

## 10A RECORDER AND ASSOCIATED APPARATUS USED IN 2AA AND MODIFIED 2A TELEPHONE ANSWERING SETS OPERATING METHODS

	CONTENTS	PAGE
1.	GENERAL . . . . .	1
2.	TOOLS AND TEST APPARATUS . . . . .	2
3.	OPERATION . . . . .	2
	DESCRIPTION OF OPERATION . . . . .	2
	PREPARING TO START INITIALLY . . . . .	5
	INITIAL ADJUSTMENTS . . . . .	5
	ROUTINE ADJUSTMENTS . . . . .	6
4.	ROUTINE CHECKS . . . . .	7
5.	TROUBLES . . . . .	7
	Trouble Chart . . . . .	7
6.	ELECTRICAL TESTS . . . . .	11

### 1. GENERAL

1.01 This section covers the operation of the 2AA and modified 2A telephone answering sets used in transcribed announcement service such as the 7A announcement system for machine intercept service.

1.02 This section is reissued to change the title.

1.03 The 2AA and modified 2A telephone answering sets consist mainly of the 10A recorder, the 152A amplifier, and the control circuit mounted in a common housing. The recorder is essentially a motor-driven drum on the surface of which is mounted a magnetic recording band. A single magnetic recording head is provided for recording and reproducing the announcement on the recording band. Announcements up to 60 seconds in length may be handled by the recorder. The 152A amplifier amplifies the signal in both the recording and reproducing operations. The control circuit permits an announcement to be recorded and checked with the set disconnected from the line, and permits the reproductions of the announcement (when connected to the line) upon receipt of a call. The

distinguishing difference between the 2A and the 2AA telephone answering sets is the externally mounted terminal strip on the rear of the 2AA set. The modified 2A telephone answering set was formerly the 2A telephone answering set used on subscriber premises but changes were made in the strapping options on the internal terminal strip to permit its use in the 7A announcement system.

1.04 These instructions are based on drawing SD-95268-01. For a detailed description of the operation, see the associated sequence chart and the corresponding circuit description.

1.05 For more detailed information on the operation and maintenance of individual equipment or apparatus, refer to the appropriate Bell System Practice.

1.06 Routine checks are intended to detect defects, particularly in infrequently operated parts of the apparatus and, insofar as possible, to guard against circuit failures liable to interfere with service. Checks and adjustments should be made after removing the set from service as covered in 1.07.

1.07 **Make Busy:** Before performing any work on a machine, remove the equipment from service in accordance with local instructions. Do not remove the equipment if running. When a unit is removed, substitute a new one immediately.

1.08 **Removal of Cover:** When making initial adjustments or attempting to locate troubles, it will be necessary to remove the cover assembly. To do this, proceed as follows. Note the positions of the front panel controls and remove the three controls using the R-2958 wrench to loosen the screws and slide off the controls. Lift the front of the set and, with the R-2485 wrench, back off the two screws located in the underside of the base until they are dis-

engaged from the cover. Back off the two screws located at the rear of the base about three turns each using the R-2958 wrench. Remove the cover assembly by lifting the rear and pivoting the cover on its front edge. If the cover snags, check that the **OPERATE** lever screw is free of the front panel opening.

**1.09 Replacement of Cover:** To replace the cover, proceed as follows. Grasp the cover with the two hands and with the front panel nearest the body. Tilt the cover so that the bottom edge of the rear is approximately 6 inches higher than the bottom edge of the front of the cover. Maintaining this position, engage the control shafts and lever at the front of the set in the associated holes in the cover. The rear may then be lowered into position. Lift the front of the set and tighten the two screws in the underside of the base using the R-2485 wrench. Tighten the two setscrews at the rear using the R-2958 wrench. Slide the button in place on the lever allowing approximately 1/64-inch clearance between the button and panel surface. Tighten the screw securely using the R-2958 wrench. With the function switch operated to its center position, mount the larger knob on the shaft so the white dot on the knob is opposite the **CHECK** dot. Tentatively tighten the knob mounting screws using the R-2958 wrench. Position the smaller knob so that the distance between the white dot on the knob and the **ON** designation when operated to the **ON** position will equal the distance between the dot and the **OFF** designation when operated to the **OFF** position. Adjust both knobs so that there is a clearance of approximately 1/64 inch between the knob and the panel. Tighten the mounting screws in both knobs securely.

