BELL SYSTEM PRACTICES
Outside Plant Construction and Maintenance

SECTION G86.060.7
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AT&T Co Standard

71- AND 72-TYPE TEST SETS

Contents **Page**

1. GENERAL

1.01 This section replaces Issue 2. It describes the 71- and 72-type test sets used in identifying cable conductors. The section has been rewritten to cover the 71C and 72C test sets which are suitable for identifying conductors in cables containing K and N carrier circuits. The 71B and 72B sets are intended primarily for use in cables containing N carrier circuits and the 71A and 72A sets in cables containing K carrier circuits.

1.02 While the 71- and 72-type sets were designed for use in toll cables to permit making replacements of faulty sections, they are equally applicable to exchange cable testing under circumstances in which the possibility of interference with service must be reduced to a minimum.

1.03 The apparatus consists of two units, a 72 set which produces a high-frequency tracing current and a 71 set which detects and amplifies the tracing current. The 72A provides a 250 kilocycle tracing current and the 72B and C, 300 kilocycle current; the output of the 72C set is crystal controlled. The 72A set must be used with a 71A, the 72B with the 71B, etc.

1.04 Because of the high-frequency tracing signal employed, the apparatus has limited range; about six miles over nonloaded conductors or between adjacent loading coils when the conductors are loaded with any of the existing types of voice-frequency or carrier coils.

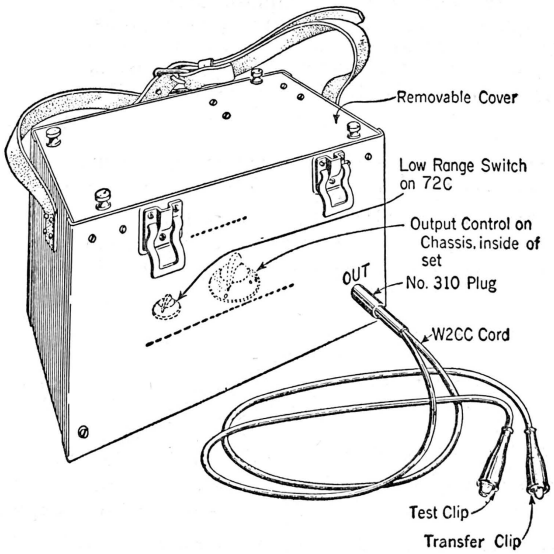
1.05 If a section transfer involves a loading coil case or a length of cable having loading coils, the identification must be done with audio-frequency apparatus such as a 76-type

test set and the 108A amplifier or 91A test set (147-type amplifier), as the current from a 72-type set will not pass through the loading coils.

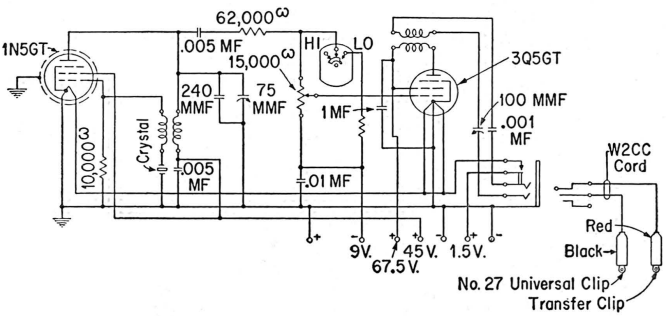
1.06 The 71- and 72-type sets will cause no noticeable interference in working exchange or toll cable circuits of existing types, including C and J carrier, if the apparatus is used as outlined. The 71C and 72C sets can also be used without causing interference in cables containing both K and N carrier circuits, the 71A and 72A sets in cables containing K but not N carrier and the 71B and 72B sets in cables containing N but not K carrier.

2. 72A, B AND C TEST SETS

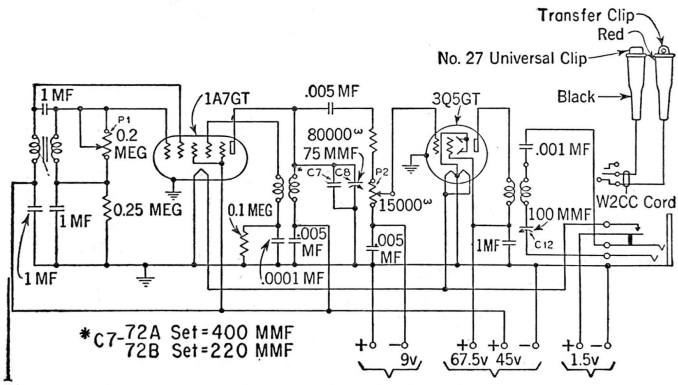
2.01 These sets are electron tube oscillators. The 72A generates a 250 kilocycle tracing current and the 72B and C sets 300 kilocycle currents. The output of the 72C set is controlled by a crystal to within ± 100 cycles. The A and B sets are modulated at approximately 500 cycles. The output circuit is terminated in a jack marked OUT. A cord coded W2CC, equipped with a plug at one end and clips at the other is provided for connecting the set to cable conductors.



