

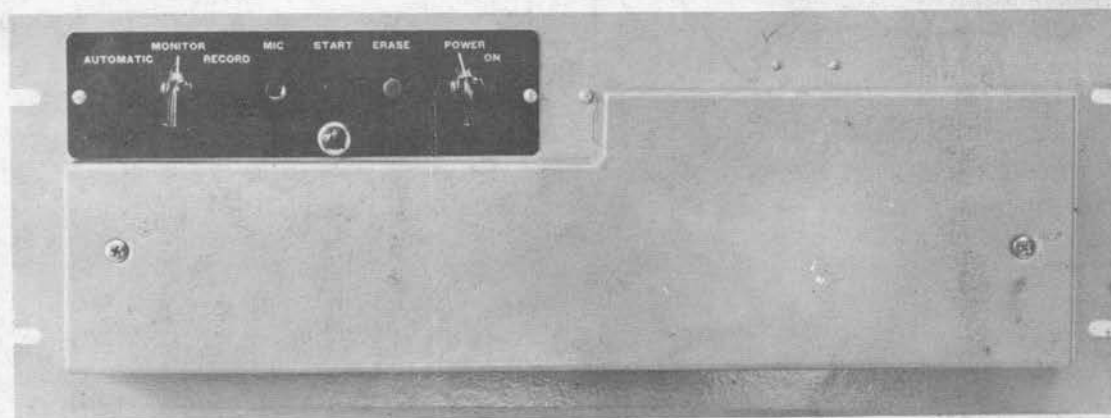
MODEL

INT-2A

Automatic Intercept Recorder
MANUAL

MAY

1960



Electronic Secretary

INDUSTRIES INC.

1101 S. PRAIRIE AVENUE, WAUKESHA, WISCONSIN

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Supersedes issue of September 1959

DESCRIPTION, INSTALLATION, CONNECTIONS**1**1.00 DESCRIPTION —

- 1.01 The INT-2A is a rack mounted, automatic, magnetic repeater which is adaptable to a variety of central office telephone intercept purposes.
- 1.02 Properly installed, the unit is capable of delivering a 12 second voice message to callers who dial numbers which have been changed, disconnected, etc. Sufficient power is delivered at the output of the machine to answer five calls simultaneously.
- 1.03 Central office personnel may change the message to suit the occasion by erasing the previous message and dictating a new one using the microphone supplied. Such messages may then be monitored to insure satisfactory delivery before the unit is connected to receive calls from subscribers.
- 1.04 A DC voltage will start the machine. Complete messages are repeated until this voltage is removed. The present cycle will then be completed and the unit will return to standby.

2.00 TRANSPORTING —

- 2.01 The INT-2A should be handled carefully at all times to avoid damage. Whenever possible the machine should be packed in the original shipping carton, or equivalent, if it is to be moved any distance.
- 2.02 Before transporting the machine always:
- (a) Remove the tape cover and carefully release the tape loop from the rollers, heads and switch. Place the loop in a protective container and replace the tape cover. Mechanical shocks incurred in normal transportation are liable to damage the tape loop if it is left in operating position.
 - (b) Pack the microphone carefully to avoid damage during shipment.
 - (c) All auxiliary parts included in the same carton with the INT-2A should be secured to prevent possible damage to components on the machine.

3.00 LOCATING —

- 3.01 The INT-2A should be mounted in a central office standard 19 inch telephone relay frame. Panel height of the unit is seven inches. Frames of larger widths require an adapter panel to accommodate the INT-2A.

- 3.02 If possible space on the frame should be selected to position the machine within easy reach of personnel who change the recording.
- 3.03 It is preferable to locate the machine where background noise can be held at a low level during recording.
- 3.04 Avoid locations that would subject the equipment to extremes of temperature, moisture, dust and vibration.
- 3.05 Locations convenient to intercept trunk connections and a proper power source will ease installation. See 6.00 in this section for power supply requirements.
- 4.00 INSTALLATION —
- 4.01 Do not connect the machine to a power source until installation is complete.
- 4.02 Fasten the INT-2A in the selected rack space using four 10 - 32 x 1/2 inch binding or truss head screws, with the control panel toward the front.
- 4.03 Connect the signal and start terminals on TB-1, as indicated under Section 5.00 "Connections," to proper intercept trunk connections in the central office equipment.
- 4.04 Remove the tape cover by loosening the two 10 - 32 Phillips head screws holding it.
- 4.05 Check to see that all surfaces which contact the tape are clean. See Section 5. Install the tape loop around the pillars, rollers and heads as shown in Figure 1. The oxide coating (dull side) should be on the inside of the loop. Be sure that the capstan pressure roller is held away from the capstan, and the tape threaded to run between them. While holding the pressure roller open, grasp the loop at the slotted switching section, and position the splice so that the tape switch actuator seats in the splice slot. After determining that the tape moves freely, release the pressure roller.
- 4.06 Avoid kinking and scratching of the tape loop during the threading operation. Excessive handling of the recording portion of the loop may cause its useful life to be shortened.
- 4.07 Connect the machine to a 115 Volt 60 cycle power source as indicated under 6.00 "Power Supply" in this section.

