

## AUTOMATIC TELEPHONE ANSWERING AND RECORDING

### 1A TELEPHONE ANSWERING SET

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#### 1. GENERAL

**1.01** The 1A Telephone Answering Set is used in conjunction with regular telephone service to answer an incoming call with a subscriber's prerecorded announcement and to record the calling party's message if he cares to leave one. The maximum time allotted for both the announcement and incoming messages is approximately 28 seconds for each, and the maximum circuit holding time for the complete cycle is approximately 60 seconds. Total message time available for incoming recordings is about 10 minutes.

**1.02** The set connects directly to the telephone line and can be used with individual, two-party, and four-party full selective lines and PBX extensions. In the case of party lines, it is necessary to use a modified 531C subscriber set as auxiliary equipment to reduce the chance of

false starts from cross rings and to give full selective ringing for four-party lines.

#### 2. DESCRIPTION

**2.01** The machine is enclosed in a gray metal cabinet about 14 inches wide, 15-1/2 inches deep, and 7 inches high and weighs approximately 45 pounds.

**2.02** Subscriber-operated controls are all mounted on the front panel and consist of a function selector knob, start and stop keys, ON-OFF switch, playback volume control, message selector knob, and message indicator dial. In addition, there are three indicating lights on the front panel: the ON-OFF light, ready light, and dictate light. (See Fig. 1.)

**2.03** The mechanical parts within the set consist principally of a motor, belt drive, recording drums, recording head carriages, lead screws, cam, and erase coils. (See Fig. 2.)

**2.04** A terminal strip located at the rear of the machine provides for connections to the telephone line and the local station.

#### 3. POWER REQUIREMENTS

**3.01** The power consumption of the 1A Telephone Answering Set in the standby condition (function selector knob on automatic answer, awaiting an incoming call) is about 10 watts, and, when the machine is answering a call, it requires about 70 watts. Power requirement during erasure is about 125 watts.

**3.02** The set is intended for use on a 115-volt 60-cycle ac power supply. For operation in dc areas, an inverter per KS-15662 is available.

**3.03** Machines with serial numbers below about No. 1531 are protected by means of a 2-ampere Littelfuse No. 312002 or equivalent, which is located at the rear of the machine near the power transformer. Later machines are protected

## SECTION 852-551-100

by means of a one-ampere Littelfuse, No. 312001 or equivalent.

**3.04** A manual reset thermal overload relay (K-9) is provided to protect the erase coils in case the operating contacts fail to open. Operation of this relay opens the main 115-volt circuit to the machine. (See Fig. 3.)

### 4. POWER SUPPLY

**4.01** Direct current for the amplifier, relays, solenoids, and lamps is obtained from selenium rectifiers X-1 and X-2 connected to separate windings of power transformer T-4. The 48-volt direct current is supplied by X-1, and 75-volt direct current is supplied by X-2. When the ON-OFF switch is ON, the relay power (48 volts) is on continuously in order that the relays and signal lamps may be immediately available for use. Current to the signal lamps, solenoids, and relays K-3 and K-6 is filtered only by C-122. However, in order to reduce hum pickup in various circuits, current to relay K-2 is also filtered by R-203 and C-208. Current to relays K-1, K-4, and K-5 is filtered by C-122, R-211, and C-210. Current for the calling party control relay (K-7) is obtained from the central office battery.

**4.02** When the machine is in operation (K-5 operated), rectifier X-2 supplies 75-volt direct current for the amplifier. Current for the filaments of V-3, V-4, V-5, and V-6 is filtered by C-123, R-124, and C-120, and for V-1 and V-2 also by C-121. Current for the plate and screen circuits of V-3, V-4, and V-6 is filtered by C-123, R-121 and C-119, and for V-1 and V-2 also by R-113 and C-118. Current for the plate circuit of V-5 is filtered only by C-123. Current for the transmitter of the local telephone set when recording an outgoing message is obtained from the amplifier power supply and filtered through C-123, R-123, and C-117. R-209 and R-210 are also in the local set transmitter current circuit. These two resistors, in conjunction with C-117, provide a balanced speech circuit. This circuit limits the transmitter current to about 6 milliamperes.

### 5. OPERATION

**5.01** In order to record an announcement message, the user must turn the machine ON, set the function selector knob to announcement-dictate, momentarily depress the start key, wait for the

dictate light to light, and dictate the announcement message into the telephone transmitter. He can record for a minimum of 10 to 15 seconds and a maximum of about 25 seconds, at which time the dictate light flashes to indicate that he has about 3 seconds recording time left. The announcement message should include information describing the called station and instructions to the caller regarding the recording of his message. If he finishes the announcement message before the time allotted has elapsed, he momentarily depresses the stop key so that the adjustable limit switch (S-7) will be positioned to comply with the message interval. This will insure a short time interval (when the machine is handling an incoming call) from the end of the announcement message to the time the machine is ready to record an incoming message.

**5.02** The announcement is checked by turning the machine ON, setting the function selector knob to announcement-check, depressing the start key, and listening to the reproduction of the announcement through the receiver of the telephone set. If the user wishes to erase the message so as to replace it with another, he merely repeats the operation described in 5.01. Erasure is automatically accomplished during the first revolution of the drum, as discussed in 6.06, after which the dictate light lights to indicate to the user that he can proceed with his new message.

**5.03** In order to enable the machine to answer the line, the function selector knob is turned to automatic answer and the machine is turned ON. The dot on the message selector knob skirt is set in line with zero mark on the message indicator dial. If erasure of previously recorded incoming messages is desired, both the message selector knob and the message indicator dial must be turned back to their zero settings. Erasure is accomplished between the time the set responds to the next incoming ring and the announcement message is transmitted to the caller. The method of erasure is discussed in 6.11.