2.02 The circuit diagram of the 72C set is shown below.



2.03 The circuit diagram of the 72A and B sets is shown below; these two sets are identical except for one of the capacitors as indicated.



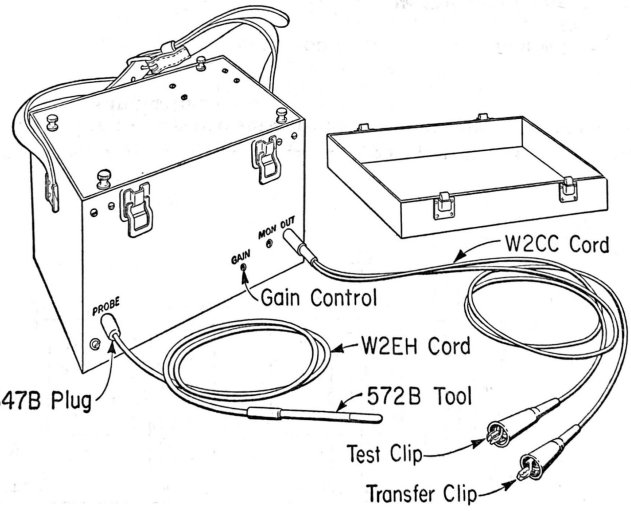
2.04 The output circuit is such that no appreciable bridging loss occurs when a set is connected to working exchange or toll conductors.

2.05 The 72C set has a HI-LO level switch for changing the output level by about 25 db. The 72C as well as the 72A and B sets have output potentiometers that are adjustable by means of a dial calibrated from 0 to 100. The control is accessible by removing the inside cover. The selection of the output level to be used under various conditions is outlined in Part 4.

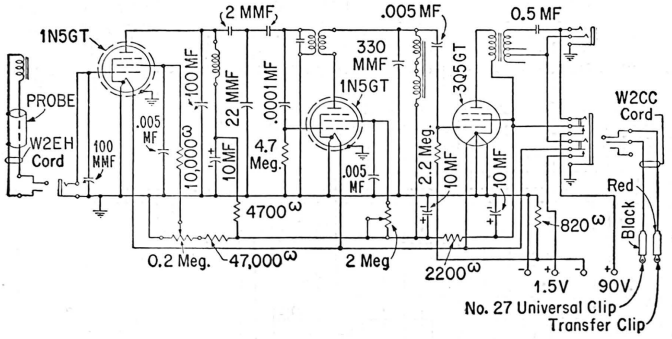
2.06 The 72 sets utilize one 1-1/2-volt, two 4-1/2-volt and three 24-volt batteries for filament, grid and plate, respectively. The batteries must be ordered separately. The set is 12 inches long, 8-1/4 inches wide and 7-1/2 inches high. Its weight including batteries is about 19 pounds.

3. 71A, B AND C TEST SETS

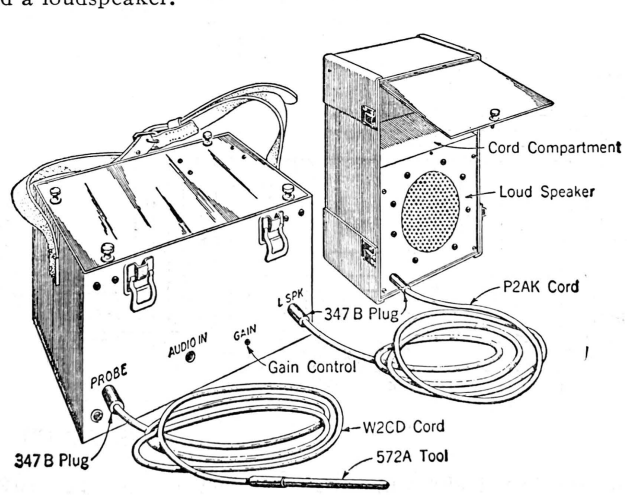
3.01 The 71C set for use with the 72C set, consists of an electron tube detector-amplifier and an exploring probe (572B Tool).