5.00 CONNECTIONS —

- 5.01 Several terminals are provided on TB-1 to accommodate various intercept terminations.
- 5.02 Terminal L-2 is always connected to the signal ground intercept trunk terminal.
- 5.03 Connect the remaining signal lead to one of the L-1 terminals to secure proper service as follows:
- (a) Connecting the signal lead to L1-A will complete the output circuit only when a DC start signal is present.
 - (b) Connecting the signal lead to L2-A will permit completion of the output circuit through a 2 microfarad capacitor only when a DC start signal is present.
 - (c) Connection of the signal lead to L1-C will complete the output circuit at all times when the set is in automatic service.
- 5.04 Connect a 24 to 48 volt DC supply to the "BATT." terminal.
- 5.05 Wire the "START" terminal to the switch gear so it will receive ground when the machine is to be started.

6.00 POWER SUPPLY —

- 6.01 The INT-2A is designed to operate from a 115 volt, 60 cycle, AC power supply only. The machine must not be connected to a direct current source.
- 6.02 An eight foot detachable power cord is provided with the machine.
- 6.03 The cable receptacle on the cord should be connected to the 2 prong AC plug P-5, mounted on the amplifier chassis.
- 6.04 The cap of the AC cable receptacle on the power cord may be removed, exposing screw terminals. Thus the power cord may be shortened or removed for more direct wiring. Be sure the cap is replaced on the receptacle and the cord clamp tightened before energizing the power line.

7.00 FINAL TESTS —

- 7.01 Upon completion of installation, make certain that all features of the INT-2A operate properly by recording a test message and monitoring it as under "Operating Instructions," Section 2.