**5.04** When the user wishes to hear the incoming messages which have been recorded on the machine, he turns the machine ON, sets the function selector knob on message playback, and depresses the start key. He then selects the messages to be played back by pushing in and turning the message selector knob, releases the knob, and listens to the messages through his telephone

receiver. The playback volume control enables him to adjust the volume to the desired level.

**5.05** An auxiliary receiver jack is provided for announcement-check and message playback in case the subscriber wishes to use an auxiliary receiver for these functions rather than, or in addition to, his regular telephone receiver. If this arrangement is required, the following assembly can be provided:

723A Receiver

15A Headband

R2DB Cord, 6 ft. long, equipped with a 347B Plug

## 6. FUNCTIONING OF EQUIPMENT

**6.01** The recording drums, gear train, timing cams, and lead screws are driven by a shaded pole, approximately 1670 rpm, 115-volt, 60-cycle single-phase induction motor through a two-stage belt and pulley system.

**6.02** The two recording drums are mounted on the main shaft but are not directly connected to it. Each is driven by a constant torque clutch which is continuously rotating when the motor is running. Each drum is kept from rotating by a pawl which engages in a slot in the drum until the pawl is released by a solenoid allowing the drum to rotate. Both drums rotate at the rate of about 20 rpm which produces a lineal speed of approximately 4 inches per second.

**6.03** The recording drums are covered with a wax-impregnated neoprene band containing magnetic iron oxide which provides the recording medium. Recording is accomplished by applying audio and high-frequency bias currents to a magnetic recording head held in contact with a surface of the band. This band, or tire, operates satisfactorily in temperatures ranging from 50° to 120° F. Temperatures beyond these limits may temporarily impair transmission qualities of the band.

**6.04** The announcement record-reproduce head (used for announcement-dictate, announcement-check, and the announcement reproduction of the automatic answer functions) is mounted on a pivoted arm which is moved into position by the action of a solenoid. This solenoid, in operating, causes a

half-nut associated with the carriage to engage a lead screw. As the announcement drum rotates, it turns this lead screw by a 1:2 gear ratio. This moves the head across the width of the band, tracing a helical path about 0.10 inch between the centers. The 0.042-inch magnetic recording head is kept in contact with the surface of the band by means of a spiral spring applying 20 to 25 grams pressure between the head and the band.

**6.05** As the announcement head carriage moves from its zero position, a cord attached to an arm of the carriage rotates a pulley which winds a spiral spring. When the solenoid releases and the half-nut is disengaged from the lead screw, this pulley rewinds and pulls the carriage back to its zero position. By causing the head to be indexed at the same place each time and the drum to stop at the same position, the head always begins at the same place and traces the same path on the drum. The drum is stopped at this index position by a pawl which engages a slot in its periphery.

**6.06** A previously recorded announcement message is erased automatically when a new message is to be recorded. This is accomplished by bringing the erase coil in close proximity (between 0.063 and 0.093 inch) to the announcement drum for slightly more than one revolution of the drum, at which time a pin on the side of the drum engages a latch and trips the mechanism holding the erase coil close to the drum. It then drops to its normal position about 0.4 inch from the drum. When the erase coil is brought up close to the drum, its movement releases a microswitch which enables 115-volt 60-cycle erase current to flow through the erase coil. Likewise, when the erase coil drops to its normal position, the microswitch is operated and erase current is cut off.

**6.07** The announcement drum has a variable cycle feature in that it can record and reproduce messages of any length from about 10 to 28 seconds without appreciable "dead" time between the end of the message and the beginning of the incoming recording cycle. This is accomplished by means of an adjustable limit switch (S-7) which is automatically positioned at the end of the dictate function by a friction pad arranged so that it normally presses against the arm carrying the switch, holding the switch in a fixed position. The adjustable limit switch remains in this "set" position until a new message is dictated, at which time it is positioned

to comply with the interval of the new message (with a minimum time interval of about 10 to 15 seconds). The adjustable limit switch is operated by an arm moving with the head carriage. When it is operated, the machine either stops (announcement-check) or switches to a record condition (automatic answer). In either case, the announcement head springs back to its original position as discussed in 6.05.

**6.08** The incoming message record-reproduce head, is mounted on a pivoted arm and is used for automatic answer and message playback functions. As the incoming message drum rotates, it turns the associated lead screw through a 2:1 gear reduction which, in driving the recording head carriage, causes the head to trace a helical path on the drum and gives a center-to-center track spacing of 0.025 inch. The active width of the record-reproduce head is 0.014 inch. On both sides of the active 0.014-inch lamination appears a 0.014-inch brass lamination. The later lamina serve to decrease the unit band pressure by providing an approximate 0.042-inch contact width with the drum. There are four slots in the periphery of this drum which the pawl can engage to stop it, since it need not be indexed at the same place each time as is the case with the announcement drum.

**6.09** There is no provision for automatic return of the incoming message record-reproduce head. Instead, the carriage is connected to a cable and pulley arrangement which connects the message selector knob. This arrangement enables manual selection for playback of recorded messages.

**6.10** The incoming message drum is equipped with a flyback switch (S-8) which prevents incoming calls from being recorded over a portion of the drum which has been used but has not been erased. This switch is mounted on two parallel horizontal slide rods and must be engaged by the contacts on the carriage during standby and automatic answer conditions. During the recording of an incoming message, the carriage physically moves this switch ahead of it. When the carriage is moved back manually for the playback of recorded incoming messages, the switch is held in place by friction and must be engaged by the carriage (manually) before the next incoming call can be answered. A ready light indicates that this engagement has been made and the machine is set to automatically answer

subsequent calls except when it is desired to erase all recorded incoming messages as noted in 6.11.

