

1A AND 1AA TELEPHONE ANSWERING SETS MAINTENANCE

1.00 INTRODUCTION

1.01 This section was formerly Station Installation and Maintenance Section C55.611, 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 information on the maintenance of 1A and 1AA telephone answering sets installed at subscriber stations.

1.03 Some of the information in this section supersedes similar information in C Section entitled 1A and 1AA Telephone Answering Sets, Description.

1.04 All information in this practice will apply to the 1AA set as well as to the 1A set except where a difference is noted.

1.05 Work actually done on the customer's premises should be limited to verification and analysis of the trouble, performance of readily made adjustments, if approved, and the replacement of easily accessible parts which are available through normal supply channels.

1.06 Disassembly of 1A telephone answering set shall be undertaken only when approved by a supervisor.

1.07 Maintenance of telephone sets and subscriber sets which may be used with the 1A telephone answering set is covered in sections dealing with these apparatus items.

1.08 Access to the inside of set is obtained by removing the cover. This is accomplished by loosening two slotted-head setscrews in lower back

section of case, and then raising and tilting the cover to clear the control panel.



To prevent personal hazard, always remove power-cord plug from receptacle before removing or replacing cover case or working on the inside of set.

Note: On early production sets the operation of ON-OFF switch does not control the power to the set.

1.09 The 1A telephone answering set derives its power from customer's power supply and, therefore, will not operate during power failures. However, regular telephone service is not affected.

1.10 Weight, size, and design of set necessitates added handling care to avoid damage to desks, tables, etc, when working on customer's premises. Be particularly careful with loose covers, sets tilted on side, lowered front panel assembly, etc.

1.11 The KS-16328, List 1 cleaner should no longer be used because it has been found to acidify with age and therefore is undesirable for use on telephone answering sets. A new KS-16328, List 2 cleaner-lubricant, now available, replaces the KS-16328, List 1 cleaner. The same cleaning 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.

1.12 The K2-type lamp has been found to be inadequate for use in 1A and 1AA telephone answering sets and should be replaced with the 2T lamp. The 2T lamp provides a longer life and is directly interchangeable with K2 lamp.

2.00 MECHANICAL OPERATION**General**

2.01 Mechanical parts within the set consist principally of a motor, belt drive, recording drums, recording-head carriage assemblies, lead screws, manual message selecting and indicating means, cams, and erase coils (see Fig. 10).

2.02 Recording drums are driven by a 4-pole, 1700-rpm, 115-volt 60-cycle, single-phase induction motor. On the motor shaft is mounted a 52-tooth gear which is the rotor of the tone generator. This gear forms a path of variable magnetic reluctance between 2-pole pieces connected by a permanent magnet and surrounded by a coil of wire. As gear turns, the variation of magnetic flux induces an alternating voltage in the coil at a frequency of 1400 cycles. Main drum shaft is driven by 2-stage belt-pulley speed reduction. Each belt on 1A sets is tensioned by an adjustable idler roller. On 1AA sets the first-stage belt is tensioned by an adjustable idler pulley, while the one in the second stage is tensioned by a spring-loaded idler pulley (see Fig. 12).

2.03 Two recording drums are mounted on main shaft, but are not connected directly to it (see Fig. 1). Each is driven by a constant torque clutch which is continuously rotating. Each drum is kept from rotating by a pawl which engages a slot in the drum until the pawl is released by a solenoid, allowing drum to rotate (see Fig. 3). The record-reproduce heads are each mounted on carriages which slide on horizontal guide rods. Each carriage is moved by a half-nut which engages a lead screw driven by gears from the respective drum (see Fig. 1).

Recording and Checking Announcement Message

2.04 The smaller drum is used for recording and reproducing 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 surface of the band. As drum rotates, it turns a lead screw by a 1:2 gear

ratio which moves the head across width of the band, tracing a helical track with 0.10-inch spacing between track centers. Drum rotates at about 20 rpm.

2.05 Recording head is mounted on a pivotal 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 drum to turn, half-nut to engage lead screw, and allowing recording head to come in contact with the magnetic band (see Fig. 2).

2.06 As 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 (see Fig. 2). When half-nut is disengaged from lead screw, this spring pulls the carriage back to its zero position.

2.07 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 (see Fig. 2). By causing the drum to stop always in the same position, the record-reproduce head always retraces the same track on magnetic band.

2.08 Provision is made for recording and reproducing announcement messages of a length from 12 to 30 seconds with a minimum interval between end of one message and beginning of the recording of incoming message. This is accomplished by means of adjustable limit switch S7 which is automatically positioned at end of the travel of the announcement carriage when machine is in ANNOUNCEMENT DICTATE condition (see Fig. 2 and 4). This limit switch consists of Micro Switch S7 carried on a pivotal arm which is moved by an extension of the head carriage. Switch arm is locked in position by spring-held friction pad. When machine is operating in ANNOUNCEMENT DICTATE condition, solenoid L2 raises this friction pad and allows switch arm to return to start position. Since there is a minimum announcement message time of 10 to 15 seconds,

switch arm does not return to a position equivalent to the zero-head position. During dictate period, limit-switch arm is moved along as the head progresses. When STOP key is operated at end of the announcement message, solenoid L2 is released, and friction pad locks the switch arm in place. This holds until a new announcement message is recorded. When announcement message is reproduced, switch arm is not released, and the carriage progresses to end of the message, at which time carriage arm operates switch S7 releasing the solenoid and causing 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 (see Fig. 4). The core has a face approximately the length of the recorded area on the drum so that entire helical track is erased in one revolution. The erase coil is mounted on a pivotal arm, and an adjustable stop limits the travel so that the pole piece is close to magnetic band (about 0.080-inches) 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 erasing current is turned off by switch S5 which is operated just before the coil reaches its rest position. Erase coil is moved to its operating position by the same solenoid L2 which releases the arm holding the adjustable-limit switch. However, since limit switch must be released during entire time of recording the announcement message, and 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 (see Fig. 4). It is located so that it does not engage the release lever after 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 announcement drum, but located at the opposite

end of the shaft away from the drive pulley (see Fig. 1). Rotation of message drum is controlled by a pawl and solenoid L3 similar to those used on the announcement drum (see 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 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 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 MESSAGE SELECTOR KNOB which appears on the front panel (see Fig. 5 and 6). This knob rotates as carriage is moved by lead screw, and shows position of the head. When playing back messages, this knob is used for manually moving the head to any desired part of 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 lead screw, and this is done by pushing in on MESSAGE SELECTOR KNOB (see Fig. 3). This engages an arm on the bail on which 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 MESSAGE SELECTOR KNOB shaft, operating switches S9, S10, and S11 (see Fig. 5). Another cam on a concentric shaft, but connected to MESSAGE INDICATOR DIAL, operates switches S39 and S40.

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

which operates switches S39 and S40 which control the mechanism for erasing incoming messages (see Fig. 5).

2.12 Message-head carriage is also equipped with switch S8 which prevents recording over a portion of the drum already used but not erased. This switch consists of two parts; fixed contacts, located on an insulator attached to the head carriage; and shorting contact, mounted on switch carriage (see Fig. 6). The switch carriage has a locking spring normally pressed against a slide bar on message carriage with sufficient friction to hold it in position, but not enough to keep 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 machine is set for AUTOMATIC ANSWER with message record-reproduce head at the beginning of head carriage travel (MESSAGE SELECTOR KNOB at zero), switch carriage is released before the first message is recorded, by operation of solenoid L4 through the incoming carriage actuating linkage (see Fig. 6 and 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 announcement drum (see Fig. 7). The erase-coil core is approximately the length of the recorded area and is mounted on a pivotal support. An adjustable stop limits the travel so that pole piece is close to magnetic band (about 0.010 inch) 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 coil bracket. Since message drum is not always stopped at same angular position, it is not feasible to have the erase cycle timed directly by drum. 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

Note: 2.14 does not apply to the 1AA set, since the 1AA set is not equipped for an external recorder.