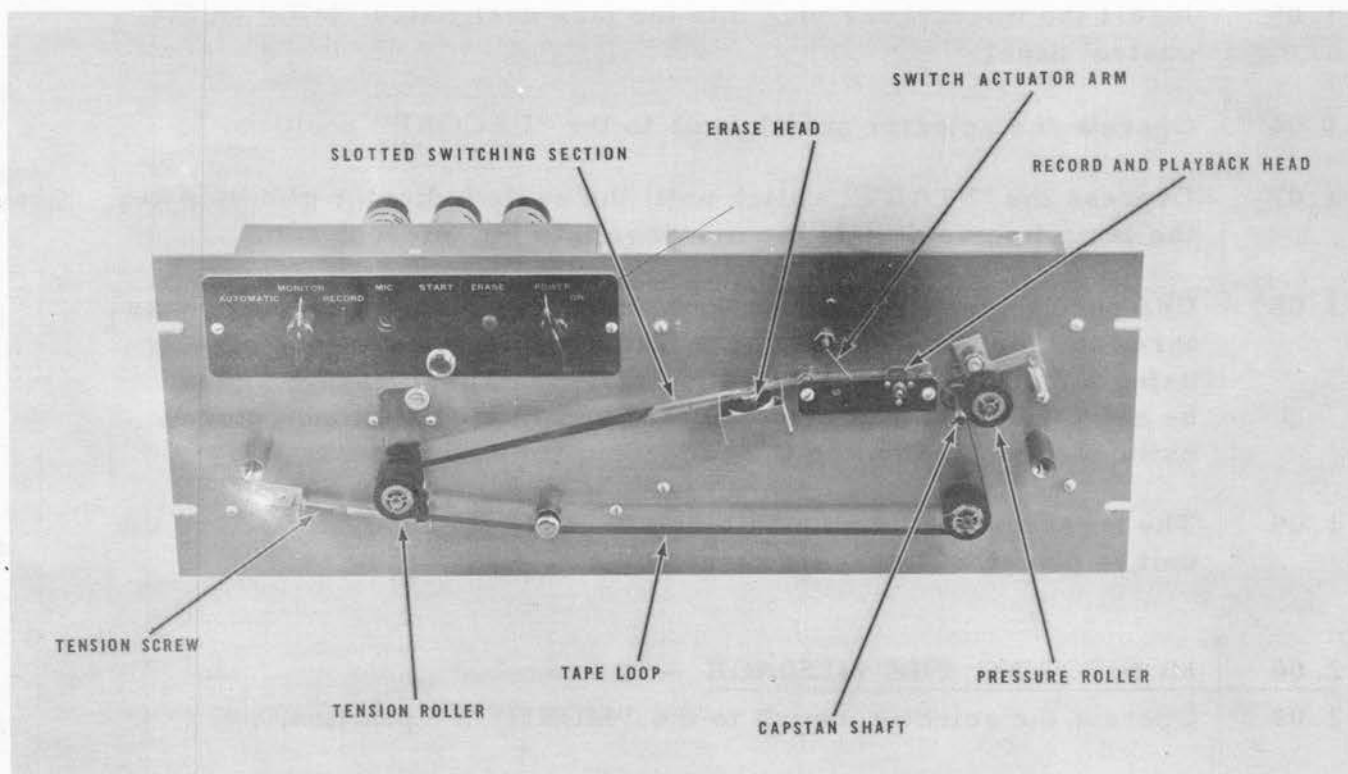


FIGURE 1

OPERATING INSTRUCTIONS

1.00 RECORDING A MESSAGE --

- 1.01 Rotate power switch knob on the INT-2A to the "ON" position.
- 1.02 Operate the selector knob to the "MONITOR" position.
- 1.03 Depress both "START" and "ERASE" switch buttons. Release the "START" switch after the cycle indicator glows. See figure 2. Hold the "ERASE" switch until the cycle has been completed and the indicator lamp is extinguished. This action will clear the tape in preparation for new recording.
- 1.04 In no case should a new recording be made before the old message is erased.
- 1.05 Insert the microphone plug into the jack designated "MIC" on the control panel.
- 1.06 Operate the selector switch knob to the "RECORD" position.
- 1.07 Depress the "START" switch until the cycle indicator glows. After the lamp lights, dictate the message into the microphone.
- 1.08 Use good telephone practice while dictating. Hold the microphone three to four inches from the mouth and speak slowly and clearly using a moderate voice level. A short, simple message should be selected which can be completed before the cycle indicator is extinguished, indicating the recording time is exhausted.
- 1.09 The message should be monitored to check acceptability before the unit is placed in intercept service.

2.00 MONITORING THE MESSAGE --

- 2.01 Operate the selector switch to the "MONITOR" position.
- 2.02 Depress the "START" switch until the cycle indicator glows.
- 2.03 Play back of the message can now be heard in the microphone.
- 2.04 Leaving the microphone connected to the machine will not affect automatic performance, but in any case the microphone should be protected from heat, moisture and damage when in use or not.
- 2.05 If the recording is not acceptable as monitored, repeat the erase and recording procedures.

3.00 AUTOMATIC OPERATION —

- 3.01 To connect the INT-2A for automatic intercept operation operate the selector switch knob to the "AUTOMATIC" position.
- 3.02 Be sure that the power switch remains at the "ON" position.
- 3.03 A ground closure received at the "START" terminal will now initiate an automatic cycle, delivering the recorded messages to the telephone line.
- 3.04 Output level may be varied as desired by adjusting the screw driver control on the amplifier chassis at the rear of the unit.

