

BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

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TEST SETS

WILKINSON LINE LOCATORS

DESCRIPTION AND MAINTENANCE

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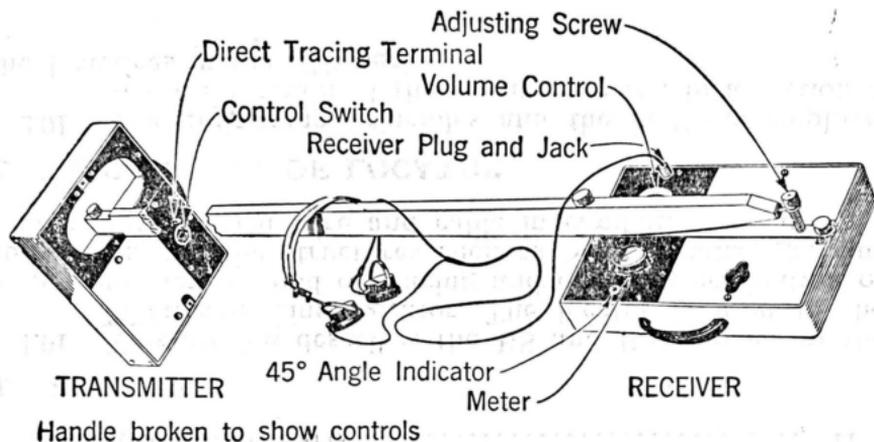
1. GENERAL

1.01 This section describes the BS and BS1 models of the Wilkinson Line Locator. The locator is used in the high frequency method of tracing and depth determination of subsurface metallic structures such as buried cables, gas and water pipes, buried wire and cable in conduit.

2. DESCRIPTION OF LOCATOR

2.01 The underlying principles and the methods employed in the operation of the set are covered in a section of the Practices in the G50 Series.

2.02 There are two models of the Wilkinson Line Locator in the field, the BS and the BS1; these are similar in outward appearance. The BS model was furnished prior to January 1950; the BS1 model has been furnished since that time. The BS1 model is shown in the illustration below.



2.03 The transmitter and the receiver are housed in separate cases, each with its own loop antenna and self-contained dry batteries. In the BS1 transmitter the control switch also turns the set on or off. In the BS transmitter there is a separate ON-OFF switch. Both models have a DIRECT TRACING binding post to which a ground lead is connected for use in the "conductive method of tracing." A 4-foot lead is furnished with the set for this purpose.

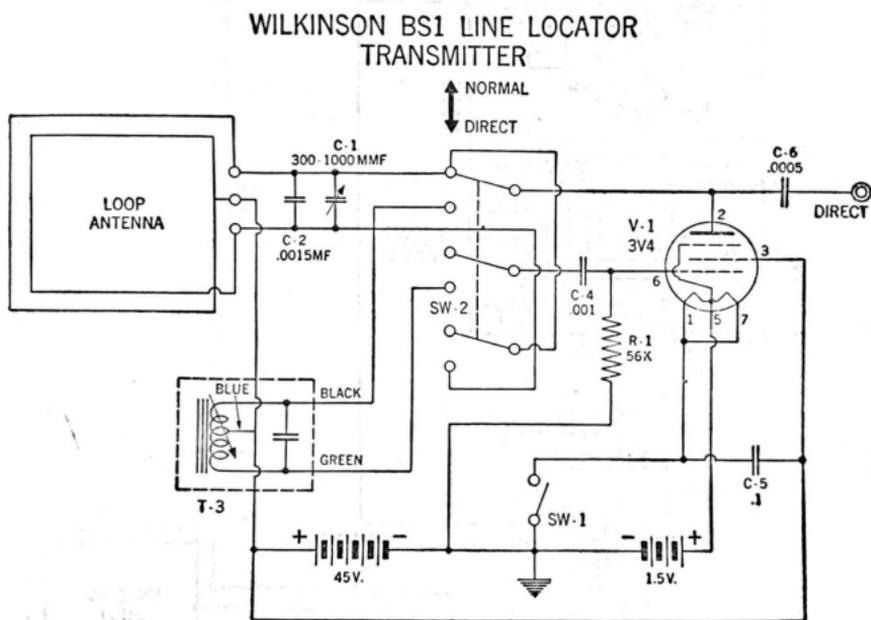
2.04 Both models of the receiver have a volume control, a meter, a headphone jack and a 45° angle indicator. These controls appear in different positions on the faceplates of the two models. The angle indicator is a short metal rod, suspended in such a way that the visible end will center in its housing when the receiver is at an angle of 45° to the horizontal.

