BELL SYSTEM PRACTICES
Station Installation and Maintenance

SECTION C55.611
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AT&T Co Standard

1A TELEPHONE ANSWERING SET
MAINTENANCE

1. GENERAL

1.01 This section provides information on the maintenance of the 1A Telephone Answering Set installed at subscriber stations. With the objective of aiding the analysis of trouble and its subsequent correction, the basic maintenance requirements and procedures are supplemented by additional information on the mechanical and electrical operation of the set.

1.02 This section has been revised to include more complete maintenance information. Due to the extent of the changes, arrows indicating changes have been omitted.

1.03 Some of the information in this section supersedes similar information in Section C55.607. This latter section will be reissued at a later date.

1.04 Work actually done on the subscriber's premises should be limited to verification and analysis of the trouble, performance of readily made adjustments, where approved, and the replacement of easily accessible parts which are available through the normal supplies organization.

1.05 Disassembly of the 1A Telephone Answering Set shall be undertaken only when approved by a supervisor.

1.06 The maintenance of telephone sets and subscriber sets which may be used with the 1A Telephone Answering Set is covered in the sections dealing with these apparatus items.

1.07 Access to the inside of the set is obtained by removing the cover. This is accomplished by loosening the two slotted-head set screws in the lower back section of the case,

Recording and Checking Announcement Message

2.04 The smaller drum is used for recording and reproducing the "Announcement" or outgoing message. The aluminum drum is covered by a band (or "tire") containing magnetic iron oxide, which provides a recording medium. Recording is accomplished by applying audio and high frequency bias currents to a 0.042 inch wide magnetic recording head held in contact with the surface of the band. As the drum rotates, it turns a lead screw by a 1:2 gear ratio, which moves the head across the width of the band, tracing a helical track with 0.10 inch spacing between track centers. The drum rotates at about 20 rpm.

2.05 The recording head is mounted on a pivoted arm with a spiral spring applying pressure to keep the head riding on the band. When the solenoid is energized the "Bail" which mounts the head carriage is rotated on the lower slide bar as a pivot so that the pawl is disengaged, allowing the drum to turn, the half-nut is engaged with the lead screw, and the recording head allowed to come in contact with the magnetic band (Fig. 2).

2.06 As the announcement head carriage moves from its zero position (from left to right) a cord attached to an arm of the carriage rotates a pulley which winds up a spiral spring (Fig. 2). When the half-nut is disengaged from the lead screw, this spring pulls the carriage back to its zero position.

2.07 The drum is stopped in a given "index" position by providing a single slot into which the stopping pawl can rest. When the pawl is seated switch S19 releases, opening the power circuit to the motor (Fig. 2). By causing the drum to always stop in the same position, the record-reproduce head always retraces the same track on the magnetic band.

2.08 Provision is made for recording and reproducing announcement messages of any length from 12 to 30 seconds with a minimum interval between the end of this message and the beginning of the recording of the incoming message. This is accomplished by means of the Adjustable Limit Switch S7 which is automatically positioned at the end of the travel of the announcement carriage when the machine is in the ANNOUNCEMENT DICTATE condition (Figs. 2 & 4). This limit switch consists of a microswitch (S7) carried on a pivoted arm which is moved by an extension of the head carriage. The switch arm is locked in position by a spring held friction pad. When the machine is operating in the ANNOUNCEMENT DICTATE condition, solenoid L2 raises this friction pad and allows the switch arm to return to a start

position. Since there is a minimum announcement message time of 10-15 seconds the switch arm does not return to a position equivalent to the zero head position. During the dictate period the limit switch arm is moved along as the head progresses. When the STOP key is operated at the end of the announcement message, solenoid L2 is released, and the friction pad locks the switch arm in place. This holds until a new announcement message is recorded. When the announcement message is reproduced, the switch arm is not released, the carriage progresses to the end of the message, at which time the carriage arm operates switch S7 releasing the solenoid and causing the carriage to return to zero. Operation of S7 also starts the incoming message drum and operates relays K1 and K4 which make the necessary changes in connections to record incoming messages.

2.09 Before a new announcement message is recorded, the previous one must be erased. This is accomplished by means of an iron core coil which is energized by 60 cycle current and held near the drum for one revolution (Fig. 4). The core has a face approximately the length of the recorded area on the drum so that the entire helical track is erased in one revolution. The erase coil is mounted on a pivoted arm and an adjustable stop limits the travel so that the pole piece is close to the magnetic band (about .080 in.) while erasing but is at a considerable distance away when in the released position. This latter distance is such that it prevents residual magnetization of the band when the erasing current is turned off by switch S5 which is operated just before the coil reaches its rest position. The erase coil is moved to its operating position by the same solenoid, L2, which releases the arm holding the adjustable limit switch. However, since the limit switch must be released during the entire time of recording the announcement message and the erase coil is to be operated for only one revolution, the latter is mechanically released by a pin on the drum. The pin, after one revolution, engages a latch which releases the coil although solenoid L2 remains energized (Fig. 4). It is located so that it does not engage the release lever after the first revolution.

Recording and Reproducing Incoming Messages

2.10 The large message drum, on which incoming messages are recorded, is driven by a continuously rotating clutch similar to that used on the announcement drum but located at the opposite end of the shaft, away from the drive pulley (Fig. 1). Rotation of the message drum is controlled by a pawl and solenoid L3 similar to those used on the announcement drum (Fig. 3). There are four slots in which the pawl

can engage to stop the drum, since it is not necessary that it always stop in the same position. As the message drum rotates it turns the associated lead screw through a 2:1 gear reduction, giving a track spacing of 0.025 inch, center to center. The message record-reproduce head (active width 0.014 inch) is mounted on a carriage similar to the announcement head carriage, with a half-nut engaging its lead screw, but with no provision for automatic return of the head carriage. Instead the head carriage is connected by means of a flexible cable and pulleys to the MESSAGE SELECTOR KNOB which appears on the front panel (Figs. 5 & 6). This knob rotates as the carriage is moved by the lead screw, and shows the position of the head. When playing back messages this knob is used for manually moving the head to any desired part of the drum to pick out any messages or to repeat a message. Before this can be done it is necessary to disengage the half-nut from the lead screw, which is done by pushing in on the MESSAGE SELECTOR KNOB (Fig. 3). This engages an arm on the bail on which the carriage is mounted, moving it enough to release the half-nut, however, the motion is not enough to affect the cable running on the pulleys. A cam is mounted on the MESSAGE SELECTOR KNOB shaft, operating switches S9, S10 and S11 (Fig. 5). Another cam on a concentric shaft but connected to the MESSAGE INDICATOR DIAL operates switches S39 and S40.

2.11 A MESSAGE INDICATOR DIAL graduated in 20 parts (Figs. 5 & 6) is provided to show the extent of recording on the message drum. This is useful as an indication that messages have been recorded and also when the subscriber wishes to set the machine for recording additional messages without erasing those already recorded. The MESSAGE INDICATOR DIAL is mounted between the panel and the MESSAGE SELECTOR KNOB and is rotated by the MESSAGE SELECTOR KNOB during recording. However, it remains in position when the MESSAGE SELECTOR KNOB is turned for playing back messages and must be manually returned to zero before incoming messages can be erased. Connected to the MESSAGE INDICATOR DIAL shaft is a cam which operates switches S39 and S40 which control the mechanism for erasing incoming messages (Fig. 5).

2.12 The message head carriage is also equipped with a switch S8 which prevents recording over a portion of the drum already used but not erased. This switch consists of two parts, the fixed contacts located on an insulator attached

to the head carriage and the shorting contact mounted on the switch carriage (Fig. 6). The switch carriage has a locking spring normally pressed against a slide bar on the message carriage with sufficient friction to hold it in position but not enough to keep the head carriage from pushing it along during recording of messages. On later sets the slide bar has been threaded to give a more positive action. When the machine is set for AUTOMATIC ANSWER with the message record-reproduce head at the beginning of the head carriage travel, (MESSAGE SELECTOR KNOB at zero) the switch carriage is released before the first message is recorded, by operation of solenoid L4 through the incoming carriage actuating linkage (Figs. 6 & 7) and is pulled to the zero position by means of a coil spring. The contacts are closed and remain so during recording of incoming messages but are opened when the carriage is moved manually for playing back messages.

2.13 Erasing the incoming messages is accomplished by means of 60 cycle current in a manner similar to that used for the announcement drum (Fig. 7). The erase coil core is approximately the length of the recorded area and is mounted on a pivoted support. An adjustable stop limits the travel so that the pole piece is close to the magnetic band (about .010 in.) while erasing but is at a considerable distance away when in the released position. It is operated by solenoid L4 and 115 volt 60 cycle current is turned on and off by Switch S6 which is operated by the coil bracket. Since the message drum is not always stopped at the same angular position, it is not feasible to have the erase cycle timed directly by the drum. The timing is done by cam 1-1 and relay K2, releasing relay K6 and solenoid L4 after 3-1/2 seconds or slightly more than one revolution of the drum.

External Recorder

2.14 Switches S12, S41 and S42, providing for the operation of an external recorder, are located beyond the end of the normal travel of the incoming message head carriage (Fig. 6). In order to operate these switches, the MESSAGE SELECTOR KNOB is pushed in and turned all the way to the right, past a detent. To do this requires relocation of a stop which is intended to prevent the message head carriage from operating to this position on machines not equipped with an external recorder. Since external recorders suitable for attachment to the 1A Telephone Answering Set are not available at this time, these switches (and the jack J2 providing connections to the external recorder) will not be used, although they may be sources of trouble for normal operation.

Timing Cams

2.15 Various timing functions are accomplished by the following cams (Fig. 8):

(a) Cams driven when Announce drum rotates:

Cam 1-1 Seizes line (S15)
Times message drum erase cycle (S44)

1-2 Enables calling party control relay, K7, (S14)

1-3 Flashes "Dictate" lamp (S13)

(b) Cams driven when message drum rotates:

Cam 2-1 Releases line (S16)

2-2 Times beep tones and disables AVC (S17)

2-3 Increases level on last beep tone (S18)

2.16 These cams are arranged in two groups, the first three being at the bottom and the last three at the top of the cam tower. A set of gears from the main drive shaft provides continuous drive to each of the clutches mounted on the respective cam shafts. Clutch 1 connecting the announce cams (1-1, 1-2, 1-3) to the driving gears is actuated by a lever operated by solenoid L1, which also releases the stop pawl on the announce drum. Consequently, these cams start to rotate as soon as the announce drum starts. As the cams rotate they operate their respective contact springs and also wind up the return spring. At the end of the announcement, solenoid L1 is released, releasing Clutch 1 and allowing these cams to be returned to zero position by the return spring. The other end of this return spring is attached to the other set of cams and thus serves to return either set to zero. Similarly the message cams (2-1, 2-2 and 2-3) are driven through Clutch 2 which is operated by a lever from solenoid L3 at the same time that L3 operates the message drum release pawl.

Function Selector Switch

2.17 In order to change from one function to another, as from PLAYBACK to ANSWER, it is necessary to effect a number of changes in connections. These are accomplished by two slide switches manipulated by the FUNCTION SELECTOR KNOB. A bevel gear on the knob shaft engages a similar bevel gear on the shaft extending to the right side of the machine behind the front panel. On this rod is a plate carrying a pin which engages in a pivoted T arm in a manner to push the slider of one switch in and the other slider out. Flat bars on the slides engage spring contact clips to make or break circuits as required. These contacts make up switches S21 and S38.

3. ELECTRICAL OPERATION

Amplifier

3.01 A single speech amplifier is used for recording and reproducing both incoming and outgoing messages. Associated with the speech amplifier are the automatic volume control amplifier, recording bias oscillator, and beep tone amplifier.

3.02 The speech amplifier consists of two CK-512AX Tetrodes (V1 and V2) and one 3V4 Pentode (V3). The first two tubes (V1 and V2) are of the subminiature, hearing-aid type while the remainder are miniature type. All have direct heated filaments operated on filtered DC from a 75 volt power supply. Speech input voltage is applied directly to the grid of V1, with resistance-capacitance coupling to V2. A potentiometer R-106 at the input to V2 is mounted on the amplifier chassis and is not accessible to the subscriber. It is adjusted at the factory and should not be changed in the field. Resistors R-103 and R-107 are connected across the filaments of V1 and V2 since these require only 0.020 amp. filament current while 0.050 amp. is required for the other tubes. Resistors R-104 and R-125 form a voltage divider to supply screen voltage to V1, providing a small amount of degenerative feedback. Resistor R-126 provides grid bias for V3.

3.03 Feedback is provided around V3 by means of R-130 and C-126. C-116 partially compensates for the increase in response of the magnetic reproducer at the higher frequencies. However, the response of the combined recording and reproducing operation is purposely made lower at 200 cycles than at 1000 cycles in order to obtain maximum intelligibility. Output transformer T1 is used for connecting the speech amplifier to the isolating transformer T2 for transmission to the telephone line. It is also used for the speech connection to the external recorder connection. When recording, audio output from V3 is combined with the high frequency bias from V5 and connected to one of the magnetic recording heads by way of R-112, T3, R-129, relay K4 and switch S21.