**1.10** When necessary to electrically operate a solenoid to make the initial adjustments outlined in Part 3 of this section, proceed as follows. Disconnect ac power from the set. Connect 48 volts dc across the solenoid terminals.

## 2. TOOLS AND TEST APPARATUS

CODE OR SPEC. NO.	DESCRIPTION
<b>TOOLS</b>	
R-2485	5/32-Inch Allen Socket Screw Wrench
R-2958	5/64-Inch Allen Socket Screw Wrench
	6-Inch C Screwdriver

CODE OR SPEC. NO.

DESCRIPTION

### TEST APPARATUS

5A	Attenuator
13A	Transmission Measuring Set
KS-14510 L1	Volt-Ohm-Milliammeter
—	30-35 Ohm Resistor— 1/2 Watt
—	Electron Tube Test Set

## 3. OPERATION

### DESCRIPTION OF OPERATION

#### General

**3.01 10A Recorder:** The recorder is a machine with the primary purpose of recording and playing back an announcement. The announcement is recorded on a magnetic recording band mounted on a motor-driven drum. The movement of the recording head across the band is synchronized with the rotation of the drum by a feedscrew and gear arrangement. Several switches which are part of the recorder perform the following functions.

(a) **Limit Switch:** The limit switch is an adjustable position switch which terminates an announcement when operated. The maximum travel of the limit switch is determined by the setting of the limit switch stop. The position of the stop determines the length of the maximum announcement that may be recorded. During the dictation of an announcement, the normally clamped limit switch is released by the operation of the L2 solenoid and travels with the recording head. When the dictation is concluded, the limit switch is clamped in position and the recording head returns to the extreme left (zero) position. When the announcement is played back, the operation of the limit switch ends the cycle and causes the recording head to return to its zero position.

(b) **Drum Index Switch:** When operated by the latch, this switch connects power to the motor. When the latch drops into the drum notch, the switch is released disconnecting power from the motor and halting further rotation of the drum.

(c) **Flasher Switch and Flasher:** The flasher is a thermal-type switch which opens and closes its contacts when sufficient current flows through it. Current is connected to the flasher when the flasher switch is operated. The operation of the flasher causes the **DICTATE** lamp to flash off and on, providing the operator with a visual warning that the end of the maximum available recording time is being approached. The flasher switch operation is controlled by mechanical adjustment of the flasher switch actuator mounted on the carriage.

(d) **Timing and Drum Pulsing Switches and Erase Coil:** The erase coil is connected into the circuit during the first revolution of the drum when the set is in the **DICTATE** function. 48 volts dc is connected across the coil to erase any previously recorded announcement. The drum pulsing switch is operated once every drum revolution by a stud mounted on the drum. The operation of the timing switch is controlled by an adjustable position operating rod and is normally operated midway between the first and second operations of the drum pulsing switch. The two switches are connected in series and the second operation of the drum pulsing switch operates a relay causing the **DICTATE** lamp to light and also de-energizes the erase coil.

(e) **L1 Solenoid:** The engagement of the half nut on the head carriage assembly with the feedscrew and the contact of the recording head with the band is produced by the operation of the L1 solenoid. This solenoid also operates the latch which releases the drum and operates the drum index switch.

(f) **L2 Solenoid:** The L2 solenoid is only operated during the dictation cycle to release the limit switch. When operated, the solenoid pulls up the limit switch clamp allowing the limit switch freedom of movement. When released at the conclusion of the dictation, the limit switch clamp locks the switch in place. The clamped position of the limit switch determines the end of the announcement played back during the **CHECK** or **AUTOMATIC ANSWER** cycle.

**3.02 152A Amplifier:** The amplifier is a plug-in-type printed circuit board mounted behind the front panel with CDO terminal strap-

ping instead of TAS terminal strapping. It has the dual function of amplifying the announcement signal and providing a high frequency bias current necessary for recording the signal on the band.