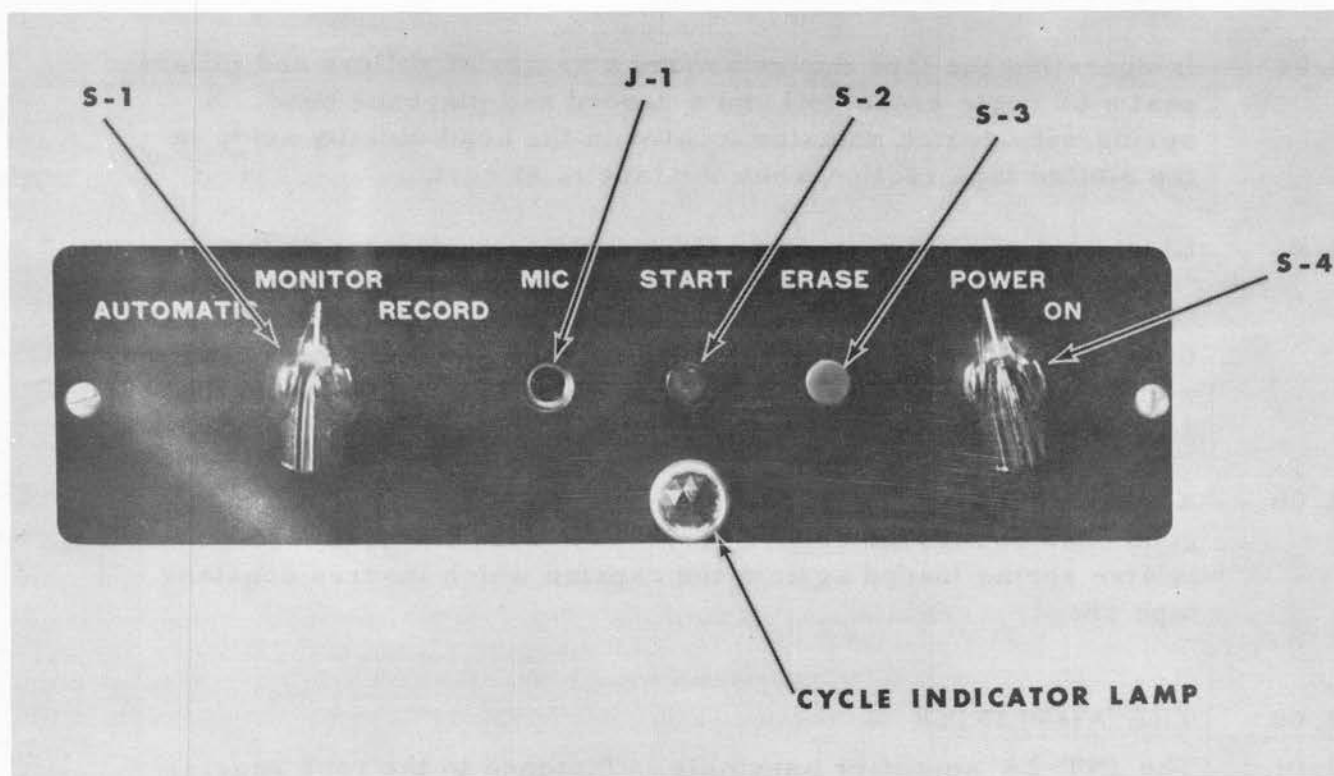


FIGURE 2

GENERAL OPERATING PRINCIPLES AND DESCRIPTION OF BASIC COMPONENTS

1.00 THE TAPE MECHANISM —

- 1.01 The tape transport mechanism is powered by an 1800 RPM hysteresis synchronous ball bearing motor. Speed reduction is accomplished by coupling the motor shaft through a rubber faced idler to a large flywheel and capstan shaft assembly.
- 1.02 Contact of the tape loop with the capstan shaft and a rubber pressure roller drives the tape at two inches per second.
- 1.03 A tape loop in good condition has a completed circumference of 27-3/16 inches. It consists of a section of heavy duty, lubricated, mylar recording tape, and a heavier, slotted, mylar switching tape, welded into an endless loop.
- 1.04 In operation the tape moves around a series of rollers and pillars past a 60 cycle erase coil and a record and playback head. A spring wire switch actuator located in the head vicinity seats in the slotted tape section when the tape is at rest.
- 1.05 Electrical start signals from the telephone equipment or the "START" button will cause the switch (controlled by the actuator) to be by-passed, energizing the motor and moving the tape. As the slot moves away from the head area the actuator and switch will cause the motor to run until the cycle is completed and the actuator falls into the slot.
- 1.06 A movable spring loaded tension roller keys the tape taut and in good contact with the record playback head. The pressure roller is also spring loaded against the capstan which insures constant tape speed.

2.00 THE AMPLIFIER —

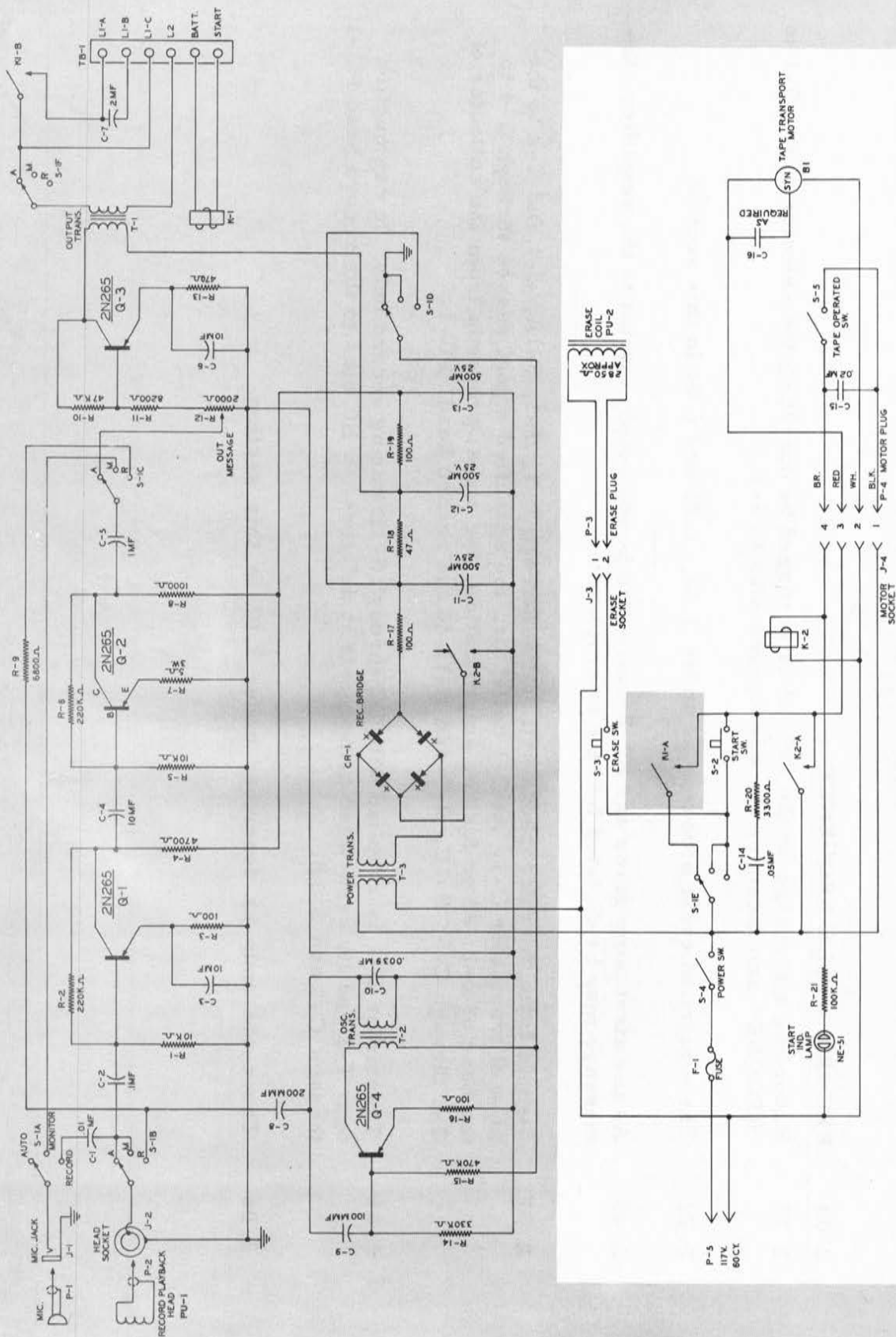
- 2.01 The INT-2A amplifier assembly is fastened to the rack panel which also is the foundation for the tape transport mechanism.
- 2.02 Signal amplification and recording is accomplished in four type 2N265 transistors. Two are used in the record amplifier. These same two provide monitor amplification. An additional transistor is cascaded with the above mentioned two providing a three stage amplifier driving the telephone line. The fourth 2N265 delivers high frequency energy to the record head for bias purposes.