3.04 Bias Oscillator V5 is designed to operate at a frequency of about 13,000 cycles per second. When the speech amplifier is used for reproducing sound from either magnetic band, relay K4 is not operated and the filaments of V4 and V5 are shunted by a 51 ohm resistor R-117. This reduces the filament current in these tubes to about 1/3 of normal and eliminates high frequency bias and automatic volume control while reproducing either the announcement or incoming messages.

3.05 Automatic Volume Control is used during recording of both the announcement and incoming messages. Speech voltage is taken from the plate of V2 to the grid of V4 via C-111. Frequencies above 1 KC are removed by C-110, the remainder being rectified by X3 and filtered by R-102 and C-103 and fed back to V1. The filter elements are chosen to give a short attack and long release time. The AVC circuit is disabled by S17 on cam 2-2 during transmission of beep tones while recording incoming messages.

3.06 Signal or "beep" tones are obtained from the tone generator mounted on the driving motor. The comparatively low level from this generator is amplified by V6 before transmission to the line. Transformer T2 serves as an output transformer for V6 as well as the isolation transformer. The level of the first three tones (two at the beginning of the incoming message and the first of the two final warning tones) is set by the voltage divider R-205 and R-204 to give the proper level on the line. The level of the final tone is about twice as loud as the rest. Plate current is connected to V6 by switch S32 only in the AUTOMATIC ANSWER position of the FUNCTION SELECTOR KNOB.

Power Supply

3.07 Direct current for the amplifier, relays, solenoids and lamps is obtained from selenium rectifiers X1 and X2 connected to separate windings of the power transformer T4. When the ON-OFF switch is ON the relay power (48 volts) is on continuously in order that the signal lamps and relays may be immediately available for use. Current to the signal lamps, solenoids and relays K3 and K6 is filtered only by C-122. However, to reduce hum pickup in various circuits, current to relay K2 is also filtered by R-203 and C-208, and current to relays K1, K4 and K5 is filtered by R-211 and C-210. Current for operating K7 is obtained from the Central Office battery.

3.08 Rectifier X2 supplies 75 volt direct current for the amplifier only when the machine is in operation (K5 operated). Current for the vacuum tube filaments of V3, V4, V5 and V6 is filtered by C-123, R-124 and C-120 and for V1 and V2 by C-121. Current for the plate circuits of V3, V4 and V6 is filtered by C-123, R-121 and C-119, of V5 by C-123 and for V1 and V2 by C-123, R-121, C-119, R-113 and C-118. Current for the transmitter of the local telephone set when recording an announcement message is obtained from the amplifier power supply and filtered through R-123 and C-117. The circuit limits the transmitter current to about 6 milliamperes.

Calling Party Disconnect

3.09 The Telephone Answering Set is designed to function with "calling party disconnect" facilities. At locations where the central office equipment does not supply the required battery interruption, the machine will operate normally, without internal modifications, but on a fixed time incoming message basis; i.e. after the full announcement message the incoming message drum will run its full cycle, whether or not the calling party completes his message and disconnects in less than the allotted time.

Headset Playback

3.10 Headset playback can be made available for announcement check and message playback. A head receiver jack J1 is provided in the right side of the base of the 1A Telephone Answering Set for the following assembly:

1—723A Receiver

1—15A Headband

1—R2DB Cord, 6 ft. long, equipped with one 347B plug.

4. CIRCUIT DESCRIPTION (Fig. 14)

Normal Telephone Service

4.01 With ON-OFF switch S4 OFF, R terminal is connected through R1 and T terminal through T1.

Announcement-Dictate

4.02 With ON-OFF switch S4 ON and FUNCTION SELECTOR KNOB at ANNOUNCEMENT-DICTATE, the Ready Lamp lights, through S4, R207, K5, S9, S29 and P+. When START switch S2 is momentarily pressed, K3 operates and locks through its contacts 5T and 6T, STOP key S3, S27, S11, Adjustable Limit switch S7, and P1+. K3 operates K5 through 3T and 4T. K5 starts motor M1 through 1B and 2B. 4T and 5T of K5 apply AC to rectifier X2 for amplifier plate supply and operation of 2T and 3T extinguishes the Ready lamp.

4.03 K3 operates Announcement Erase Solenoid L2 through 2T, 1T and S36. L2 moves the Erase Coil close to the announcement drum and releases the adjustable limit switch (S7) holding mechanism which allows the switch arm to drop back to minimum announcement position (10-15 seconds from the start). Erase current is supplied from one side of line through S5, which is closed by operation of L2, through the erase coil L5 to contacts of the thermal overload relay and the other side of line. At the same time a path

is closed through R218, R212 through the heater winding of K9. If erase coil circuit is closed for an interval longer than permitted by the adjustment of K9, it will operate and open the circuit thus protecting the erase coils from overheating.

4.04 K1 operates through S38 and contacts 5B and 6B of K3, and locks through contacts 8T and 9T of K1 and 6B and 5B of K3. L1 Announcement Drum Clutch Solenoid operates through S24, S41, contacts 1T and 2T of K1, and 3B and 4B of K3 permitting drum and announcement cam rotation. K4 operates through 4T and 5T to K1 and activates bias oscillator and the AVC circuit by removing shunt resistor R117 from filaments by opening contacts 3T and 4T. The local telephone set is connected to the amplifier input from terminals R1 and T1 via S4, S30, S31, C203, S25, T2, R119, R120 and contacts 7B, 6B, 5T, 6T of K4.

4.05 After one drum revolution (about 3 seconds) a mechanical trip mechanism drops the erase coil and erase current is cut off by S5.

4.06 Approximately 1/2 second later (3-1/2 seconds after START key is pushed), the red Dictate lamp lights through R-206, S37, S13 of Cam 1-3 to P+.

4.07 The announcement recording head is connected to the output of the amplifier and the bias oscillator tube (V3) through S21, 1B and 2B of K4, R129, T3, R112 and C108. The announcement message is recorded on the recording band. During the recording of the Announcement, the adjustable limit switch arm and associated switch S7 are moved by the head carriage.

4.08 At the end of Announcement, the subscriber momentarily operates the STOP key S3, releasing K3, and thence solenoids L1 and L2. Releasing Solenoid L2 clamps the adjustable limit switch mechanism in a position corresponding to the end of the Announcement. The head carriage and cams restore to normal when L1 is released. K5, however, stays operated until the announcement drum is indexed because S19 is held closed by the announcement drum clutch pawl until the announcement drum has rotated to a point where the pawl can drop in the notch. Release of K5 lights the Ready lamp. Switch S20 which is in the ringup circuit is closed when the pawl is in the notch of the drum.

4.09 If the STOP switch is not pressed by the subscriber, the adjustable limit switch S7 operates at the limit of its arm travel (30 sec.) and releases K3 after which the above action takes place.

Announcement-Check

4.10 With ON-OFF switch S4, ON and FUNCTION SELECTOR KNOB at ANNOUNCEMENT CHECK, the Ready lamp is lighted through S4, R-207, 3T and 1T of K5, S9, S29 and P+.

4.11 When START switch S2 is momentarily pressed, K3 operates and locks up through 5T and 6T, STOP switch S3, S27, S11, Adjustable Limit Switch (S7) and P1+.

4.12 K3 operates K5 through 3T and 4T which starts Motor M1 through 1B and 2B of K5. K5 applies B+ voltage to amplifier by connecting rectifier X2 to AC and also extinguishes Ready lamp.

4.13 K3 operates L1 Announcement drum clutch solenoid using P+ through 3B and 4B of K2, 2T and 3T of K1 and S23 to L1.

4.14 Announcement drum recording head H1 is connected through 2 and 3 of S22, 7T and 6T of K4 to amplifier input. Amplifier output is connected to Telephone Set through S25 to R201 in order to reduce the level of the message compared to that heard by a distant subscriber.

4.15 Announcement is reproduced in receiver of the local telephone set or the Auxiliary Headset. The latter, if used, is plugged into jack J1 which is in the right-hand side of the base near the back.

4.16 Announcement cams rotate but perform no operating functions.

4.17 At end of Announcement, Adjustable Limit switch S7 operates, releasing K3 and L1. Head carriage and cams return to standby position. If STOP key S3 is pressed before S7 operates, K3 is immediately released. K5 stays operated until Announcement drum is indexed because S19 is held closed by the clutch pawl until indexing is completed. K4 releases and Ready lamp lights.

Message Playback

4.18 With ON-OFF switch S4 ON and FUNCTION SELECTOR KNOB at MESSAGE PLAYBACK, START key S2 is momentarily pressed, operating K3 which locks through STOP key S3, S27, S11, S7 and P1+.

4.19 K3, through its contacts 4T and 3T, operates K5 which starts motor M1 through 1B and 2B and applies AC from transformer T4 through 5T and 4T of K5 to X2 to supply B+ voltage to amplifier. READY lamp is extinguished.

4.20 K3 operates Message Drum Clutch Solenoid L3, and connects P+ through 3B and 4B, 2T and 3T of K1 and S23 to L3.

4.21 Message drum and cams rotate until they reach their stop. The cam rotation is incidental; no operating function being performed.

4.22 The subscriber picks out messages to be played back from the message drum with the MESSAGE SELECTOR KNOB which must be pushed forward before it can be turned and then released for reproduction. The MESSAGE INDICATOR DIAL remains stationary and serves as an index for the end of the last recorded incoming message and the amount of space remaining for recording.

4.23 The Message drum pickup head H2 is connected to the amplifier input through 1 and 3 of S22 and 7T and 6T of K4. Messages are reproduced in the Telephone Set or Headset through S25 and the Playback Volume Control, R-202.

4.24 The Message drum is stopped by the subscriber operating STOP Switch S3 or by limit switch S11. The latter opens when the head carriage reaches the end of the drum and has the same effect as operating S3 except that S11 remains open until the Message head carriage is manually returned by means of the MESSAGE SELECTOR KNOB to a position away from this end of the drum.

Automatic Answer

4.25 With ON-OFF switch S4 ON and FUNCTION SELECTOR KNOB at AUTOMATIC ANSWER, and with Message head in position to receive a message, S8, S9, S10, S11 are closed. READY lamp is lighted through S4, R-207, 3T and 1T of K5, S9 and S8 to P+.

4.26 See Par. 4.50 for description of erasing process involved in the recording of the first incoming message.

4.27 Ringing current from terminals R and G passes through S4, C-202, thermistor R-215, S10, S35, S20 and is rectified by varistor X4 and actuates winding 6T and 4B of K2. K2 locks up through winding 3B and 5T, R-203, 1B and 2B of K2, through 3B and 2B of K1, S14A of cam 1-2, S16 of cam 2-1, S34 and S8 to P+.

4.28 K2 operates K3 through 1T and 2T of K2 and S8 to P+.

4.29 K3 operates K5 through 3T and 4T of K3 to P1+. Motor M1 starts through 1B and 2B of K5 to AC power. K5, 4T and 5T supplies AC to rectifier X2 furnishing

B+ to amplifier and extinguishes Ready lamp by contacts 1T and 3T.

4.30 L1 operates from P+, through 3B and 4B of K3, 2T and 3T of K1 and S23.

4.31 L1 releases Announcement drum pawl and engages announcement cam clutch 1.

4.32 Approximately 3-1/2 seconds after K2 operates DC termination of the telephone line is completed via terminals R and T, S4, S15 contact of cam 1-1, winding of K7, S14B of cam 1-2, 5B and 6B of K1, S30 tripping ringing current.

4.33 K7, "Calling Party Disconnect" relay, operates and closes locking path to CO battery from terminal R through S4, S15 of cam 1-1, winding of K7, 1T and 2T of K7, S30, S4 and terminal T.

4.34 Announcement goes out on line as follows: Announcement head H1 is connected to amplifier input via S22, 7T and 6T of K4. Amplifier output is connected to the telephone line via T1, 1T and 2T of K4, T2, S25, S30, S31, S15 of cam 1-1 and S4 to T and R.

4.35 About 1 second after the telephone line is terminated, cam 1-2 opens contacts of S-14B, making DC line termination dependent on holding of K7 through its 1T and 2T contacts. Any interruption of Central Office battery will then cause K7 to release, which causes Answering Set to return to standby condition by release of K2, which also releases K3 and K5. If the calling party disconnects during the announcement, the open contacts of S20, (associated with the announcement drum clutch) prevent K2 from operating on a new call until the drum and cams are indexed.

4.36 At end of Announcement, K1 relay operates from P1+ through Adjustable Limit Switch (S7), S33, K1 winding to ground.

4.37 K1 locks up through 8T and 9T, 6B and 5B of K3 to P1+.

4.38 K1 contacts 7B-8B take over the job of holding the Telephone Line from S15 of cam 1-1 and L1 is released by opening of 2T and 3T of K1. This disengages announcement head half-nut, releases clutch 1 and allows the head H1 and announcement cams to return to normal positions.

4.39 L3 operates from P+ through 3B and 4B of K3, 2T and 1T of K1, S41 and S24. Message drum starts rotating and cam clutch 2 engages to start incoming message cams rotating.