2.14 Switches S12, S41, and S42, providing for operation of an external recorder, are located beyond end of the normal travel of incoming-message head carriage (see Fig. 6). In order to operate these switches, 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 message-head carriage from operating to this position on machines not equipped with an external recorder. Since external recorders that are suitable for attachment to the 1A telephone answering set are not available at this time, these switches (and jack J2 which provides connections to the external recorder) will not be used, although they may be a source of trouble for normal operation.

Timing Cams

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

Cams driven when announcement drum rotates

- Cam 1-1 — Seizes line (S15) and times message-drum erase cycle (S44).
- Cam 1-2 — Enables calling party control relay, K7, (S14).
- Cam 1-3 — Flashes dictate lamp (S13).

Cams driven when message drum rotates

- Cam 2-1 — Releases line (S16).
- Cam 2-2 — Times beep tones and disables AVC (S17).
- Cam 2-3 — Increases level on last beep tone (S18).

2.16 These cams are arranged in two groups: the first three are at bottom, and the last three at top of the cam tower. A set of gears from the main drive shaft provides continuous drive to each clutch mounted on the respective cam shafts. Clutch 1, connecting announcement cams (1-1, 1-2, and 1-3) to driving gears, is actuated by a lever

operated by solenoid L1 which also releases stop pawl on announcement drum. Consequently, these cams start to rotate as soon as announcement drum starts. As cams rotate, they operate their respective contact springs and also wind up the return spring. At end of announcement, solenoid L1 is released releasing clutch 1, 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, 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 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 FUNCTION SELECTOR KNOB. A bevel gear on knob shaft engages a similar bevel gear which is on the shaft extending to right side of the machine behind front panel. On this rod is a plate carrying a pin which engages in a pivotal T arm in a manner to push slider of one switch in and 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.

3.00 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 direct current from a 75-volt power supply. Speech input voltage is applied directly to the grid of V1 with resistance-capacitance coupling to V2. A poten-

tiometer R-106 at the input to V2 is mounted on amplifier chassis and is not accessible to customer. 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 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 increase in response of the magnetic reproducer at higher frequencies. However, response of 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 speech amplifier to isolating transformer T2 for transmission to the telephone line. It is also used for speech connection to external recorder connection. When recording, audio output from V3 is combined with high-frequency bias from V5, and is 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 speech amplifier is used for reproducing sound from either magnetic band, relay K4 is not operated and filaments of V4 and V5 are shunted by a 51-ohm resistor R-117. This reduces filament current in these tubes to about 1/3 of normal and eliminates high-frequency bias and automatic volume control while reproducing either announcement or incoming messages.

3.05 Automatic volume control is used during recording of both announcement and incoming messages. Speech voltage is taken from the plate of V2 to 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 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 incoming messages and the first of two final warning tones) is set by voltage divider R-205 and R-204 to give the proper level on the line. The level of 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 power transformer T4. When ON-OFF switch is ON, the relay power (48 volts) is on continuously so that 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 CO battery.

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

Calling Party Disconnect

3.09 The telephone answering set is designed to function with calling-party-disconnect facilities. At locations where CO equipment does not supply the required battery interruption, the

machine will operate normally without internal modifications, but on a fixed-time incoming message basis; ie, 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 right side of the base of 1A telephone answering set for the following assembly:

- 1 — 723A Receiver
- 1 — 15A Headband
- 1 — R2DB Cord, 6 feet long, equipped with one 347B plug.

Modification for ANSWER ONLY Service

3.11 The 1A and 1AA telephone answering sets may be modified to provide optional ANSWER ONLY service. Since the modification does not provide for indicator lights associated with service selector switch, AUTOMATIC ANSWER ready light must serve as a ready light for ANSWER and RECORD and ANSWER ONLY.

3.12 Modifications necessary to provide optional ANSWER ONLY service are as follows:

1. Remove playback and volume-control potentiometer R202 from the front panel. Securely join the three wires removed from potentiometer (solder or use connector), and tape and tie to cable CA1.
2. Install a Centralab switch No. 1462 and a B-910097 indicator plate as shown in Fig. 16. This replaces the volume-control potentiometer.
3. Secure switch and plate firmly with nut and lockwasher to prevent rotation. Cut switch shaft to leave about a 3/8-inch extension beyond threaded bushing.
4. Attach knob removed from volume control so that its indicator dot will line up adequately with dots on the plate.
5. Wire the switch in accordance with Fig. 15 and stitch the wires to cable CA1 as indicated in Fig. 1.

4.00 CIRCUIT DESCRIPTION (See Fig. 16 For 1A Sets, Fig. 17 For 1AA Sets)

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 alternating current 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 announcement drum and releases adjustable-limit-switch S7 holding mechanism which allows switch arm to drop back to minimum announcement position (10 to 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 thermal overload relay and the other side of line. At the same time, a path is closed through R218, R212, and through the heater winding of K9. If erase coil circuit is closed for an interval longer than permitted by adjustment of K9, it will operate and open the circuit, thus protecting 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. The L1 announcement-drum clutch solenoid operates through S24 (and S41 on 1A sets), contacts 1T and 2T of K1, and 3B and 4B of K3, permitting drum and announcement cam rotation. K4 operates through 4T and 5T of K1, and activates the bias oscillator and AVC circuit by removing shunt resistor R117 from filaments by opening contacts 3T and 4T (see Fig. 11). The local telephone set is

connected to amplifier input from terminals R1 and T1 via S4, S30, S31, C203, S25, T2, R119, R120, and contacts 7B, 6B, 5T, and 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, and S13 of cam 1-3 to P+.

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

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

4.09 If STOP switch is not pressed by customer, the adjustable-limit switch S7 operates at the limit of its arm travel (30 seconds) and releases K3, after which the action as in 4.08 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 switches 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 alternating current and also extinguishes ready lamp.

4.13 K3 operates L1 announcement-drum-clutch solenoid, using P+ through 3B and 4B of K3, 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 message compared to that heard by a distant customer.

4.15 Announcement is reproduced in receiver of local telephone set or auxiliary headset. The latter, if used, is plugged into jack J1 which is in right-hand side of 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 clutch pawl until indexing is completed. K5 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 alternating current 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. Cam rotation is incidental, no operating function being performed.

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

4.23 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.

Note: If set has been modified for optional ANSWER ONLY service, R202 potentiometer will not be present.

4.24 Message drum is stopped by the customer operating STOP switch S3 or by limit switch S11. The latter opens when head carriage reaches end of 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 drum.

Automatic Answer—Answer and Record

4.25 With ON-OFF switch S4 on, function selector knob at AUTOMATIC ANSWER, service selector knob at ANSWER and RECORD, and with message head in position to receive a message, S8, S9, S10, and S11 are closed. Ready lamp is lighted through S4, R207, 3T and 1T of K5, S9, and S8, to P1+.

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

4.27 Ringing current from terminals R and G passes through S4, C-202, thermistor R-215, S10, S35, and 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+.