**6.11** The message indicator dial is provided to show how much of the incoming recording drum has been used. It is rotated by the message selector knob as it turns, but it stays in its maximum position when the message selector knob is turned back to select messages for message playback. It is turned back to its zero setting along with the message selector knob when erasure of previously recorded incoming messages is desired. Two cam-operated contacts, which are controlled by a cam associated with the message indicator dial, control operation of erase relay K-6 and the ready light. When the line is answered, flyback switch (S-8) slides back to its normal position and controls future incoming calls since the cam-operated contacts are disengaged as the message indicator dial rotates. Erasure is accomplished in a manner similar to that provided for erasing announcement messages. In this case, however, the erase coil is brought to between 0.001 and 0.020 inch of the magnetic band, and no latch and pin arrangement is provided for tripping the erase coil but it falls back to its normal position when its operating solenoid releases.

**6.12** Cams are provided to accomplish certain timing functions. When the announcement drum rotates, cams are driven which seize the line (cam 1-1, switch S-15), time the incoming message drum erase cycle (cam 1-1, switch S-44), enable the calling party control relay (cam 1-2, switch S-14), and operate the dictate lamp (cam 1-3, switch S-13). When the message drum rotates, cams are driven which time the beep tones (cam 2-2, switch S-17), give a higher level on the last beep tone (cam 2-3, switch S-18) and release the line (cam 2-1, switch S-16). See Fig. 3 for Cam Timing Chart.

## **7. AMPLIFIER**

**7.01** 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. See Fig. 4.

**7.02** The speech amplifier consists of two CK-512AX Pentodes (designated V-1 and V-2) of the subminiature type and one 3V4 Pentode (designated V-3) of the miniature type. All have direct heated filaments operated on filtered dc from a 75-volt

power supply as discussed in 4.02. Speech input voltage is applied to the grid of V-1, with RC coupling to V-2. A potentiometer R-106 is mounted on the amplifier chassis and is not accessible to the subscriber. It is intended only to compensate for accumulated variations in vacuum tubes and circuit components. Resistors R-103 and R-107 are connected across the filaments of V-1 and V-2 since these require only 0.020-ampere filament current while the other tubes require 0.050-ampere filament current. Resistors R-104 and R-125 form a voltage divider to supply screen voltage to V-1 providing a small amount of degenerative feedback. Resistor R-126 provides grid bias for V-3.

**7.03** Feedback is provided around V-3 by means of R-130 and C-126. C-116 limits the high-frequency response of the amplifier so that the amplifier response is similar to that of the recording heads and medium.

**7.04** Output transformer T-1 is used for coupling the speech amplifier to the isolating transformer T-2 for transmission to the telephone line. It is also used to couple the speech to the external recorder receptacle. When recording, audio output from V-3 is combined with the high-frequency bias from V-5 (about 13,000 cycles per second) via C-108, R-112, C-114, and T-3 and connected to one of the recording heads by way of R-129, relay K-4, and switch S-21 or S-22.

**7.05** When the speech amplifier is used for reproducing sound from either magnetic drum, relay K-4 is not operated and the filaments of V-4 and V-5 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.

**7.06** Automatic volume control is used during recording of both the announcement and incoming messages. Speech voltage is taken from the plate of V-2 to the grid of V-4 via C-111. Frequencies above 1 kc are removed by C-110, the remainder being rectified by X-3 and filtered by R-102 and C-103. The filter elements are chosen to give a short attack and long release time. The AVC circuit is isolated during the transmission of beep tones by means of S-17 which is associated with the same cam (2-2) which energizes the beep amplifier V-6.

**7.07** The signal, or beep, tone is a 1400-cycle tone which is generated by a 52-tooth gear mounted on the motor shaft rotating in a magnetic field. The comparatively low level from the generator is amplified by V-6 before transmission to the line. The level of the first three beep tones (two at the beginning of the incoming message cycle and the first of the two final warning tones) is set by the voltage divider R-204 and R-205 to give a level of about -10 dbm on the line. Cam 2-3 operates at the same time as the last lobe on cam 2-2 to increase the level of the last beep tone to about -5 dbm. Plate current is connected to V-6 by switch S-32 only in the automatic answer position of the function selector knob. Transformer T-2 serves as an output transformer for V-6 as well as an isolation transformer.

**7.08** Amplifier power capacity is about 0.010 watt.

## 8. TRANSMISSION CONSIDERATIONS

### A. General

**8.01** The machine is designed to operate at normal telephone speech levels. The speech quality reproduced from both the announcement and incoming message drums is expected to be intelligible and comparable to good telephone transmission.

**8.02** The announcement should be recorded with room noise at a minimum so background noise will not be recorded since the AVC of the amplifier increases the sensitivity of the recording input circuit.

**8.03** The announcement message should begin as soon as the dictate light lights, so the interval between the time the machine responds to an incoming ring and the caller hears the start of the announcement will be short.

**8.04** The machine is designed to give less response at the lower frequencies to minimize low-frequency noise and greater response at the higher frequencies to insure improved intelligibility. Particular attention has been given to the 200- to 3000-cycle range since the machine is designed for use with telephone facilities. Figure 5 shows the frequency characteristic for each drum of a representative machine. It is expected that characteristics of other machines may vary considerably from this, however, for a number of reasons

including variations in the tolerances of components, tangency of heads, amount of pressure between heads and drums, and amount of wax on the drums.