4.40 K4 operates through 4T and 5T of K1, to P1+.

4.41 The telephone line is connected via terminals R and T, S4, S30, C203, S25, C124, C125, T2, R119, R120, 7B, 6B, 5T, 6T of K4 to input of speech amplifier. The output of the speech amplifier is connected to the message recording head, H2, via 2B and 1B of K4 and S21.

4.42 About 1/2 second after S7 operates, cam 2-2 operates S17 twice connecting B+ to Beep Amplifier transmitting two beep tone signals to Line and to Message head through Amplifier.

4.43 Incoming message is recorded on drum through the Amplifier and recording head.

4.44 Cam 2-2 operates S17 again about 25 seconds after recording starts, sending the third beep out on the Line in the same manner as the first 2 beeps.

4.45 About one second later cam 2-3 operates S18 and overlaps the fourth operation of S17 by Cams 2-2, and connects full output of tone generator to Amplifier.

4.46 S16 of cam 2-1 releases K2 about 2-1/2 seconds after last beep is transmitted, allowing a total of about 28 seconds recording time including beep tones.

4.47 Release of K2 releases all relays; Motor stops; Message drum stops; Message cams return to zero, telephone Line DC path is opened and set is ready to answer another call.

4.48 If the Telephone Line battery supply is interrupted for a short time, (as by calling party disconnect in certain types of C.O. or PBX) during the call when K7 is controlling the telephone line termination, K7 releases, releasing K2, stopping the cycle and the Answering Set returns to standby condition ready to receive another call.

4.49 When the Incoming Message head reaches the point on the drum where there is inadequate space for another complete recording cycle, S9 contacts are opened by the cam on the MESSAGE SELECTOR KNOB and the READY lamp will not light at the end of the call. Slight additional movement of this cam causes S10 to open the operating ground for the K2 relay and a "don't answer" condition will be presented to subsequent calls. After the head travels an additional distance equivalent to 30 seconds of message recording, S11 is opened by the same cam. This opens the circuit to L3 so that the Message-record-reproduce head will run off the end of the drum.

Incoming Message Drum Erasure

4.50 With ON-OFF switch S4 ON and FUNCTION SELECTOR KNOB at AUTOMATIC ANSWER, MESSAGE SELECTOR KNOB, to extreme counter-clockwise position and MESSAGE INDICATOR DIAL to extreme counter-clockwise (zero) position, S39 and S40 are closed.

4.51 P+ through S40, S9, 1T and 3T of K5, R207, lights the Ready lamp. Ringing current on the first call operates K2, as in Automatic Answer, above.

4.52 K3, K5, L1 operate—starting motor, amplifier, announcement drum and cams, and READY lamp is extinguished as described above.

4.53 The message drum erase relay, K6, operated from P+ via 3B and 4B of K3, 2T and 3T of K1, S39, 3T and 4T of K2, and S44 of Cam 1-1 then locks through 1T and 2T of K6.

4.54 K6 operates L3 through 1B and 2B starting incoming message drum and cams. K6 also operates L4, incoming message drum erase solenoid, through 3T and 4T which moves the Erase Coil close to drum. Erase current is supplied from one side of power line through S6, which closes as Erase Coil is raised, through erase coil to contacts of thermal overload relay K9 and other side of power line. At the same time a path is closed from S6 through R219, R213 through the heater winding to contacts of K9. If the erase coil circuit is closed for an interval longer than permitted by the adjustment of K9, the thermal relay will operate and open the circuit thus protecting the erase coil from serious overheating. Operation of L4 also releases flyback contact (S8) allowing it to return to incoming message head carriage and close the P+ circuit.

4.55 After a little more than one revolution of the Incoming Message drum, (about 3-1/2 seconds) S44 of cam 1-1 opens and releases K6 and the erase coil drops back to its normal position, at which time erase current is cut off by S6.

4.56 K6 also releases L3 stopping incoming message drum and releasing clutch 2 which allows the message cams to return to zero position.

4.57 Switch S15 of Cam 1-1 closes the DC path of the Telephone Line as Incoming Message drum erase cycle ends tripping the ring and operating K2.

4.58 Remainder of answering cycle proceeds as in Automatic Answer.

4.59 The MESSAGE INDICATOR DIAL is advanced by the lead screw and associated mechanism during the erasure cycle and S39 and S40 are opened, which prevents erasure from occurring on subsequent calls.

5. REQUIREMENTS AND PROCEDURES

5.01 Determine, if possible, whether or not the subscriber has been properly operating the controls. Prior to inspecting the mechanism of the Answering Set for defects, check the power, station and set connections. With the ON-OFF switch in the OFF position, check the normal operation of the associated telephone set.

5.02 Some of the troubles of the 1A Telephone Answering Set may be located by the careful visual inspection for obvious defects. When inspecting the set look particularly for the following:

1. Burned out pilot lamps. Before inserting a new Ready or Medallion lamp (K-2 type), a portion of the white plastic band around the lamp should be removed with a knife or other sharp instrument so that the light is directed at the panel. The Dictate lamp (51A type) needs no modification. If lamps repeatedly burn out the sets should be returned for repair. As a temporary expedient the K-2 type lamps may be replaced by the C-2 type.
2. Vacuum tubes not seated in their sockets. (Note that the two CK512AX tubes are oriented so that the red mark on the tube base faces the outside of the set and coincides with the molded dot on the socket.)
3. Improper adjustment of switch contacts or contact operating cams. In cases where contacts are not readily accessible and in case of malfunctioning of tower cams the set should be replaced.
4. Displaced wiring or cables interfering with operation of set.
5. Obstruction of moving parts.
6. Binding of carriage bails due to improper location of front panel.
7. Control knobs loose on shafts.
8. Bevel gears loose on shafts.
9. Loose collars on drum shaft.
10. Loose or improperly adjusted lever linkage connected between solenoids and operating mechanisms.
11. Loose assemblies or components.

12. Drive belts loose or not in place on pulleys.

Note: the corrective measures in most of the cases are obvious.

5.03 The following adjustment requirements (5.04 to 5.12) are included only to assist the repairman in locating and clearing trouble.

Erase Coils

5.04 Erase coils shall erase messages completely and shall not touch the drum at any point during a complete revolution. If the coil cannot be readily and satisfactorily adjusted by the adjusting nuts (Fig. 7) the set should be replaced.

Recording Heads

5.05 Lamination of magnetic recording heads should be free of rough spots, nicks, spreading, etc. If heads are not satisfactory the set should be replaced.

5.06 The pressure of the head when lowered on the recording band shall be between 20-35 grams measured normal to the band. No attempt should be made to adjust these heads.

5.07 Wax may be removed from surfaces of the heads by carefully scraping with a KS-6320 orange stick.

Recording Bands

5.08 The bands shall not be loose on the drums. If bands are loose replace the machine.

5.09 Excess wax may be removed from the bands by wiping the bands with a lint-free cloth, such as KS-2423 Twill Cloth, saturated with General Electric Co. No. 10-C Insulating Oil. Excess oil shall be wiped from the band with a dry cloth and care should be taken that the oil does not get on the drum or other parts of the set.

Drive Belts

5.10 The drive belts from the motor to the drum should be tensioned so as to drive the drums without slippage of the belts or stalling of the motor. Proper tension of the belts can be approximately checked by operating the set in the ANNOUNCEMENT CHECK condition. The motor should drive the announcement drum at an even speed. Grasp the edges of the announcement drum and stop it from rotating. (Never handle the recording band.) The motor should not stall, the drive belts should not slip and the drum shaft should con-

tinue to turn. If belt adjustment is necessary, it may be accomplished by repositioning the idler pulleys. The pulleys should be positioned so that the belt rides evenly on the pulleys. In no case should the idler pulley be positioned so that the clearance between the two halves of the belt be less than one quarter inch. Upon completion of adjustment repeat above test several times. If set does not meet these requirements it should be replaced.

Spring Pile-Ups (Except Relays):

5.11 If the following requirements are not met the springs may be adjusted or the set removed.

1—The distance between contact springs intended never to make contact and between contact springs and other metal parts shall be minimum 0.015".

2—All contacts when open shall have a gap of minimum 0.006".

3—The pressure between contacts when closed shall be a minimum of 15 grams.

4—All contacts shall have an observable follow.

5—The point of contact shall fall wholly within the circumference of the opposing contact at all times during contact.

6—The spring pile-up shall meet the requirements for gap, pressure and follow for both normal and operated position.

S9, S10, S11 Adjustment

5.12 The switch springs provide the following approx. timing sequence:

S9 Opens—5 sec. later S10 Opens—30 sec. later S11 Opens. Above requirements are met if machine functions as outlined in Par. 4.49.

KS-15662 Inverter

5.13 In areas with DC power supply the KS-15662, L-1 Inverter is used. This is equipped with a circuit breaker which has an external reset near the power cord entrance. If this circuit breaker operates frequently the vibrator should be suspected. The vibrator is an internal plug-in unit listed as a KS-15662, L-2 Vibrator.

Final Test

5.14 Make final check of complete operating sequence of the four functions performed by the 1A Telephone Answering Set—Announcement Dictate, Announcement Check, Auto-

matic Answer and Message Playback. If the set fails to perform satisfactorily, and the above maintenance procedures do not remedy the fault, replace the set.

Handling and Transporting

5.15 Before set is removed, the two erase coils should be clamped in position for transporting and the two recording heads should be secured to prevent contact with the recording drums. (See procedure in Section C55.608.)

5.16 It is desirable to transport all 1A Telephone Answering Sets in a shipping carton which shall protect it externally and cushion it from shock. The exterior of the carton should be marked in such a manner as to promote careful handling (for example: FRAGILE—HANDLE WITH CARE).

6. TOOLS AND SPARE PARTS

6.01 The following special tools are required for maintenance of the 1A Telephone Answering Set.

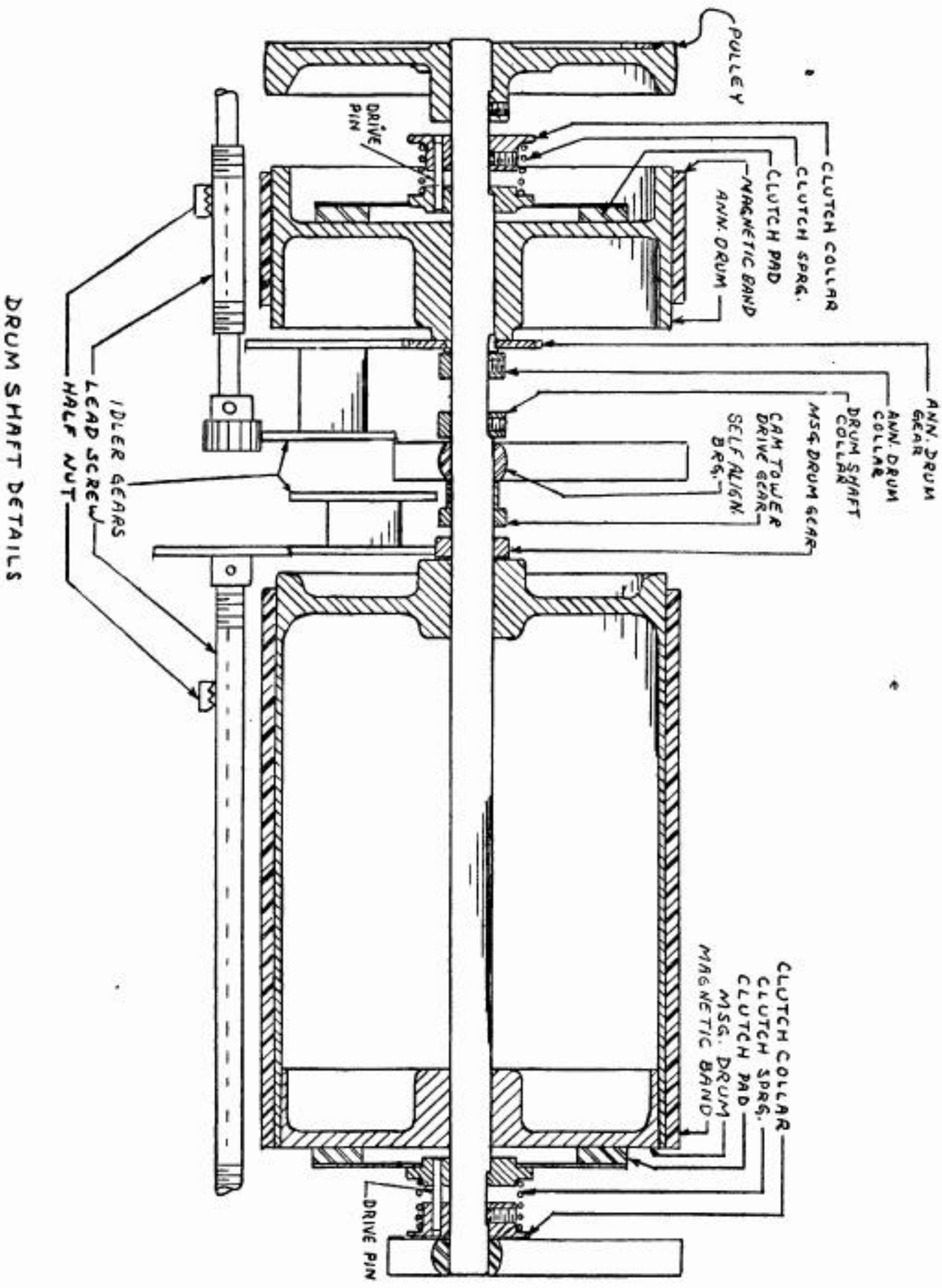
(a) 1/16", 5/64", 3/32" and 5/32" Allen Hexagonal Key Wrenches.

