2A TELEPHONE ANSWERING SET

MAINTENANCE

1.00 GENERAL

1.01 This section was formerly Station Installation and Maintenance Section C55.618, Issue 3 and Addendum, Issue 1. Except for editorial changes and renumbering for inclusion in the Station Operations Manual, no other revisions have been made.

1.02 This section provides maintenance and supply information, circuits, and circuit description on the 2A telephone answering set.

1.03 Work actually done on the customer's premises should be limited to verifying and analyzing the trouble, making adjustments as described in this practice, and replacing easily accessible parts which are normally available through supply channels.

1.04 Disassembly of the 2A telephone answering set should be undertaken only with supervisory approval.

1.05 The associated telephone set should be maintained in the standard manner as covered in the related Bell System Practices.

1.06 In the event of a customer's power failure, the 2A telephone answering set will not operate. If the set is turned on, there will be an audible signal in the answering set to signify an incoming call. Normal telephone service will not be affected.

1.07 Cover-removal procedure is covered in the C Section entitled 2A Telephone Answering Set, Installation and Connections.

1.08 The 2A telephone answering set is made up of three major components: the 152A amplifier, the 10A recorder, and the power and control unit.

1.09 A final check on the complete operating sequence of the 2A telephone answering set should be made on every maintenance visit, as described in Part 6 of the C Section entitled 2A Telephone Answering Set, Installation and Connections.

1.10 If the set fails to perform satisfactorily and maintenance procedures included in this section do not remedy the fault, the set should be replaced.

Caution: The power supply voltage (115-volt 60-cycle ac) is on contact 2B of the K5 relay and 75 volts dc is on several relay contacts and windings.

1.11 The KS-16328, List 1 cleaner has been found to acidify with age and therefore is undesirable for use on telephone answering sets and should no longer be used. A new KS-16328, List 2 cleaner-lubricant is now available replacing the KS-16328, List 1 cleaner. The same procedure should be followed when using the list 2 type, and since this preparation contains a silicone lubricant, no additional lubrication need be applied subsequent to cleaning.

2.00 AMPLIFIER

2.01 A plug-in printed circuit amplifier is used in all models of the 2A telephone answering set.

- On early type sets the amplifier will be similar to that shown in Fig. 1 but will not have a code number stamped on the card. (See Fig. 6 for circuit schematic.)
- On standards sets initial production will be equipped with the type amplifier shown in Fig. 1. The card will be stamped as shown. (See Fig. 7 for circuit schematic.) Later production sets will be equipped with the type amplifier shown in Fig. 2. The center of the card will be stamped 152A AMPLIFIER. (See Fig. 8 for circuit schematic.)

Note: The amplifiers in the standard sets described above are interchangeable. Amplifiers for early type and standard sets are not interchangeable.

2.02 The amplifier may be removed from the chassis for testing, repair, or replacement as follows:

1. **Turn power off** before the amplifier is removed or replaced.
2. For early type sets loosen the screws shown in Fig. 3 and remove the amplifier brace assembly. For standard sets loosen the screws shown in Fig. 4 and remove the amplifier brace assembly.

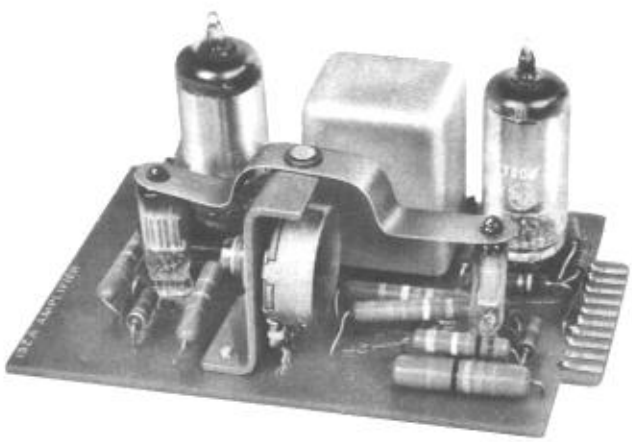


Fig. 1 — 152A Amplifier — Early Type

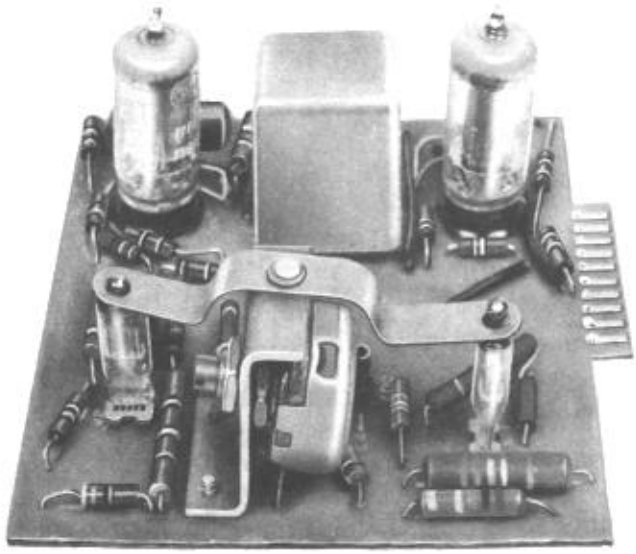


Fig. 2 — 152A Amplifier — Later Type

3. Grasp the amplifier as shown in Fig. 5 and rock gently from side to side while exerting an upward pull.

Caution: Care must be exercised while placing or removing the amplifier to avoid damaging the metal contacts on its plug end. To avoid damage to the jack (J4), do not rock the amplifier from front to back.

2.03 The amplifier uses two CK512AX and two 3V4 electron tubes. If tests indicate the trouble is in the amplifier, replace individual tubes until the defective tube is located. The condition of the tubes cannot be determined by visual examination. The **power must be turned off** before a tube is removed or replaced.

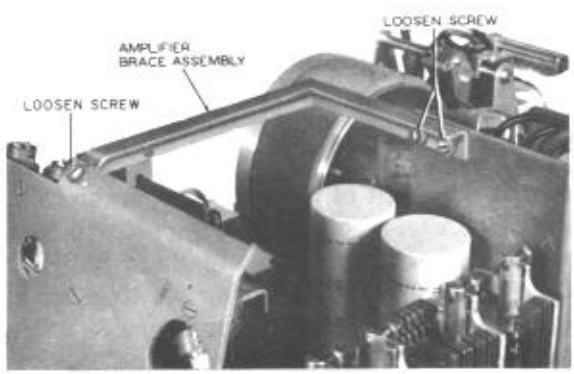


Fig. 3 — Amplifier Brace Assembly — Early Type Sets

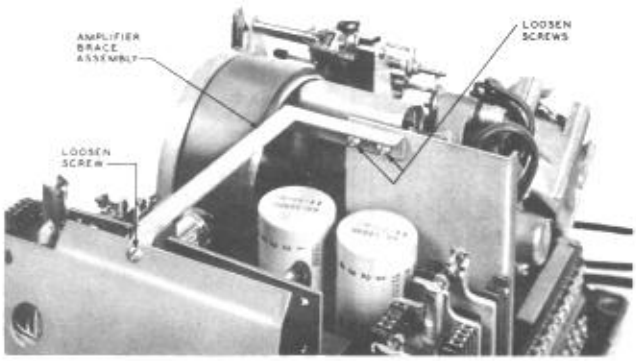


Fig. 4 — Amplifier Brace Assembly — Standard Sets

2.04 When removing the CK512AX electron tubes, proceed as follows:

1. Grasp both ends of the spring tube retainer, lift the ends until they clear the tips of the tubes, then rotate the spring until it will not touch the tubes when released.

2. Grasp the CK512AX tube to be removed and withdraw it gently from the socket.

3. Before placing new CK512AX tubes, the length of the leads shall be checked. The length of the leads should be 0.200 to 0.230 inch (approximately 7/32 inch). Cut the leads to meet these requirements.

Caution: Be certain that the two CK512AX tubes are inserted in the sockets so that the red mark on the tube base coincides with the molded dot on the socket.