(a) **Dictate:** When recording an announcement, the signal produced by the recording telephone is fed to the amplifier through terminal A. The signal is then amplified. The signal is mixed with the bias frequency and fed to the recording head.

(b) **Reproduction:** When a recorded announcement is reproduced, the signal is picked off the recording band by the recording head and fed to the amplifier. During the reproduction of the announcement the oscillator is disabled.

#### DICTATE Function

**3.03 General:** To dictate an announcement, the knobs are turned to **DICTATE** and **ON**. Depressing and holding the **OPERATE** button starts the cycle. The dictation of the announcement is begun when the **DICTATE** lamp lights. At the finish of the announcement, the **OPERATE** button must be immediately released, thus automatically setting the length of the announcement cycle. If the dictated announcement is longer than the maximum announcement length set by the limit switch stop, the announcement is terminated prematurely and continuing to hold down the **OPERATE** button has no effect except to extinguish the lamp which is used to illuminate the medallion.

**3.04** With the set on and the function S1 switch set to **DICTATE** depressing the **OPERATE** button, (S2 **OPERATE** switch) operates the K2 start relay. Closure of K2 relay contacts energizes the L1 solenoid in the recorder, the K5 power relay, and the K4 record-reproduce relay. The K2 relay locks itself through its own contacts and the operated contacts of K5 relay, the normally closed contacts of K8 relay, the limit switch, and S2 contacts. Energizing the L1 solenoid operates the drum index switch and the bail assembly. Operation of the bail assembly brings the carriage half nut into engagement with the feedscrew and the recording head into contact with the recording band. The holding circuit for K5 relay is made through the oper-

ated contacts of the motor control switch in the recorder. Closure of K4 relay contacts energizes the L3 erase coil and the L2 solenoid, connects the recording head to the amplifier, and removes the connection which disabled the bias oscillator. The holding circuit for K4 relay is made through the operated contacts of K2 relay and the S1 (function selector) switch.

**3.05** Operation of the motor rotates the drum and moves the carriage assembly to the right by means of a gear-driven feedscrew. The drum pulsing switch (S1 of the recorder) is operated once each drum revolution. The timing switch (S2 of the recorder) is operated by the carriage movement at a time midway between the first and second operations of the drum pulsing switch. The contacts of the two switches are connected in series with the windings of the K6 timing relay. Prior to the second closure of the drum-pulsing switch contacts, any previously recorded announcement is erased. The second closure of the drum-pulsing switch contacts causes K6 relay to operate which locks through its own contacts and K2 relay and the S1 switch. Operation of the K6 relay opens the circuit to the erase coil, energizes the recording telephone set to the amplifier, and lights the E2 *DICTATE* lamp, signaling the operator to begin dictating the announcement.

**3.06** During the dictation of the announcement, the recording drum continues to rotate and the carriage assembly and recording head are driven toward the right. Before the end of the maximum permissible announcement is reached, the S5 flasher switch is operated by the adjustable position rod mounted on the carriage assembly. This causes the *DICTATE* lamp to flash off and on, warning the operator of the approaching end of the maximum announcement. The movement of the carriage assembly towards the right carries the limit switch towards the previously adjusted limit switch stop. The dictated announcement may be terminated either by releasing the *OPERATE* button or, if too lengthy, by the operation of the limit switch when it reaches the stop.

**3.07** If the announcement is terminated by releasing the *OPERATE* button, the holding path for K2 relay is opened and causes the release of the L1 and L2 solenoids. The L2 solenoid

clamps the limit switch in place. The carriage assembly returns to the zero position. The clamped position of the limit switch determines the length of the announcement played back. The latch, released by the L1 solenoid, rides on the drum until the latch shoe drops into the notch halting further rotation of the drum. The drum index switch remains operated until the latch drops completely into the notch. Release of the drum index switch releases relay K5 and disconnects the motor.

**3.08** If the announcement is terminated by operation of the limit switch while the *OPERATE* switch contacts are still closed, the K8 stop relay is operated. Operation of K8 relay releases K2 relay and extinguishes the medalion lamp. Release of K2 relay produces the results described in 3.07. Continuing to hold operated the *OPERATE* switch keeps K8 relay operated and prevents the dictate cycle from starting again. Releasing the *OPERATE* button releases K8 relay, permitting the operator to dictate the announcement again in a shorter form.