(b) #1 and #2 Phillips screwdrivers.

6.02 The following is a list of the more common spare parts that can easily be replaced in the field.

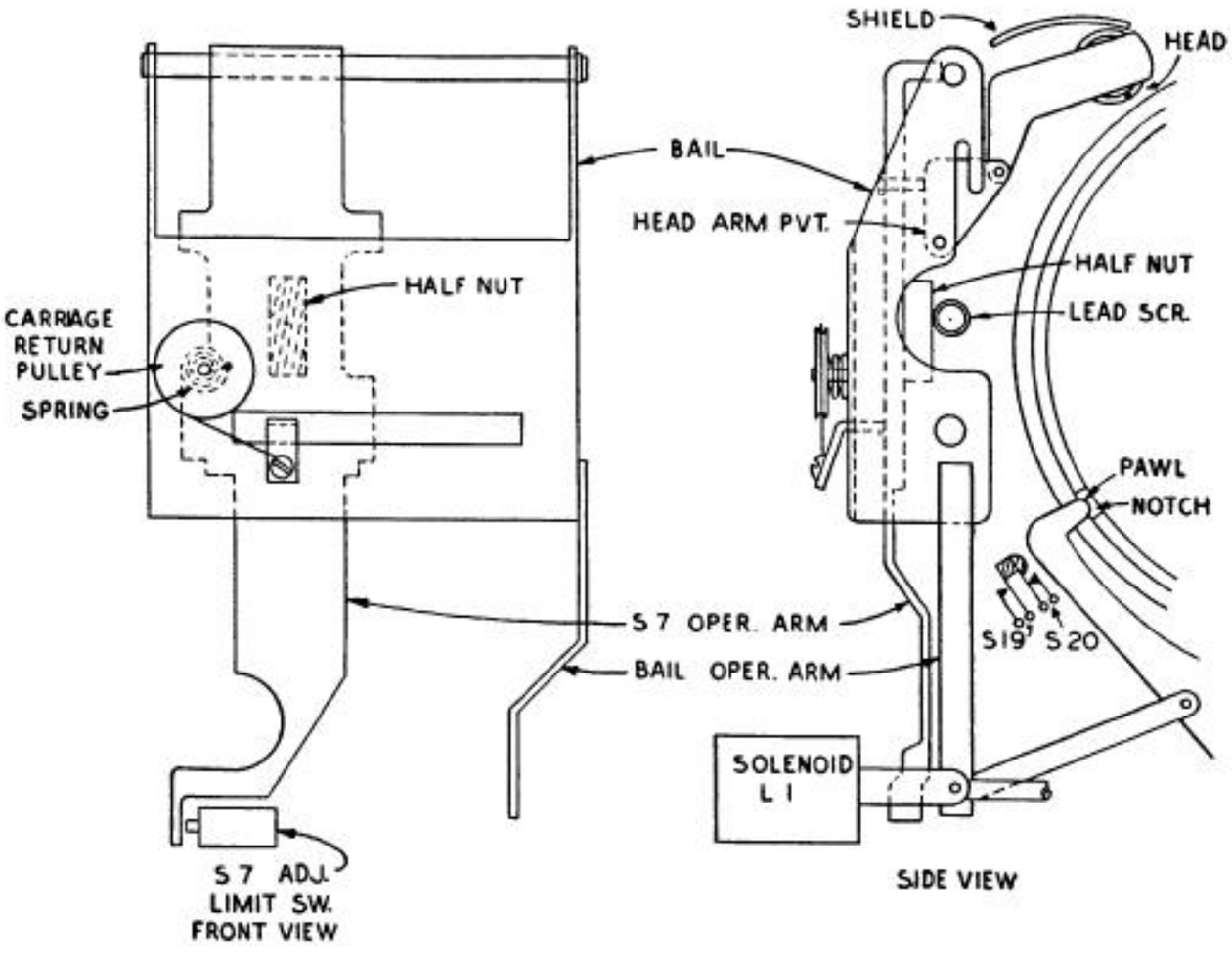
Cct. Designation or Part No.		
F1	Fuse—2 Amp.	Bussman Type AGC or Littel Fuse 312002 (Early Sets)
F1	1 Amp.	Bussman Type AGC or Littel Fuse 312001 (About Serial No. 1530 Up)
FM1	Fuseholder	Bussman Type HKP
	Lamp (On-Off)	W.E. Co. No. K-2
	Lamp (Ready)	W.E. Co. No. K-2
	Lamp (Dictate)	W.E. Co. No. 51-A
V1, V2	Vacuum Tube	Raytheon CK-512AX (Cut lead lengths to 5/32 to 7/32 in.)

Cct. Designation or Part No.		
V3, V4, V5, V6	Vacuum Tube	RCA, G.E. or Equiv. 3V4
B177612	Knob (ON-OFF and Volume)	
B177612	Knob (Message Selector)	
B177613	Knob (Function Selector)	
B177647	Dial (Message Indicator)	
B177717	Medallion (Bell System)	
B178353-1	Button Assembly (Start)	
B178353-2	Button Assembly (Stop)	
B177478-1	Drive Belt, Motor, 15″ long	
B177478-2	Drive Belt, Drum, 17-1/8″ long	
B177846	Cover Plate, External Recorder Jack	



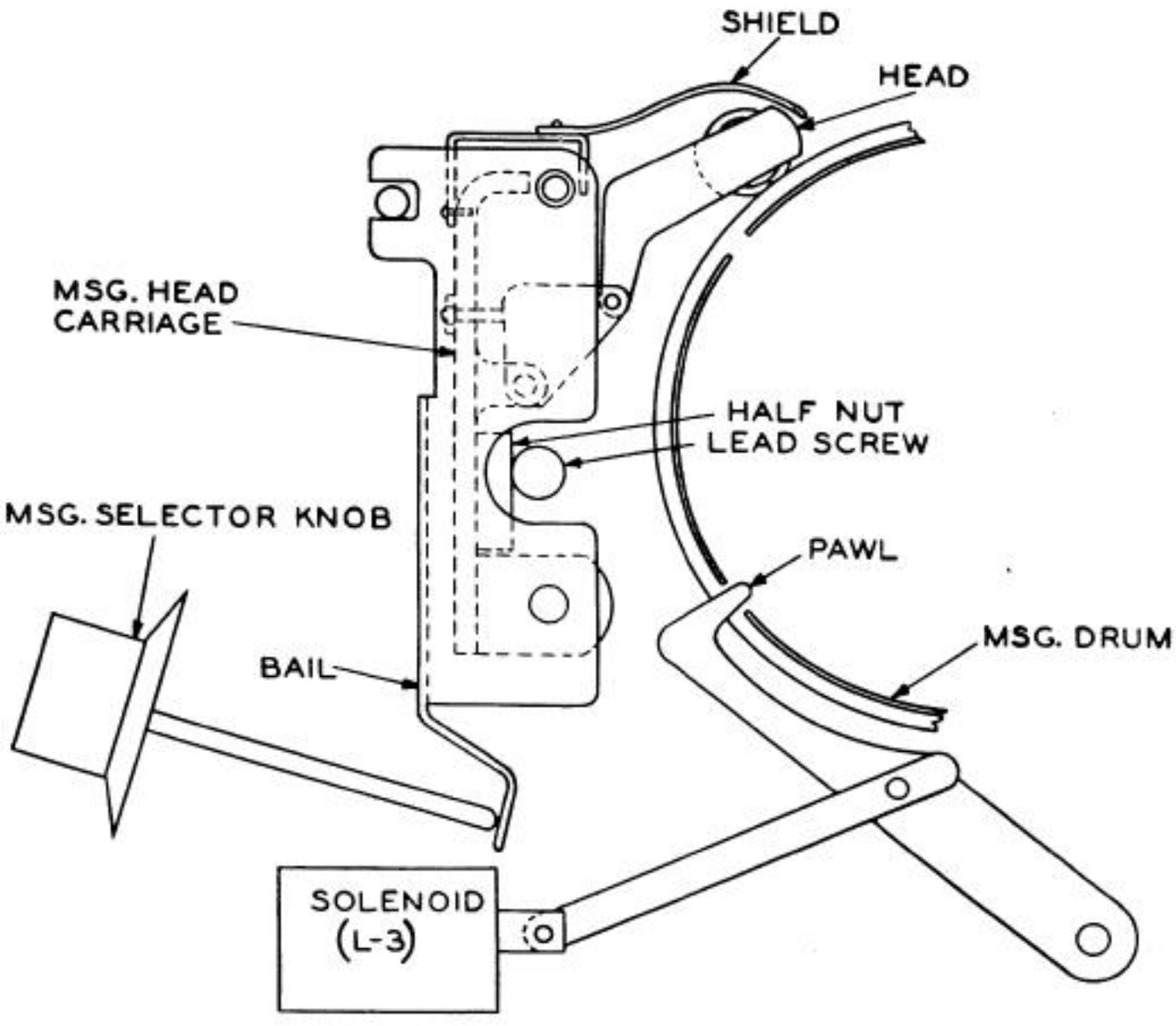
DRUM SHAFT DETAILS

Fig. 1



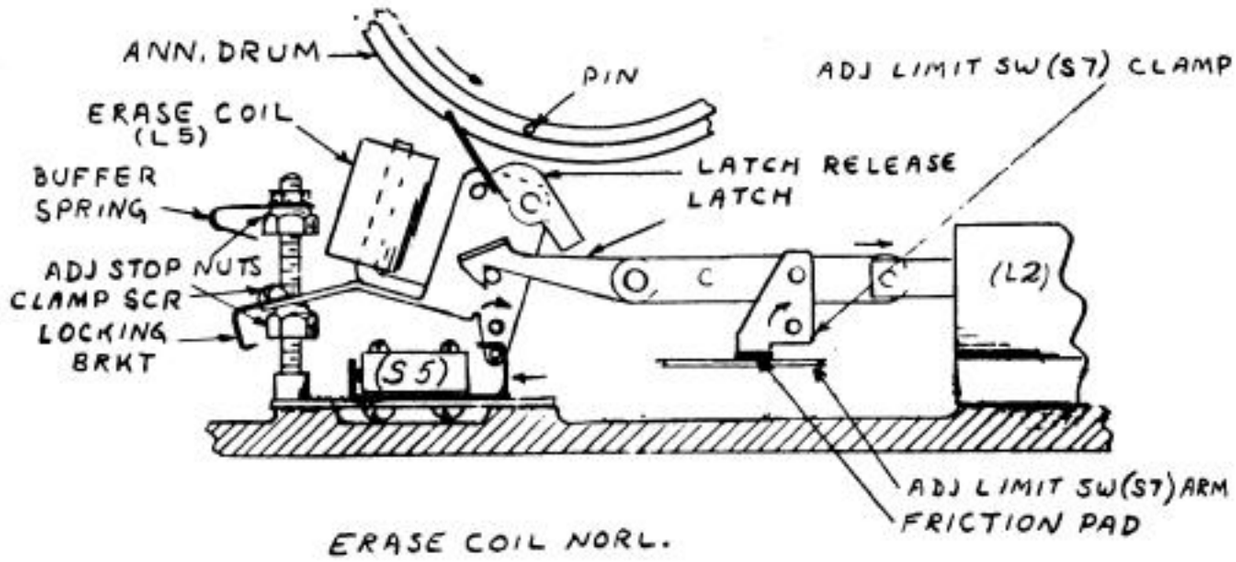
ANNOUNCE DRUM RECORDING HEAD DETS.

Fig. 2

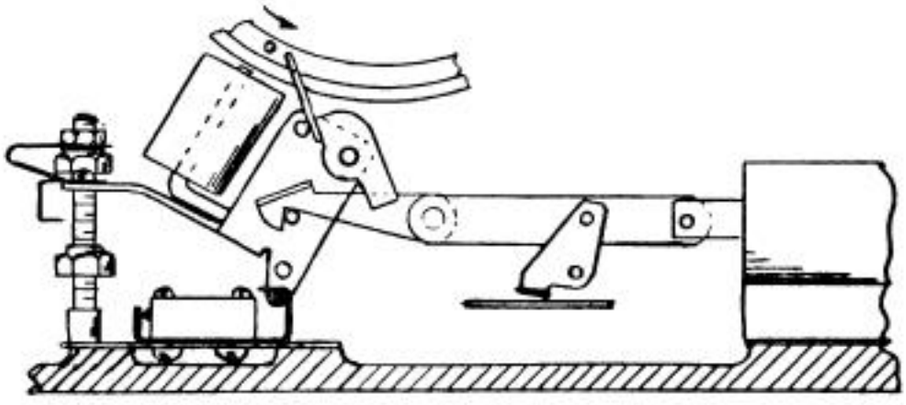


MESSAGE DRUM RECORDING HEAD DETS.