2.05 If replacing the electron tube does not clear the trouble in the amplifier, the amplifier should be replaced.

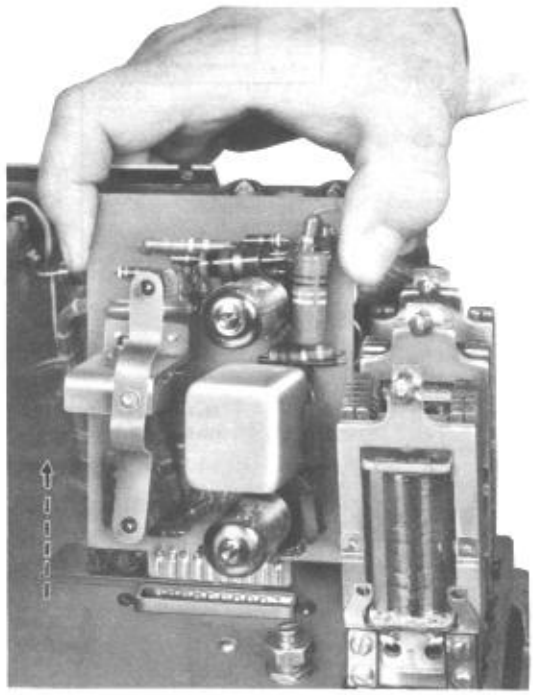
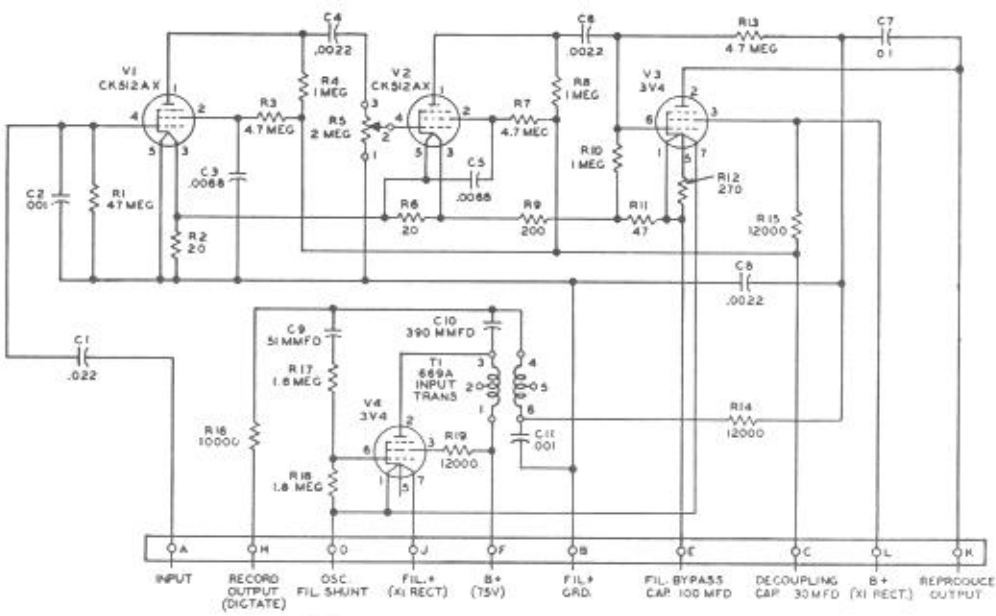
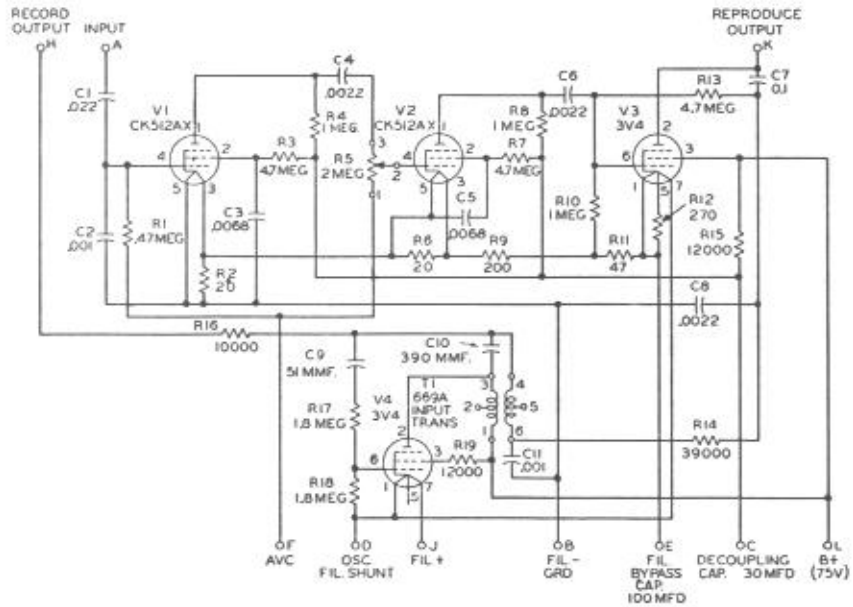


Fig. 5 — Amplifier Removal



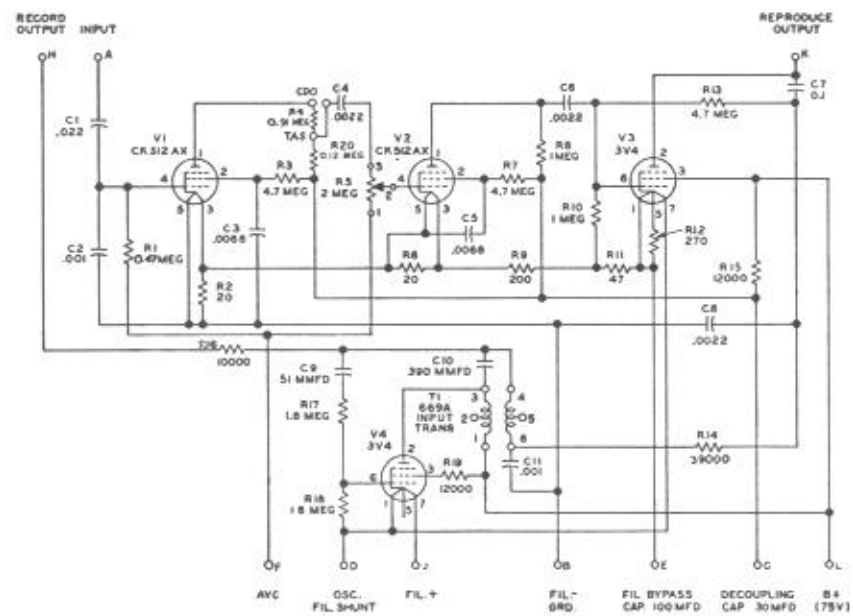
Note 1: Unless otherwise specified, resistor values are ohms and capacitor values are microfarads.

Fig. 6 — Schematic of Amplifier Used with Early Type Sets



Note 1: Unless otherwise specified, resistor values are ohms and capacitor values are microfarads.

Fig. 7 — Schematic of 152A Amplifier Shown in Fig. 1 — Standard Sets



Note 1: Unless otherwise specified, resistor values are ohms and capacitor values are microfarads.

Fig. 8 — Schematic of 152A Amplifier Shown in Fig. 2 — Standard Sets

3.00 MAGNETIC BAND, LAMPS, FLASHER, AND FUSE

Caution 1: Do not try to rotate the announcement drum or flywheel by hand because of danger of stripping the gears.

Caution 2: Avoid touching the magnetic recording band or allowing dirt or other foreign material to fall on it. If loose matter is observed on the band, wipe off lightly with a clean KS-2423 twill jean or other approved lint-free cloth.

3.01 If volume level is low or if distortion is experienced, the record heads and magnetic bands should be cleaned with KS-16328, List 2 cleaner-lubricant.

- This cleaner-lubricant is flammable to a small degree (about the same as rubbing alcohol) and is susceptible to freezing. All precautions should be taken to prevent exposure to sparks, flame, and freezing temperatures.
- Remove dirt from the band by wiping lightly with a clean, dry KS-2423 cloth. Remove dirt from the record head with a toothpick or orange stick and then wipe lightly with a clean, dry KS-2423 cloth.
- Shake the container of KS-16328, List 2 cleaner-lubricant thoroughly before use, as the components have a tendency to separate. Apply a small quantity to a clean, dry KS-2423 cloth and wipe on to the recording bands while they are rotating. Wipe the cleaner-lubricant and the emulsified dirt from the drums with a clean, dry KS-2423 cloth. The cleaned drum should be dry and have a polished appearance. Repeat the process if necessary. The cleaner contains adequate lubricant; therefore, it is not necessary to perform a separate lubrication operation. Also, use solution on cloth to clean heads. Dry the recording heads thoroughly. Avoid letting the cleaner-lubricant come in contact with metal parts.

3.02 The lamps used for the ON-OFF (E1), DICTATE (E2), and READY (E3) lights in early type sets are removed by grasping the base of the lamp and pulling upward out of the lamp socket (see Fig. 9). The 1847 lamps used for the ON-OFF (E1, when provided), DICTATE (E2), and READY (E3) lights in standard sets are removed by pressing the lamp into the socket, turning counterclockwise until free, and withdrawing. To place a lamp, press the lamp into the socket; turn clockwise until secure. It may be necessary to loosen the clamp in order to remove the lamp. After placing a new lamp, tighten the clamp securely. (See Fig. 9.)