3.02 The circuit diagram of the 71C set is shown below.

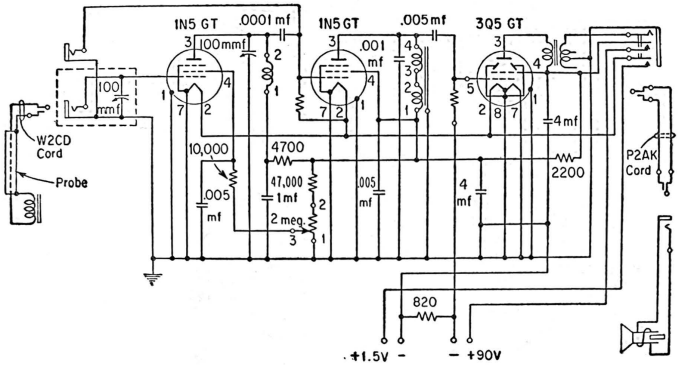


3.03 The 71A and 71B sets are similar in design. The 71A set is used with the 72A set and the 71B with the 72B set. The 71A and B sets, illustrated below, consist of three units, an exploring coil (572A Tool), an electron tube detector-amplifier and a loudspeaker.

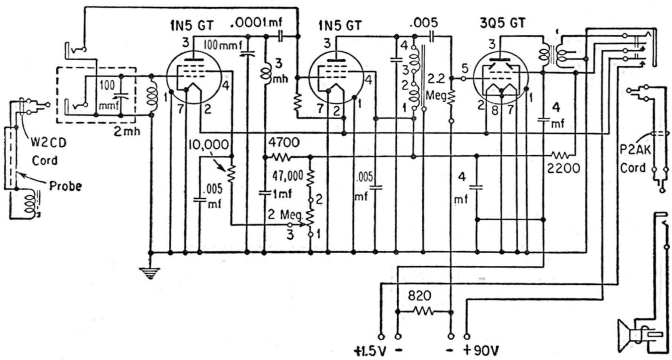


3.04 The circuit diagrams of the 71A and B sets are shown below.

(a) 71A Set



(b) 71B Set



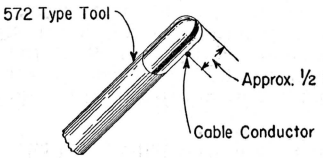
3.05 The detector-amplifier first amplifies the tracing signal picked up by the probe and then converts it into an audible signal. In the 71A and B sets the signal is amplified sufficiently to operate a loudspeaker. The degree of amplification is adjustable by means of the screwdriver control marked GAIN on the outside of the set.

3.06 The 71A and B sets employ a loudspeaker for the tone pickup and the 71C set the receiver of the cableman's talking set through the talking pair to get the signal. The receiver is used in the 71C set in place of a loudspeaker because a higher sensitivity is required by the C set under some conditions. The speaker is mounted in the cover of the set which also provides space for storing the leads.

3.07 The 71-type sets utilize one 1-1/2-volt and four 24-volt dry batteries for filament and plate, respectively. The batteries must be ordered separately. The 71A and B sets are housed in a steel case 12 inches long, 8-1/4 inches wide and 11 inches high. The weight with batteries is about 28 pounds. The 71C set is housed in a case about 12 inches long, 8 inches wide and 6 inches high. The set with batteries weighs about 19 pounds. One extra tube of each type used in the 71 and 72 sets can be carried in the spare tube compartment at the end of the battery tray in the 71 set.

3.08 **Audio-Frequency Tests with 71A and B Sets:** In the 71A and B sets the jack labeled AUDIO IN is provided to permit using the set in place of an amplifier for identifying the talking pair. In this case the 513A tool (audio-frequency probe) should be connected to the AUDIO IN jack and a receiver to the L SPK jack. The amplification control marked GAIN is not in the circuit when the set is used in making audio-frequency tests. These facilities are not provided in the 71C set.

3.09 **572A and 572B Tools:** These probes are used to detect the tracing current on the wire to which the 72-type set is connected. The probe is a cylindrical device 1/2 inch in diameter and 6-5/8 inches long equipped with a shielded cord and a plug. In the blunt end of the probe is a small exploring coil that responds to both magnetic and electric fields produced by the 250 or 300 kilocycle tracing current of a 72 set. With these probes, maximum signal is obtained when its position with respect to the conductor is as illustrated below. The 572A tool is used with 71A and B sets and the 572B tool with the 71C set.