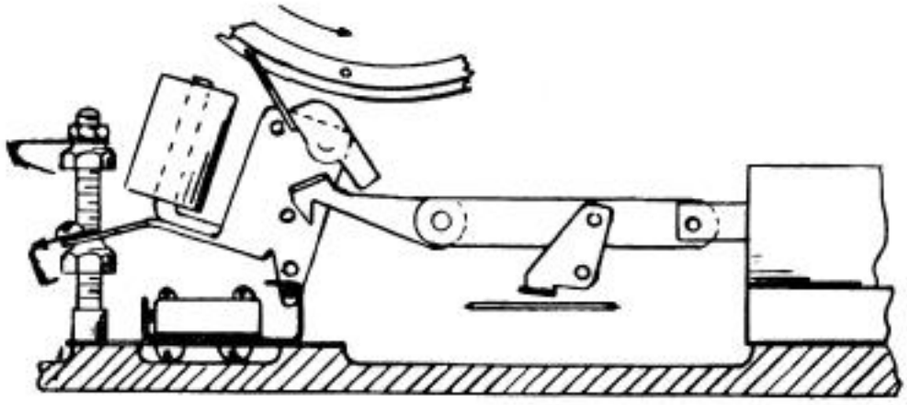
Fig. 3



ERASE COIL NORL.



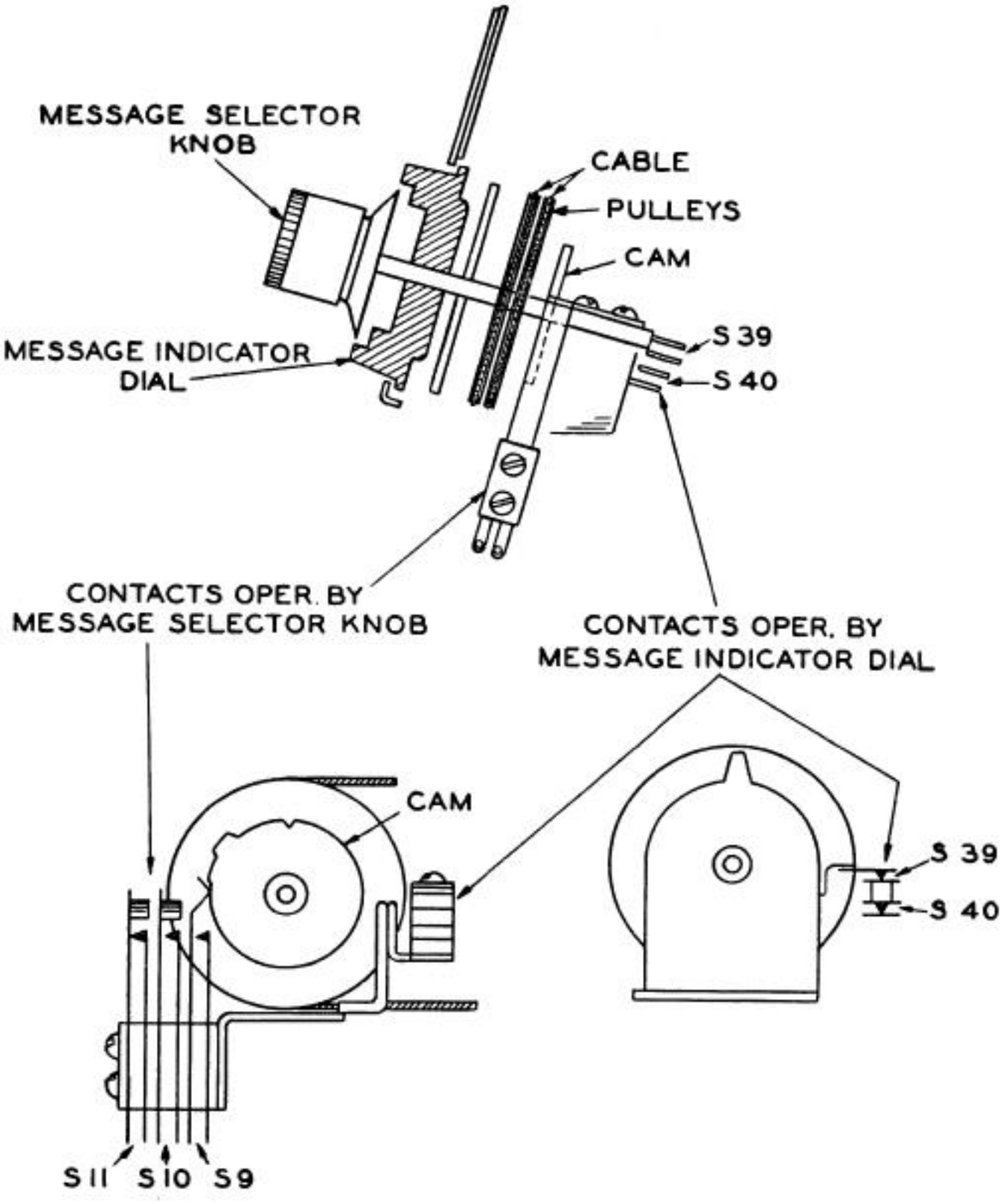
ERASE COIL OPER. - (L2) OPER.



ERASE COIL NORL. - (L2) OPER.

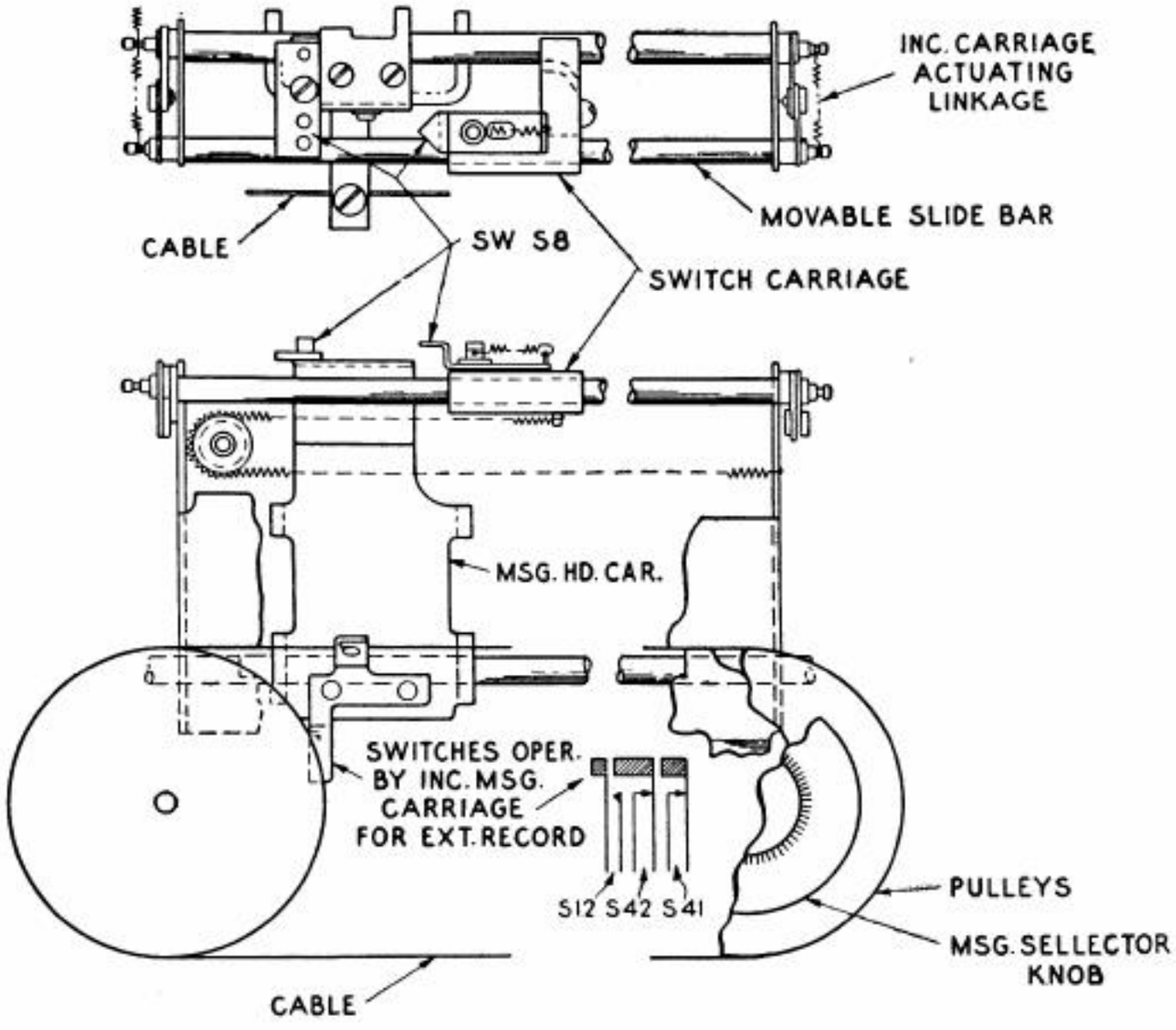
OPERATION OF ANN. DRUM ERASE COIL

Fig. 4



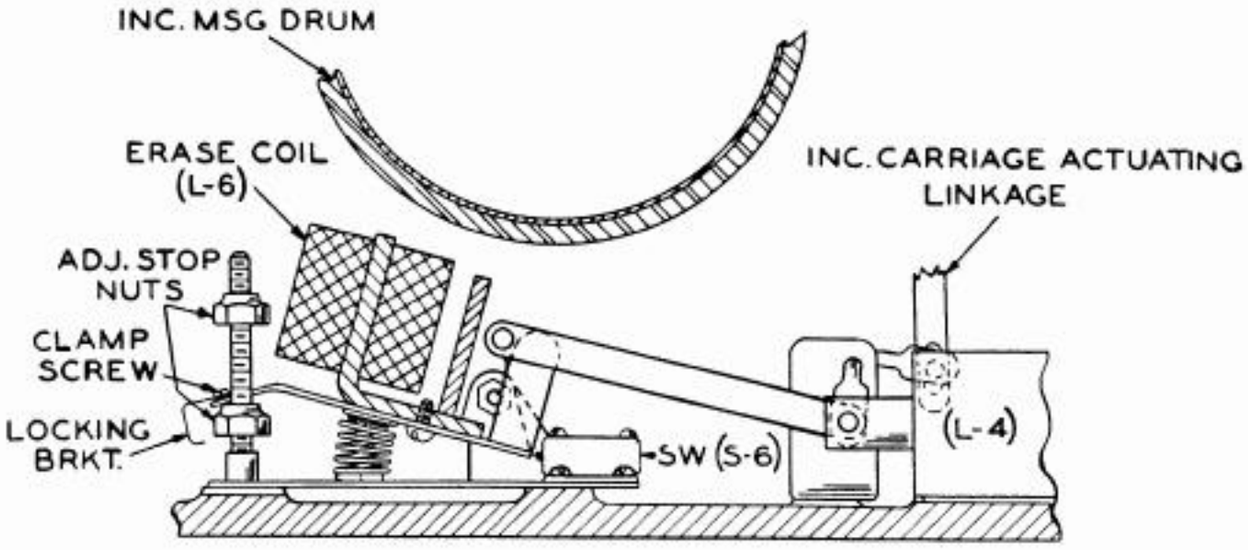
MESSAGE SELECTOR KNOB & INDICATOR CONTACT ASSEMBLIES.

Fig. 5

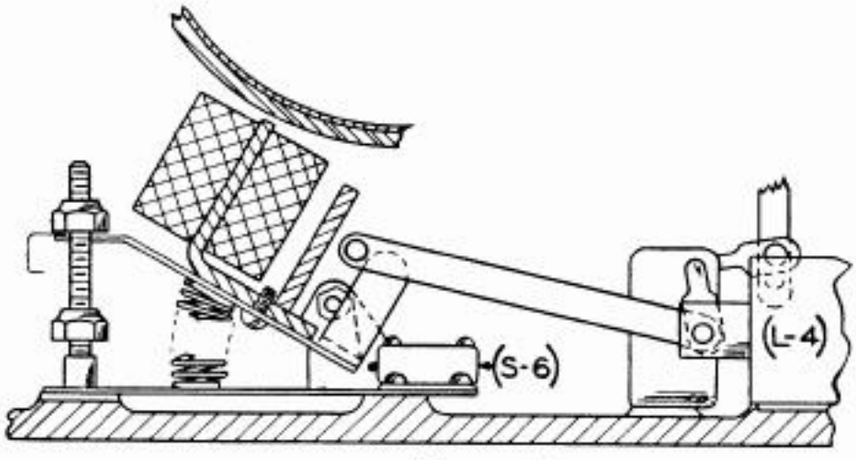


INCOMING MESSAGE CARRIAGE DETS.

Fig. 6



ERASE COIL NORMAL



ERASE COIL IN "ERASE" POS.

MESSAGE DRUM ERASE COIL DETS.