**B. Transmission Levels**

**8.05** The transmitting level from the machine to the telephone line will normally be approximately -5 vu. If the user departs from normal speaking level when dictating his announcement message, this value might vary from about 0 to -8 vu. Levels from the machine to the telephone line are limited by the output of the V-3 tube to about +8 vu.

**8.06** The minimum incoming signal which the equipment will pick up and record for intelligible reproduction is about -60 vu. It is expected that this will enable messages to be recorded at a satisfactory level by a weak talker over limiting connections. If the caller does not speak properly or loudly enough, especially on limiting connections, some calls may be missed. It is apparent that if the gain were increased beyond what is provided, to compensate for low incoming level noise, crosstalk problems would become more important.

**8.07** The message playback level to the telephone set is generally about -10 to -20 vu and may be controlled to the extent of about 6 db by the user by means of the playback volume control knob.

**8.08** The announcement-check transmission path introduces a loss of about 15 db so the recorded talkout announcement is heard by the subscriber in the local telephone set at approximately the same level as would normally be heard at the calling end of an average telephone line.

**8.09** The impedance presented to the line while the machine is handling a call is approximately as follows:

<u>Frequency (cps)</u>	<u>Impedance (ohms)</u>
200	580
500	800
800	970
1000	1050
1500	1100
2000	1140
3000	1150

These figures were obtained from tests on a representative set and are an indication of what may be encountered. It is expected that individual machines may vary considerably from the above. The resistance of the holding circuit is about 110 ohms.

**9. SUPERVISION**

**9.01** The ringing circuit, as designed, represents the equivalent of two high-impedance bridges and the impedance to ringing is in the order of 4000 or 5000 ohms. Minimum ringing current required at 20 cps is 5 to 6 milliamperes. Since there is no provision in the 1A Telephone Answering Set for an audible signal, the telephone set ringer must also be connected across the line. This combination represents three high-impedance bridges in a normal installation and may limit its use in some types of service such as on certain PBX connections. It is expected that this may be modified in future designs of the machine so that its ringing circuit impedance approximates that of a 302- or 500-type telephone set.

**9.02** The impedance of the ringing circuit of the machine to voice frequencies is above 25,000 ohms. As mentioned in 1.02, a 531C subscriber's set is used for party-line installations. With proper connections, the machine does not tend to false start on dialing or other transients. Protection against transients across the line is obtained by a balanced circuit.

**9.03** The machine responds to a ringing signal within a fraction of a second of the first ringing pulse but does not seize the line for about 3-1/2 seconds. With this arrangement, the calling subscriber will ordinarily receive the recognizable ringing signal before ringing is tripped.

**9.04** The set has a maximum cycle of about 60 seconds. If the telephone line current is interrupted for a short time (approximately 25 milliseconds) after about 4 to 5 seconds of operation and before the 60-second period has elapsed, the "calling party disconnect" relay, K-7, releases the line and restores the machine to its standby condition. In cases where the required interruption of battery is not supplied by the central office equipment, the incoming message drum will run its full cycle of about 60 seconds whether the calling party disconnects within the allotted time or not.

**10. ANSWER ONLY**

**10.01** The machine is not arranged for answer-only service, but this feature can be had by blocking the 7B and 8B contacts of the K-1 relay and disconnecting the S-24-1 contact of the slide switch (Fig. 3). In addition, if a large number of calls are expected, it is advisable to loosen the

collar of the incoming recording drum clutch so that the clutch does not ride tightly against the driving surface of the drum. The clutch collar should be tightened in place so as to clear the bearing post by about 1/16 to 1/64 inch. If the answer-only feature is desired, the commercial aspects of furnishing this service should be considered before providing it.