- 2.03 DC power is supplied to the amplifier from a low voltage power transformer feeding a full wave bridge rectifier and a three section filter network.
- 2.04 All telephone line connections are brought out to a six terminal barrier strip TB-1. Connections to the record-play head, the erase coil and AC power circuits on the tape deck appear at J-2, J-3 and J-4 respectively. An AC line source to power the unit is connected at P-5.

OPERATING SEQUENCES

1.00 ERASE CYCLE SEQUENCE -

- 1.01 With the INT-2A power switch S-4 operated to the "ON" position and the selector switch S-1 in "MONITOR" the erase sequence proceeds as follows.
- 1.02 As "START" switch S-2 is closed, AC supplied to it from P-5, F-1, S-4, and rotary switch section S-1E will continue to pin 3 of J-4 and P-4, starting the tape transport motor B-1.
- 1.03 Motor B-1 drives the tape, moving the slot away from the switch actuator which closes S-5. AC line voltage is supplied to the normally open contact of S-5 from power switch S-4 through pin one of J-4 and P-4. As S-5 closes it will complete an AC path through pin 4 of P-4 and J-4 energizing K-2 coil and lighting the start indicator lamp. S-5 will continue to hold K-2 until the tape slot returns to the switch actuator.
- 1.04 As K-2 operates contact K2-A will bridge S-1E and S-2 supplying AC to the transport motor B-1 for the duration of the cycle after S-2 is released.
- 1.05 Erase switch is closed supplying AC from S-1E through S-3, pin 2 of J-3 and P-3 to the erase coil PU-2. S-3 is held during the entire cycle to clear the tape of previous recording.
- 1.06 K2-B completes the power supply circuit to the amplifiers. They are not used during the erase cycle.
- 1.07 After the tape loop completes one revolution S-5 actuator will again drop into the tape slot. As S-5 opens K-2 will release, causing K2-A to open the power circuit to transport motor B-1, and extinguishing the start indicator lamp. K2-B will open the DC power supply circuit to the amplifier.