Fig. 7

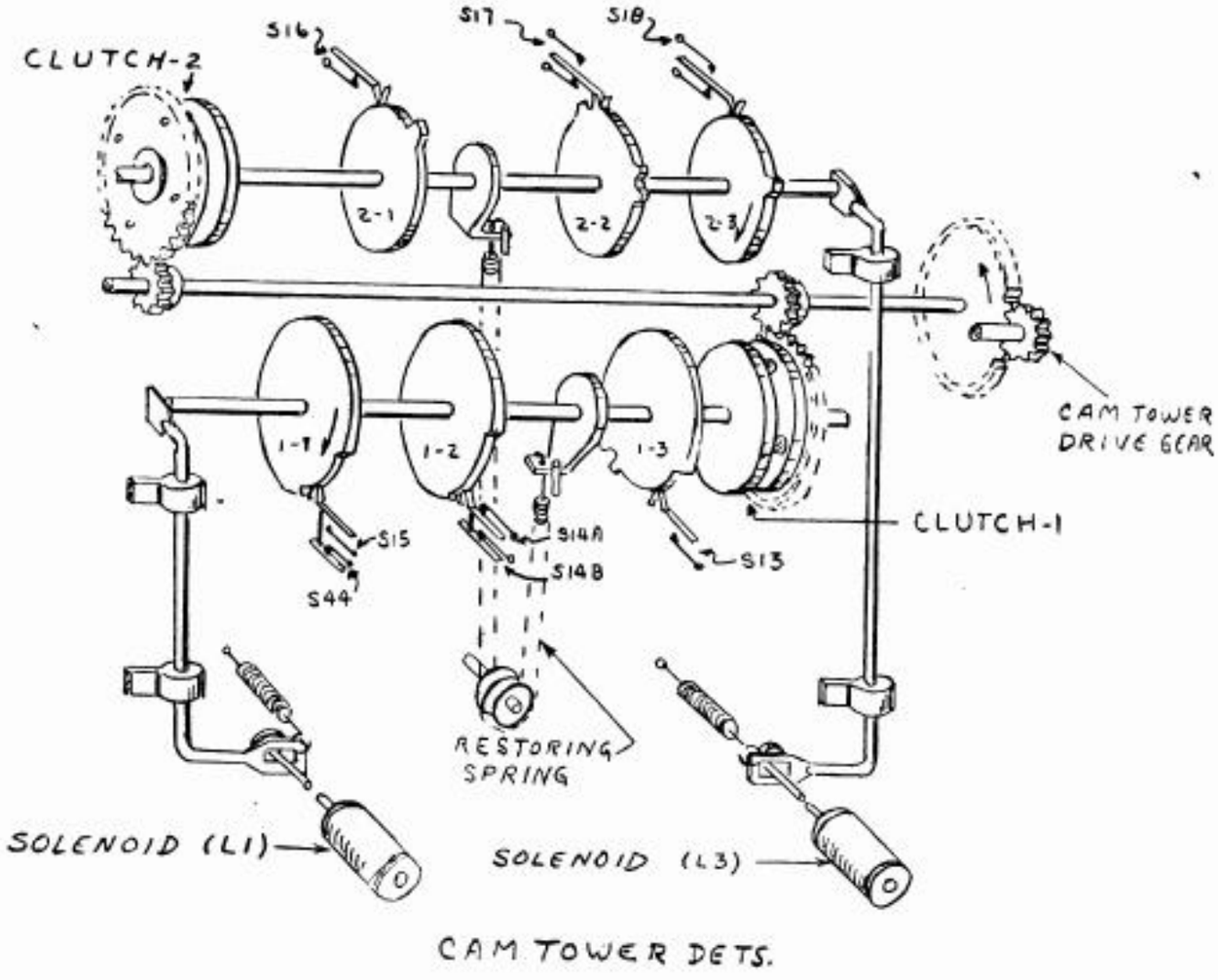
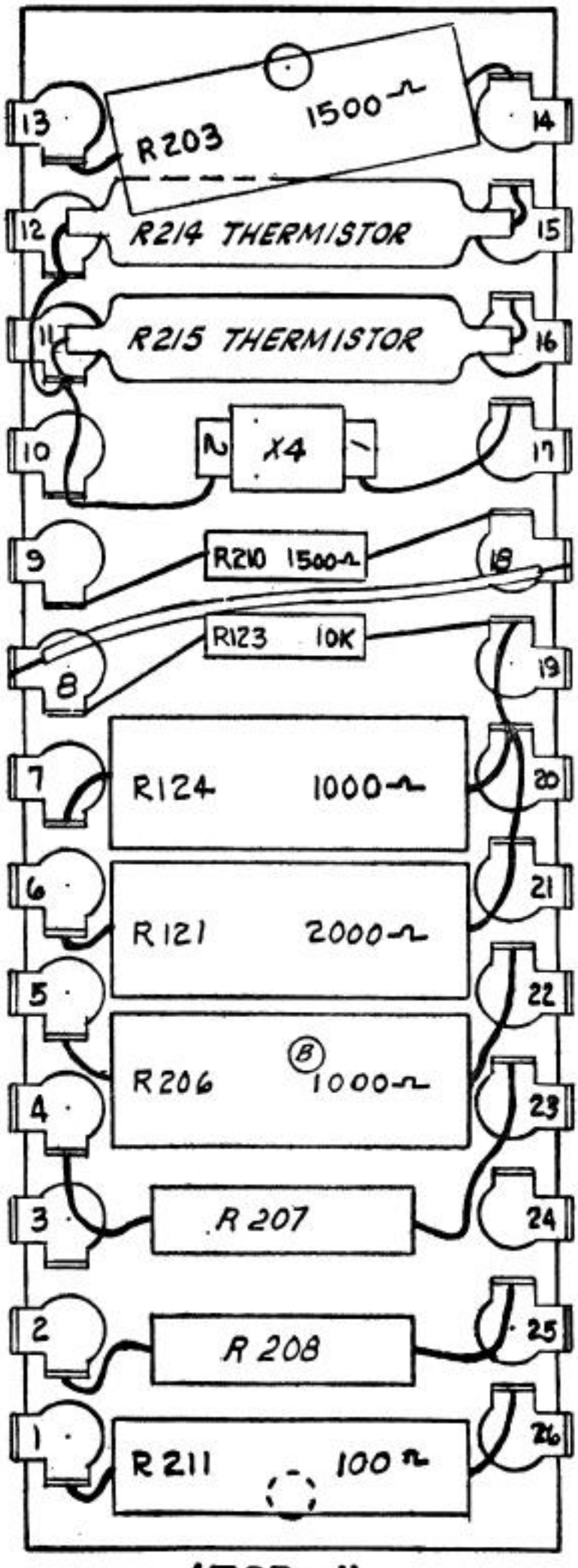
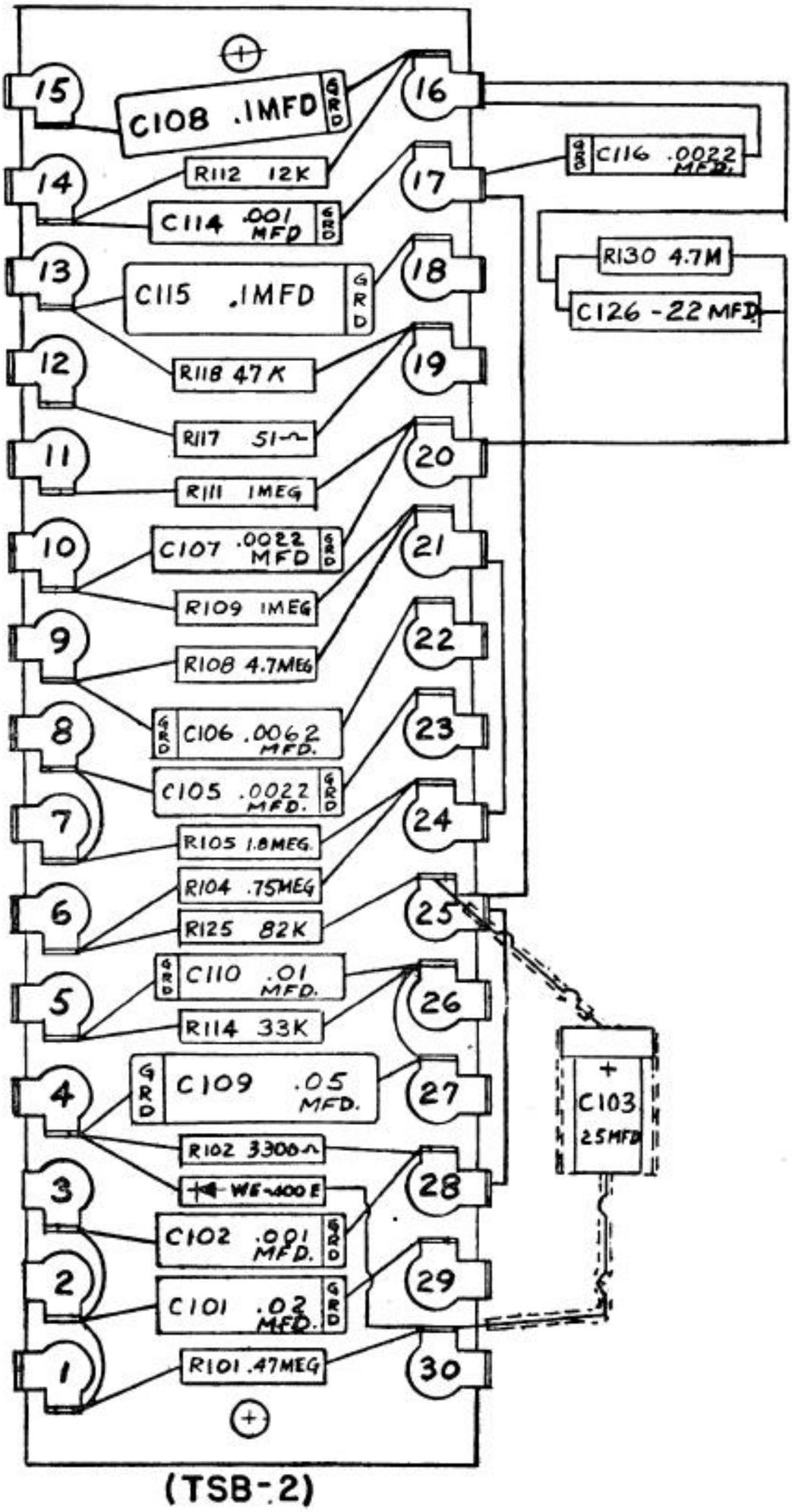

CLUTCH-2
S16
S17
S18
2-1
2-2
2-3
1-1
1-2
1-3
CAM TOWER
DRIVE GEAR
CLUTCH-1
S15
S44
S14A
S14B
S13
RESTORING
SPRING
SOLENOID (L1)
SOLENOID (L3)
CAM TOWER DETS.

Fig. 8


13
R203
1500Ω
14
12
R214 THERMISTOR
15
11
R215 THERMISTOR
16
10
2
X4
1
17
9
R210 1500Ω
18
R123 10K
8
19
7
R124
1000Ω
20
6
R121
2000Ω
21
5
22
R206
B
1000Ω
4
23
3
R 207
24
2
R 208
25
1
R 211
100Ω
26