#### CHECK Function

**3.09 General:** With the function selector switch (S1) set to *CHECK* and the *OPERATE* switch operated, the answering set will play back the announcement previously recorded. The operation of the limit switch at the end of the announcement will stop the set from recycling. If a repeat of the check cycle is desired, the *OPERATE* switch must be released first and then operated again for each cycle.

**3.10** Depressing the *OPERATE* switch button with the function switch set to *CHECK* operates K2 relay. The sequence of events thereafter is similar to that described in 3.04 with the exception that K4 relay is not operated. With K4 relay unoperated, the output of the recording head is fed to the amplifier. The amplifier output is fed to the calling party through the T2 transformer.

**3.11** The check cycle may be terminated by releasing the *OPERATE* switch or through the operation of the limit switch. Releasing the *OPERATE* button de-energizes K2 and K6 relays. The set will then stop as described in 3.07. The position of the limit switch

is determined by the length of the previous dictate cycle. Termination of the check cycle by the limit switch operates K8 relay and produces the same results as described in 3.08.

### **AUTOMATIC ANSWER Function**

**3.12 General:** Interception of a call operates an external relay and connects the calling party across terminals T and R of the TS1 and TS1A terminal strips. Closure of the external relay contacts starts the announcement cycle. The announcement cycle is terminated by the operation of the limit switch.

**3.13** With the set on and the function selector switch (S1) set to **AUTOMATIC ANSWER**, an incoming call operates an external relay, which closes contacts between terminals 1 and 10 of the terminal strip. The calling party is connected to T and R terminals. Closure of the external relay contacts operates the K2 start relay and indirectly the L1 solenoid and K5 power relay. The L1 solenoid operates the drum index switch, disengages the latch from the drum notch allowing the drum to rotate, and places the record-reproduce head in contact with the recording band. Operation of K5 relay energizes the amplifier and the motor. The amplifier feeds the announcement signal through the T2 transformer to T and R terminals of the TS1 terminal strip. The answering of an intercepted call is indicated by the extinguishing of the E3 ready lamp. The lamp circuit is broken by the operation of the motor control switch.

**3.14** The announcement cycle may be terminated by the calling party hanging up or by the operation of the limit switch at the end of the announcement. If the announcement is completed, the limit switch is operated by the movement of the carriage assembly beyond this point. Operation of the limit switch causes K2 relay to release. The release of K2 relay releases the L1 solenoid which releases the latch, disengages the carriage half nut from the feedscrew, and removes the recording head from contact with the recording band. The carriage returns to its starting position. The released latch will ride on the drum rim, maintaining power to the motor until the latch drops into the drum notch. Engagement of the latch and the drum notch halts further drum rotation. The answering set

will recycle, repeating the announcement until the external relay is released when the last calling party disconnects.

**3.15** When the announcement is terminated by the last calling party disconnecting, the external relay is released, opening the contacts closed across the 1 and 10 terminals of the TS1 terminal strip. This opens the holding path for K2 relay causing the relay to release. The operating sequence of the circuit following the release of K2 relay is the same as that described in 3.14. Note that the T and R leads are short-circuited at all times except during the playing of the message.

### **PREPARING TO START INITIALLY**

**3.16** When preparing to put the telephone answering set into service initially, check that:

- (a) The proper fuse is provided in the fuse holder.
- (b) All external connections are made in accordance with SD-95268-01 covering the circuit of which the set is a part.
- (c) Where a 2A telephone answering set is used, the set has been modified for announcement system service.
 

*Note:* Modification of this set for announcement system service is shown on SD-32202-01.
- (d) The set is connected to 115-volt, 60-cycle ac power.
- (e) The twine used to secure the carriage of the 10A recorder from movement during shipping has been removed.
- (f) The head lock spring has been disengaged from the recording head.