ERASE CYCLE SEQUENCE
FIGURE 3

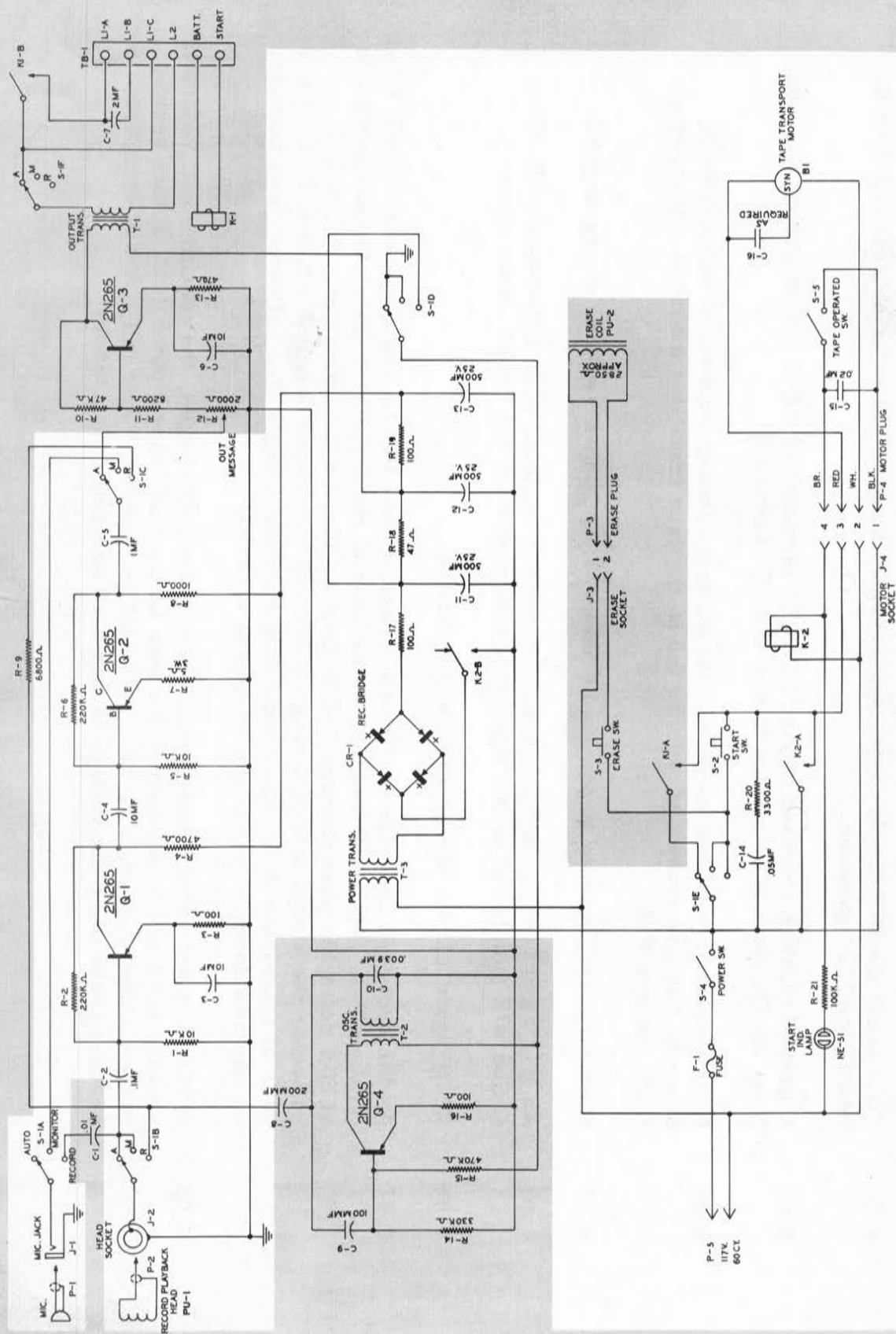
2.00 RECORD CYCLE SEQUENCE -

- 2.01 Recording a message on the INT-2A is arranged by operating the selector switch S-1 to "RECORD" and inserting the microphone plug in J-1.
- 2.02 The electrical cycle proceeds as under 1.02, 1.03 and 1.04 in this section.
- 2.03 As the start lamp glows and K2-B closes the power supply circuit to the amplifier, the message may be dictated into the microphone.
- 2.04 Signals from the microphone will travel through P-1, J-1, S-1A, C-1 and C-2 to the base of transistor Q-1. At Q-1 collector, the amplified signal passes through C-4 to the base of Q-2. After further amplification, the signal proceeds from the collector of Q-2 through C-5, S-1C, R-9 and S-1B to the record head, PU-1.
- 2.05 Transistor Q-4 is supplied with DC through S-1D during record only. In conjunction with T-2 and its associated components it delivers 50 KC bias to the record head PU-1 through C-8 and S-1B.
- 2.06 The cycle ends as described under 1.07 in this section.