4. PRECAUTIONS

4.01 To employ the 71- and 72-type sets successfully, it is imperative that the workman adhere strictly to the following precautions. If this is not done, serious service interruptions may occur.

4.02 When using the sets in cables containing J, K, L or N carrier circuits, the output of the control of the 72 set should be no higher than that outlined below, to avoid possible interference with carrier circuits. However, the best results will be obtained using the lowest dial setting consistent with positive identification.

4.03 When applied to voice-frequency quads or pairs in toll or exchange cables, the 72-type set will cause no interference regardless of the setting of the volume control. However, for the best results, the minimum output that will provide positive identification should be employed. An excessive output may make the conductors more difficult to identify.

72C Test Set

Cables with L (Coaxial) Carrier: Set the HI-LO switch at LO and the output control at 40, but preferably lower.

Cables with J Carrier: Set the HI-LO switch at LO and the output control at 100, but preferably lower.

Cables with K Carrier: Switch and control settings should not exceed those given below.

Miles from K Repeater	Position of HI-LO Switch	Maximum Control Setting
0 to .5	LO	80
.5 to 1	LO	100
1 to 2	HI	12
2 to 3	HI	30
Above 3	HI	100

Cables with N Carrier: Switch and control settings should not exceed those given below.

Miles from N Repeater	Position of HI-LO Switch	Maximum Control Setting
0 to .5	LO	10
.5 to 1	LO	15
1 to 2	LO	22
2 to 3	LO	50
3 to 4	LO	100
4 to 5	HI	15

72A and B Test Sets

Cables with J Carrier: The output control should be set no higher than 12 on the dial.

Cables with L Carrier (Coaxial): The output control should be set no higher than 6 on the dial.

Cables with K Carrier (using 71A and 72A Test Sets): The maximum permissible setting of the output control will depend on the point of application of the tone with respect to the K carrier repeater, as shown in the following table:

Miles from K Repeater	Maximum Control Setting
0 to .5	6
.5 to 1	8
1 to 2	12
2 to 3	24
3 to 4	54
Over 4	100

Cables with N Carrier (using 71B and 72B Test Sets): The maximum permissible setting of the output control will depend on the point of application of the tone with respect to the N carrier repeater, as shown below:

Miles from N Repeater	Maximum Control Setting
0 to 1	0
1 to 2	4
2 to 3	8
3 to 4	20

4.04 In toll cables, and exchange cables containing N carrier circuits, the conductors should be transferred one wire at a time, a bridging wire between the transfer points being used to maintain circuit continuity. Each twisted joint should be soldered and sleeved before identifying the next wire.

4.05 When the sets are used in exchange cable, except for N carrier circuits, the necessity of bridging will depend on the nature of the circuits involved; local routine should be followed.

5. MAINTENANCE

Batteries

5.01 The 71-type sets utilize one KS-14367 and four KS-6571 Dry Batteries. The 72-type sets utilize one KS-14367, three KS-6571 and two KS-6569 Dry Batteries.

5.02 The batteries should be replaced when their voltages fall below the values given in the table. The tests should be made while the sets are in operation with a voltmeter having a resistance of at least 500 ohms per volt, to avoid excessive drain on the batteries.

Battery	Nominal Voltage	Discard Voltage
KS-14367	1.5 volts	1.2 volts
KS-6571	24.0 volts	19.0 volts
KS-6569	4.5 volts	4.3 volts

5.03 The KS-14367 Dry Battery is specified as its operating life at the rate of drain obtaining in these sets is longer than that of the KS-6542 Dry Battery. The latter, however, may be used, if the KS-14367 battery is not readily obtainable.

5.04 If the batteries must be replaced on short notice and the recommended types are not available, commercial batteries of corresponding voltages may be employed.

5.05 The battery life in these sets is about 100 hours of operation, assuming that the sets are used 8 hours a day.

Electron Tubes

5.06 The 71-type sets utilize two 1N5-GT and one 3Q5-GT electron tubes; the 72C set utilizes one 1N5-GT and one 3Q5-GT electron tubes and the 72A and B sets utilize one 1A7-GT and one 3Q5-GT tubes. These tubes are commercially available and when replacements must be made on short notice, they can be obtained from a local radio store. Normal replacements should be made in accordance with local routine.

5.07 In replacing the 1N5-GT tube in the 72C set or the 1A7-GT tube in the 72A or B sets, it may be necessary to readjust the output control in the set to obtain sufficient 500-cycle signal in the receiving end. To do this, turn on both sets and place the probe just near enough to the output leads of the 72-type set to give a relatively weak 500-cycle signal. Then loosen the cover plate to expose the output control screw, and with a screwdriver adjust the output control to obtain the maximum signal in the receiver or loudspeaker.