### **INITIAL ADJUSTMENTS**

**3.17 Maximum Announcement Length:** The length of the maximum announcement that may be dictated is determined by the position of the limit switch stop. The stop position shall be in accordance with local instructions and, if necessary, may be adjusted as follows. The five marks on the stop represent 0-, 15-, 30-, 45-, and 60-second maximum announcement lengths, the mark nearest the band end representing 0 seconds. With the

carriage at the extreme left, operate the L2 solenoid so that the limit switch moves to the extreme left. Loosen the screw securing the stop using the R-2958 wrench. Position the stop so that the mark representing the required maximum announcement length is flush with the left face of the tube. Tighten the screw to secure the adjustment.

**3.18 *DICTATE Lamp Flashing Time:*** Near the end of the dictation cycle, the *DICTATE* lamp will flash off and on several times warning the operator that the end of the announcement recording interval is being approached. The length of warning is determined by the position of the flasher indicator on its associated rod. When the maximum announcement length is changed or a change in the length of warning time is necessary, proceed as follows. Operate the L2 solenoid and slide the carriage to the right until further movement is prevented by contact between the limit switch tab and stop. Operate the L1 solenoid to hold the carriage in this position and release the L2 solenoid. Loosen the screw in the flasher indicator using the R-2958 wrench. Position the indicator so that the mark representing the desired warning length is directly below the arrow on the carriage bracket. The six marks on the flasher indicator represent time intervals in seconds, each space representing approximately 5 seconds. The mark nearest the bent end represents 5-second warning. If the length of warning is not covered by local instructions, adjust the flasher indicator position for 5-second warning. Secure the adjustment by tightening the screw securely. Release the L1 solenoid.

#### ROUTINE ADJUSTMENTS

**3.19** When an announcement is to be dictated, the set should be removed to a quiet location in accordance with local instructions. This location should be a quiet room suited for making recordings. Connect a 302-type or preferably, if available, a 500-type subscriber telephone set across T1 and R1 terminals of TS1 terminal strip on the modified 2A telephone answering set or across T1 and R1 terminals of TS1A terminal strip on 2AA sets. Connect the subscriber telephone set leads as follows. Connect leads between T1 and R1 of TS1A terminal strip to the binding posts of the telephone set to which green and red leads, respectively, are connected. Plug the set into 115-volt, 60-cycle power.

**3.20** The following simple rules, if properly adhered to in dictating an announcement, will generally produce a satisfactory announcement.

- (a) The voice used to record the announcement should have the following qualities.
  - (1) Medium to low pitch.
  - (2) Good volume but not high volume.
  - (3) Clarity of diction.
  - (4) Uniform volume and speed.
- (b) Practice operating the set and recording the announcement.
- (c) Check and redictate until a satisfactory sounding announcement is obtained.

**3.21 *Dictation:*** To dictate an announcement, proceed as follows. With the set connected to ac power, turn the set on and operate the function switch to *DICTATE*. Pick up the recording telephone, depress and hold the *OPERATE* button until the dictation is completed. Begin dictating the announcement into the recording telephone promptly to minimize dead time between repetitive announcements if the caller listens to several announcements when the *DICTATE* lamp lights. Flashing of the *DICTATE* lamp off and on is a visual warning to the operator that the end of the dictate cycle is being approached. The cycle is terminated when the *DICTATE* lamp extinguishes. If the *DICTATE* lamp extinguishes before the *OPERATE* button is released, the announcement is too lengthy and the set will not begin the cycle over again until the button is released. The announcement should be redictated in a shortened form. The operator should exercise care to dictate the announcement at a uniform pace and to avoid hastening toward the end of the cycle when the *DICTATE* lamp begins to flash. Check the recorded announcement, as covered in 3.22.

**3.22 *Checking:*** To check the dictated announcement, operate the function switch to the *CHECK* position and pick up the recording telephone. Depress the *OPERATE* button and hold it down to hear the announcement. Release the button when finished. The set will cease operation if the *OPERATE* button is held down after the cycle is finished. To cause the set to repeat the announcement, release the *OPERATE* button and depress again.

**3.23 Automatic Answering:** When a satisfactory announcement has been recorded, shut the set off and disconnect the recording telephone set and the power. Connect the set into the announcement system circuit, turn the function knob to **AUTOMATIC ANSWER**, connect the set to ac power, and turn the set on. When a call is received, the **AUTOMATIC ANSWER** lamp will be extinguished and remain so until the announcement is completed or the last calling party hangs up.

