THE VACUUM TUBE DETECTOR, DT–3–A.

Equipment.

1 vacuum tube VT–1.
1 detector, DT–3–A.
1 wave meter, SCR–61.
1 SCR–54–A (set box BC–14–A only).
1 4-volt storage battery (BB–14).
2 batteries, type BA–2 (or BA–8).
1 voltammeter, model 280.
1 rule.

Information.

When using the SCR–54 or SCR–54–A receiving sets for receiving long distance signals, it may be found that the crystal detector of the set is not sensitive enough to detect the faint signals received. A

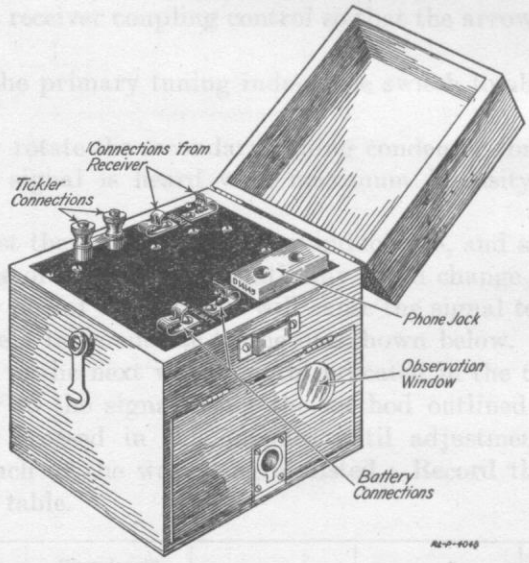

Fig. 54.—The DT–3–A detector unit.

more sensitive device, known as a vacuum tube detector may then be used to receive these very faint signals. This type of detector is provided in the DT–3–A equipment. (See Fig. 54.)

After this detector is once connected and adjusted no further adjustment is required and the operation of tuning in the receiving set is not altered in any way.

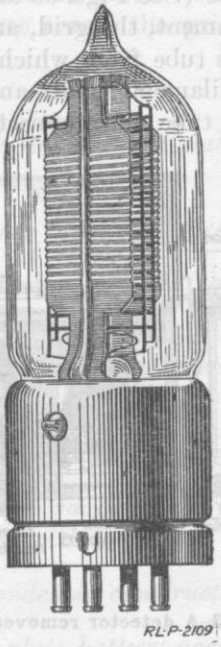

Fig. 55.—Type VT–1 vacuum tube.

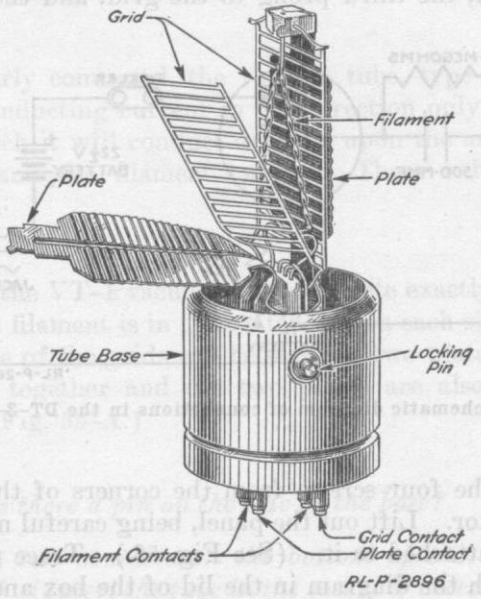

Fig. 55–A.—Details of VT–1 vacuum tube.

The VT–1 vacuum tube (See Figs. 55 and 55–A) consists of three elements, namely the filament, the grid, and the plate which are all inclosed in a sealed glass tube from which the air has been pumped out. Leads from the filament, grid, and plate are brought out through one end of the tube and connected to four prongs. This

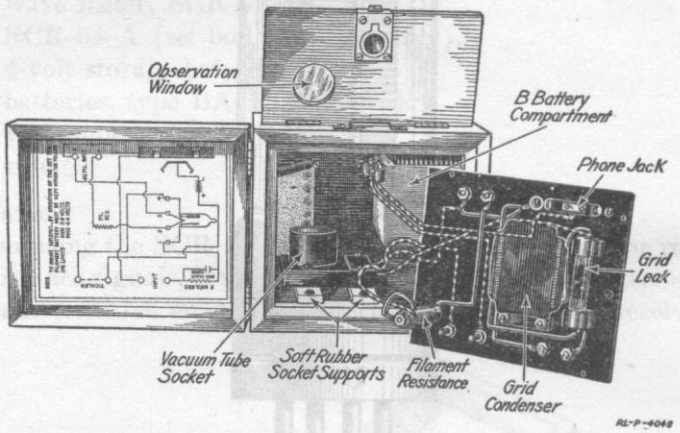

Fig. 56.—Panel of DT–3–A detector removed to show interior parts.

end is called the base of the tube. Two of the prongs are connected to the filament, the third prong to the grid, and the fourth to the plate.