5.08 If no signal is detected when the probe is first brought near the output leads of the 72-type set, turn the output control clockwise to its farthest position and move the probe toward the output leads until a relatively weak signal is heard. Then adjust the output control for maximum signal.

Operating Tests

5.09 After checking the batteries a preliminary operating test should be made to ensure that the sets are in good condition and thereby avoid possible delays on the job. This test can be made as follows:

(1) Plug the output leads into the 72-type set and short-circuit them. The output control dial should be set at 6 (on the 72C, set the HI-LO switch to "HI").

(2) Connect the receiver or loudspeaker to the 71-type set and plug the probe into the PROBE jack. The gain control should be set at about the midpoint of its rotation.

(3) Then move the probe to the vicinity of the output leads of the 72-type set. Tone should now be heard.

(4) To check the magnetic pickup of the probe, adjust its position with respect to the wire as illustrated in Paragraph 3.09. Maximum tone should be heard when this position is established.

(5) To check the condition of the cord connections, hold the probe firmly against the output lead and jiggle the cords at each plug. No scratching or large change in tone level will occur if the cords and plugs are in good condition.

5.10 If the 71- and 72-type sets fail to function satisfactorily when in use, the following tests can be made to assist in determining the cause of the trouble:

(1) See that the plugs are firmly inserted in the correct jacks and that the proper 572 type tool is being used. Clean the plugs with standard plug cleaning paste, or fine steel wool if the former is not available.

(2) Check the battery connections in both sets for tightness and polarity.

(3) Connect the red lead of the 72-type set to a cable conductor that is known at both splices, such as the tracer quad, and hold the probe of the 71-type set in contact with the quad.

(a) If a weak 500-cycle signal is heard, increase the gain of the 71-type set by turning the screwdriver gain control clockwise. The output of the 72-type set may also be increased provided the maximum setting specified in Paragraph 4.03 is not exceeded.

(b) If no tone can be picked up, check the cords and plugs of both sets to see whether any of the connections are loose.

(4) If the above measures do not reveal the trouble, move the 71-type set to the location of the 72-type set and turn on both sets.

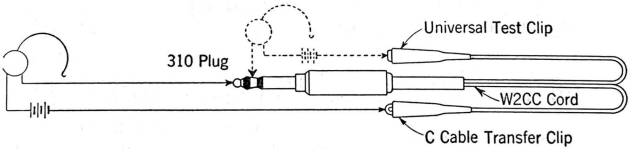
(a) Short-circuit the output leads of the 72-type set and connect them to one of the knurled head screws on the inner cover of the 71-type set. Set the output control of the 72-type set at 6 (with 72C set HI-LO switch should be set at "HI") and the gain control of the 71-type set about midway of its rotation.

(b) A loud tone should sound in the receiver or loudspeaker when the probe is held against one of the output leads in the position of maximum pickup as shown in Paragraph 3.09.

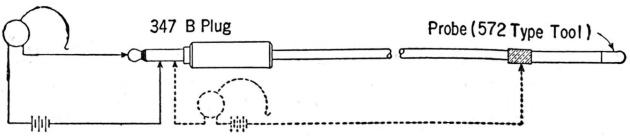
(c) Next hold the end of the probe against the same lead. Tone may then be heard; however, by moving the probe slightly with respect to the lead, a null point should be found where almost no tone is heard.

(d) If the probe does not function as indicated in (b) and (c), it indicates that the probe or one of the leads probably is defective.

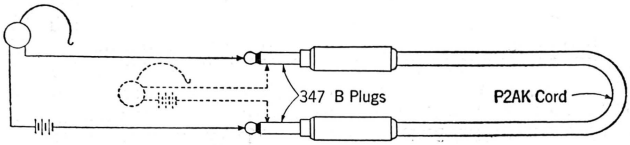
(e) The output leads can be checked by making continuity tests with battery and receiver between the tip and ring contacts of the plug and the associated test clips as illustrated below. The sketch indicates the correct association of the various elements.



(f) The continuity of the probe leads and the exploring coil in the probe can be determined by testing between the tip and sleeve contacts of the plug as illustrated below. If this is done by means of an ohm meter or Wheatstone bridge, the resistance should be between 8 and 15 ohms. The test indicated by the dotted lines is made to ensure that the sleeve of the plug is connected to the shield on the cord and probe.