For 1AA sets:

- Ringing current (bridged ringing—low impedance) from R terminal passes through S4, C202, thermistor R215, strap A-B, X4 varistor (which rectifies current that actuates winding 6T and 4B of K2), S20, S35, and S10, to G.
 - Ringing current (bridged ringing—high impedance) from L2Y terminal to 531C subscriber set flows through electron tube K to ground operating relay in 531C. 48-volt P+ from E terminal in 1AA passes through closed contacts of relay in 531C, B terminal of 1AA, 6T and 4B of K2, S20, S35, S10, G terminal, and strap G-F, to chassis ground, operating K2.
- 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 supply ac power 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 K operates, dc termination of the telephone line is completed via terminals R and T, S4, S15, contact of cam 1-1, S31, winding of K7 (3B and 3T), S14B of cam 1-2, 5B and 6B of K1, and 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, S31, winding 3B, 1T and 2T of K7, S30, S4, and terminal T. If set has been modified for ANSWER ONLY service, circuit will be from 1T and 2T of K7, to service selector switch (Centralab No. 1462), 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 CO 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 announcement, open contacts of S20 (associated with the announcement-drum clutch) prevent K2 from operating on a new call until drum and cams are indexed.
- 4.36** At end of announcement, K1 relay operates from P1+ through adjustable limit switch S7, S33, and K1 winding to ground.
- 4.37** K1 locks up through 8T, 9T, and 6B and 5B of K3, to P1+.
- 4.38** K1 contacts 7B and 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 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. If set has been modified for ANSWER ONLY service, the circuit will be from S24 to service selector switch (Centralab No. 1462) to L3.
- 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, and 6T of K4 to input of speech amplifier. Output of speech amplifier is connected to 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 amplifier and recording head.
- 4.44** Cam 2-2 operates S17 again, about 25 seconds after recording starts, sending third beep out on the line in the same manner as 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 telephone line battery supply is interrupted for a short time (as by calling-party disconnect in certain types of CO or PBX) during the call when K7 is controlling the telephone line termination, K7 releases, releasing K2, thus stopping the cycle, and the answering set returns to standby condition ready to receive another call.
- 4.49** When the incoming message head reaches point on the drum where there is inadequate space for another complete recording cycle, S9 contacts are opened by cam on MESSAGE SELECTOR KNOB and ready lamp will not light at end of call. Slight additional movement of this cam causes S10 to open the operating ground for K2 relay and a do-not-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 message record-reproduce head will run off end of 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, and R207 lights the ready lamp. Ringing current on the first call operates K2, as in automatic answer, 4-50.
- 4.52** K3, K5, and L1 operate starting the motor, amplifier, announcement drum, and cams; and ready lamp is extinguished as described above.
- 4.53** 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, and through the heater winding to contacts of K9. If the erase coil circuit is closed for an interval longer than permitted by adjustment of K9, 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 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 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 MESSAGE INDICATOR DIAL is advanced by lead screw and associated mechanism during erasure cycle; S39 and S40 are opened, thus preventing erasure from occurring on subsequent calls.

Automatic Answer—Answer Only

4.60 With set turned on, function selector knob turned to AUTOMATIC ANSWER, and service selector knob turned to ANSWER ONLY, the ready lamp lights: ground through S4, ready lamp, R207, normal K5, 3T to 1T, S9, and S8, to P1+.

4.61 In 1A sets, ringing current from terminals R and G passes through S4, C202, thermistor R215, S10, S35, and S20, is rectified by varistor X4, and actuates primary winding 6T and 4B of K2. K2 locks up through winding of 3B and 5T, R203, 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 P1+.

4.62 In 1AA sets, ringing current (bridged ringing—low impedance) from R terminal passes through S4, C202, thermistor R215, strap A-B, X4 varistor (which rectifies current that actuates primary winding 6T and 4B of K2), S20, S35, and S10, to G.

4.63 In 1AA sets, ringing current (bridged ringing—high impedance) from L2Y terminal in 531C subscriber set flows through electron tube K to ground, operating relay in 531C. The 48 volts P+ from E terminal in 1AA is applied through closed contacts of relay in 531C, B terminal of 1AA, 6T and 4B of K2, S20, S35, S10, G terminal, and strap G-F, to chassis ground, operating K2.

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

4.65 K3 operates K5 through 3T and 4T of K3 to P1+. Motor M1 starts through 1B and 2B of K5 to ac power. 4T and 5T of K5 supplies ac to

rectifier X2, furnishing B+ to amplifier, and extinguishes ready lamp by opening contacts 1T and 3T of K5.

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

4.67 Approximately 3-1/2 seconds after K2 operates, dc termination of telephone line is completed via terminals R and T, S4, S15 of cam 1-1, S31, winding of K7 (3B-3T), S14B of cam 1-2, 5B and 6B of K1, and S30, tripping ringing current.

4.68 K7 calling-party disconnect relay operates and closes locking path to CO battery from terminal R through S4, S15 of cam 1-1, S31, winding 3B, 1T and 2T of K7, service selector switch (Centralab No. 1462), 5B and 6B of K1, S30, S4, and terminal T.

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

4.70 About 1 second after telephone line is terminated, cam 1-2 opens contacts of S14B, making dc line termination dependent on holding K7 through its 1T and 2T contacts. Any interruption of CO battery will then cause K7 to release, which causes answering set to return to standby condition by release of K2, thus releasing K3 and K5. If calling party disconnects during announcement, open contacts of S20 (associated with announcement drum clutch) prevent K2 from operating on a new call until drum and cams are indexed.

4.71 At end of announcement, K1 relay operates from P1+ through adjustable limit switch S7, S33, and K1 winding, to ground.

4.72 Operation of K1 opens locking circuit of the K7 relay at contacts 5B and 6B of K1. The K7 releases and drops the telephone line. All relays release and motor stops.

Note: Operation of K1 does not operate the L3 solenoid in this function, since the L3 circuit is open at service selector switch (Centralab No. 1462).

5.00 REQUIREMENTS AND PROCEDURES

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

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

- Burned-out pilot lamps. The K2 lamp, used in ON-OFF (medallion) and ANSWER AND RECORD indicators, should be replaced with the 2T lamp in accordance with 5.18 and 5.19. If thereafter the lamps repeatedly burn out, the set should be returned for repair.
- Electron tubes not seated in their sockets: (Note that two CK512AX tubes are oriented so that red mark on tube base faces outside of set and coincides with molded dot on socket.) 1AA sets have a retainer holding these two tubes in place. When it is necessary to remove tubes, lift end of retainer just high enough to clear tops of tubes, then pull out and down at bend, pivoting retainer at rivet (see Fig. 13).
- 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.
- Displaced wiring or cables interfering with operation of set.
- Obstruction of moving parts.
- Binding of carriage bails due to improper location of front panel.
- Control knobs loose on shafts.
- Bevel gears loose on shafts.
- Loose collars on drum shaft.

- Loose or improperly adjusted lever linkage connected between solenoids and operating mechanisms.
- Loose assemblies or components.
- 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 (see 5.04 to 5.13) 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 coil cannot be readily and satisfactorily adjusted by adjusting stop nuts (see 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 Pressure of the head when lowered on recording band shall be between 20 to 35 grams measured to the band. No attempt should be made to adjust these heads.

5.07 Wax may be removed from surfaces of heads by carefully scraping with a KS-6320 orange stick (this does not apply to 1AA set).

Recording Bands

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

5.09 For sets equipped with neoprene bands, excess wax may be removed from bands by wiping bands with KS-2423 twill cloth saturated with General Electric No. 10-C insulating oil. Excess oil shall be wiped from band with a dry KS-2423 cloth, and care should be taken that oil does not get on drum or other parts of set.

5.10 For sets equipped with Hypalon bands, if volume level is low or if distortion is experi-

enced, record heads and magnetic bands should be cleaned with KS-16328, List 2 cleaner—lubricant.

- This cleaner 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 loose dirt from bands by wiping with a clean, dry KS-2423 cloth. Remove loose dirt from record heads 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 using, as components have a tendency to separate. Apply a small quantity to a clean, dry KS-2423 cloth and wipe this on recording bands while they are rotating. Wipe cleaner and emulsified dirt from drums with a clean, dry KS-2423 cloth. The cleaned drum should be dry and have a polished appearance. Repeat process if necessary. Cleaner contains adequate lubricant, therefore, it is not necessary to perform a separate lubrication operation. Also, use solution on cloth to clean heads. Dry recording heads thoroughly. Avoid letting the cleaner come in contact with metal parts.

5.11 Drive belts from the motor to drum should be tensioned so that drums will be driven without slippage of belts or stalling of motor. Proper tension of belts may be checked by operating the set in MESSAGE PLAYBACK condition. The motor should drive message drum at an even speed. Grasp edges of message drum and stop it from rotating. (Never handle recording band.) Motor should not stall, drive belts should not slip, and drum shaft should continue to turn. If belt adjustment is necessary, it may be accomplished by repositioning adjustable idler pulley. (Spring-tensioned idler pulley on 1AA sets should not require adjustment.) To increase belt tension in the first stage of 1AA set, loosen set screw in side of idler post. Loosen locknut on top of idler post and turn associated vertical set screw until desired tension is obtained. Force idler assembly downward during this adjustment. Tighten locknut and set screw in idler post with pulleys positioned so that belt rides evenly on pulley (see Fig. 13). In

no case should idler pulley be so positioned that clearance between two halves of the belt is less than 1/4 inch. Upon completion of adjustment, repeat above test several times. Replace belt if necessary. If set does not meet these requirements, it should be replaced.

