R15	1 K 1/4 Watt - 10% Carbon

MISCELLANEOUS

Symbol No.	Part No.	Description
B1		Regency No. 215 Battery
C2, C3	300-433	Variable Tuning Capacitor
D1	100-773	Germanium Diode Detector
J1	300-434	Earphone Jack
L1, L2	300-432	Ferrite Core Loop Antenna
L3, L4	100-731	Oscillator Coil
LS1	100-766	Loud Speaker
R12	100-596-2	Volume Control (1K-Audio Taper)
T1, T2, T3	100-728	IF Transformer
T4	100-629	Output Transformer
X1	100-626	Mixer Transistor
X2, C10	100-767	IF Transistor Replacement
X3, C14		(Transistor & Neut. Cap.)
X4	100-628	Audio Transistor
	600-061	Case (Front & Back-State Color)
	100-732	Dial
	100-734	Dial Screw
	300-435	Volume Control Knob (State Color)



RESISTANCE MEASUREMENTS

Based Upon Use of Meter With 1.5-Volt Internal Battery and 1,000-Ohm Center Range; All Measurements Taken With Positive Probe (Not Necessarily the Red Probe) Connected to Terminal Being Measured.

TRANSISTOR	BASE	BASE (WITH METER LEADS REVERSED)	EMITTER	COLLECTOR (MEASURED FROM B+ LINE)
X1	7KΩ		10KΩ	2.2KΩ
X2	600Ω	3.0KΩ	550Ω	2.2KΩ
X3	750Ω	725Ω	2.7KΩ	2.2KΩ
X4	850Ω	3.5KΩ	750Ω	850Ω

Fig. 7. Schematic of Regency Model TR-1 Pocket-Sized Radio Receiver.

Printed Circuit Service Notes

All of the circuit components of the Regency TR-1 are assembled by inserting leads or tabs through holes in a phenolic plastic circuit board (see Fig. 1) on the reverse side of which is the interconnecting circuit wiring in the form of a photo-etched copper layer. All of the lead wires which extend through holes in the printed circuit conductor "straps" are clipped off close to the board by a special machine and the board solder dipped to produce all of the soldering of connections in a single operation.

While the bond between the laminated plastic board and the copper foil, representing the wiring of the circuit, is sufficiently strong to resist the careful time and temperature controlled factory solder dip, it can be easily damaged by overheating during servicing operations. The printed circuit wiring of the TR-1 is similar to that used in recent radio and television receiver design except that the miniature construction of this set necessitated closer spacing of conducting strips than in other printed circuits. This increases the hazard of shorts between circuits by solder "bridges" when making repairs.

If replacement of components or other servicing operations which would require the application of a soldering iron to the printed circuit board should become necessary it is important that the following precautions be observed:

1. Use only a small (low wattage) soldering iron having a small point or wedge. This should be of the "pencil" type having a rating of not more than 35 watts.

2. Since the copper foil, being metal, expands to a greater extent than the underlying plastic board, the bond between them may be broken and the circuit "arched" away from the board if heat is applied for too long a period. The iron should be applied for the shortest possible time to effect softening of the solder and removal of the old part or attachment of the new.

3. Use only low-temperature solder of small diameter and having a rosin flux core. This type is known as 60/40 since it is composed of 60% tin and 40% lead. The ordinary solder which has a higher melting point and has a composition of 40% tin and 60% lead should not be used.

4. A small fine wire brush, as used for cleaning suede shoes, is helpful in brushing away surplus solder and in removing solder bridges between circuits.

5. With the exception of replacement of transformers, transistors or the oscillator coil, repairs can be effected without unsoldering the component leads of the printed circuit side of the board. This technique is as follows:

a. Cut the defective unit (resistor or capacitor) in half with diagonal pliers.

b. Cut or "crush" each half of the unit until only its connecting leads remain.

c. Make a small loop in each lead of the replacement component and slide these loops over the leads of the part removed.

d. Make a secure solder connection using as little solder and as short a time as possible. Too much heat may cause the original lead to fall out of the board.

To recapitulate — use as little heat as possible, remove excess solder quickly and completely, and never attempt repairs with a large soldering iron.

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