2.05 When not in use, the receiver and transmitter can be fastened together, face to face, using the two long knurled head machine screws that fasten these units to the handle when the set is being used. The short knurled head machine screw, the headphones and the ground lead are stored in a compartment provided in the transmitter.

3. CIRCUIT OF BS1 LOCATOR

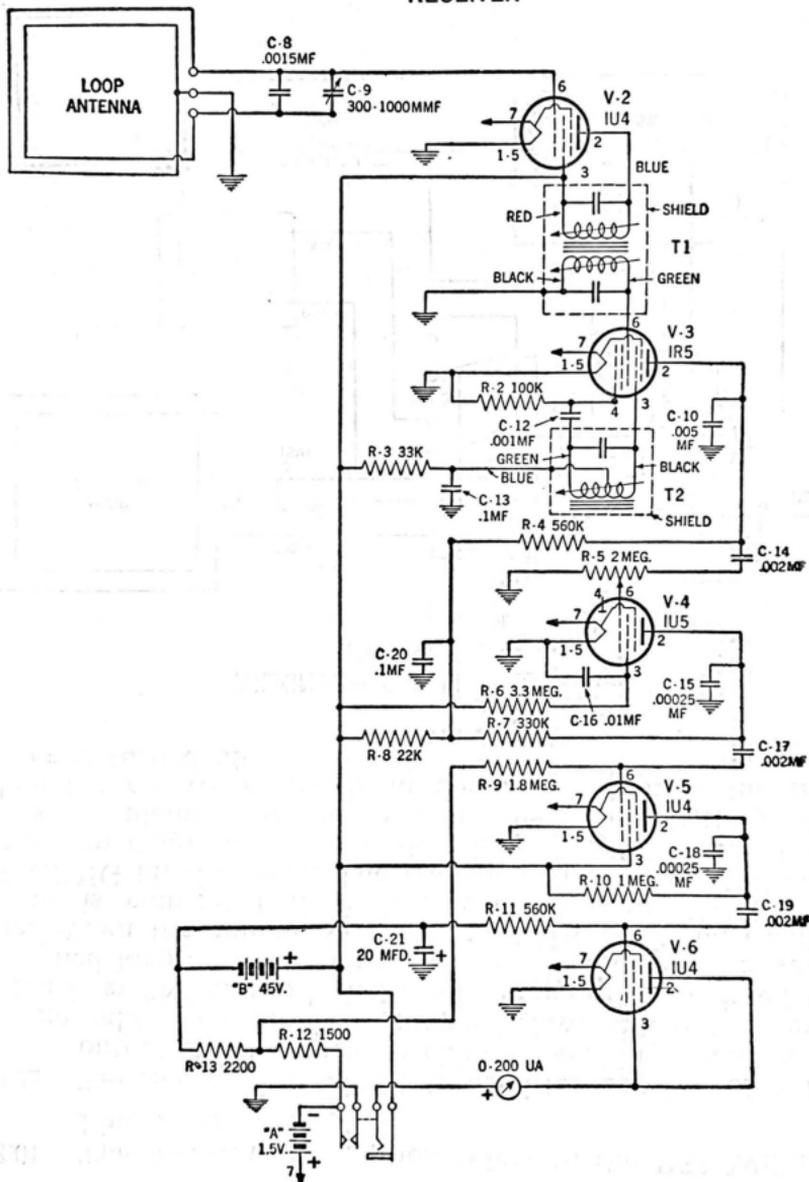
3.01 The following description refers to the BS1 Wilkinson Line Locator.

3.02 **Transmitter, BS1:** The transmitter consists of a fixed output 130-kilocycle oscillator working from a 3V4 vacuum tube. The circuit is shown below. When the control switch is at "NORMAL" the oscillator output is radiated from the tuned loop antenna, housed in the sides of the transmitter case. When the control switch is at "DIRECT" the oscillator circuit is connected through a condenser to the DIRECT TRACING binding post. The control switch, marked SW-2 in the circuit diagram, also operates the switch SW-1 which connects the filament of the vacuum tube to the battery. Thus, when the control switch is in the center position the transmitter is turned off.