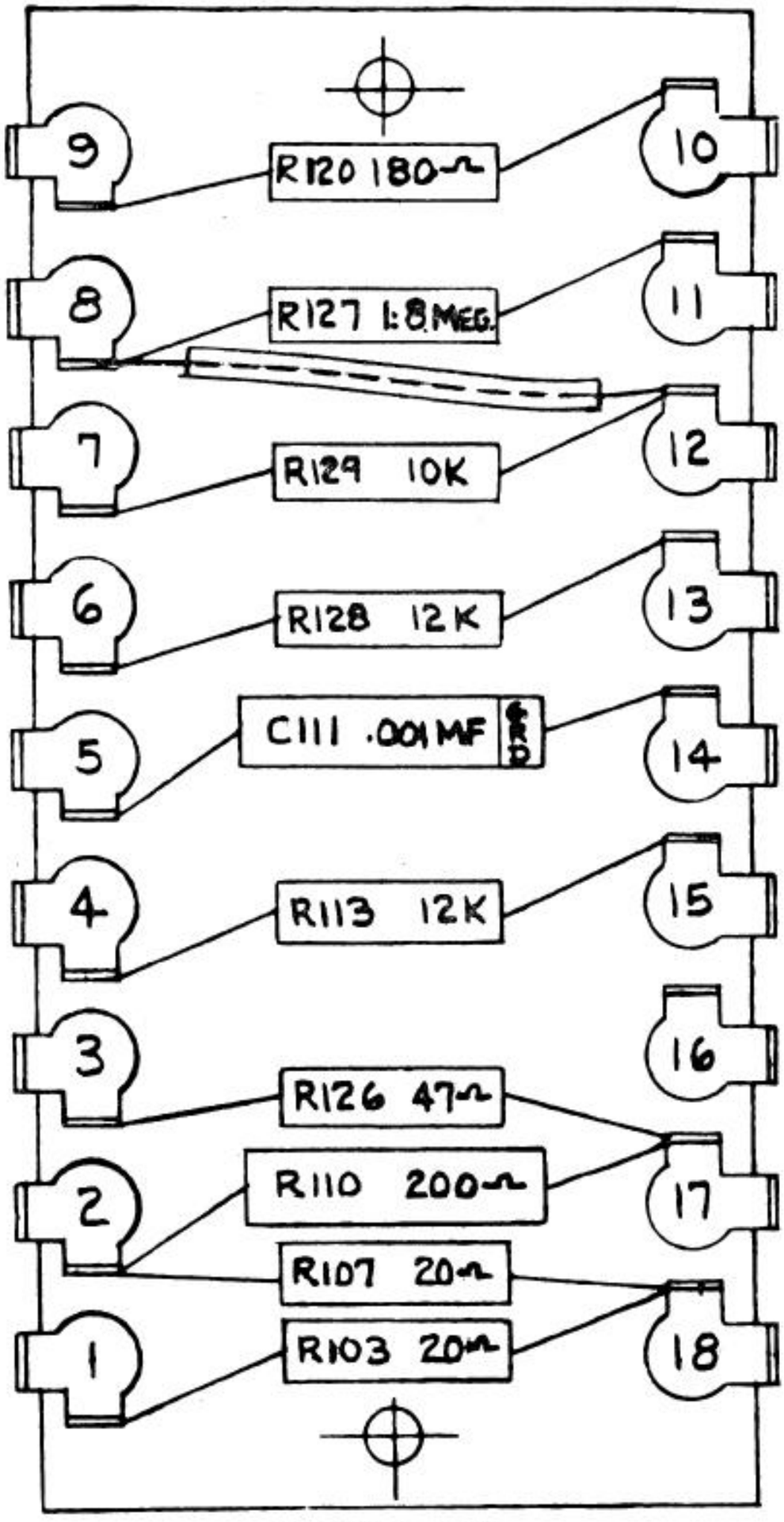
(TSB - 1)

Fig. 9


15
C108 .1MFD GRD
16
14
R112 12K
C114 .001 MFD GRD
17
C116 .0022 MFD.
13
C115 .1MFD GRD
18
R130 4.7M
C126 - 22 MFD.
12
R118 47K
19
11
R117 51
R111 1MEG
20
10
C107 .0022 MFD GRD
21
R109 1MEG
9
R108 4.7MEG
22
8
GRD C106 .0062 MFD.
23
C105 .0022 MFD. GRD
7
R105 1.8MEG.
24
R104 .75MEG
6
R125 82K
25
GRD C110 .01 MFD.
5
R114 33K
26
4
GRD C109 .05 MFD.
27
C103 2.5MFD
R102 3300
3
WE-400E
28
C102 .001 MFD. GRD
2
C101 .02 MFD. GRD
29
1
R101 .47MEG
30

(TSB-2)

Fig. 10


9
R120 180Ω
10
8
R127 1.8 MEG.
11
7
R129 10K
12
6
R128 12K
13
5
C111 .001 MF
GND
14
4
R113 12K
15
3
16
R126 47Ω
2
R110 200Ω
17
R107 20Ω
1
R103 20Ω
18

(TSB-3)

Fig. 11

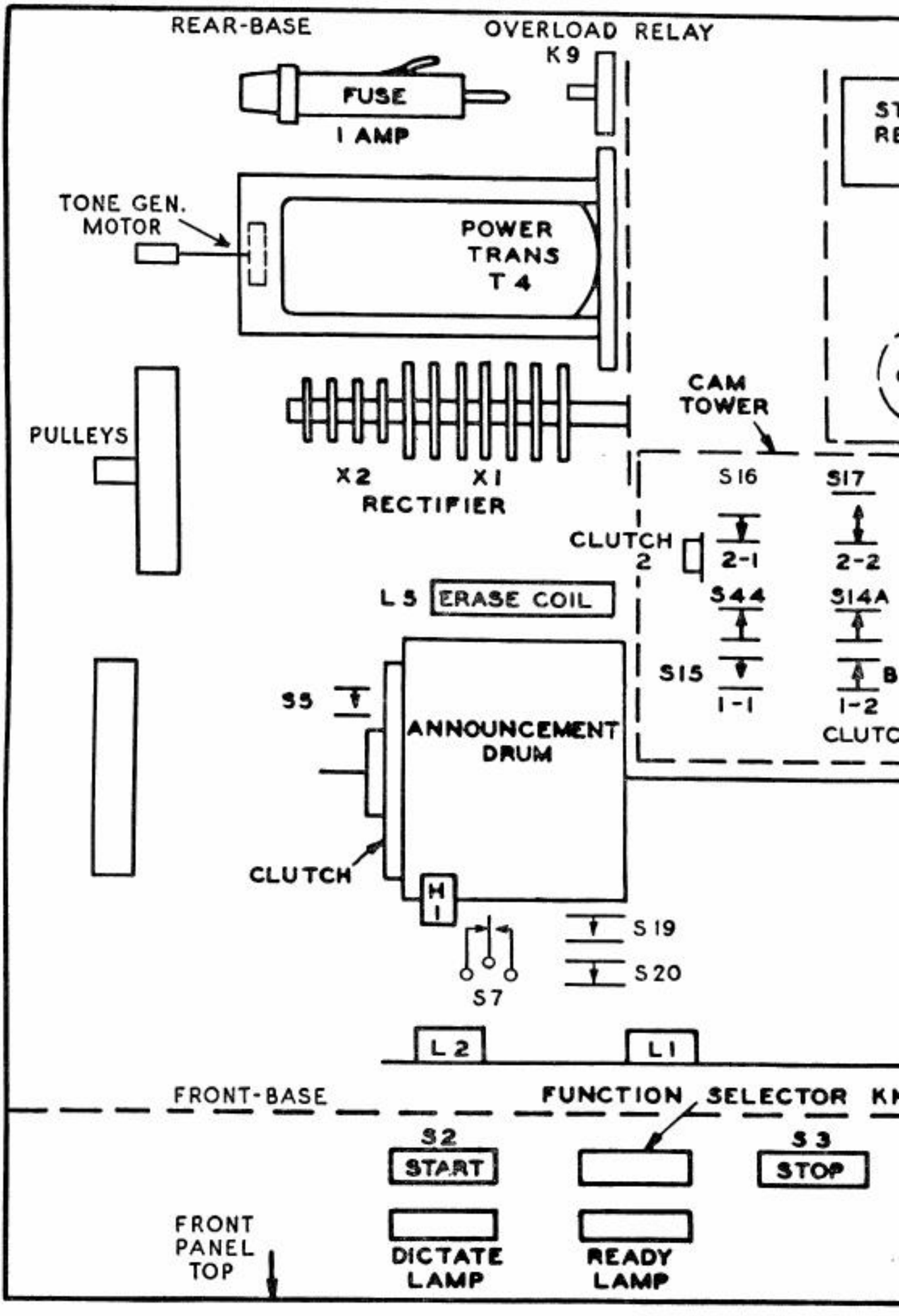
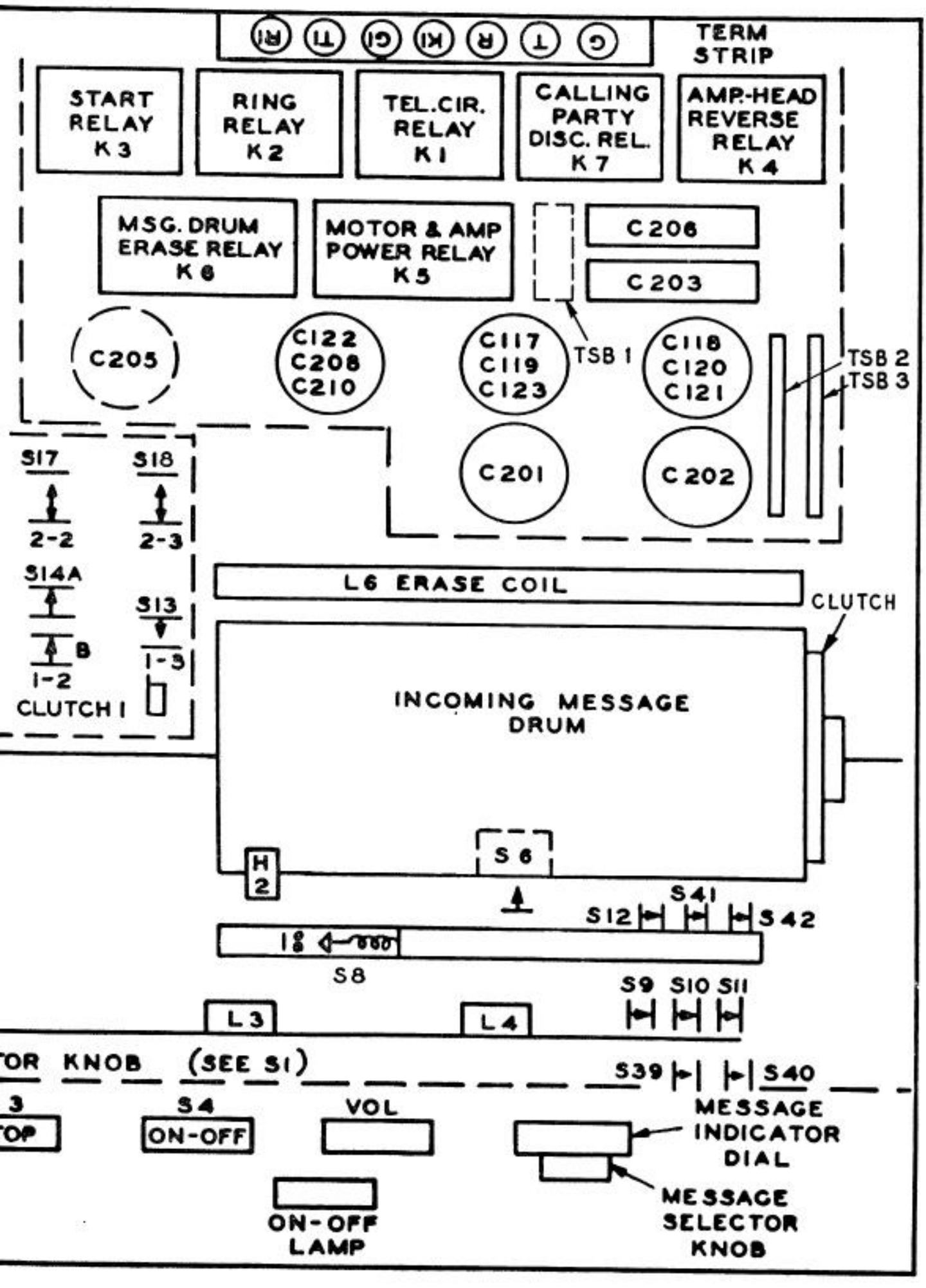
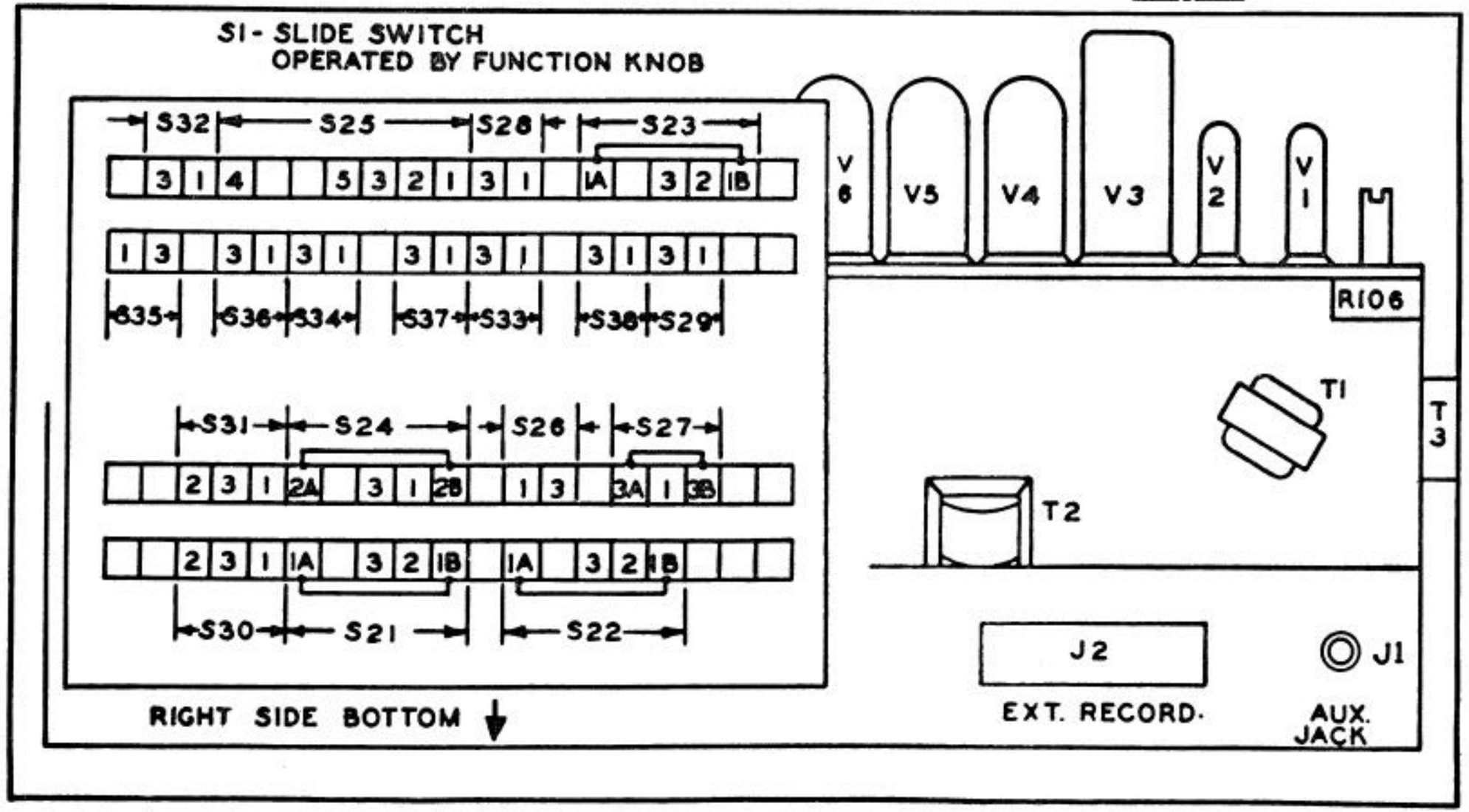
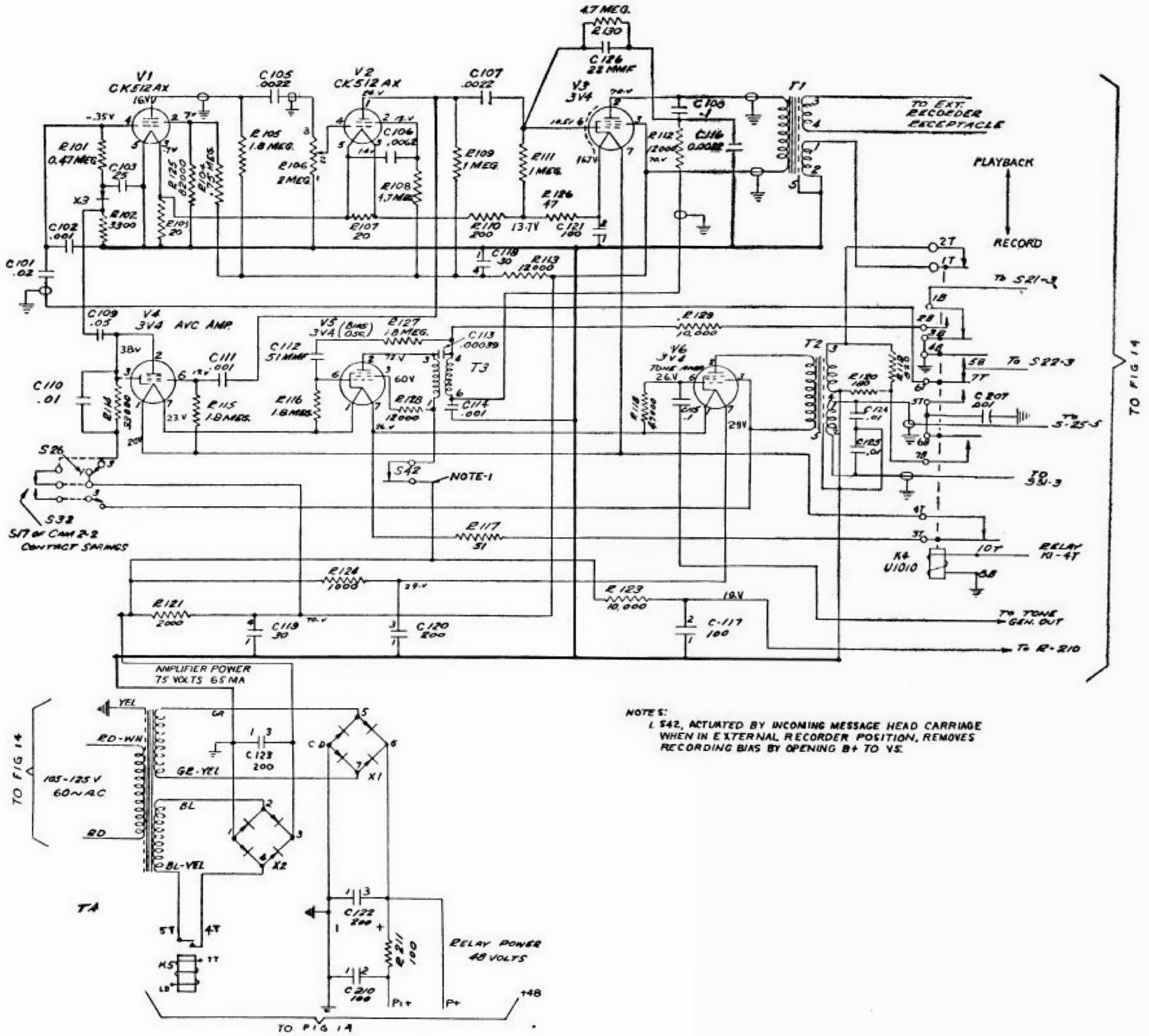