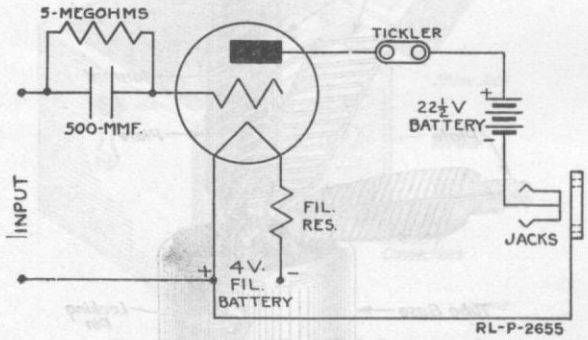

Fig. 57.—Schematic diagram of connections in the DT–3–A detector.

Directions.

1. Remove the four screws from the corners of the panel of the DT–3–A detector. Lift out the panel, being careful not to break the flexible wires attached to it. (See Fig. 56.) Trace the wiring and compare it with the diagram in the lid of the box and also with the schematic diagram in Fig. 57.

2. Examine the resistance in series with the filament battery. Also examine the resistance across the grid condenser. Note how these resistances differ.

Questions.

(1) *What kind of clips are used to make the connection to the input circuit and the battery circuits?*

(2) *How many telephones can be plugged into this detector unit?*

(3) *How is the grid leak resistance constructed? What is its resistance?*

(4) *How is the filament resistance constructed? What is its resistance?*

(5) *How is the vacuum tube socket fastened in the box? Why?*

(6) *Which contacts on the vacuum tube socket make contact with the filament leads? Which with the plate? Which with the grid?*

(7) *How is the fixed condenser constructed?*

(8) *Which lead of the plate battery goes to the plate?*

(9) *Can the filament current be varied? How?*

Information.

When properly connected, the vacuum tube, type VT–1, has the property of conducting current in one direction only. The amount of current which it will conduct depends upon the amount of plate battery used and the filament current. These values vary with different tubes.

Directions.

3. Examine the VT–1 vacuum tube and note exactly how it is constructed. The filament is in the center and on each side of it are the grids. Outside of the grids can be seen the two plates. Both grids are connected together and the two plates are also connected together. (See Fig. 55–A.)

Questions.

(10) *Why is there a pin on the side of the base?*

(11) *Which two contacts on the bottom of the base go to the filament leads? (Insert the tube in the socket if necessary to discover this. Use the pin on the side as a reference point.)*

(12) *Which contact goes to the grid? Which contact goes to the plate?*

(13) *How many cross bars are there in each side of the grid?*

(14) *Is there a grid on each side of the filament? Is there a plate on each side?*

Information.

The results obtained in the following experiments will depend upon the hearing ability of the student. Inasmuch as the sensitivity of the ear varies with different individuals the results recorded will only be approximate. However, they will be sufficiently accurate to bring out the idea intended.

EXPERIMENT No. 1.

COMPARISON OF SIGNAL STRENGTHS BETWEEN THE CRYSTAL DETECTOR AND THE VACUUM TUBE DETECTOR.

Directions.

4. Set up the SCR–61 wave meter as a transmitter and the SCR–54–A as a receiver, as shown in Fig. 40 of Unit Operation No. 9. Plug in a pair of receivers in the jacks of the SCR–54–A set. Start the buzzer of the SCR–54–A operating and locate a sensitive spot on the crystal detector. Turn off the current to the buzzer. Adjust the SCR–61 wave meter to a wave length of 250 meters and start its buzzer in operation. Tune the secondary of the SCR–54–A set so that the signal from the wave meter can be heard with maximum volume. Without changing any other adjustments reduce the coupling between the SCR–54–A set and the wave meter until the wave meter signal is just faintly heard in the telephone receivers. Try increasing the signal strength by readjusting the detector of the SCR–54–A set and by retuning the secondary. If an increase in signal strength is obtained, again reduce the coupling between the receiver and the wave meter until the signal is just faintly heard. This signal may be compared to the faint signal of a distant transmitting station which is received by an SCR–54–A receiver using a crystal detector. Measure the distance between the wave meter and the BD–14–A set box with the rule.

5. Without disturbing the tuning adjustments or the location of either the wave meter or the SCR–54–A set open the crystal detector circuit in the latter by removing the contact from the surface of the crystal. Remove the head set plug from the SCR–54–A set and insert it in the jack of the DT–3–A detector. Connect the input

terminal of the DT–3–A to the extra detector terminals of the SCR–54–A. (See Fig. 58.)

6. Connect a 4-volt battery in series with the low reading ammeter (0-3 scale) and a small rheostat to the filament battery terminals of the set. Be sure to get the positive lead connected to the plus (+) binding post and the negative lead to the minus (—) binding post. Set the rheostat so all the resistance is in the circuit.