Spring Pile-ups (Except Relays)

- 5.12** If the following requirements are not met, springs may be adjusted or set removed.
- Distance between contact springs intended never to make contact and between contact springs and other metal parts shall be minimum 0.015 inch.
 - All contacts when open shall have a gap of minimum 0.006 inch.
 - Pressure between closed contacts shall be a minimum of 15 grams.
 - All contacts shall have perceptible follow.
 - Point of contact shall fall wholly within circumference of opposing contact at all times during contact.
 - Spring pile-up shall meet requirements for gap, pressure, and follow for both normal and operated position.

S9, S10, S11 Adjustment

- 5.13** Switch springs provide the following approximate timing sequence:
- S9 opens, 5 seconds later S10 opens, and 30 seconds later S11 opens. These requirements are met if machine functions as outlined in 4.49.

KS-15662 Inverter

- 5.14** In areas with dc power supply, KS-15662, List 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, vibrator should be suspected. The vibrator is an internal plug-in unit listed as a KS-15662, List 2 vibrator. If noise is experienced when using an inverter with the 1A set, strap the G terminal to chassis for bridged ringing, and G1 terminal to chassis for party ser-

vice. On 1AA sets, if noise is experienced, the external ground should be strapped to F terminal as shown in Table A. (For other connecting information see C Section entitled 1AA Telephone Answering Set, Station Connections.)

TABLE A

Type of Service	Ground-conductor Connections	
	531C Subset Term.	1AA Set Term.
Individual Lines— Bridged Ringing— Low Impedance		Strap G-F
High Impedance	Grd*	F
2- and 4-party Selective Flat Rate and 2-party Message Rate (-) Party on Ring	Grd†	F
(+) Party on Ring	L2Y†	F
(-) Party on Tip	Grd†	F
2- and 4-party Selective Flat Rate and 2-party Manual Message Rate (+) Party on Tip	L2Y†	F
Message Rate (Dial Only), Flat Rate, AMA, and Zone Registration (-) Parties on Tip		Strap G1-F
(+) Parties on Tip		Strap G1-F
Flat Rate Automatic Ticketing (-) Party on Tip		Strap G1-F
(+) Party on Tip		Strap G1-F

*Use D5AA-9 cord or equivalent.

†Use D4AN cord or equivalent.

Final Test

5.15 Make final check of complete operating sequence of the four functions performed by 1A telephone answering set: Announcement

dictate, announcement check, automatic answer, and message playback. If set fails to perform satisfactorily, and foregoing maintenance procedures do not remedy the fault, replace set.

Handling and Transporting

5.16 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 recording drums. (See procedure in C Section 1A and 1AA Telephone Answering Sets, Installation.)

5.17 It is desirable to transport all 1A telephone answering sets in a shipping carton which shall protect it externally and cushion it from shock. Exterior of the carton should be marked in such a manner as to ensure careful handling, ie: FRAGILE—HANDLE WITH CARE.

Suppression of Radio Station Interference

5.18 If customer hears radio programs on either announcement or recorded messages, the trouble might be eliminated by installation of a 1542A inductor in accordance with C Section entitled Radio Signal Suppression in Telephone Sets. If this does not remedy the trouble, consult your supervisor.

Lamps

5.19 Prior to installation or during a maintenance visit, ON-OFF (medallion) and ANSWER AND RECORD lamps (K2 type) should be replaced with 2T lamps. The 2T lamp is directly interchangeable, both electrically and mechanically, with K2 lamp. However, illumination is less and in some cases may not be adequate.

5.20 If, after 2T lamps have been installed, illumination of ANSWER AND RECORD lamp is not adequate, replace R207, 1000-ohm resistor with a KS-13492, List 1 620-ohm, 2-watt resistor, or equivalent. The R208 resistor may be replaced with KS-13492, List 1 resistor, or equivalent, to increase illumination of ON-OFF (medallion) indicator, but generally this will not be necessary.

6.00 TOOLS AND SPARE PARTS

6.01 The following special tools are required for the maintenance of the 1A telephone answering set:

- Allen hexagonal key wrenches, sizes 1/16, 5/64, 3/32, and 5/32 inch.
- No. 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.

INDEX	ORDERING INFORMATION AND DESCRIPTION
Belts	Belt, Drive B-177478-1 Motor drive belt, 15 inches long.
	Belt, Drive, B-177478-2 Drum drive belt, 17-1/8 inches long.
Buttons	Button Assembly, B-178353-1 Start button.
	Button Assembly, B-178353-2 Stop button.
Cleaner— Lubricant	Cleaner—Lubricant, KS-16328, L2 Cleaner and lubricant for magnetic bands and record heads available in 2 oz and 1 qt screw cap glass bottles.
Cover	Coverplate, B-177846 Cover plate for external recorder jack. 1A telephone answering sets only.

INDEX

Dial

Fuses

Holder, Fuse

Knobs

Lamps

Tubes

ORDERING INFORMATION AND DESCRIPTION**Message Indicator Dial, B-177647****Fuse, Bussman Type AGC,**
2 Amperes.**Fuse, Littlefuse, 312002,**
2 Amperes.
For early sets.**Fuse, Bussman Type AGC,**
1 Ampere.**Fuse, Littlefuse, 312001,**
1 Ampere.
For later sets (about Serial No. 1530 and up).**Holder, Fuse, HKP**
(Bussman Mfg Co).
Power supply fuseholder.**Knob, B-177612**
ON-OFF, volume, service selector (Centralab switch), and message selector knob.**Knob, B-177613**
Function selector knob.**Lamp, 2T**
For ON-OFF and record lights.**Lamp, 51A.**
For dictate light.**Tube, Electron, CK512AX.**
For V1 and V2 (cut lead lengths to 5/32 to 7/32 inch).**Tube, Electron, 3V4.**
For V3, V4, V5, and V6.