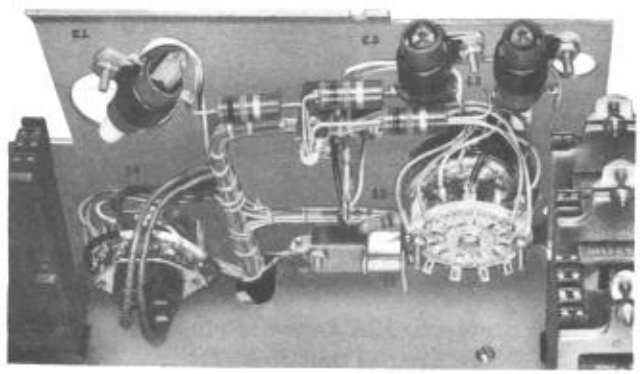


Fig. 9 — 2A Telephone Answering Set — Back of Front Panel Showing Lamps, OFF-ON and Function Switches

3.03 When replacing lamps in early type sets, use K2 lamps. When placing K2 lamps, enough of the white plastic band should be removed so that the light will be directed at the panel. They must be placed carefully so that the metal sides of the lamps are against the metal spring contacts of the lamp sockets.

3.04 If the No. 627 Tungsol thermal flasher becomes defective, remove it by grasping firmly and pulling straight away from the side of the answering set (see Fig. 10).

3.05 The F1 fuse is mounted in an HKP fuse holder located in the center of the TS1 terminal strip. For fuse inspection or replacement, turn top of fuse holder counterclockwise and withdraw. See Fig. 6 in C Section entitled 2A Telephone Answering Set, Installation and Connections.

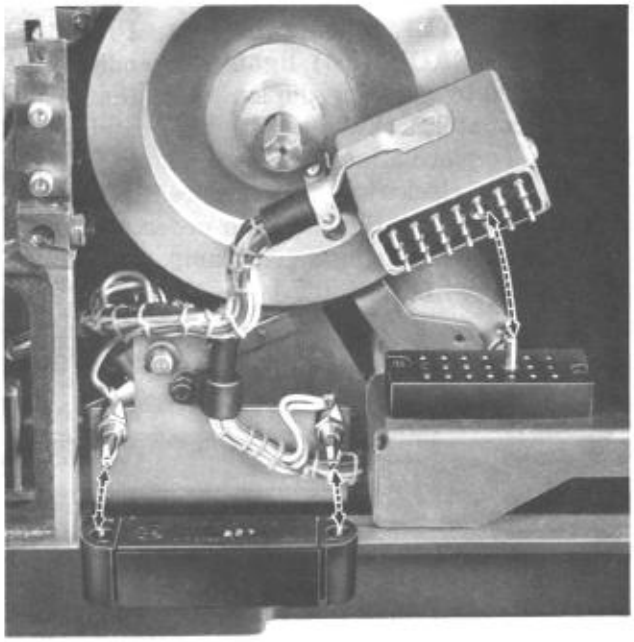


Fig. 10 — 2A Telephone Answering Set — Showing Tungsol Thermal Flasher No. 627 Removed, 10A Recorder Plug, and Power and Control Unit Jack (J1)

4.00 INVERTER

4.01 In areas where only dc power supply is available, a KS-15662 inverter is used to furnish power. For information, see C Section entitled DC-AC Inverter for Use with Telephone Answering Sets.

4.02 If the inverter introduces noise in the circuit, a ground in accordance with C Sections covering protector and signaling grounds should be connected to terminal 10 on terminal strip TS1 in the answering set as follows:

Individual Line Bridged Ringing	Connect terminal 10 on TS1 to GRD on connecting block.*
2-Party Selective	Strap 10 and G on TS1.
4-Party Selective (—) Party on Tip or Ring	Connect terminal 10 on TS1 to GRD in 531C subscriber set.*
4-Party Selective (+) Party on Tip or Ring	Strap 10 and R on TS1.

* Use D4AN mounting cord or equivalent.

5.00 TOOLS AND SPARE PARTS

5.01 The following special tools are required for maintenance of the 2A telephone answering set:

Cloth, Twill Jean, KS-2423

Tool, 373D—burnishing blade holder

Tool, 374A,

Tool, 374B,

Tool, 374C—burnishing blades

Wrench, Key, hexagonal, 1/16-inch,

Wrench, Key, hexagonal, 5/64-inch,

Wrench, Key, hexagonal, 5/32-inch—Allen wrenches

5.02 The following list contains all the spare parts that are required for field substitution.

Amplifier—For use with 2A telephone answering set with the letter *A* preceding the serial number. This amplifier has no code number and must be used only with the first 50 sets.

Amplifier, 152A—This applies to the coded amplifiers previously described. They can be used interchangeably.

Bracket Assembly, LP-13A979—This bracket is used to fasten station cords in standard sets and is mounted under 10A recorder mounting screw.

Bracket Assembly, LP-17A760—This bracket is used to fasten station cords and to block unused entrance hole in standard sets. It is mounted under TS1 terminal mounting screws.

Button, LP-19B954—STOP button.

Button, LP-19B955—START button.

Button, LP-14A142—OPERATE button.

Cleaner-lubricant, KS-16328, List 2. (2-ounce or 1-quart bottle)—Cleaner and lubricant for magnetic bands and recording heads.

Cover Assembly, LP-19B953—Cover for 2A telephone answering set. Specify whether to be used for sets with the letter *A* preceding the serial number, or sets without the letter *A* preceding the serial number.

Flasher, KS-16294, L1—Flasher control for DICTATE light of all sets equipped with medallion light sockets except where letter *A* precedes serial number.

Flasher, Tungsol, No. 627—Flasher control for DICTATE light on all other sets.

Fuse, AGC, 1 amp 250 volt—F1 power supply fuse.

Holder, Fuse, HKP — Power supply fuse holder.

Indicator Assembly, P-18A704 — DICTATE indicator (red). For standard 2A telephone answering sets.

Indicator Assembly, P-18A705 — AUTOMATIC ANSWER indicator (amber). For standard 2A telephone answering sets equipped with medallion light socket.

Lamp, K2—For E1, E2, and E3 lights in early type sets

LAMP, 1847—For E1 (when provided), E2, and E3 lights in standard sets

Knob, Control, KS-14941—OFF-ON switch knob

Knob, Control, KS-14942—Function switch knob

Screw, P-290738—.112-40 x 1/4 hex socket steel cap screw in DICTATE light flashing indicator assembly. Also used in tube of adjustable mechanical stop in standard 2A telephone answering sets.

Screw, P-290746—.164-32 x 3/8 hex socket head steel set screw used in rear corners of chassis to secure cover

Screw, Cap, hex socket head steel .112-40 x 3/16—Used for holding flasher switch mounting in early type 2A telephone answering sets

Screw, Machine, BH brass 4-40 x 1/4—Used in terminal strip lugs on TS1, TS2, and TS3

Screw, Set, hex socket steel .138-32 x 3/16—Used in tube of adjustable mechanical stop of early type 2A telephone answering sets

Screw, Set, hex socket steel .164-32 x 1/4—Used in function and OFF-ON knobs

Tube, Electron, CK512AX

Tube, Electron, 3V4—Used in all type amplifiers

Washer, Brass, No. 4—Used with hex head cap screw for holding flashing switch mounting in early type sets

Washer, Lock, spring steel, No. 4

6.00 CIRCUIT DESCRIPTION—EARLY TYPE SET

6.01 This circuit description and Fig. 11 apply only to early type 2A telephone answering sets.

Normal Telephone Service

6.02 With the OFF-ON knob (S4 switch) in the OFF position, the associated telephone set is connected to the CO or PBX line as follows: from line to TS1 terminal R, S4A 8 to 7 and 4 to 5, TS1 terminal R1, through associated telephone set, TS1 terminal T1, S4A 2 to 1 and 10 to 11, TS1 terminal T, to other side of line. Terminal G on TS1 is closed through to TS1 terminal G1 via S4B 9 to 8.

Power Control and Bell System Medallion

6.03 With the OFF-ON knob (S4 switch) in the ON position, the following circuits are common to all functions of the 2A telephone answering set:

- The X1 and X2 rectifiers are energized: 115 volts ac from power plug PG1, F1, S4B, through R-RW winding of transformer T1, to other side of PG1.
- The ON-OFF lamp (E1) lights: 48 volts dc, through R9, E1 lamp to ground.

Announcement Dictate

6.04 With the answering set turned on and the function selector (S1 switch) turned to ANNOUNCEMENT DICTATE, operate the START button (S2 switch) momentarily.

6.05 K2 relay operates: ground through S1E 12 to 9, S2, normal K5 1T to 3T, R15, K2 winding, normal K5 6T to 5T, to 75 volts dc.

6.06 K2 relay locks up: 75 volts dc, through normal K5 5T to 6T, K2 winding, operated K2 4T to 3T, normal K3 3B to 2B, jack 13 of J1, adjustable limit switch, jack 14 of J1, S3, S1D 5 to 8, to ground.

6.07 K5 relay operates: 48 volts dc, K5 winding, operated K2 1B to 2B, to ground.

6.08 Operation of the K5 relay inserts the R14 resistor into the K2 lockup circuit to limit the holding current.

6.09 Motor starts: 115 volts ac from power plug PG1, F1 fuse, S4B, operated K5 1B to 2B, J4, through motor winding, J4, to other side of PG1.