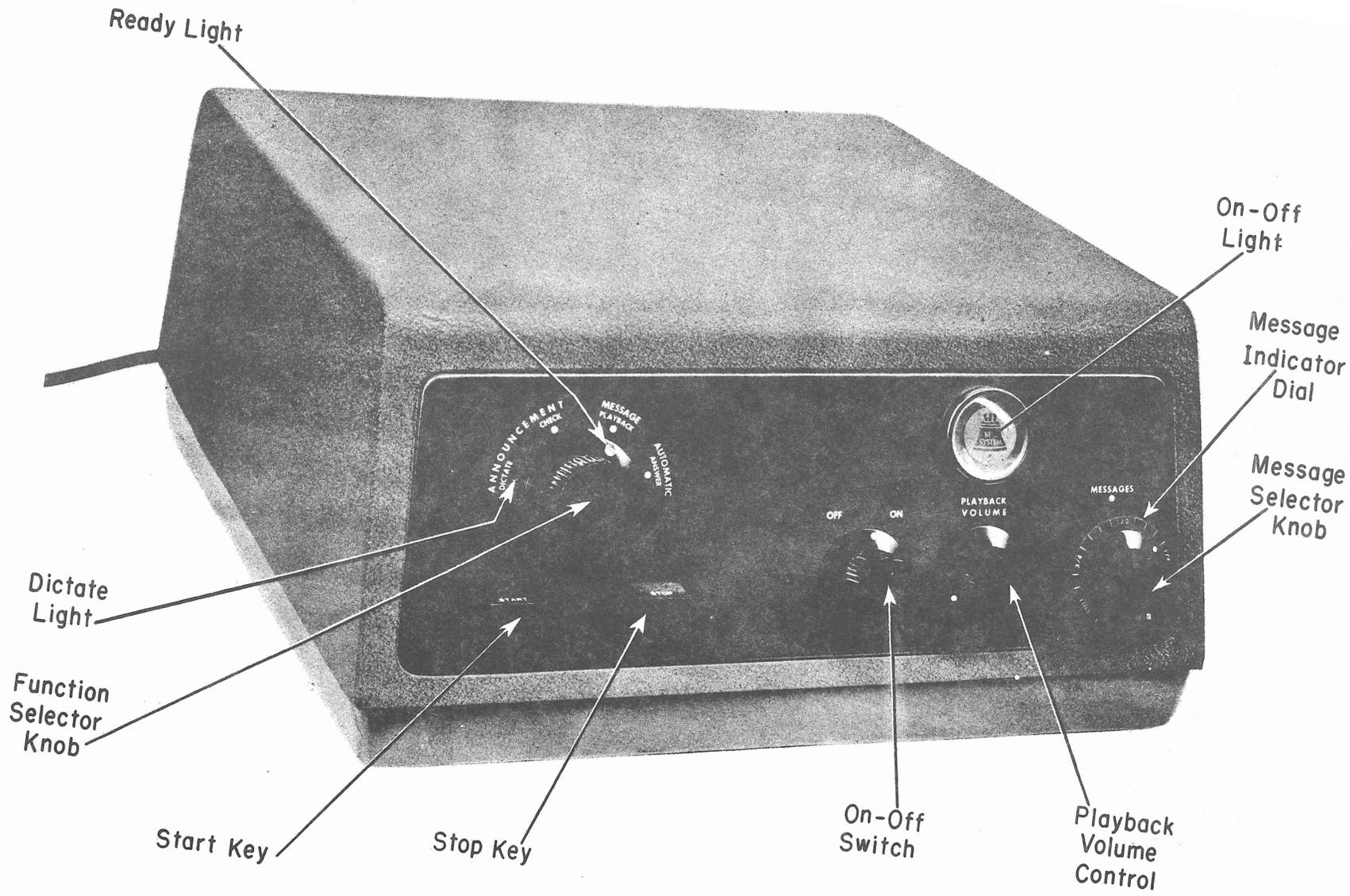
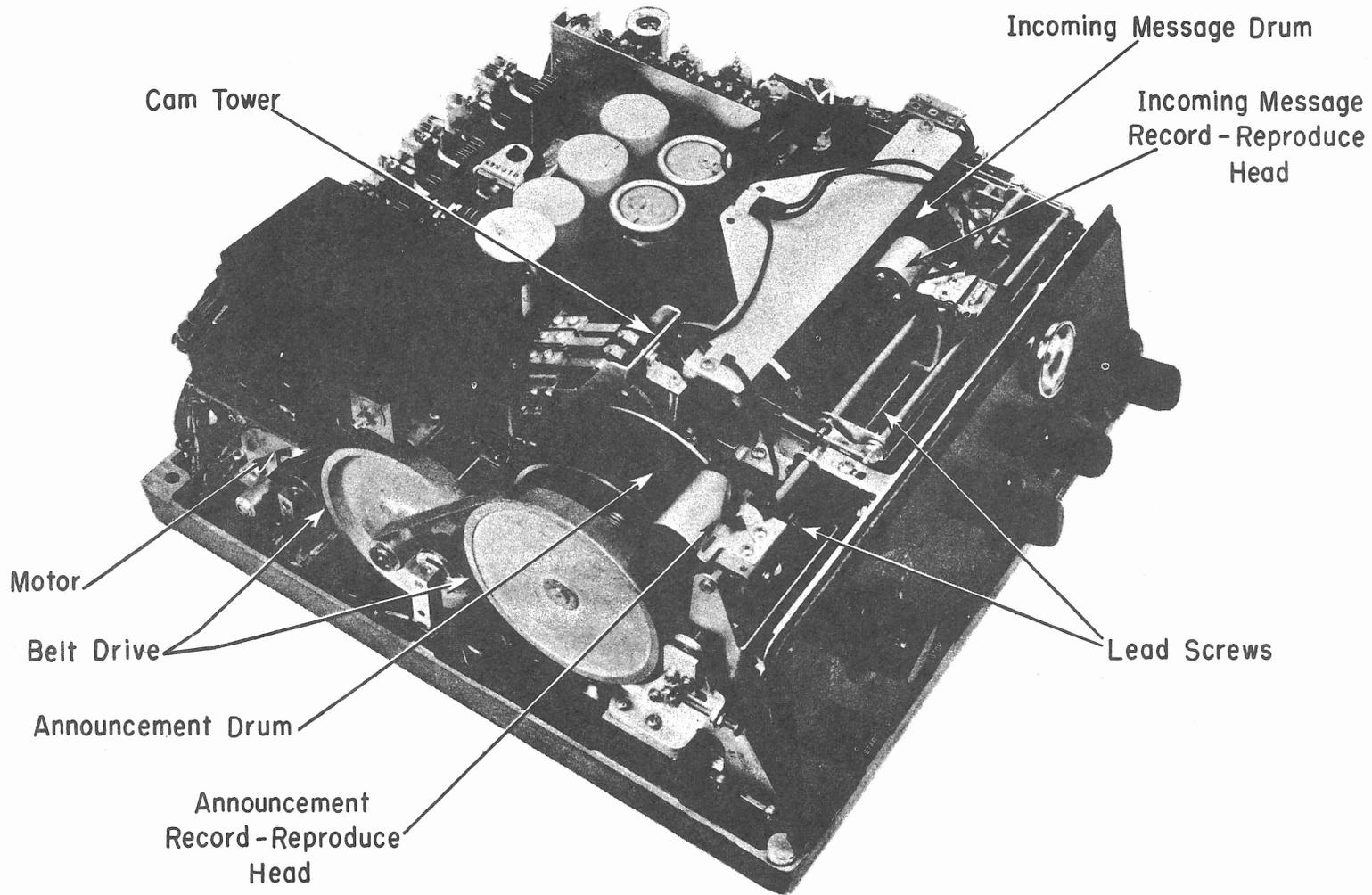