Fig. 1 — Drum Shaft Details

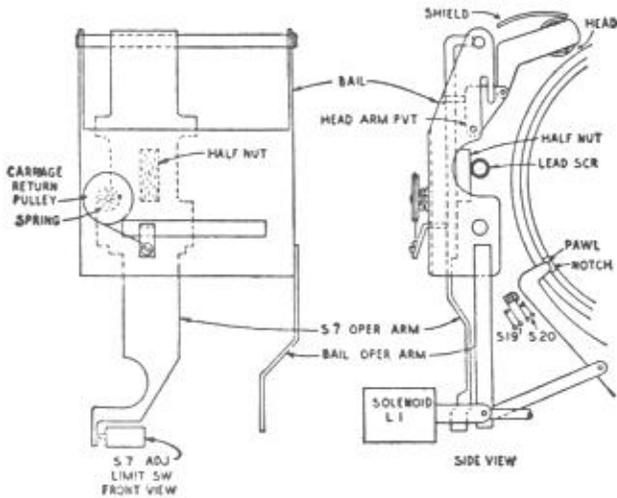
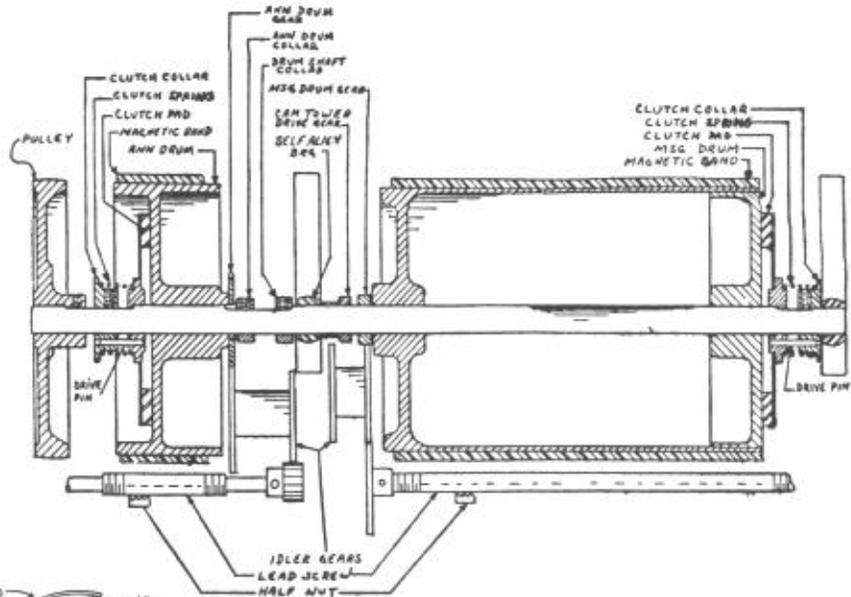
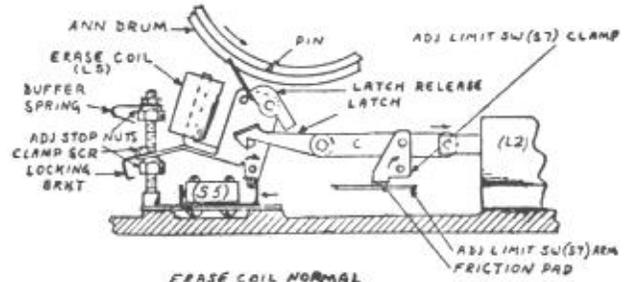
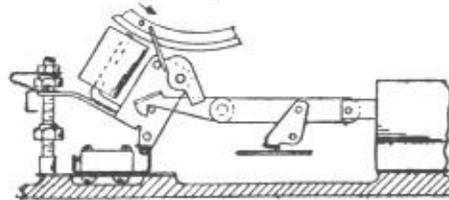


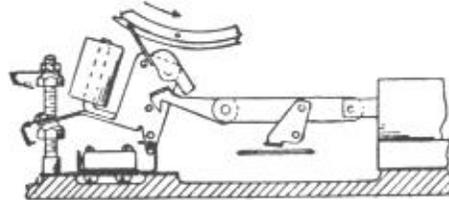
Fig. 2 — Announcement Drum Recording Head Details



ERASE COIL NORMAL



ERASE COIL OPER - (L2) OPER.



ERASE COIL NORMAL (L2) OPER.