7. See that a serviceable type BA–2 battery is properly connected in the set box.

8. Open the side door of the DT–3–A and connect the proper leads from the "B" or 22½-volt battery to the binding posts.

9. Insert a VT–1 vacuum tube in the socket.

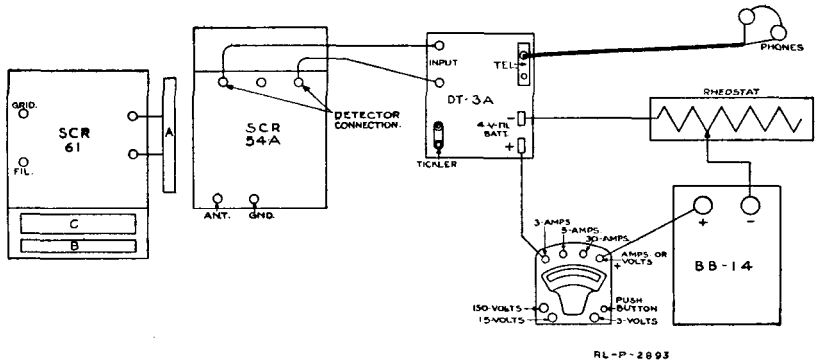

Fig. 58.—Method of connecting apparatus used in Experiment No. 1.

10. Increase the current in the filament of the VT–1 by cutting out the resistance of the rheostat until the ammeter reads 1.1 amperes.

11. Retune the secondary of the SCR–54–A receiver until the signal from the wave meter is heard with maximum strength in the telephone receivers.

12. Decrease the coupling between the wave meter and the BC–14–A set box until the signal from the wave meter is just faintly heard in the telephone receivers. Again measure the distance between the wave meter and the BC–14–A set box.

13. Leave the apparatus adjusted in this manner for the next experiment.

Questions.

(15) *What was the distance measured between the wave meter and the set box under Direction 4 in the above experiment?*

(16) *What was the distance measured between the wave meter and the set box under Direction 12 above?*

(17) *From your observations in the above experiment, which is the more sensitive to a weak signal, the vacuum tube detector or the crystal detector?*

(18) *Which detector requires the more adjustment? Explain.*

(19) *Why was the coupling between the wave meter and the SCR–54–A set loosened?*

(20) *Is the tuning of the set any sharper when using a vacuum tube detector than when using a crystal detector?*

EXPERIMENT No. 2.

SIGNAL STRENGTH WITH DIFFERENT VALUES OF FILAMENT CURRENT.

Directions.

14. Increase the coupling between the wave meter and the set box until the signal from the wave meter is fairly loud in the telephone receivers.

15. Decrease the current in the filament of the VT–1 by increasing the resistance of the rheostat until the ammeter reads about 0.1 ampere.

16. Start decreasing the resistance of the rheostat until the point is reached where the wave meter signal is just faintly heard in the telephone receivers. Note the reading of the ammeter and the brightness of the detector tube filament.

17. Again slowly decrease the resistance until all of the resistance is cut out of the circuit. Note the reading of the ammeter at the point where no increase in signal strength is perceptible. Also note the brightness of the detector filament.

18. Turn off the filament current and be careful not to disturb any of the other adjustments as the same set-up will be used in the next experiment.

Questions.

(21) (*a*) *What is the lowest value of filament current for which the VT–1 will act as a detector?*

(*b*) *Did the filament burn with a bright red color or with a very dull red color at this value?*

(22) (*a*) *What value of filament current gives a signal of greatest strength?*

(*b*) *How bright did the filament burn at this value?*

(23) *What is the value of the filament current with the rheostat resistance cut out?*

(24) *What is the best value of filament current?*

(25) *Would it be safe to connect a 4-volt battery direct to the filament battery contacts of the set? Does the small resistance in the set box, in series with the filament, protect it from being burned out?*

EXPERIMENT No. 3.

SIGNAL STRENGTH WITH DIFFERENT VALUES OF PLATE VOLTAGE.

Directions.

19. Adjust the rheostat until the ammeter shows the reading which was found to be the best value of filament current in Experiment No. 2.

20. Reduce the coupling between the wave meter and the SCR-54-A set until the signal from the wave meter is just faintly heard in the telephone receivers.

21. Connect a serviceable type BA-2 battery in series with the BA-2 battery in the set box. To do this remove the negative lead of the BA-2 battery from the clip binding post on the side of the container. Connect this lead by means of a short piece of wire to the positive lead of the second BA-2 battery. With another piece of wire connect the remaining lead from the second battery to the negative clip binding post.

22. Note any change in the strength of the signal from the wave meter when the additional battery is used.

23. Turn off the filament current and disconnect the apparatus.

Questions.

(26) *Was there an increase in signal strength when the plate voltage was increased to 45 volts?*

(27) *From the observations made what would you say is the best plate voltage to use in conjunction with a VT-1 vacuum tube as a detector?*

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