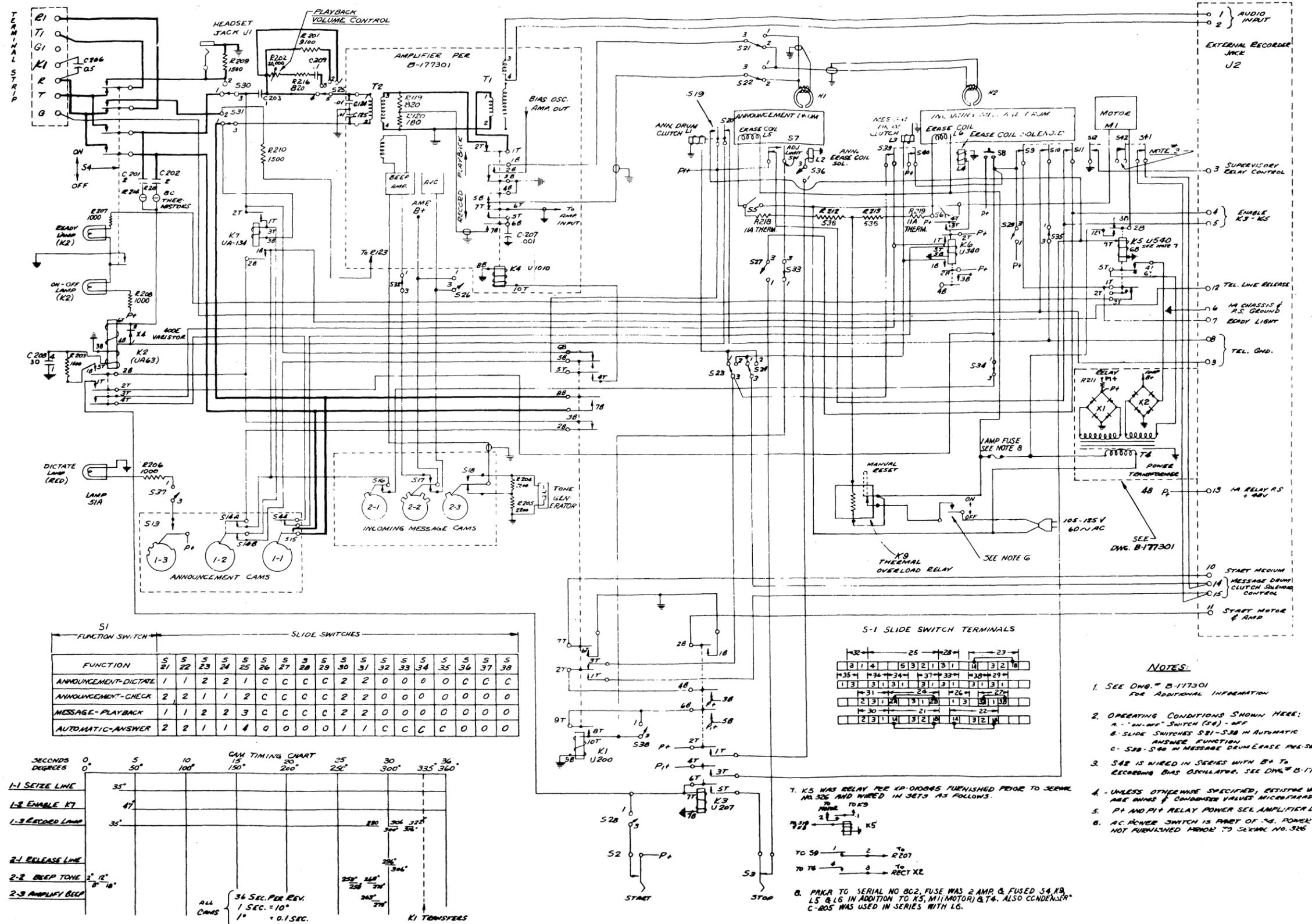