(g) The following illustrates how the continuity test should be made on the loudspeaker cord.



5.11 If the preceding tests do not reveal the trouble, make the following tests using the 71A or B set as an audio-frequency amplifier.

(1) Connect a 513-A Tool (the audio-frequency probe normally used with an amplifier) to the AUDIO IN jack and 716-A (or equivalent) receiver equipped with a cord and 347-B plug to the L SPK jack.

(2) Bring the tip of the 513-A Tool near a set producing audio tone, such as the 76-Type, 43-A, 20-C or similar test set. The tone should be reproduced in the receiver.

(3) If tone is reproduced in the receiver, replace the 1N5-GT tube in the end position. If tone is not heard, replace the 1N5-GT tube in the middle position and, if necessary, the 3Q5-GT tube. The audio tone should now be heard.

(4) Then repeat the test outlined in Paragraph 5.10 (4) to determine whether the tube replacement has corrected the condition. If tone still can not be picked up from the short-circuit output leads of the 72-type set, replace one or both of the tubes in the 72-type set.

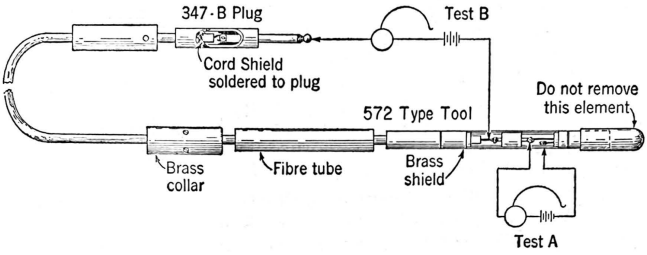
Repair of Probe

5.12 If the continuity test described in Paragraph 5.10 (f) indicates an open circuit in the lead, proceed as follows:

(1) Remove the fibre sleeve from the 347-B plug, and examine the connections.

(2) Loosen the set screws in the brass collar of the 572-type tool and slide it and the adjacent fibre tube onto the cord.

(3) Remove the set screw in the brass shield and rotate the latter to expose the connections, as illustrated below.



(4) Do not loosen the set screws on the fibre tip as the leads from the small coil therein may be damaged.

(5) Examine the soldered connections of the coil leads and make Test A indicated in the sketch, to check the condition of the coil. If an open circuit is found in the coil, the 572-type tool should be reassembled and returned for repair in accordance with local routine.

(6) If the test in (5) shows the coil to be satisfactory, make Test B indicated in the sketch. If the wire is open, re-terminate the lead at both probe and plug ends.

(a) In doing this, unsolder the lead at the probe and the shield at the plug, and twist the cord out of the plug and probe in a counterclockwise direction.

(b) Cut off about 3 inches of the lead at the probe end and 2 inches at the plug end.

(c) Expose the shield at each end as in the original lead. Then twist the ends into the plug and probe, and solder the shield and conductor in their original position.

(7) In reassembling the probe after replacing the cord or 572-type tool, the metal collar at the cord end of the probe should be pushed firmly against the fibre sleeve while tightening the set screw, to ensure proper alignment of the probe tip.

5.13 The 71-type set is tuned at the factory to match the probe and leads supplied with it. When a probe is repaired or if a probe from one 71-type set is used with another set, it may be necessary to readjust the tuning of the 71-type set. This is done as follows:

(1) Both sets should be turned on and the probe brought near enough to the output lead of the 72-type set to pick up a relatively weak signal. With the probe in this position, the screwdriver operated control on the chassis of the set, marked C1, should be adjusted to obtain maximum 500-cycle tone from the loudspeaker, or receiver in the case of a 71C set.

(2) Control C2 should require no field adjustment.

5.14 If the trouble in the sets can not be detected and corrected as outlined in the preceding paragraphs, the defect is probably of such a nature as to require electrical tests that can not be made with the apparatus ordinarily available to the field forces. In this event the sets should be returned for repair in accordance with local routine.

Cleaning and Oiling Strap

5.15 The leather strap on the set requires cleaning and oiling about every 6 months to keep it in good condition.

Parts for Field Replacement

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

Battery, Dry, KS-14367
Battery, Dry, KS-6571
Battery, Dry, KS-6569
Cord, W2CC
Cord, W2CD
Cord, W2EH
Cord, P2AK
Plug, 310
Plug, 347B
Tool, 572 (A or B)
Tube, Electron, 1A7-GT
Tube, Electron, 1N5-GT
Tube, Electron, 3Q5-GT