3.03 **Receiver, BS1:** The circuit of the BS1 receiver is shown below.

WILKINSON BS1 LINE LOCATOR RECEIVER



3.04 When the headphone jack is plugged into the receiver, the filaments of the tubes are connected to the battery, turning the set on. The receiver contains five vacuum tubes and operates as follows:

- (a) The incoming 130-kilocycle signal from the transmitter is picked up by the loop antenna housed in the sides of the receiver case. The radio frequency amplifier, a 1U4 vacuum tube (V2 on the circuit diagram), amplifies this signal and passes it through the r.f. transformer to the 1R5 tube which is the mixer and local oscillator.
- (b) At this stage the incoming signal is mixed with the 130.4-kilocycle output from the local oscillator to yield an audio frequency of about 400 cycles. This audio output is fed into a three-stage resistance coupled amplifier consisting of one 1U5 and two 1U4 tubes.
- (c) Grid bias for the second and third stages of the audio amplifier is supplied by the IR drop across resistors R12 and R13.
- (d) The output from the last stage is fed into the headphones through the meter. The receiver volume control is a potentiometer in the grid circuit of the first stage of the audio amplifier (V4).

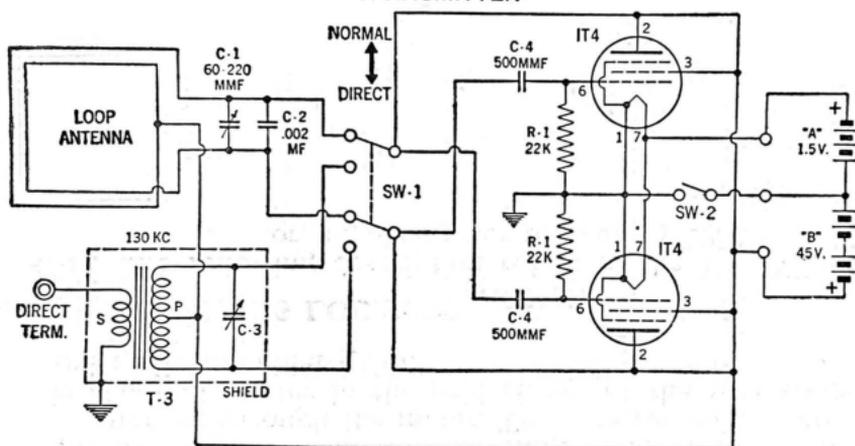
4. CIRCUIT OF BS LOCATOR

4.01 The following description refers to the BS Wilkinson Line Locator, supplied prior to January 1950.



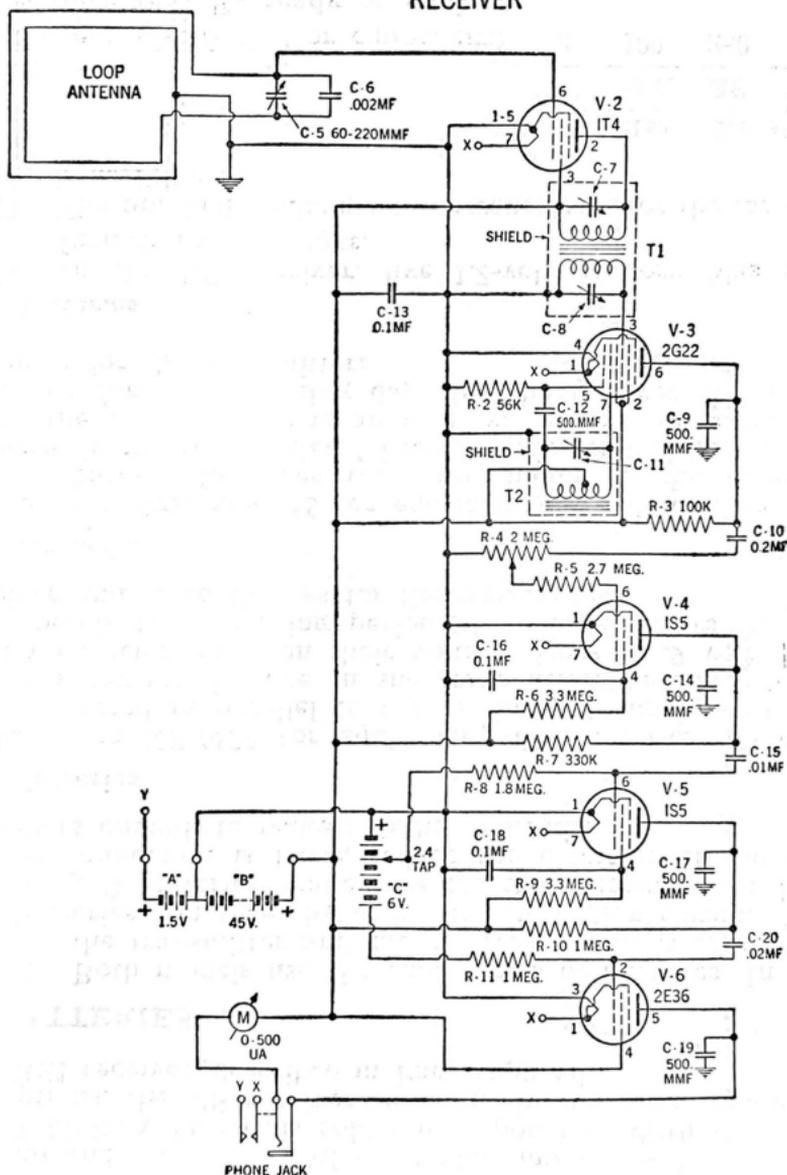
4.02 Transmitter, BS: The BS transmitter consists of a fixed output 130-kilocycle oscillator, working from two 1T4 vacuum tubes. The circuit is shown below. The ON-OFF switch closes the battery circuit to the tube filaments when the transmitter is turned to ON. When the control switch is at "NORMAL" the oscillator output is radiated from the tuned loop antenna, housed in the sides of the transmitter case. When the control switch is at "DIRECT," the oscillator circuit is transformer coupled to a low impedance coil connected to the "DIRECT" terminal.

WILKINSON BS LINE LOCATOR TRANSMITTER



4.03 **Receiver, BS:** The circuit of the BS receiver is shown below.

WILKINSON BS LINE LOCATOR RECEIVER