6.10 75 volts dc is connected to amplifier, via operated K5 5T to 4T, to jack F of J2.

6.11 Drum pawl solenoid operates: 48 volts dc, operated K2 6B to 7B, jack 1 of J1, through drum pawl solenoid winding, jack 0 of J1, to ground.

6.12 Operation of the drum pawl solenoid causes the following:

- Engages the half-nut and lead screw.
- Brings the recording head into contact with the magnetic recording band.
- Pulls the drum pawl from slot in rim of drum, allowing motor to rotate drum.
- The drum pawl motion operates the drum index switch.

6.13 K5 relay lock up: 48 volts dc, K5 winding, jack 8 of J1, operated drum index switch, jack 0 of J1, to ground.

6.14 K4 relay operates: 48 volts dc, operated K2 4B to 3B, K4 winding, S1F 1 to 4, to ground.

6.15 Record reproduce head is connected to amplifier output: ground from jack 19 of J1, through record reproduce head, jack 17 of J1, operated K4 7B to 6B and 9B to 10B, jack H of J2.

6.16 Shunt resistance R4 is removed from across the bias oscillator tube filament terminals, jacks D and J of J2, when 1B and 2B of the K4 open.

6.17 Adjustable limit switch solenoid operates: ground from jack 0 of J1, through solenoid winding, jack 2 of J1, operated K4 7T to 6T, to 48 volts dc.

6.18 This solenoid lifts the adjustable limit switch holding mechanism, allowing the switch to return to its minimum position.

6.19 The erase coil is energized: ground from jack 0 of J1, through erase coil, jack 3 of J1, normal K6 2B to 1B, operated K4 5T to 4T, to 48 volts dc.

6.20 The 48 volts dc through the erase coil saturates the magnetic medium on the recording band for one complete revolution of the recording drum, removing the previous message.

- After approximately 0.8 second of recording drum rotation, a pin attached to the drum engages the drum pulsing switch. Since the timing switch is open, the K6 relay does not operate.
- After approximately 1.5 seconds of drum rotation, the lateral movement of the head carriage causes the timing switch to close.
- Approximately 3.5 seconds after the START button has been depressed, the drum pulsing switch is engaged a second time by the drum pin.

6.21 K6 relay operates: 48 volts dc, operated K2 4B to 3B and 1T to 2T, K6 winding, jack 4 of J1, drum pulsing switch, timing switch, jack 0 to J1, to ground.

6.22 K6 relay locks up: 48 volts dc, operated K2 4B to 3B and 1T to 2T, K6 winding, operated K6 6B to 7B, to ground.

6.23 The erase coil is de-energized when the K6 relay contacts 2B and 1B are opened.

6.24 The associated telephone set is connected to the amplifier input: 75 volts dc, through operated K5 5T to 4T, R1, R3, operated K6 10T to 11T, operated K4 9T to 8T, S4A 3 to 2, TS1 terminal T1, through associated telephone set, TS1 terminal R1, S4A 5 to 6, S1J 9 to 6, R7 potentiometer, operated K4 3B to 4B, to amplifier input via jack A of J2.

6.25 The DICTATE lamp (E2) lights: 48 volts dc, through R11, E2, operated K6 4T to 5T, jack 6 of J1, through flasher, jack 7 of J1, S1F 1 to 4, to ground. Flasher does not operate at this time because of insufficient current.

6.26 The customer can now dictate an announcement.

6.27 During the recording of the announcement, the head carriage pushes the adjustable limit switch toward its maximum position stop.

6.28 As the adjustable limit switch approaches its maximum travel position, the head carriage mechanism closes the flasher switch approximately 5 seconds before the end of the dictate time. The additional 48 volts dc through R12, jack 9 of J1, and the flasher switch causes the flasher to operate.

6.29 The DICTATE lamp (E2) flashes. Its circuit is interrupted by the operation of the flasher.

6.30 The dictate function will terminate either by the customer's operation of the STOP switch (S3) or by the operation of the adjustable limit switch when it reaches the adjustable mechanical stop which has been set for maximum recording time.

6.31 The release sequence is as follows:

1. Relays K2, K4, and K6 release.
2. The adjustable limit switch solenoid releases, allowing a spring to clamp the adjustable limit switch in the position it occupies at the time of operation of the STOP switch.
3. Drum pawl solenoid releases, which disengages the half-nut from the lead screw, allowing the head carriage to be returned to start position by the return spring.
4. Release of the drum pawl solenoid also removes the constraint on the drum pawl. When the slot in the rim of the recording drum reaches the drum pawl, the drum pawl engages the slot releasing the drum index switch.
5. K5 relay releases and motor stops.

Announcement Check

6.32 With the answering set turned on and the function selector knob (S1 switch) turned to ANNOUNCEMENT CHECK, operate the START button (S2 switch) momentarily.

6.33 K2 relay operates: ground through S1E 12 to 10, S2, normal K5 1T to 3T, R15, K2 winding, normal K5 6T to 5T, to 75 volts dc.

6.34 K2 relay locks up: 75 volts dc, through normal K5 5T to 6T, K2 winding, operated K2 4T to 3T, normal K3 3B to 2B, jack 13 of J1, adjustable limit switch, jack 14 of J1, S3, S1D 6 to 8, to ground.

6.35 K5 relay operates: 48 volts dc, K5 winding, operated K2 1B to 2B, to ground.

6.36 Operation of the K5 relay inserts the R14 resistor into the K2 lockup circuit to limit the holding current.

6.37 Motor starts: 115 volts ac from power plug PG1, F1, S4B, operated K5 1B to 2B, J4, through motor winding, J4, to other side of PG1.

6.38 75 volts dc is connected to amplifier, via operated K5 5T to 4T, to jack F of J2.

6.39 Drum pawl solenoid operates: 48 volts dc, operated K2 6B to 7B, jack 1 to J1, through drum pawl solenoid winding, jack 0 to J1, to ground.

6.40 Operation of the drum pawl solenoid causes the following:

1. Engages the half-nut and lead screw.
2. Brings the recording head into contact with the magnetic recording band.
3. Pulls the drum pawl from slot in rim of drum, allowing motor to rotate drum.
4. The drum pawl motion operates the drum index switch.

6.41 K5 relay locks up: 48 volts dc, K5 winding, jack 8 of J1, operated drum index switch, jack 0 of J1, to ground.

6.42 As in ANNOUNCEMENT DICTATE, the K6 relay operates and locks up but has no function in this sequence.

6.43 The record reproduce head is connected to the amplifier input: ground from jack 19 of J1, through record reproduce head, jack 17 of J1, normal K4 7B to 8B and 5B to 4B, to jack A of J2.

6.44 The amplifier output is connected to output transformer (T2): from jack K of J2, to terminal R of T2, through T2 to terminal BK, through C1-4, to ground.

6.45 The associated telephone set is connected to the output transformer (T2): ground through T2 4 to 3, R8, S1J 7 to 9, S4A 6 to 5, TS1 terminal R1, through associated telephone set, TS1 terminal T1, S4A 2 to 3, C1-2, to ground.

6.46 After approximately 3.5 seconds of drum rotation, the record reproduce head should reach the recorded announcement and it will be heard in the associated telephone set.

6.47 The announcement check function will be terminated, either by the customer's operation of the STOP button (S3 switch), or by the operation of the adjustable limit switch by the head carriage arm movement. The release sequence is as follows:

1. Relays K2 and K6 release.
2. Drum pawl solenoid releases, which disengages the half-nut from the lead screw, allowing the head carriage to be returned to start position by the return spring.
3. Release of the drum pawl solenoid also removes the constraint on the drum pawl. When the slot in the rim of the recording drum reaches the drum pawl, the drum pawl engages the slot, releasing the drum index switch.
4. K5 relay releases and motor stops.

Automatic Answer

6.48 With the answering set turned on and the function selector knob (S1 switch) turned to AUTOMATIC ANSWER, the ready lamp (E3) lights: 48 volts dc, through R10, E3, S1G 7 to 8, jack 10 of J1, normal drum index switch, jack 0 of J1, to ground.

6.49 When an incoming call is received, the K1 relay vibrates: ringing current from the CO or PBX line to TS1 terminal R, S4A 8 to 9, K1 winding, C6, S4B 10 to 9, TS1 terminal G, to other side of CO or PBX line, or to local ground.

6.50 K2 relay operates: 75 volts dc, normal K5 5T to 6T, K2 winding, normal K2 4T to 5T, R13, operated K1 1T to 2T, jack 12 of J1, telephone ground switch, jack 11 of J1, S1C 3 to 4, to ground.

6.51 K2 relay locks up: 75 volts dc, normal K5 5T to 6T, K2 winding, operated K2 4T to 3T, normal K3 3B to 2B, jack 13 of J1, adjustable limit switch, jack 14 of J1, TS4 terminal 7 to 8, S1D 7 to 8, to ground.