#### 4. ROUTINE CHECKS

**4.01** The following should be performed.

(a) The quality of the recorded announcement should be checked from time to time, bearing in mind the following.

- (1) Volume of announcement.
- (2) Clarity of announcement. Listen for distortion of sound or distinct WOW (slow modulation of announcement or a wavering quality in the recorded voice).
- (3) Background noise level. Listen for the presence of high noise level or a superimposed recording.

(b) Electrolytic capacitors should be maintained in accordance with Section 032-110-701.

(c) The 10A recorder should be checked and maintained in accordance with Section 034-359-701.

**4.02** If the output level of the tone or speech appears to be unsatisfactory, the answering set may be checked as covered in Part 6.

#### 5. TROUBLES

**5.01** If trouble is experienced, the sequence of operations, for example the lighting of lamps, operation of relays and solenoids, etc, should be checked against the sequence chart shown in SD-95268-01 in order to locate the cause of the trouble.

**5.02** The amplifier is a printed wiring board on which the tubes and components are mounted. If the source of trouble is determined to be in the amplifier, check and replace any defective electron tubes. If this does not clear the trouble, the amplifier should be replaced, making sure that the replacing amplifier is wired correctly for 2AA or modified 2A answering sets as shown in SD-32202-01.

**5.03** To check the amplifier electron tubes or to replace the amplifier, proceed as follows. Disconnect the ac power supply. Remove the brace by loosening the mounting screws with the screwdriver and lifting it out. Remove the amplifier by pulling it straight up. If necessary, the amplifier may be loosened by rocking it from side to side in the jack. Take care not to bend the amplifier backward or forward as this will result in breaking the printed circuit board in the jack. To replace the amplifier, insert it into the jack with the printed wiring side facing the control panel. Press the amplifier firmly in place taking care not to bend the printed wiring board. Replace the brace by engaging the screw on the front panel first. Engage the notch of the fiber retainer on the upper edge of the amplifier and lower the right angled portion of the brace into engagement with the two screws on the rear chassis. Tighten the mounting screws securely.

*Note:* If electron tubes are removed, replace them in their respective sockets so that the red mark on the side of the tube is nearest the gold dot adjacent to the socket.

**5.04** If the source of trouble is traced to the 10A recorder, check and adjust the recorder to meet the requirements of Section 034-359-701.

**5.05** Checks of electron tubes, when necessary, should be made with a suitable electron tube test set for testing subminiature tubes in accordance with the standard information on that test set.

**5.06** *Caution: The recording head should not be checked with an ohmmeter because such testing will cause the head to become permanently magnetized which results in distorted announcements thereafter. In such cases, replace the head or return it for reconditioning.*

#### Trouble Chart

**5.07** Should any of the following troubles develop, it is suggested that the possible causes be checked in the order given. If the trouble is not found, look for loose or open connections or short circuits due to foreign matter lying across wiring terminals. If a check of the possible causes listed in the following chart does not locate the trouble, it is advisable to make resistance measurements with the circuit completely deenergized, comparing the measured values with the values shown on the circuit drawing.