4.04 The BS receiver uses different vacuum tubes and components from the BS1 receiver. Grid bias for the second and third stages of the audio amplifier is furnished by small Mallory bias cells soldered in position. With the above exceptions, the BS receiver functions in the same manner as the BS1 receiver, described in Paragraph 3.04.

5. BATTERIES

5.01 Both models use the same types of batteries. In both the transmitter and the receiver, access is obtained to the batteries and tubes by lifting the inspection covers. When installing B batteries, make sure the snap fasteners are tight. If the connection is loose, reduce the diameter of the snap fasteners enough to make a tight connection.

A Batteries

5.02 Two KS-6522 (or equivalent) dry batteries are connected in parallel to act as filament supply batteries in the receiver; likewise in the transmitter. These batteries should be replaced when their voltage drops to .9 volt. This corresponds to a working period of about 20 hours for the receiver and 12 to 15 days for the transmitter.

B Batteries

5.03 An Eveready 455 (or equivalent) 45-volt minimax dry battery furnishes the plate supply in the receiver; likewise in the transmitter. These batteries should be replaced when the voltage drops to about 37 volts. This corresponds to three or four full working days for the receiver and six to ten days for the transmitter.

C Batteries

5.04 In the BS receiver, five 1.2-volt Mallory bias cells furnish bias voltages.

5.05 The nominal milliamperes current drain for the locators is as follows:

Model	Transmitter		Receiver	
	BS	BS1	BS	BS1
"A" Battery (2-KS-6522 or equivalent)	100	100	250	250
"B" Battery (455 Eveready or equivalent)	3.6	4.4	5.	.9
"C" Battery (5 Type BC-2 Mallory Bias Cells)	—	—	Very low	—

6. MAINTENANCE

6.01 Battery replacement may be done by the operator of the set. On occasion, he may also replace defective vacuum tubes. The operation of the suspected tube should be tested by a competent radio repairman. In the BS model, a spare set of tubes is supplied with the set. The 2G22 and the 2E36 vacuum tubes have a small red dot in the glass base and care must be taken to mark the chassis close to the red dot to ensure that such tubes are replaced in exactly the same position in the sockets.