6.52 K5 relay operates: 48 volts dc, K5 winding, operated K2 1B to 2B, to ground.

6.53 Operation of the K5 relay inserts the R14 resistor into the K2 lockup circuit to limit the holding current.

6.54 Motor starts: 115 volts ac, from power plug PG1, F1, S4B, operated K5 1B to 2B, J4, through motor winding, J4, to other side of PG1.

6.55 75 volts dc is connected to amplifier via operated K5 5T to 4T, to jack F of J2.

6.56 Drum pawl solenoid operates: 48 volts dc, operated K2 6B to 7B, jack 1 of J1, drum pawl solenoid winding, jack 0 of J1, to ground.

6.57 Operation of the drum pawl solenoid causes the following:

1. Engages the half-nut and lead screw.
2. Brings the recording head into contact with the magnetic recording band.
3. Pulls the drum pawl from slot in rim of drum, allowing motor to rotate drum.
4. The drum pawl motion operates the drum index switch.

6.58 Ready lamp (E3) is extinguished by operation of the drum index switch.

6.59 K5 relay locks up: 48 volts dc, K5 winding, jack 8 of J1, operated drum index switch, jack 0 of J1, to ground.

- After approximately 0.8 second of recording drum rotation, a pin attached to the drum engages the drum pulsing switch. Since the timing switch is open, the K6 relay does not operate.
- After approximately 1.5 seconds of drum rotation, the lateral movement of the head carriage causes the timing switch to close.
- Approximately 3.5 seconds after the machine has started, the drum pulsing switch is engaged a second time by the drum pin.

6.60 K6 relay operates: 48 volts dc, operated K2 4B to 3B and 1T to 2T, K6 winding, jack 4 of J1, drum pulsing switch, timing switch, jack 0 of J1, to ground.

6.61 K6 relay locks up: 48 volts dc, operated K2 4B to 3B and 1T to 2T, K6 winding, operated K6 6B to 7B, to ground.

6.62 K7 relay operates: battery from CO or PBX line to TS1 terminal R, S4A 8 to 9, S1A 3 to 4, normal K3 3T to 2T, K7 winding, operated K6 4B to 3B, S1B 9 to 8, S4A 12 to 11, TS1 terminal T, to ground on other side of CO or PBX line.

6.63 K7 relay locks up: battery from CO or PBX line to TS1 terminal R, S4A 8 to 9, S1A 3 to 4, operated K7 2T to 1T, K7 winding, operated K6 4B to 3B, S1B 9 to 8, S4A 12 to 11, TS1 terminal T, to ground on other side of CO or PBX line.

6.64 K3 relay operates about 1.5 seconds after K6 relay operates: 75 volts dc, operated K6 10B to 9B, R16, K3 winding, S1E 11 to 12, to ground.

6.65 Operation of the K7 and K3 relays transfers the locking path of the K2 relay from 2B and 3B of the K3 to 1B and 2B of the K7.

6.66 The record reproduce head is connected to the amplifier input: ground from jack 19 of J1, through record reproduce head, jack 17 of J1, normal K4 7B to 8B and 5B to 4B, to jack A of J2.

6.67 The amplifier output is connected to output transformer (T2): from jack K of J2, to terminal R of T2, through T2 to BK, C1-4, to ground.

6.68 The CO or PBX line is connected to the output transformer (T2): TS1 terminal T, over CO or PBX line to TS1 terminal R, S4A 8 to 9, S1A 3 to 4, TS4 2 to 1, C5, T2 transformer 1 to 2, TS4 3 to 4, operated K6 2T to 1T, TS2 2 to 1, S1B 9 to 8, S4A 12 to 11, to TS1 terminal T.

6.69 The announcement is sent out on line to calling party.

6.70 In central offices where calling party disconnect is effective and calling party disconnects:

1. K7 relay releases.
2. K2, K6, and K3 relays release.
3. Drum pawl solenoid releases, which disengages the half-nut from the lead screw, allowing the head carriage to be returned to start position by the return spring.
4. Release of the drum pawl solenoid also removes the constraint on the drum pawl. When the slot in the rim of the recording drum reaches the drum pawl, the drum pawl engages the slot releasing the drum index switch.
5. K5 relay releases and motor stops.
6. Ready lamp (E3) lights.
7. The 2A telephone answering set is ready to receive another call.

6.71 If the calling party does not disconnect, or where calling party disconnect is not effective, the adjustable limit switch is operated by the head carriage arm at the end of the message.

1. K2, K6, K3, and K7 relays release.
2. The sequence described in 6.70 Steps 3 through 7 follows.

7.00 CIRCUIT DESCRIPTION—STANDARD SETS

7.01 This circuit description and Fig. 12 and 13 apply only to standard 2A telephone answering sets. Fig. 12 applies to standard sets without a medallion light socket and Fig. 13 applies to standard sets with a medallion light socket.

Normal Telephone Service

7.02 With the OFF-ON knob (S4 switch) in the OFF position, the associated telephone set is connected to the CO or PBX line as follows: from line to TS1 terminal R, S4A 8 to 7 and 4 to 5, TS1 terminal R1, through associated telephone set, TS1 terminal T1, S4A 2 to 1 and 10 to 11, TS1 terminal T, to other side of line. Terminal G on TS1 is closed through to TS1 terminal G1 via S4B 9 to 8.

Power Control and Bell System Medallion

7.03 With the OFF-ON knob (S4 switch) in the ON position, the following circuits are common to all functions of the 2A telephone answering set:

- The X1 and X2 rectifiers are energized: 115 volts ac from power plug PG1, F1, S4B, through R-RW winding, to other side of PG1.
- The ON-OFF lamp (E1, when provided) lights: 4 volts from T1 transformer, E1 lamp, normal K8 1T to 2T, to ground (see Fig. 13).

Announcement Dictate

7.04 With the answering set turned on and the function selector knob (S1 switch) turned to ANNOUNCEMENT DICTATE, depress the OPERATE button (S2 switch) and hold down.

7.05 K2 relay operates: 75 volts dc, normal K5 5T to 6T, K2 winding, R15, normal K5 3T to 1T, normal K8 3B to 1B, S2, S1E 9 to 12, to ground.

7.06 K5 relay operates: 48 volts dc, K5 winding, operated K2 1B to 2B, to ground.

7.07 K2 relay locks up: 75 volts dc, through R14 (to limit holding current) K2 winding, operated K2 4T to 3T, normal K3 3B to 2B, jack 13 of J1, adjustable limit switch, jack 14 of J1, operated K5 2T to 1T, normal K8 3B to 1B, S2, S1E 9 to 12, to ground.

7.08 Motor starts: 115 volts ac from power plug PG1, F1, S4B, operated K5 1B to 2B, J4, through motor winding, J4, to other side of PG1.

7.09 75 volts dc is connected to the amplifier via operated K5 5T to 4T, R2, to jack J of J2.

7.10 Drum pawl solenoid operates: 48 volts dc, operated K2 6B to 7B, jack 1 of J1, through drum pawl solenoid winding, jack 0 of J1, to ground.

7.11 Operation of the drum pawl solenoid causes the following:

1. Engages the half-nut and lead screw.
2. Brings the recording head into contact with the magnetic recording band.
3. Pulls the drum pawl from slot in rim of drum, allowing motor to rotate drum.
4. The drum pawl motion operates the drum index switch.

7.12 K5 relay locks up: 48 volts dc, K5 winding, jack 8 of J1, operated drum index switch, jack 0 of J1, to ground.

7.13 K4 relay operates: 48 volts dc, operated K2 4B to 3B, K4 winding, S1F 1 to 4, to ground.

7.14 Record reproduce head is connected to amplifier output: ground from jack 19 of J1, through record reproduce head, jack 17 of J1, operated K4 7B to 6B and 9B to 10B, to jack H of J2.

7.15 Shunt resistor R4 is removed from across the bias oscillator tube filament terminals, jacks D and J of J2, when 1B and 2B of the K4 open.

7.16 Adjustable limit switch solenoid operates: ground from jack 0 to J1, through solenoid winding, jack 2 of J1, operated K4 7T to 6T, to 48 volts dc.

7.17 This solenoid lifts the adjustable limit switch holding mechanism, allowing the switch to return to its minimum position.

7.18 The erase coil is energized: ground from jack 0 of J1, through erase coil, jack 3 of J1, normal K6 2T to 1T, operated K4 5T to 4T, to 48 volts dc.

7.19 The 48 volts dc through the erase coil saturates the magnetic medium on the recording band for one complete revolution of the recording drum, removing the previous message.

- After approximately 0.8 second of recording drum rotation, a pin attached to the drum engages the drum pulsing switch. Since the timing switch is open, the K6 relay does not operate.
- After approximately 1.5 seconds of drum rotation, the lateral movement of the head carriage causes the timing switch to close.
- Approximately 3.5 seconds after the OPERATE button has been depressed, the drum pulsing switch is engaged a second time by the drum pin.

7.20 K6 relay operates: 48 volts dc, operated K2 4B to 3B and 1T to 2T, K6 winding, jack 4 of J1, drum pulsing switch, timing switch jack 0 of J1, to ground.