Fig. 4 — Operation of Announcement Drum Erase Coil

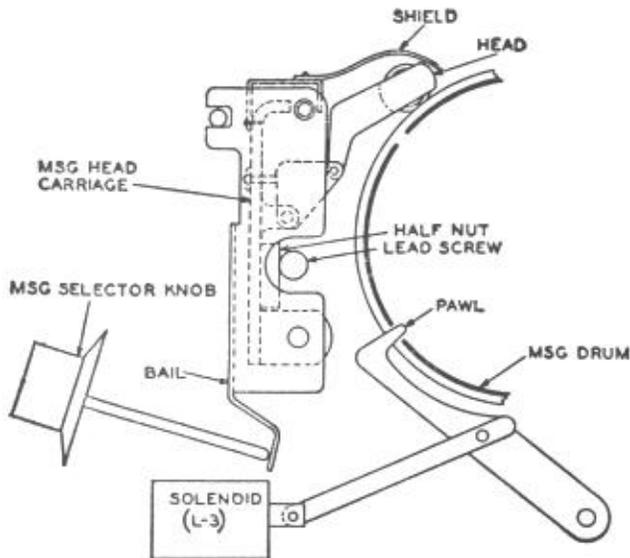


Fig. 3 — Message Drum Recording Head Details

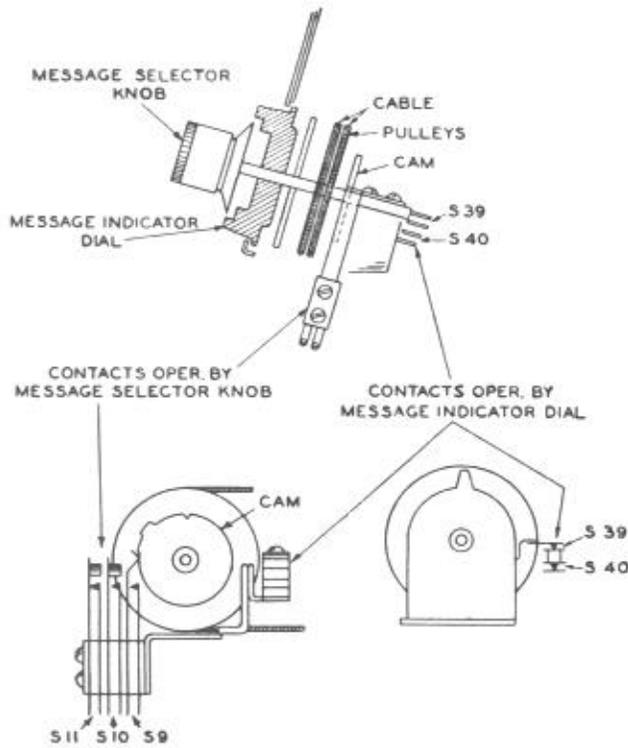


Fig. 5 - Message Selector Knob and Indicator Contact Assemblies

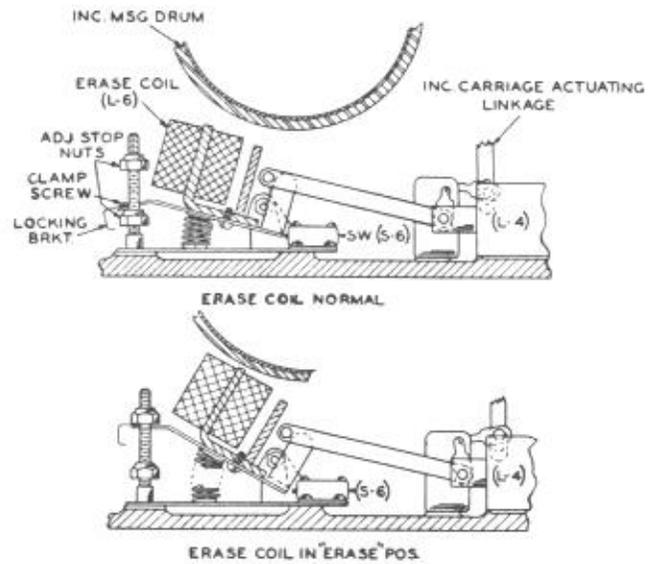