6.02 If either model of the locator becomes defective, becomes unstable in operation or loses sensitivity, **the set can be repaired by a competent radio repairman.** Work of this nature CAN NOT be done by the operator, as special testing apparatus is necessary.

6.03 Apparatus required for adjustment of locators.

Vacuum Tube Voltmeter

—General Radio Type 726A, 1800-A or equivalent.

130-Kilocycle Oscillator

—Either a signal generator having a 130-kilocycle \pm 15-kilocycle range, or

—Low frequency communications receiver having a range of 130 kilocycles \pm 15 kilocycles and including a local oscillator so that a beat signal can be obtained.

Receiver Alignment

6.04 The following method can be used on both the BS and BS1 receivers.

R.F. Alignment

(1) Check whether the local oscillator, V3, of the receiver is operating. This can be done with the signal generator set at 130 kilocycles and coupled to the receiver. Listen for a beat note in the headphones of the receiver while tuning its local oscillator. The low frequency communications type receiver may also be used to check the local oscillator. Tune the communications receiver through the range of 130 kilocycles plus and minus 15 kc. Use the local oscillator of the communications receiver to develop a beat signal for identification.

In the **BS model** this tuning is done on the adjusting condenser C11 by **unscrewing** from zero beat until a beat frequency of about 400 cycles is obtained. In the **BS1 model** this tuning is done by turning the screw on top of

the can housing the variable inductance T2, until a beat frequency of 400 cycles is obtained.

(2) Having developed a beat note in the locator receiver output, the **BS model** is adjusted for maximum signal by tuning the antenna loop with condenser C5, and by tuning the r.f. transformer T1 with condensers C7 and C8.

Maximum signal is obtained in the **BS1 model** by tuning the antenna loop with condenser C9 and tuning the r.f. transformer T1 by turning the screws on top of the can.

(3) The sensitivity of the receiver can be checked as follows: Place a coil having the following specification, against the loop antenna.

Diameter 1-3/8 inches.

30 turns of close wound No. 22 enameled copper wire.

With an input to the coil of 20 to 50 microvolts at 130 kilocycles, obtained from a signal generator, full scale deflection of the receiver meter will be obtained. Full scale deflection at twenty microvolts represents maximum sensitivity; full scale deflection at 30 to 50 microvolts will give satisfactory operation.

A.F. Amplifier

(1) Bias voltages are fairly critical and should be maintained plus or minus 10 per cent. The meter should show deflection with no signal input. The Mallory bias cells in the BS model only, should last for about two years and should be changed if they fall below 1.0 volt each. These cells **MUST BE CHECKED WITH A VACUUM TUBE VOLTMETER**; an ordinary voltmeter can not be used.

(2) About .045 volt at 400 cycles is required at the input grid of the first a.f. stage to produce full scale meter deflection.

Transmitter Alignment

6.05 For BS and BS1 models.

(1) Adjust the transmitter frequency to 130 kilocycles by means of the loop trimming condenser C1, with the switch set at "NORMAL." Satisfactory output will be obtained when the radio frequency potential appearing across the tuning condenser is about 40 volts as measured by the vacuum tube voltmeter.

(2) Adjust the oscillator transformer, T3, to the same 130-kilocycle frequency, with the switch in the "DIRECT" position.

7. REPLACEMENT PARTS

7.01 The standard listing for the replacement parts is given below and should be used for ordering purposes:

Battery, Dry, KS-6522

Battery, Dry, Eveready 455

For BS1 Line Locator.

Tube, Vacuum, RCA 1U4

Tube, Vacuum, RCA 1U5

Tube, Vacuum, RCA 1R5

Tube, Vacuum, RCA 3V4

For BS Line Locator.

Cell, Bias, Mallory BC-2

Tube, Vacuum, RCA 1T4

Tube, Vacuum, RCA 1S5

Tube, Vacuum, Raytheon 2G22

Tube, Vacuum, Raytheon 2E36

7.02 Should a replacement be needed for the receiver cord, the **R2CC Cord** may be used.