**SECTION 034-359-301**

<b>TROUBLE</b>	<b>POSSIBLE CAUSE</b>
Medallion lamp does not light. ( <i>ON-OFF</i> switch at <i>ON</i> , and function selector switch has no effect)	Power not connected. F1 fuse blown. S4 ( <i>ON-OFF</i> ) switch defective. Defective T1 transformer (power transformer). Defective PG1 plug.
Medallion lamp does not light. (set functions normally)	Defective E1 lamp (medallion). Improperly adjusted K8 relay. Shorted or open 4-volt ac secondary of T1 transformer (power transformer).
Failure to start cycle in <i>DICTATE</i> or <i>CHECK</i> with <i>OPERATE</i> button depressed.	Defective X1 or X2 rectifier. Open or shorted 48- or 75-volt secondary of T1 transformer (power transformer). K2 relay fails to operate or hold. Defective S2 ( <i>OPERATE</i> ) switch. K2 relay fails to operate or hold. K8 relay fails to operate or hold.
<i>DICTATE</i> lamp does not light.	Defective E2 lamp. K6 relay fails to operate or fails to close circuit. Recording drum does not rotate. Open contacts in S1 (function selector) switch (terminals 5 and 8 on wafer D).
<i>DICTATE</i> lamp does not flash.	Open R25 varistor. Defective S5 flasher switch. Improper adjustment of S5 flasher switch.
Motor fails to operate.	K5 relay fails to operate or hold. K5 relay improperly adjusted. Defective motor starting capacitor. Defective motor.
Recording drum does not rotate.	L1 solenoid fails to operate. Motor fails to operate. Improper drum clutch pressure. Defective motor coupling.
K2 relay fails to operate or hold.	Defective X5 varistor. Defective contacts on external relay. K5 relay fails to operate or hold. R14 or R15 resistor open. Defective K2 relay. Failure of +48 or +75 volt dc supply.
K4 relay fails to operate or hold.	K2 relay fails to operate or hold. Failure of +48 volt dc supply. Improper adjustment of K2 relay. Defective contacts on S1 switch (1 and 4). Defective K4 relay.
K5 relay fails to operate.	K2 relay fails to operate or hold. Improper adjustment of K2 relay. Failure of +48 volt dc supply. Defective K5 relay.
K5 relay fails to hold during indexing.	Improper adjustment of drum index switch (S3 in recorder).

## TROUBLE

K6 relay fails to operate or hold.

K8 relay fails to operate.

L1 solenoid fails to operate.

L2 solenoid fails to operate.

Failure to erase previous announcement.

Announcement not recorded.

Ready lamp does not light.  
Function switch in  
**AUTOMATIC ANSWER.**

No announcement played back in **AUTO-  
MATIC ANSWER.**

Weak volume.  
(To determine whether volume is below limit,  
measure as covered in Part 6. Level may be  
raised by turning R5 potentiometer of 152A  
amplifier)

## POSSIBLE CAUSE

K2 relay fails to operate.  
Improper adjustment of K2 relay.  
Failure of +48 volt dc supply.  
Failure of recording drum to rotate.  
Improper adjustment of drum pulsing switch.  
Improper adjustment of timing switch or associated  
operating rod spring pressure.  
Defective K6 relay.  
Improper adjustment of K6 relay.  
Defective contacts on S1 switch (1 and 4).

Limit switch fails to operate.  
Defective K8 relay.  
Defective contacts on S1 switch.

K2 relay fails to operate.  
K2 relay improperly adjusted.  
Defective L1 solenoid.  
Bind in bail or latch linkage.

K4 relay fails to operate.  
K4 relay improperly adjusted.  
Defective L2 solenoid.  
L2 solenoid adjusted with plunger too far out in  
nonenergized condition.

K4 relay fails to operate.  
Improperly adjusted K4 or K6 relay.  
Shorted C3-2 capacitor.  
Defective or improperly adjusted erase coil.

K4 relay improperly adjusted.  
Defective recording head.  
Defective amplifier.  
Motor fails to operate.  
K6 relay fails to operate.  
Head lock spring not lowered.

Defective lamp.  
Defective S1 switch.

Announcement not recorded.  
Shorted resistor across R and T terminals of TS1 or  
TS1A terminal strip.  
Defective T2 transformer.  
Improperly adjusted or defective K6 relay.  
Defective timing or drum pulsing switch.

Dirty contact surface on recording head.  
Improperly adjusted recording head.  
Defective amplifier.  
Shorted turns in T2 transformer.  
Shorted C10 capacitor.  
Defective recording head.  
Amplifier not properly modified for CDO applica-  
tions.