7.21 K6 relay locks up: 48 volts dc, operated K2 4B to 3B and 1T to 2T, K6 winding, operated K6 3T to 4T, to ground.

7.22 The erase coil is de-energized when the K6 contacts 1T and 2T are open.

7.23 The associated telephone set is connected to the amplifier input: 75 volts dc, operated K5 5T to 4T, R1, R3, operated K6 10T to 11T, operated K4 9T to 8T, S1H 9 to 12, S4A 3 to 2, TS1 terminal T1, through associated telephone set, TS1 terminal R1, S4A 5 to 6, S1J 9 to 6, operated K4 3B to 4B, to amplifier input via jack A of J2.

7.24 The DICTATE lamp (E2) lights:

- When not equipped with a medallion light socket: 48 volts dc, R11, E2 lamp, operated K6 5T to 6T, R12, S1F 1 to 4, to ground (see Fig. 12).
- When equipped with a medallion light socket: 4 volts ac, E2 lamp, operated K6 5T to 6T, jack 6 of J1, flasher, jack 7 of J1, S1D 5 to 8, to ground (see Fig. 13).

7.25 The customer can now dictate an announcement.

7.26 During the recording of the announcement, the head carriage pushes the adjustable limit switch toward its maximum position stop.

7.27 As the adjustable limit switch approaches its maximum travel position, the head carriage mechanism closes the flasher switch approximately 5 seconds before the end of the dictate time.

- When not equipped with a medallion light socket: 48 volts dc, to jack 9 of J1, flasher switch, through flasher, jack 7 of J1, R12, S1F 1 to 4, to ground, causes the flasher to operate. When flasher is closed, there is insufficient current through E2 to light the lamp. Operation of flasher momentarily opens circuit through flasher switch and E2 lamp lights. (See Fig. 12.)
- When equipped with a medallion light socket: 4 volts ac, through R25, jack 9 of J1, flasher switch to flasher. R25 in parallel with the lamp permits sufficient current to flow to cause flasher to operate (see Fig. 13).

7.28 The DICTATE lamp (E2) flashes. Its circuit is interrupted by the operation of the flasher.

7.29 If the OPERATE button is released:

1. K2, K4, and K6 relays release.
2. The adjustable limit switch solenoid releases, allowing a spring to clamp the adjustable limit switch in the position it occupies at the time of release of the OPERATE button.
3. Drum pawl solenoid releases, which disengages the half-nut from the lead screw, allowing the head carriage to be returned to start position by the return spring.
4. Release of the drum pawl solenoid also removes the constraint on the drum pawl. When the slot in the rim of the recording drum reaches the drum pawl, the drum pawl engages the slot, releasing the drum index switch.
5. K5 relay releases and motor stops.

7.30 If the OPERATE button is not released, the head carriage will drive the adjustable limit switch against the adjustable mechanical stop, which has been set for maximum recording time.

1. K2, K4, and K6 relays release.
2. The adjustable limit switch and the drum pawl solenoid release.
3. Before the drum pawl engages the slot and releases the drum index switch, the K8 relay operates: 48 volts dc, K8 winding, S1C 4 to 1, jack 15 of J1, operated adjustable limit switch, jack 14 of J1, operated K5 2T to 1T, normal K8 3B to 1B, S2, S1E 9 to 12, to ground.
4. K8 relay locks up: 48 volts dc, K8 winding, operated K8 2B to 1B, S2, S1E 9 to 12, to ground.
5. K5 releases and motor stops.

7.31 Operation of the K9 relay prevents the K2 relay from reoperating until the OPERATE button has been released.

7.32 When the OPERATE button has been released, the K8 relay releases and the set is restored to normal.

Announcement Check

7.33 With the answering set turned on and the function selector knob (S1 switch) turned to ANNOUNCEMENT CHECK, depress the OPERATE button and hold down.

7.34 K2 relay operates: 75 volts dc, normal K5 5T to 6T, K2 winding, R15, normal K5 3T to 1T, normal K8 3B to 1B, S2, S1E 10 to 12, to ground.

7.35 K5 relay operates: 48 volts dc, K5 winding, operated K2 1B to 2B, to ground.

7.36 K2 relay locks up: 75 volts dc, through R14 (to limit holding current), K2 winding, operated K2 4T to 3T, normal K3 3B to 2B, jack 13 of J1, adjustable limit switch, jack 14 of J1, operated K5 2T to 1T, normal K8 3B to 1B, S2, S1E 10 to 12, to ground.

7.37 Motor starts: 115 volts ac from power plug PG1, F1, S4B, operated K5 1B to 2B, J4, through motor winding, J4, to other side of PG1.

7.38 75 volts dc is connected to the amplifier via operated K5 5T to 4T, R2, to jack J of J2.

7.39 Drum pawl solenoid operates: 48 volts dc, operated K2 6B to 7B, jack 1 of J1, through drum pawl solenoid winding, jack 0 of J1, to ground.

7.40 Operation of the drum pawl solenoid causes the following:

1. Engages the half-nut and lead screw.
2. Brings the recording head into contact with the magnetic recording band.
3. Pulls the drum pawl from the slot in rim of drum, allowing motor to rotate drum.
4. The drum pawl motion operates the drum index switch.

7.41 K5 relay locks up: 48 volts dc, K5 winding, jack 8 of J1, operated drum index switch, jack 0 of J1, to ground.

7.42 As in ANNOUNCEMENT DICTATE, the K6 relay operates and locks up but has no function in this sequence.

7.43 The record reproduce head is connected to the amplifier input: ground from jack 19 of J1, through record reproduce head, jack 17 of J1, normal K4 7B to 8B and 5B to 4B, to jack A of J2.

7.44 The amplifier output is connected to output transformer (T2): from jack K of J2, R wire of T2, through T2 to BK wire, through C1-4, to ground.

7.45 The associated telephone set is connected to the output transformer (T2): ground through T2 4 to 3, R8, S1J 7 to 9, S4A 6 to 5, TS1 terminal R1, through associated telephone set, TS1 terminal T1, S4A 2 to 3, S1H 12 to 10, through C1-2, to ground.

7.46 After approximately 3.5 seconds of drum rotation, the record reproduce head should reach the recorded announcement and it will be heard in the associated telephone set.

7.47 If the OPERATE button is released:

1. K2 and K6 relays release.
2. Drum pawl solenoid releases, which disengages the half-nut from the lead screw, allowing the head carriage to be returned to start position by the return spring.
3. Release of the drum pawl solenoid also removes the constraint on the drum pawl. When the slot in the rim of the drum reaches the drum pawl, the drum pawl engages the slot, releasing the drum index switch.
4. K5 relay releases and motor stops.

7.48 If the OPERATE button is not released, the head carriage arm will operate the adjustable limit switch.

1. The K2 and K6 relays and the drum pawl solenoid release.
2. Before the drum pawl engages the slot and releases the drum index switch, the K8 relay operates: 48 volts dc, K8 winding, S1C 4 to 2, jack 15 of J1, operated adjustable limit switch, jack 14 of J1, operated K5 2T to 1T, normal K8 3B to 1B, S2, S1E 10 to 12, to ground.
3. K8 relay locks up: 48 volts dc, K8 winding, operated K8 2B to 1B, S2, S1E 10 to 12, to ground.
4. K5 releases and motor stops.

7.49 Operation of the K8 relay prevents the K2 from reoperating until the OPERATE button is released.

7.50 When the OPERATE button is released, the K8 relay releases and the set is restored to normal.

Automatic Answer

7.51 With the answering set turned on and the function knob (S1 switch) turned to AUTOMATIC ANSWER, the ready lamp (E3) lights:

- When not equipped with a medallion light socket: 48 volts dc, R10, E3 lamp S1G 7 to 8, jack 10 of J1, normal drum index switch, jack 0 to J1 ground.
- When equipped with a medallion light socket: 4 volts ac, E3 lamp, S1G 7 to 8, jack 10 of J1, normal drum index switch, jack 0 of J1, to ground.

7.52 When an incoming call is received, the K1 relay vibrates: ringing current from CO or PBX line to TS1 terminal R, S4A 8 to 9, K1 windings, C6, S4B 10 to 9, TS1 terminal G, to other side of CO or PBX line, or to local ground.

7.53 K2 relay operates: 75 volts dc, normal K5 5T to 6T, K2 winding, normal K2 4T to 5T, R13, operated K1 1T to 2T, jack 12 of J1, telephone ground switch, jack 11 of J1, S1F 3 to 4, to ground.

7.54 K5 relay operates: 48 volts dc, K5 winding, operated K2 1B to 2B, to ground.

7.55 K2 relay locks up: 75 volts dc, R14 (to limit holding current), K2 winding, operated K2 4T to 3T, normal K3 3B to 2B, jack 13 of J1, adjustable limit switch, jack 14 of J1, TS4 terminals 7 to 8, S1D 7 to 8, to ground.