Fig. 1—1A Telephone Answering Set

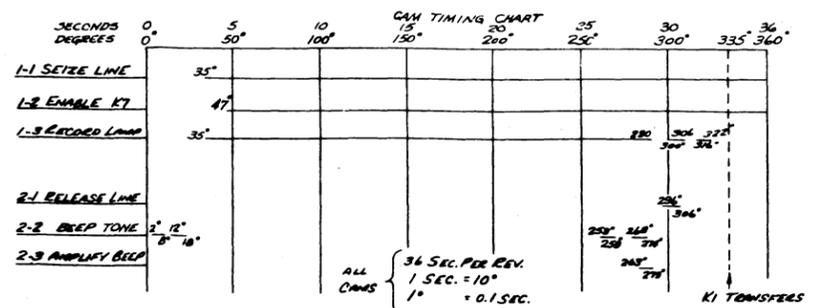


**Fig. 2—1A Telephone Answering Set—Cover Removed**



S1 FUNCTION SWITCH SLIDE SWITCHES

FUNCTION	S 21	S 22	S 23	S 24	S 25	S 26	S 27	S 28	S 29	S 30	S 31	S 32	S 33	S 34	S 35	S 36	S 37	S 38	S 39
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	

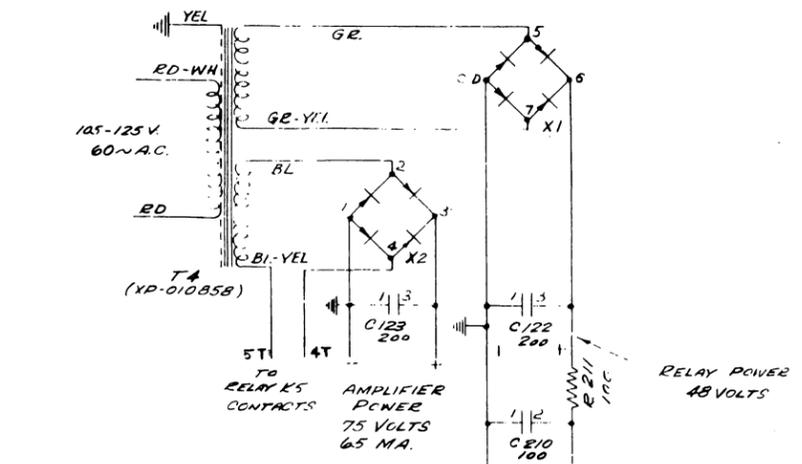
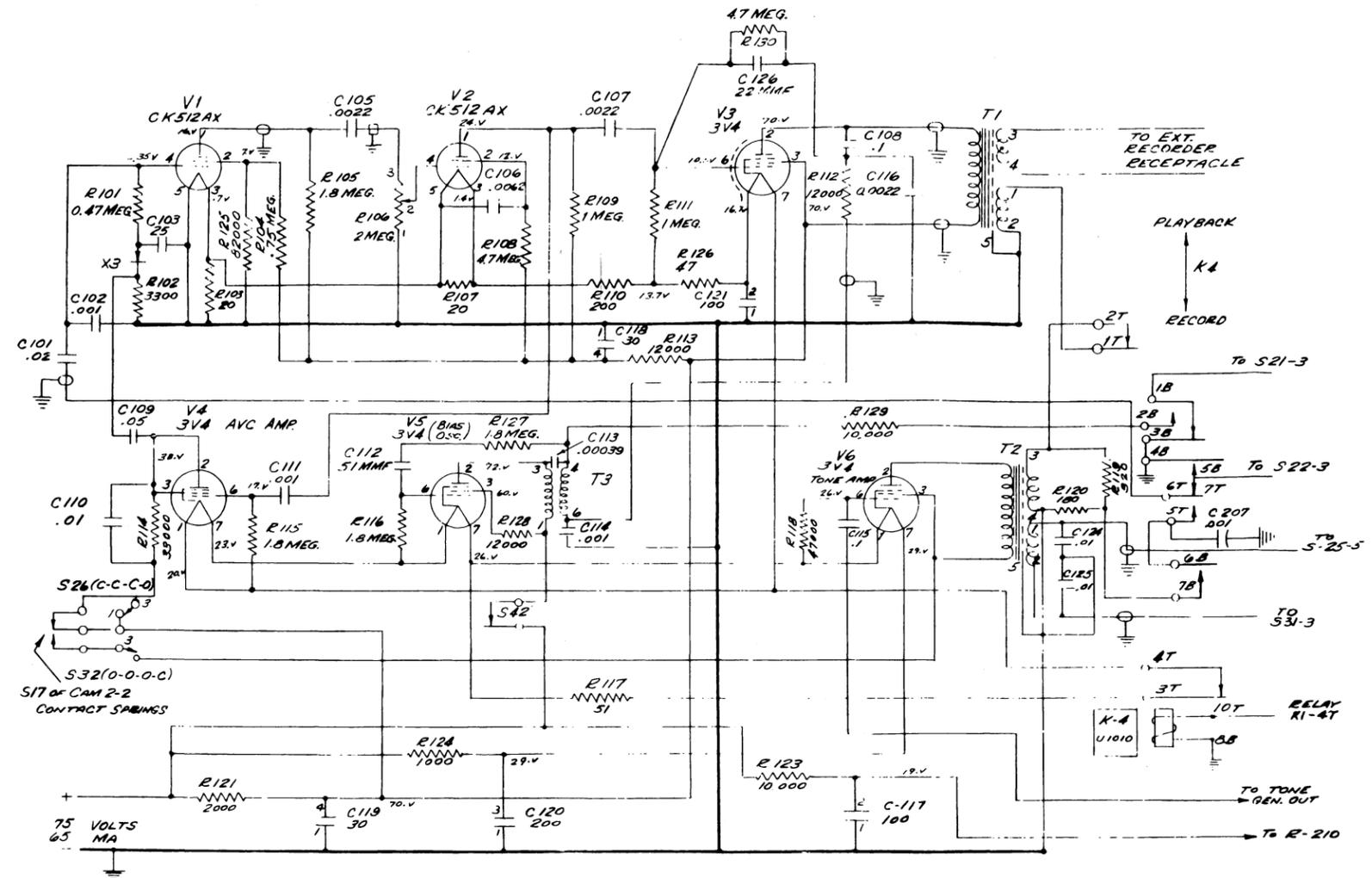


S-1 SLIDE SWITCH TERMINALS

32	25	28	23
31	34	37	33
30	31	31	31
29	24	26	27
28	21	13	13
27	14	14	14

- NOTES:
- SEE DWG. # B-177301 FOR ADDITIONAL INFORMATION
  - OPERATING CONDITIONS SHOWN HERE:
    - A. "ON-OFF" SWITCH (S8) - OFF
    - B. SLIDE SWITCHES S21-S38 IN AUTOMATIC ANSWER FUNCTION
    - C. S28-S40 IN MESSAGE DRUM ERASE PRE-SET
  - S48 IS WIRED IN SERIES WITH B+ TO RECORDING BIAS OSCILLATOR. SEE DWG. # B-177301
  - UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE OHMS & CAPACITOR VALUES MICROFARADS
  - P1 AND P14 RELAY POWER SEE AMPLIFIER DWG. # B-177301
  - AC POWER SWITCH IS PART OF S4. POWER SWITCH NOT FURNISHED PRIOR TO SERVICING NO. 326