3.00 MONITOR CYCLE SEQUENCE -

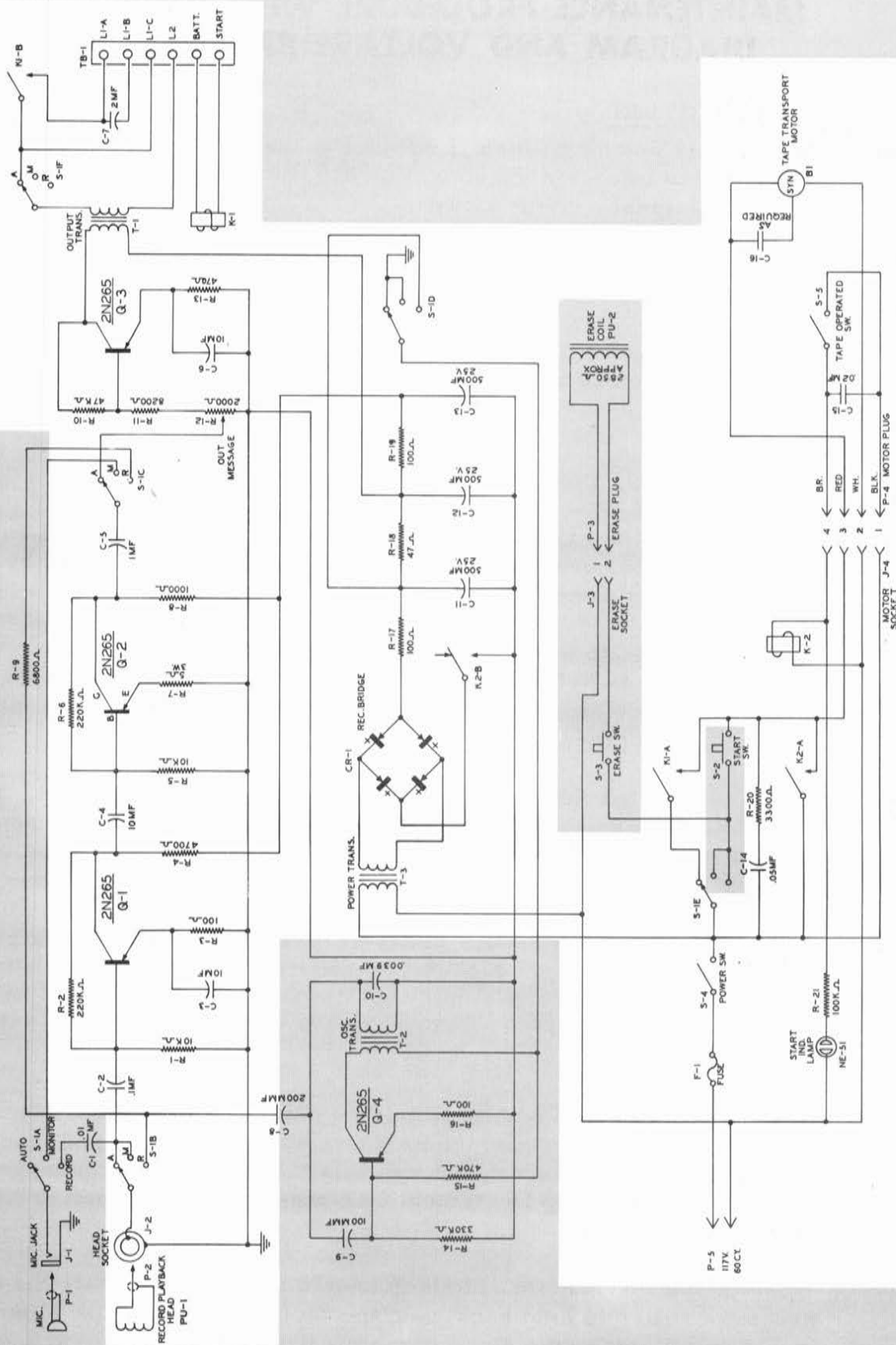
- 3.01 To facilitate checking the message recorded on the INT-2A, the selector switch S-1 is operated to "MONITOR" position. The microphone plug P-1 remains connected to J-1 during the operation.
- 3.02 Electrical cycling again functions as under 1.02, 1.03 and 1.04 in this section.
- 3.03 Contact K2-B closes, energizing the amplifiers.
- 3.04 As the recorded message on the tape passes head PU-1, signal proceeds from PU-1 through P-2, J-2, S-1B and C-2 to the base of transistor Q-1. Amplified signals at Q-1 collector pass through C-4 to the base of Q-2 for further amplification. From Q-2 collector the signal moves through S-1C, S-1A, J-1 and P-1 to the microphone which now serves as a head set type transducer.
- 3.05 Cycle termination is described under 1.07 in this section.



MONITOR CYCLE SEQUENCE
FIGURE 5

4.00 AUTOMATIC CYCLE SEQUENCE -

- 4.01 To connect the INT-2A for intercept service, operate the selector switch S-1 to the "AUTOMATIC" position.
- 4.02 A ground closure received at the "START" terminal of TB-1 will energize K-1 coil from the DC source connected to the "BATT" terminal.
- 4.03 K-1 Contact arm is now supplied with AC from Power switch S-4 through S-1E. Since K-1 is now closed AC will be fed to the tape transport motor B-1 through pin 3 of J-4 and P-4.
- 4.04 Electrical cycling now proceeds as under 1.03 in this section, energizing K2.
- 4.05 As K-2 operates contact K2-A will bridge the contacts of K-1 through S-1E. This action will supply AC to the tape transport motor for the length of the cycle.
- 4.06 K2-B again closes the power supply circuit.
- 4.07 As the recorded message on the tapes passes head PU-1, signal proceeds from PU-1 through P-2, J-2, S-1B and C-2 to the base of the transistor Q-1. Amplified signals at Q-1 collector pass through C-4 to Q-2 for further amplification. From Q-2 collector the signal moves through S-1C, out message control R-12, and R-11 to the base of transistor Q-3. After final amplification signals Q-3 collector pass through output transformer T-2 to the telephone circuits.
- 4.08 If the DC start voltage was removed after the cycle began, the machine will return to standby after one revolution of the tape loop as described under 1.07 in this section. If the voltage still remains the cycle will be repeated. The INT-2A will complete its present cycle when the voltage is removed and return to standby.



AUTOMATIC CYCLE SEQUENCE
FIGURE 6

MAINTENANCE PROCEDURE WITH WIRING DIAGRAM AND VOLTAGE READINGS

1.00 INTRODUCTION —

- 1.01 As with any machine which is subject to the duty cycles often encountered in intercept service, the INT-2A will perform best when given occasional service attention.
- 1.02 Periodic inspection of the items listed in this section will reduce the possible out of service time to a minimum.
- 1.03 Always disconnect the power source before removing covers or parts which expose AC terminals.