REAR-BASE
OVERLOAD RELAY
K9
FUSE
1 AMP
TONE GEN.
MOTOR
POWER
TRANS
T 4
PULLEYS
CAM
TOWER
X2
X1
RECTIFIER
S16
S17
CLUTCH
2
2-1
2-2
L 5
ERASE COIL
S44
S14A
S15
1-1
1-2
S5
ANNOUNCEMENT
DRUM
CLUTCH
H
1
S 19
S 20
S7
L 2
L 1
FRONT-BASE
FUNCTION SELECTOR
S2
START
S 3
STOP
FRONT
PANEL
TOP
DICTATE
LAMP
READY
LAMP

Fig. 12


RI TI GI KI R T G
TERM STRIP
START RELAY K3
RING RELAY K2
TEL.CIR. RELAY K1
CALLING PARTY DISC. REL. K7
AMP-HEAD REVERSE RELAY K4
MSG. DRUM ERASE RELAY K6
MOTOR & AMP POWER RELAY K5
C206
C203
C205
C122 C208 C210
C117 C119 C123
TSB 1
C118 C120 C121
TSB 2
TSB 3
C201
C202
S17
S18
2-2
2-3
S14A
S13
B
1-2
1-3
CLUTCH 1
L6 ERASE COIL
CLUTCH
INCOMING MESSAGE DRUM
H 2
S 6
S41
S12
S42
S8
S9 S10 S11
L3
L4
TOR KNOB (SEE S1)
S39
S40
3
TOP
S4
ON-OFF
VOL
MESSAGE INDICATOR DIAL
ON-OFF LAMP
MESSAGE SELECTOR KNOB

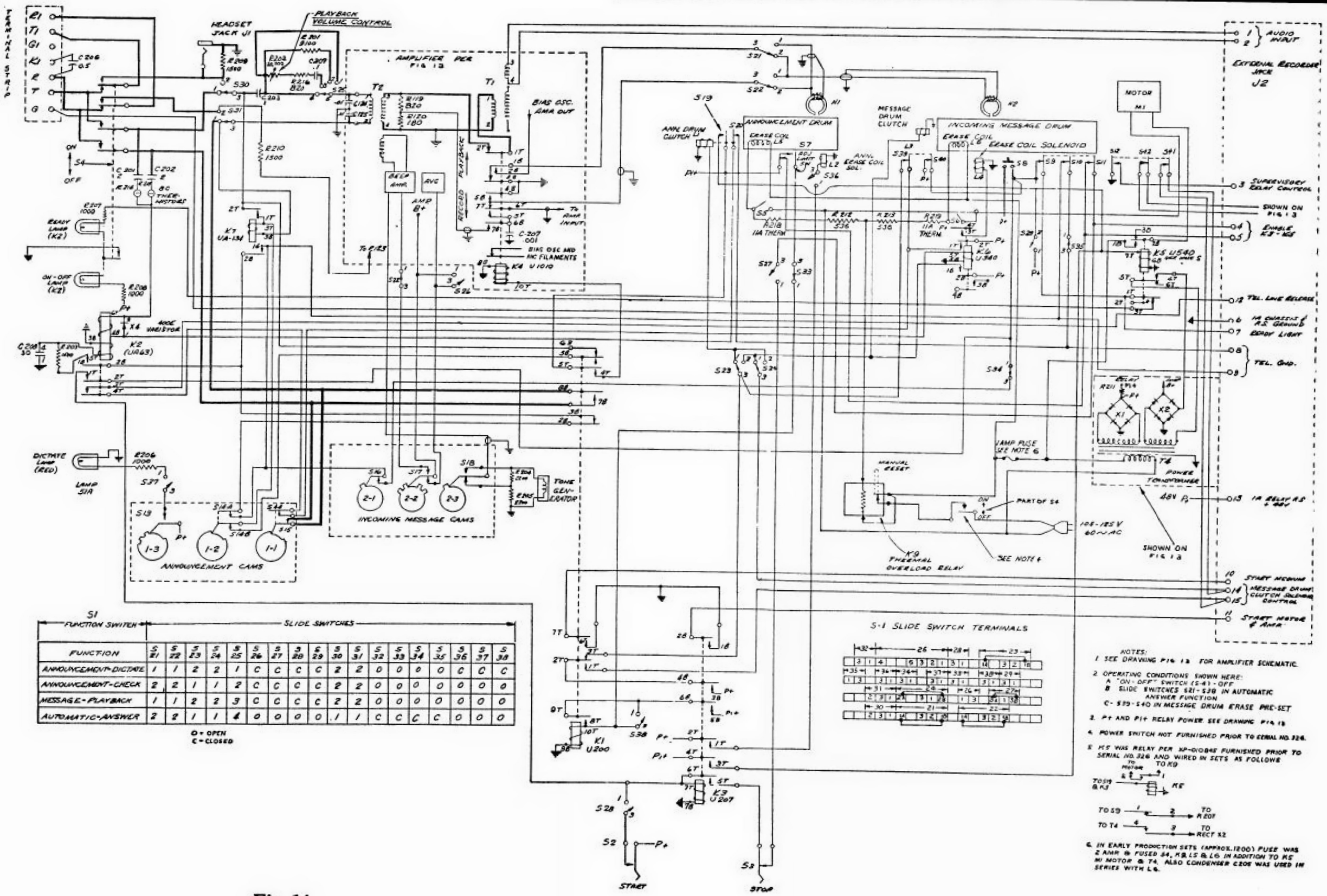

S1 - SLIDE SWITCH
OPERATED BY FUNCTION KNOB
S32
S25
S28
S23
S35
S36
S34
S37
S33
S38
S29
S31
S24
S26
S27
S30
S21
S22
V6
V5
V4
V3
V2
V1
R106
T1
T2
T3
J2
EXT. RECORD.
J1
AUX. JACK
RIGHT SIDE BOTTOM
B1
T1
B1
AY CONTACT
SIGNATION



NOTES:

1. S42, ACTUATED BY INCOMING MESSAGE HEAD CARRIAGE WHEN IN EXTERNAL RECORDER POSITION, REMOVES RECORDING BIAS BY OPENING B+ TO V5.

Fig. 13



S1 FUNCTION SWITCH / SLIDE SWITCHES	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38
ANNOUNCEMENT-DICTATE	1	1	2	2	1	C	C	C	C	2	2	0	0	0	0	C	C	C
ANNOUNCEMENT-CHECK	2	2	1	1	2	C	C	C	C	2	2	0	0	0	0	0	0	0
MESSAGE-PLAYBACK	1	1	2	2	3	C	C	C	C	2	2	0	0	0	0	0	0	0
AUTOMATIC-ANSWER	2	2	1	1	4	0	0	0	0	1	1	C	C	C	C	0	0	0

O = OPEN
C = CLOSED

NOTES:
1. SEE DRAWING P16 13 FOR AMPLIFIER SCHEMATIC.
2. OPERATING CONDITIONS SHOWN HERE:
   A "ON-OFF" SWITCH (S-4) - OFF
   B SLIDE SWITCHES S21-S38 IN AUTOMATIC ANSWER FUNCTION
   C- S39-S40 IN MESSAGE DRUM ERASE PRE-SET
3. P+ AND P1+ RELAY POWER. SEE DRAWING P16 13
4. POWER SWITCH NOT FURNISHED PRIOR TO SERIAL NO. 326.
5. K5 WAS RELAY PER KP-010845 FURNISHED PRIOR TO SERIAL NO. 326 AND WIRED IN SETS AS FOLLOWS
6. IN EARLY PRODUCTION SETS (APPROX. 1200) FUSE WAS 2 AMP & FUSED S4, K8, L5 & L6 IN ADDITION TO K5 M1 MOTOR & T4. ALSO CONDENSER C208 WAS USED IN SERIES WITH L6.

Fig. 14