Fig. 7 - Message Drum Erase Coil Details

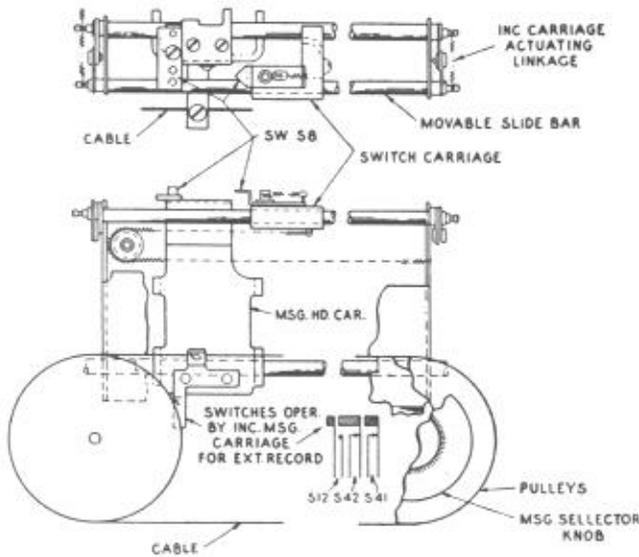


Fig. 6 - Incoming-message Carriage Details

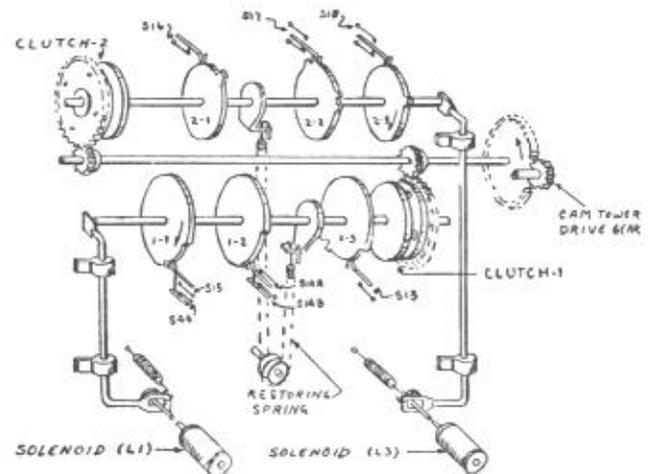


Fig. 8 - Cam Tower Details

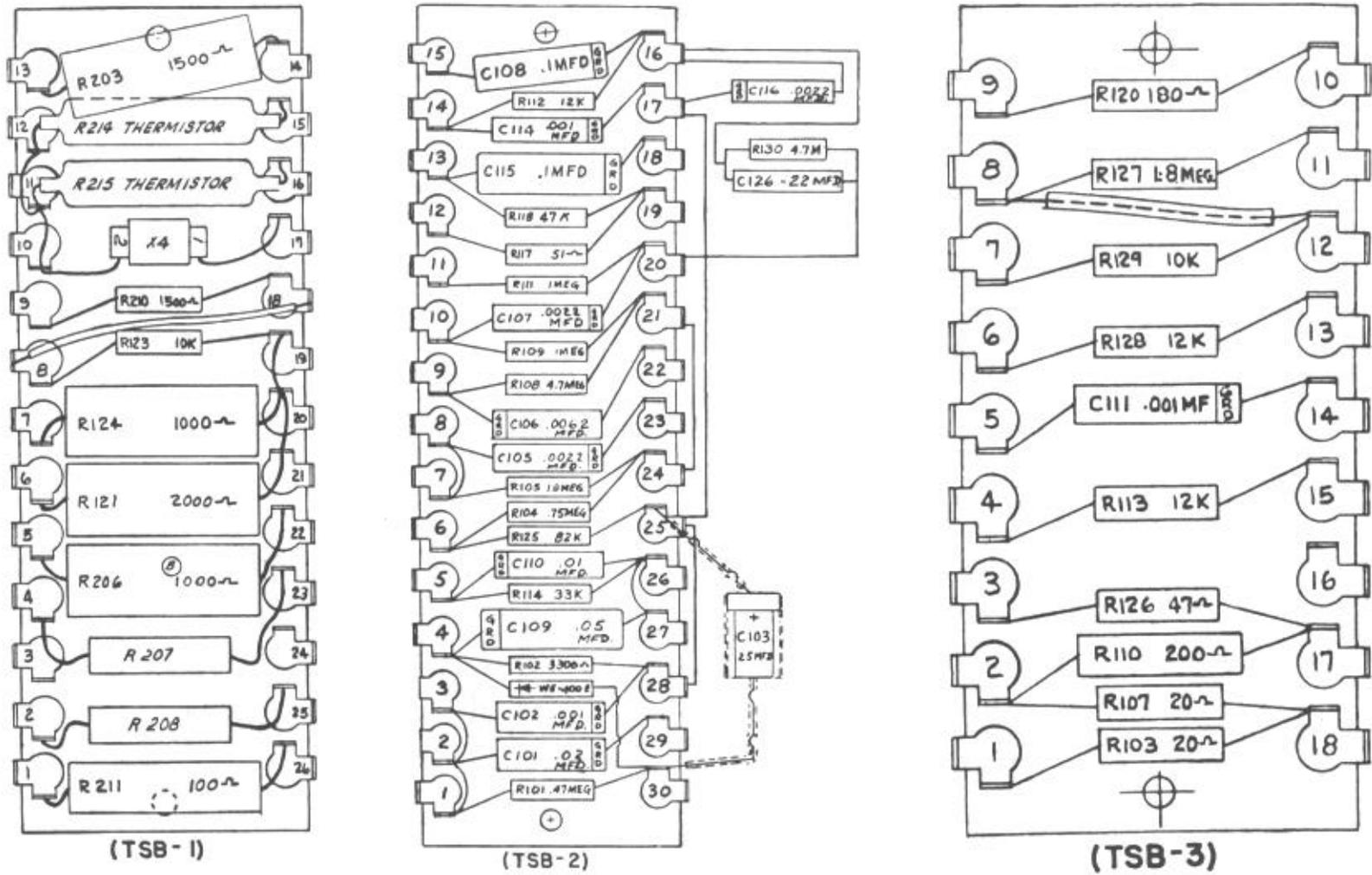
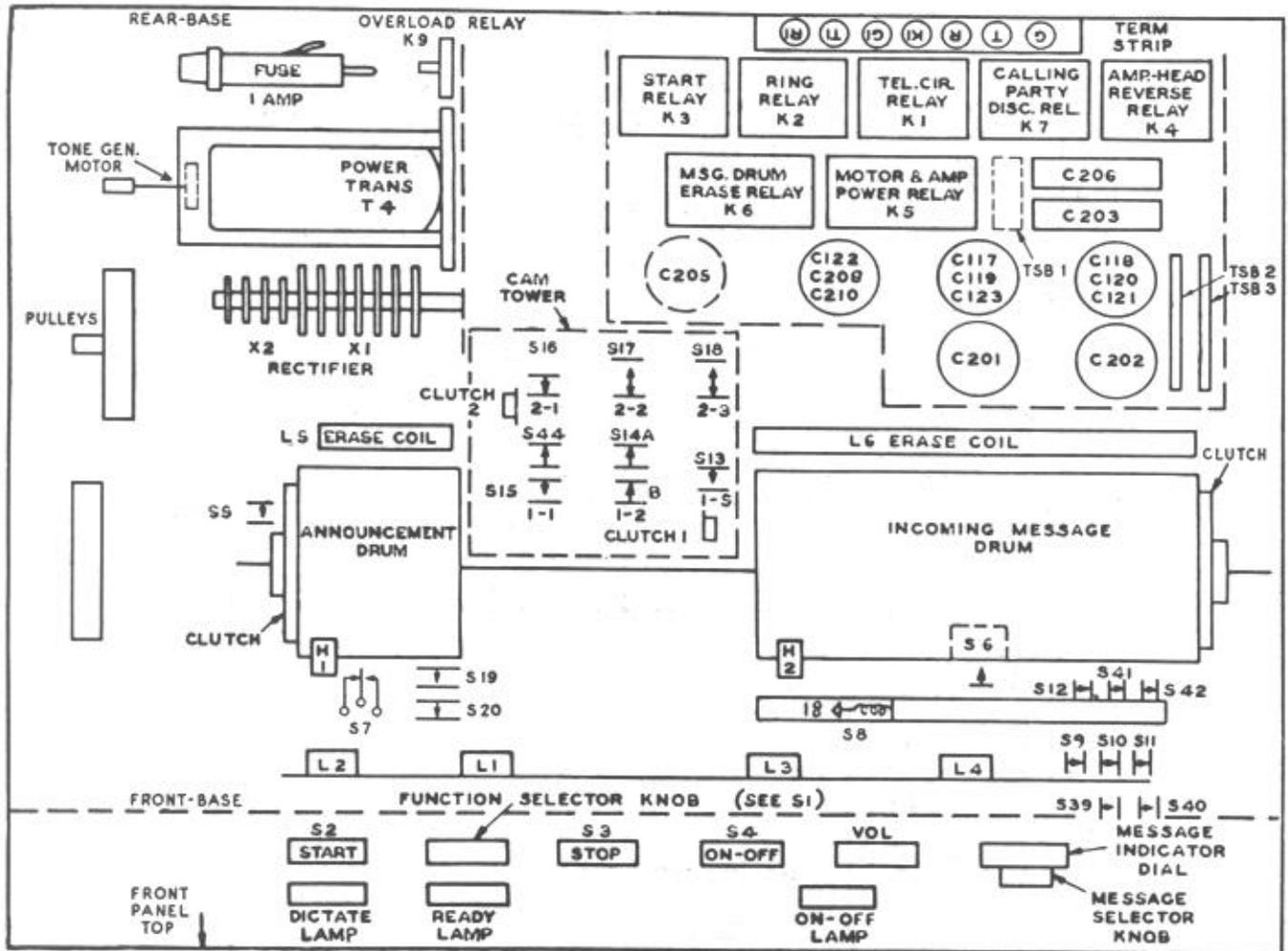
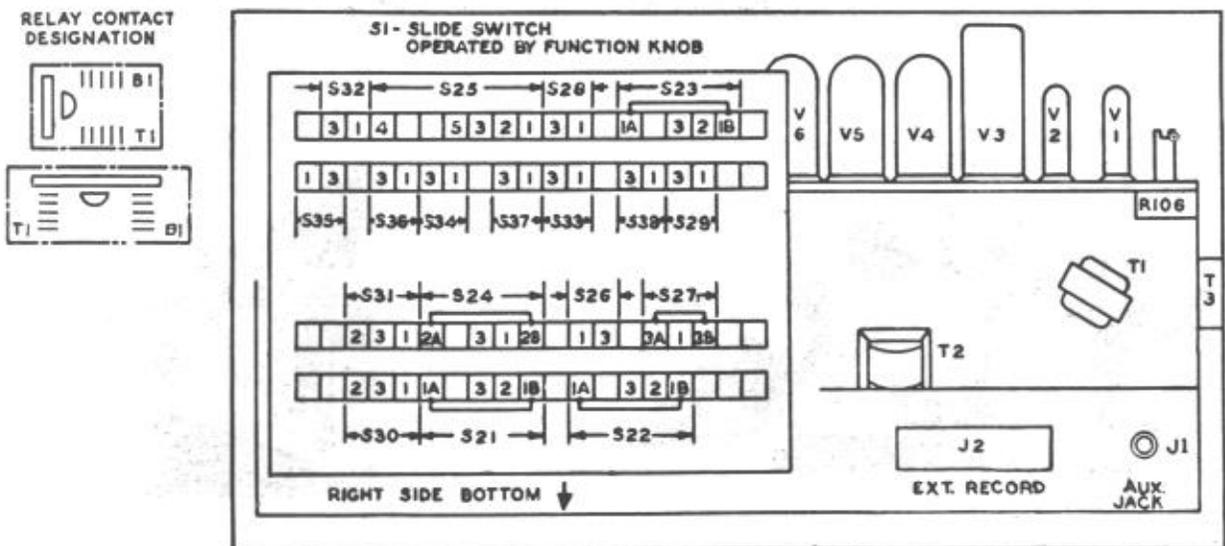