7.56 Motor starts: 115 volts ac from power plug PG1, F1, S4B, operated K5 1B to 2B, J4, through motor winding, J4, to other side of PG1.

7.57 75 volts is connected to the amplifier via operated K5 5T to 4T, R2, to jack J of J2.

7.58 Drum pawl solenoid operates: 48 volts dc, operated K2 6B to 7B, jack 1 of J1, through drum pawl solenoid winding, jack 0 of J1, to ground.

7.59 Operation of the drum pawl solenoid causes the following:

1. Engages the half-nut and lead screw.
2. Brings the recording head into contact with the magnetic recording band.
3. Pulls the drum pawl from slot in rim of drum, allowing motor to rotate drum.
4. The drum pawl motion operates the drum index switch.

7.60 Ready lamp (E3) is extinguished by operation of the drum index switch.

7.61 K5 relay locks up: 48 volts dc, K5 winding, jack 8 of J1, operated drum index switch, jack 0 of J1, to ground.

- After approximately 0.8 second of recording drum rotation, a pin attached to the drum engages the drum pulsing switch. Since the timing switch is open, the K6 relay does not operate.
- After approximately 1.5 seconds of drum rotation, the lateral movement of the head carriage causes the timing switch to close.
- Approximately 3.5 seconds after the machine has started, the drum pulsing switch is engaged a second time by the drum pin.

7.62 K6 relay operates: 48 volts dc, operated K2 4B to 3B and 1T to 2T, K6 winding, jack 4 of J1, drum pulsing switch, timing switch, jack 0 of J1, to ground.

7.63 K6 relay locks up: 48 volts dc, operated K2 4B to 3B and 1T to 2T, K6 winding, operated K6 3T to 4T, to ground.

7.64 K7 relay operates: battery from CO or PBX line to TS1 terminal R, S4A 8 to 9, S1A 3 to 4, normal K3 3T to 2T, K7 winding, operated K6 4B to 3B, S1B 9 to 8, S4A 12 to 11, TS1 terminal T, to ground on other side of CO or PBX line.

7.65 K7 relay locks up: battery from CO to PBX line to TS1 terminal R, S4A 8 to 9, S1A 3 to 4, operated K7 2T to 1T, K7 winding, operated K6 4B to 3B, S1B 9 to 8, S4A 12 to 11, TS1 terminal T, to ground on other side of CO or PBX line.

7.66 K3 relay operates after about 1-1/2 seconds: 75 volts dc, operated K6 6B to 5B, R16, K3 winding, S1E 11 to 12, to ground.

7.67 The record reproduce head is connected to the amplifier input: ground from jack 19 of J1, through record reproduce head, jack 17 of J1, normal K4 7B to 8B and 5B to 4B, to jack A of J2.

7.68 The amplifier output is connected to output transformer (T2): from jack K of J2, to R wire of T2, through T2 to BK wire, C1-4, to ground.

7.69 The CO or PBX line is connected to the output transformer (T2): TS1 terminal T, over CO or PBX line to TS1 terminal R, S4A 8 to 9, S1A 3 to 4, TS4 2 to 1, C5, T2 transformer 1 to 2, operated K6 8T to 7T, TS2 2 to 1, S1B 9 to 8, S4A 12 to 11, to TS1 terminal T.

7.70 Announcement is sent out on line to calling party.

7.71 In central offices where calling party disconnect is effective and calling party disconnects:

1. K7 relay releases.
2. K2, K3, and K6 relays release.
3. Drum pawl solenoid releases, which disengages the half-nut from the lead screw, allowing the head carriage to be returned to start position by the return spring.
4. Release of the drum pawl solenoid also removes the constraint on the drum pawl. When the slot in the rim of the recording drum reaches the drum pawl, the drum pawl engages the slot releasing the drum index switch.
5. K5 relay releases and motor stops.
6. Ready lamp (E3) lights.
7. The 2A telephone answering set is ready to receive another call.

7.72 If calling party does not disconnect, or where calling party disconnect is not effective, the adjustable limit switch is operated by the head carriage arm at the end of the message.

1. K2, K3, K6, and K7 relays release.
2. The sequence described in 7.71, Steps 3 through 7 follows.

8.00 DRAWINGS

The following drawings apply to the 2A telephone answering set:

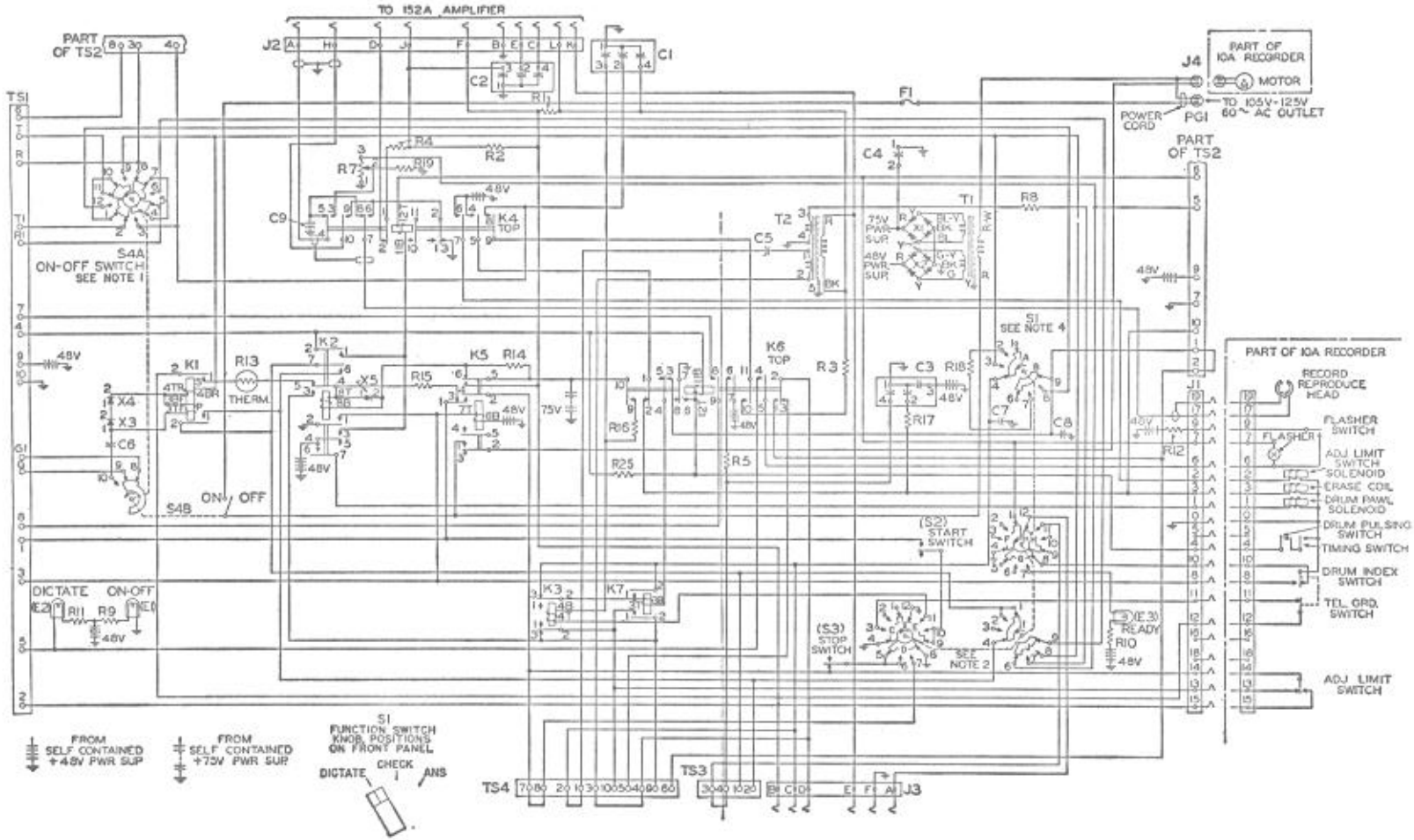
LA-777054 — 10A Recorder—Wiring Diagram and Schematic

LA-777066 — 152A Amplifier—Schematic

LA-830078 — 2A Telephone Answering Set—Wiring Diagram

LA-830081 — 2A Telephone Answering Set—Schematic

These drawings may be obtained on order from the Western Electric Company.



Note 1: *(S4)* shown in *OFF* position.

Note 2: *(S1)* shown in announcement—*DICTATE* position.