SECTION 034-359-301

TROUBLE	POSSIBLE CAUSE
Announcement not clear.	Weak clutch causing slipping drum. Dirty head. Defective motor. Binding bearings. Bias oscillator not functioning properly. (bias not reaching magnetic head — check using volt- meter across red lead to head and ground — meter should read about 10 volts)
Distortion in announcement.	Defective magnetic band. Bias oscillator not operating. Improperly positioned recording head. Defective V4 tube or C7 or C10 capacitor in amplifier. Open or shorted C11 capacitor. Improperly adjusted erase coil. Recording head magnetized. Open R4 resistor. Background noise when dictating. Poor connection between telephone set and answering set. Poor telephone transmitter. Half nut does not track properly. AC hum in filter condenser.
WOW.	Defective motor. Improperly adjusted drum clutch. Unsatisfactory pressure.
Noise in announcements.	Defective V4 tube in amplifier. Faulty contact of tubes, plugs, relays, or switches (buzzing). Defective or improperly adjusted erase coil. Mechanical vibration of magnetic head.
Limit switch fails to operate at end of message.	Drum fails to rotate. Defective limit switch clamp. Defective limit switch.
Repeats end of message only.	External relay is held operated. Limit switch set to operate exactly at drum index point.
Double tracking. (Simultaneous reproduction of adjacent tracks.)	Improper engagement of half nut with feedscrew. Excessive play between half nut and feedscrew.
Drum does not index.	Improper adjustment of drum index switch.
Excessive dead time at end of announce- ment.	Limit switch slipping. Message too short. <b>OPERATE</b> switch not released at end of announce- ment.

**TROUBLE**

Head fails to fly back at end of cycle.

Echo.

Variable speech levels and drop-outs.

**POSSIBLE CAUSE**

Limit switch failure.

Half nut and feedscrew do not disengage.

Mechanical interference with bail or head carriage motion.

Improper erasure.

Improper erase coil adjustment.

Mistracking.

Head contact with drum not uniform.

**6. ELECTRICAL TESTS****6.01 Checking Output Level**

- (a) To check the output level of the 2AA telephone answering set, apply a tone to the set using the 5A attenuator and measure the tone using the 13A transmission measuring set.
- (b) Connect the answering set to a source of 115-volt, 60-cycle power.
- (c) Connect the input terminals of the 5A attenuator to a -10 dbm, 1000-cycle supply and the output terminals to 2AA telephone answering set, TS1A terminal strip, T1 and R1 terminals.
- (d) Operate the proper keys of the 5A attenuator so that 10-db attenuation is obtained.
- (e) Operate the **FUNCTION** switch of the answering set to **DICTATE** and record for approximately 30 seconds.
- (f) Connect the 35-ohm resistor across T and R terminals of the TS1 terminal strip and also connect the input terminals of the 13A transmission measuring set across the same terminals.
- (g) Connect the measuring set to a source of power as covered in Section A702.612.
- (h) Operate the **FUNCTION** switch to **AUTOMATIC ANSWER** and then strap terminals 1 and 10 of the TS1 terminal strip.
- (i) Operate the measuring set as covered in Section A702.612. The average reading shall be minimum +3 db, maximum +5 db. The volume control setting of the 152A amplifier may be changed to meet these values.
- (j) Disconnect the leads from the attenuator, transmission measuring set, and telephone answering set.

**6.02 Checking Output Speech Level**

- (a) To check the output speech level of the 2AA telephone answering set, connect either a 302- or 500-type subscriber telephone set and a 13A transmission measuring set to the answering set.
- (b) Connect the answering set to a source of 115-volt, 60-cycle source of power.
- (c) Connect the green and red leads of the telephone set to terminals T1 and R1, respectively, of terminal strip TS1A of the answering set.
- (d) Operate the **FUNCTION** switch to **DICTATE** and make an announcement at normal talking level for approximately 30 seconds.
- (e) Connect the 35-ohm resistor across terminals T and R of the TS1 terminal strip and also connect the input terminals of the 13A transmission measuring set across the same terminals.
- (f) Connect the measuring set to a source of power as covered in Section A702.612.
- (g) Operate the **FUNCTION** switch to **AUTOMATIC ANSWER** and strap terminals 1 and 10 of the TS1 terminal strip.
- (h) Operate the measuring set as covered in Section A702.612. The speech peaks should read over -3 db.
- (i) Operate the **FUNCTION** switch to **CHECK** and listen to the speech on the telephone set. The speech should be equivalent to good telephone quality.
- (j) Disconnect the subscriber telephone set, the 13A transmission measuring set, and remove the source of power to the answering set.