Fig. 9 - Terminal Strips



Top View



Right-side View

Fig. 10 - Block Diagram of Assembled Parts

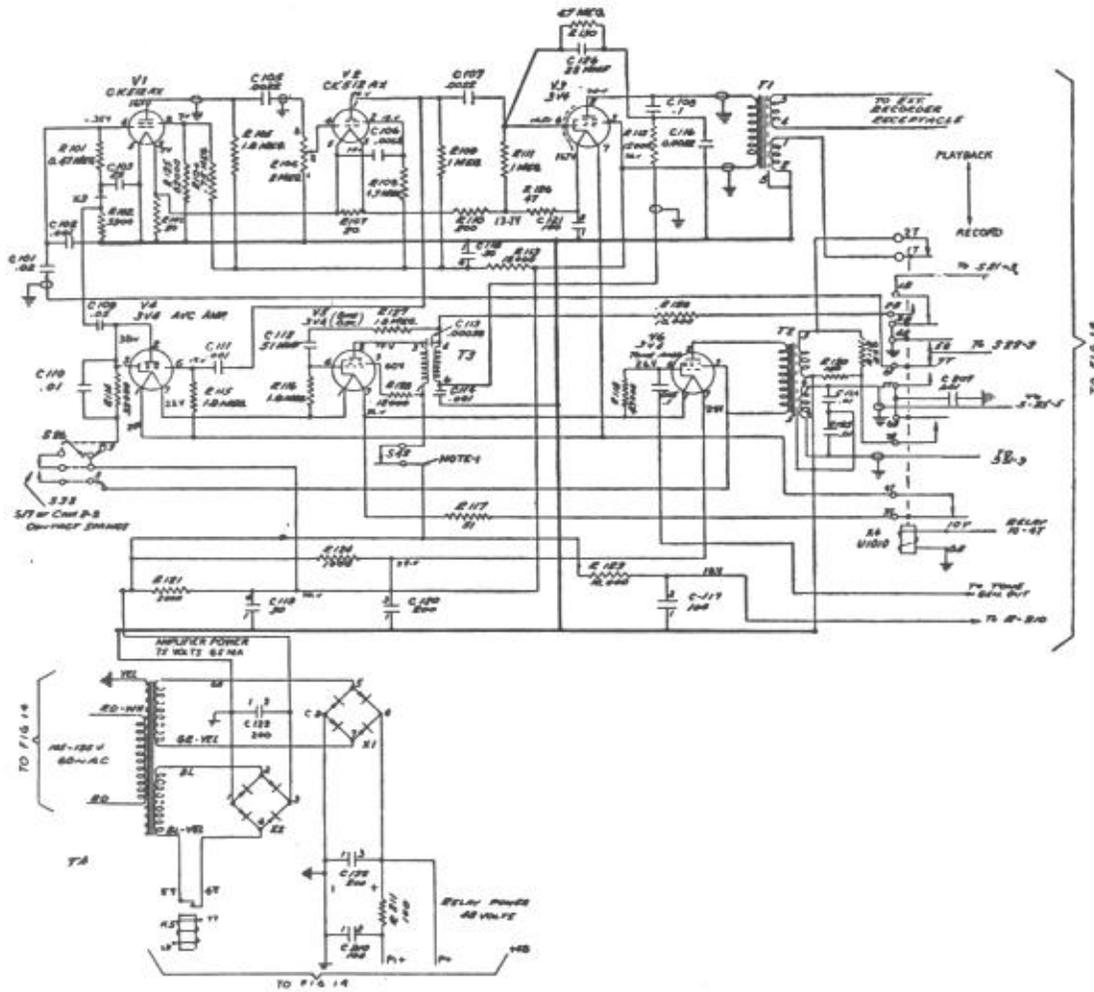


Fig. 11 - Amplifier and Power Supply Schematic

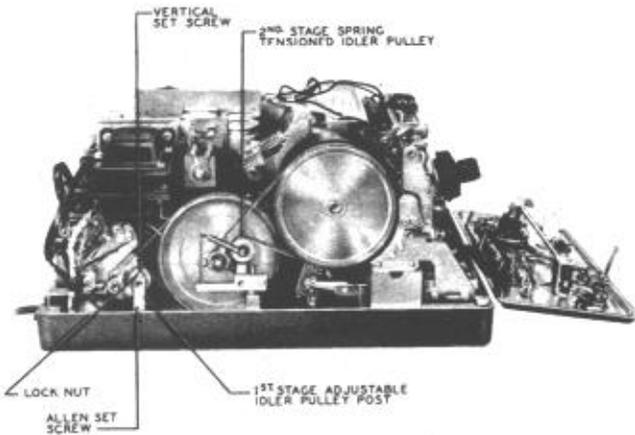


Fig. 12 - 1AA Belt Drive

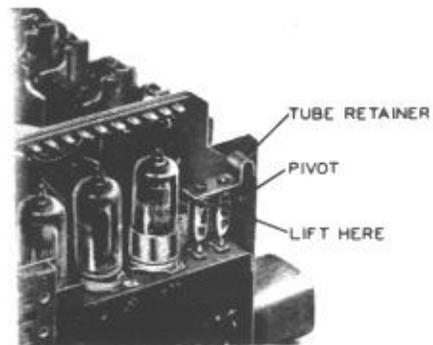


Fig. 13 - Tube Retainer on 1AA Set

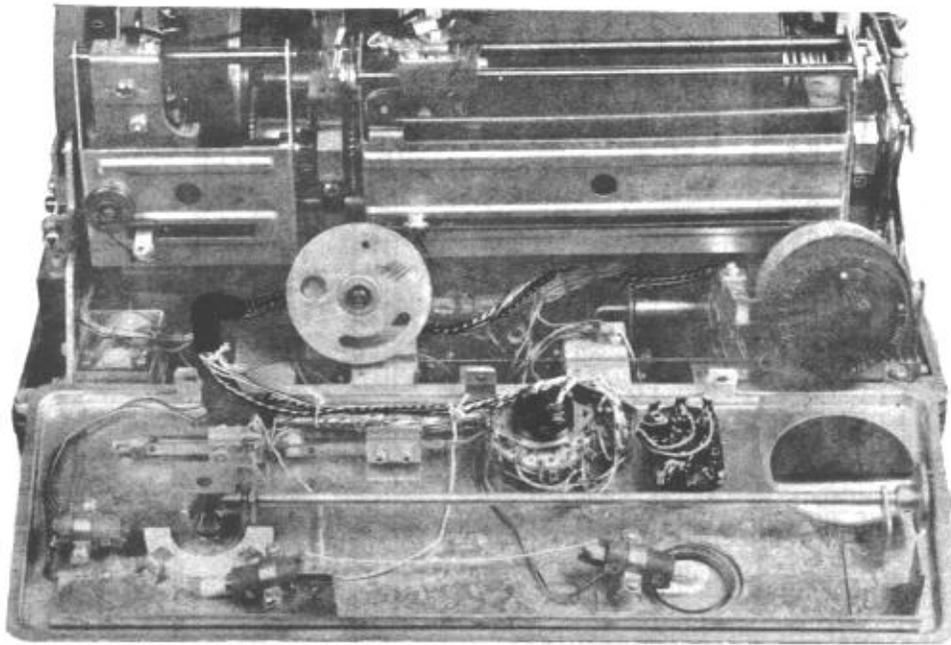
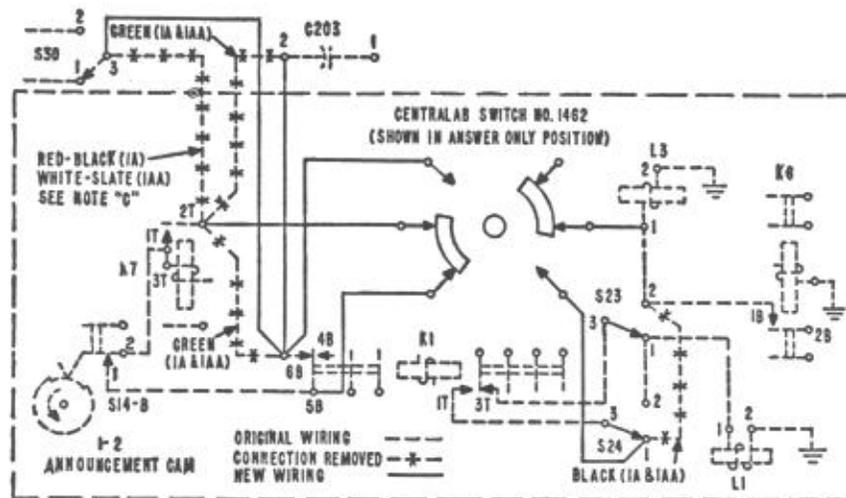


Fig. 14 — Showing Centralab Switch No. 1462



Note A: All new wiring shall be nylon jacketed, plastic covered, solid conductor AWG, 22 per B-179076, or equivalent.

Note B: S23, S24, and S30 are shown in automatic answer position.

Note C: Disconnect this wire from 2T of K7 and connect to 68 of K1.

Fig. 15 — Wiring Modification for Normal and ANSWER ONLY Service

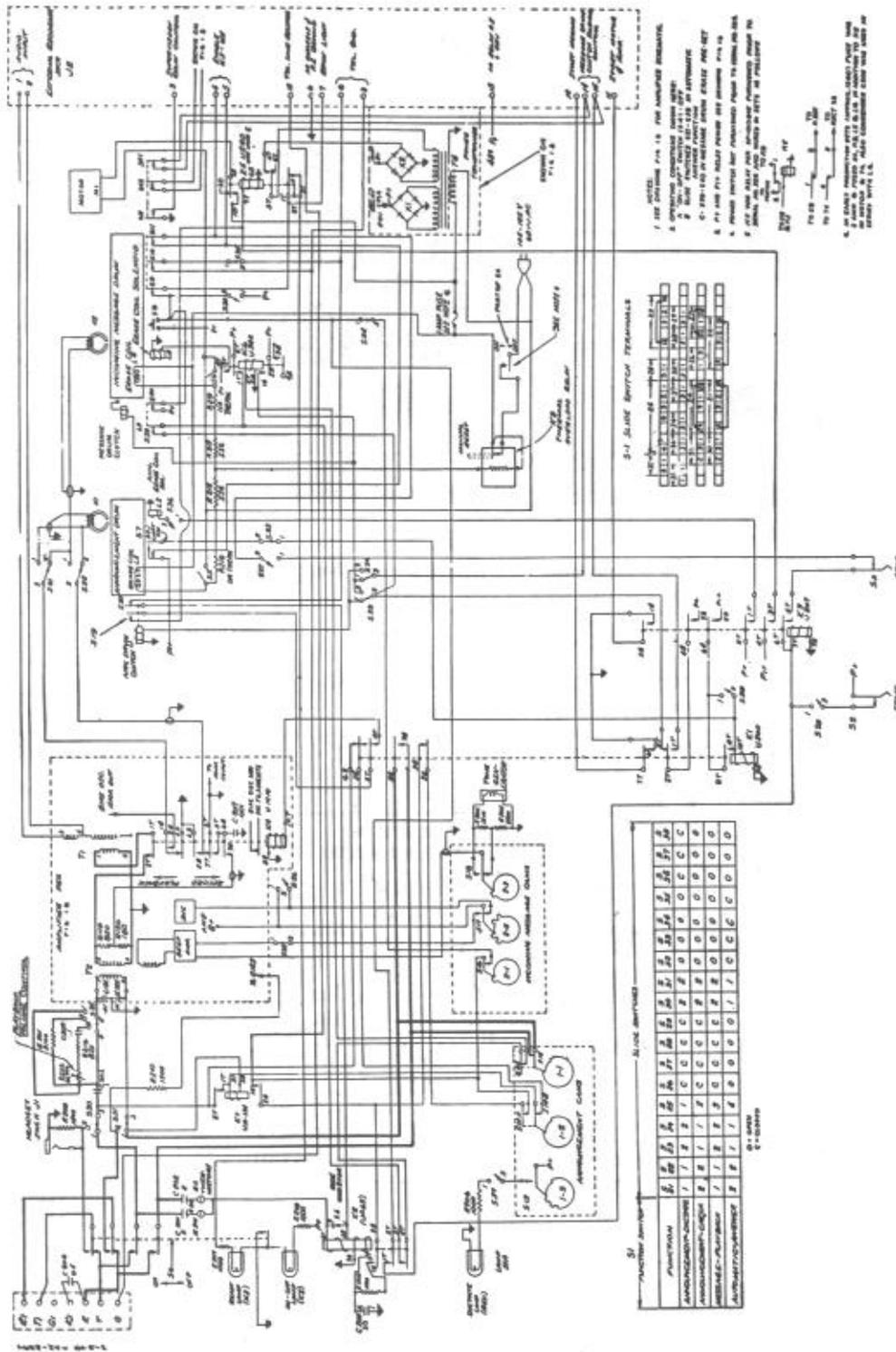


Fig. 16 - 1A Telephone Answering Set, Control Schematic