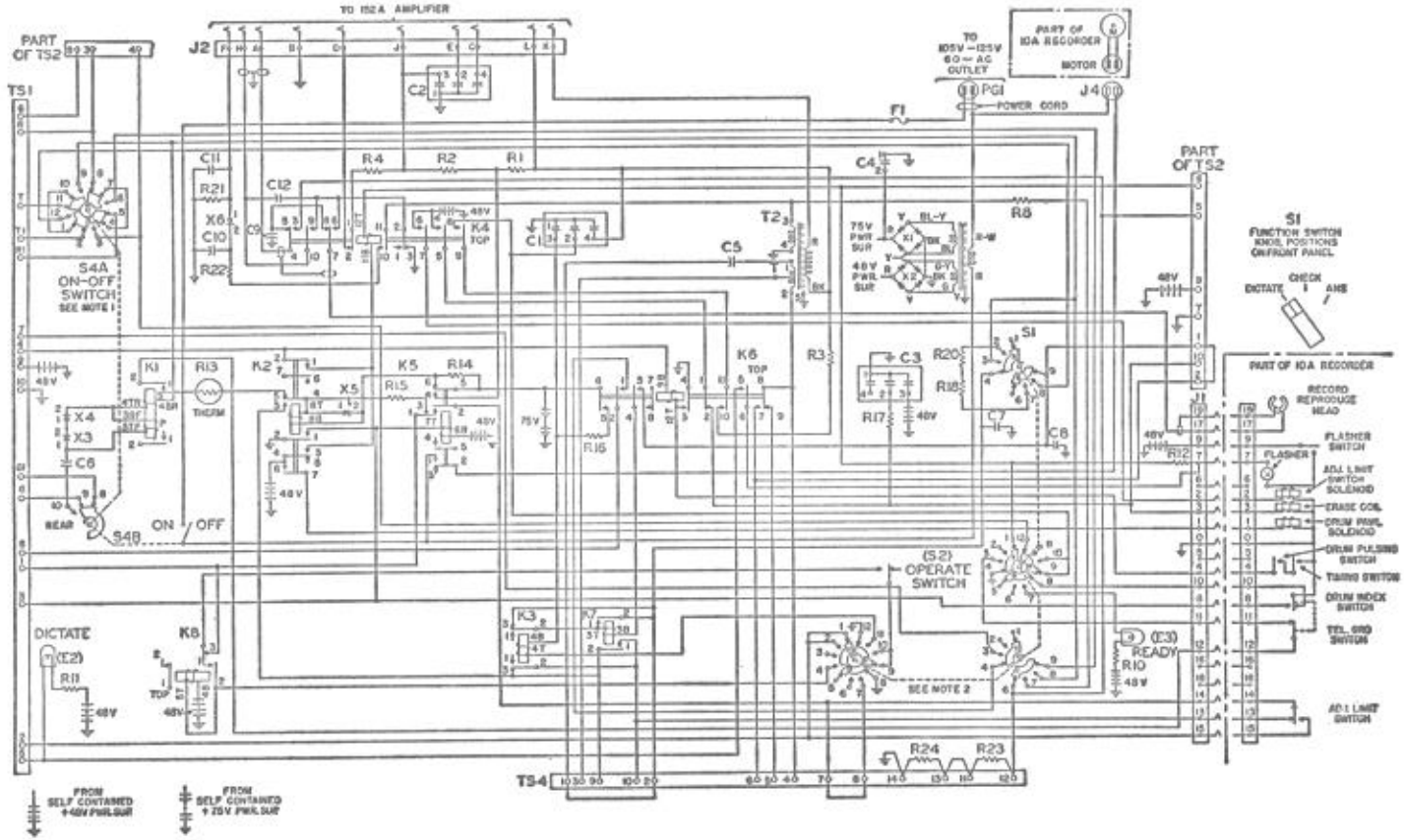
Note 3: *(TS2)*, *(TS3)*, and *(TS4)* strapping shown is for *ANSWER ONLY*.

Note 4: Sections A, B, C, D, and E of *(S1)* are on wafer closest to front panel. Sections F, G, H, I, and J are on wafer farthest from front panel.

Fig. 11 — 2A Telephone Answering Set Schematic With Letter A Preceding Serial Number

9.00 SUPPRESSION OF RADIO STATION INTERFERENCE

If customer hears radio programs on announcement messages, the trouble might be eliminated by the installation of a 1542A inductor in accordance with the C Section entitled Radio Signal Suppression in Telephone Sets.



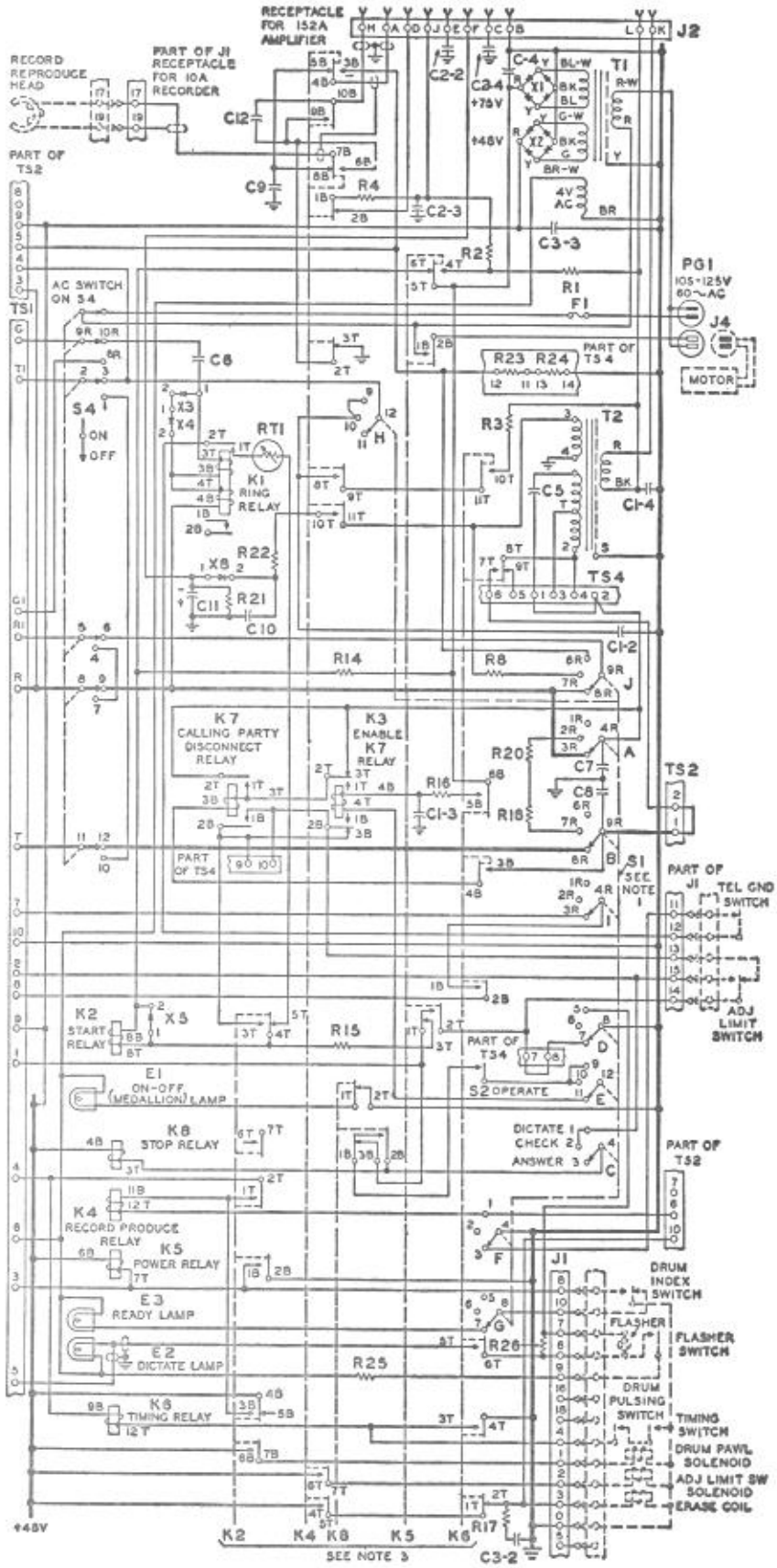
Note 1: *(S4)* shown in *OFF* position.

Note 2: *(S1)* shown in announcement—*DICTATE* position.

Note 3: *(TS2)*, *(TS3)*, and *(TS4)* strapping shown is for *ANSWER ONLY*.

Note 4: Sections A, B, C, D, and E of *(S1)* are on wafer closest to front panel. Sections F, G, H, I, and J are on wafer farthest from front panel.

Fig. 12 — Standard 2A Telephone Answering Set without Medallion Light Socket



Note 1: Sections A,B,C,D, and E of *S1* are on wafer closest to front panel. Sections F,G,H,I, and J are on wafer farthest from front panel.

Note 2: Circuit elements shown by dotted lines are part of 10A recorder. (See separate schematic.)

Note 3: Relay contacts joined by dotted lines are on the same relay and are operated by the relay indicated. Relay contacts are shown for nonoperate condition of relays.

Note 4: Straps shown on TS2 and TS4 must be made for answer only service.

Note 5: Capacitors *C1*, *C2*, and *C3* consist of 3 100V sections,

Term. 1 — Common
Term. 2 — 100UF
Term. 3 — 200UF
Term. 4 — 30UF

Fig. 13 — Standard 2A Telephone Answering Set with Medallion Light Socket