Fig. 3



- NOTES:**
1. RESISTOR VALUES ARE OHMS UNLESS OTHERWISE SPECIFIED.
  2. CONDENSER VALUES ARE MICROFARADS UNLESS OTHERWISE SPECIFIED.
  3. S42, ACTUATED BY INCOMING MESSAGE HEAD CARRIAGE WHEN IN EXTERNAL RECORDER POSITION, REMOVES B+ FROM V5, STOPPING RECORDING BIAS.
  4. NOTATION ASSOCIATED WITH S26 & S32 DESIGNATES CONDITION OF SWITCHES IN THE FOUR FUNCTIONAL POSITIONS OF S1. S26 (C-C-C) MEANS - S26 (CLOSED-CLOSED-CLOSED-OPEN) IN ANNOUNCEMENT-DICTATE, ANNOUNCEMENT-CHECK, MESSAGE-PLAYBACK, & AUTOMATIC ANSWER, RESPECTIVELY.
  5. SEE B-111302 & B-177894 FOR INTERCONNECTING INFORMATION.
  6. VOLTAGES ARE MEASURED WITH VACUUM TUBE VOLTMETER BETWEEN INDICATED TERMINAL AND GROUND, WITH FUNCTION SWITCH AT ANNOUNCEMENT-DICTATE AND WITH LINE VOLTAGE OF 115V, 60W AC.

Fig. 4

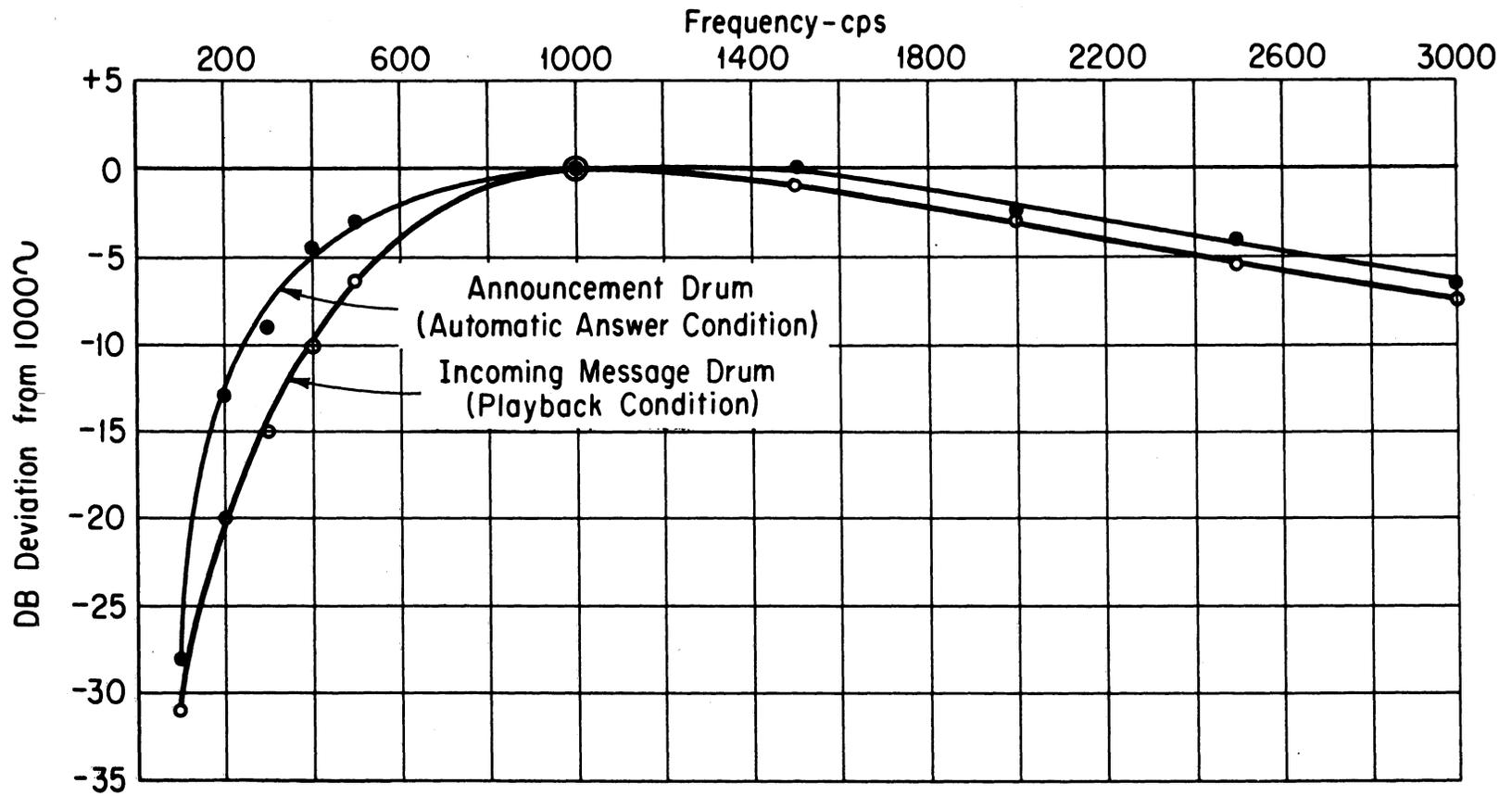


Fig. 5—Frequency Response—Representative 1A Telephone Answering Set