2.00 SUGGESTED PERIODIC INSPECTION —

- 2.01 Observation of the tape and its drive system is accomplished by removing the tape cover at the front of the machine. It is held by two 10 - 32 Phillips head screws.
- 2.02 Inspect the tape to insure that it is not kinked or scratched and that the welded joints are secure. No foreign material should appear on the tape surface except the graphite tape lubricant that was applied by the manufacturer.
- 2.03 Check to see that the tape tension roller is properly adjusted. It should provide enough tension to the loop for proper tape pressure at the head, without introducing excessive drag or causing the tape to stretch. Adjust the tension screw if necessary. See figure 1.
- 2.04 Be sure the capstan, rubber pressure roller, tension roller, pillars and heads are clean. If cleaning is required, release the capstan pressure roller, carefully unthread the tape loop, and clean the surfaces with a soft lintless cloth moistened with denatured alcohol. Re-thread the tape loop.
- 2.05 If the tape loop itself has accumulated foreign matter, the loop may be removed from the machine as above and carefully wiped with a soft dry cloth. Do not use volatile solvents. Should this cleaning be ineffective, or if the loop is stretched or ragged, replacement of the loop is indicated.
- 2.06 When on the mechanism, the loop should move freely while the capstan pressure roller is held back, and the tape switch actuator should travel in and out of the slot without binding and catching. S-5 should be operated with sufficient overtravel in each direction.

- 2.07 Occasionally the motor bracket cover at the rear of the unit should be removed, and the internal drive surfaces inspected. The cover is held with four 6 - 32 round head screws. Be sure the motor shaft, drive idler, and flywheel rotate freely. Clean the driving surfaces with a lintless cloth moistened with denatured alcohol, if necessary.
- 2.08 Replace all dust covers removed during inspection.
- 2.09 Performance of the unit should be checked frequently when the unit is in normal operation by listening to the message. Deterioration of message quality will indicate whether inspection or more intensive service is required. Such listening tests provide good indications of amplifier condition.
- 3.00 DISASSEMBLY FOR SERVICING —
- 3.01 Dust covers are removed as previously outlined under 2.01 and 2.05.
- 3.02 Removal of the amplifier from the panel is accomplished as follows:
- (a) Disconnect power supply receptacle from P-5 and motor, erase and head plugs from their respective sockets on the amplifier.
 - (b) Loosen the set screws holding selector switch and power switch knobs, and remove them from the shafts.
 - (c) Using a nut driver remove the four 6 - 32 hexagon nuts holding the amplifier to the rear of the rack panel. Slide the amplifier back off the mounting studs.
- 3.03 Extension test leads will permit the amplifier to be operated when separated from the rack panel.
- 3.04 Removal of the motor bracket assembly and flywheel from the panel is accomplished as follows:
- (a) Unthread the tape loop from the mechanism.
 - (b) Disconnect motor plug from the amplifier chassis.
 - (c) Using a nut driver remove the four 6-32 hexagon nuts holding the motor bracket assembly to the rear of the panel.
 - (d) Slide the motor bracket assembly back off the

mounting studs. Use care to avoid dropping the fly-wheel. Should it be desired to free the bracket entirely from the panel, the leads from the tape actuator switch, S-5 should be unsoldered at the 4 lug terminal strip on the motor bracket.

- 3.05 Upon reassembly of the motor bracket be sure that the actuator switch leads are properly resoldered, and that the capstan pressure roller is held back as the flywheel shaft is inserted into the rack panel bearing.
- 3.06 Clean the capstan shaft of any oil accumulated during disassembly and check by eye to insure that it is perpendicular to the panel surface.

4.00 LUBRICATION

- 4.01 Initial lubrication of the INT-2A should be sufficient for a long period of service. Should it become necessary to lubricate the mechanism proceed as outlined below.
- 4.02 Factory lubrication of the sealed ball bearings in the tape drive motor should last the life of the unit. In no case should field lubrication of these bearings be attempted.
- 4.03 Lubrication of the sintered bronze bearings used in the drive system is usually neither necessary or desirable unless the shafts are disassembled from the respective bearings.
- 4.04 Clean the bearing shafts of accumulated gum and foreign material using a lintless cloth moistened with trichlorethylene.
- 4.05 Any accumulations inside the bearings should be cleaned with a dry cloth. Avoid using volatile solvents on the sintered surfaces as this will tend to remove the impregnated lubricant.
- 4.06 One drop of STANOIL #35, or GULF CREST "C" or equivalent, applied to the internal surface of each bearing before reassembly is sufficient. Avoid over lubrication.
- 4.07 After assembly remove any excess oil forced out the end of the bearings. All drive surfaces should be cleaned after lubrication as under 2.04 and 2.07 in this section.

5.00 GENERAL MAINTENANCE PROBLEMS AND REPAIRS

- 5.01 The INT-2A does not respond to start signals. Check for the following possible troubles:
 - (a) Power switch S-4 left in "OFF" position.

- (b) Power source disconnected from P-5.
- (c) Motor Plug P-4 disconnected from socket J-4.
- (d) DC voltage at "BATT" terminal low, or discontinuity to K-1 coil.
- (e) K-1 armature actuates, but K1-A contacts do not completely close. Adjust contact springs or clean contacts.
- (f) Fuse F-1 Blown. Determine cause before replacing with 1/4 ampere AGC size fuse.
- (g) Selector switch S-1 not in "AUTOMATIC" or poor contact in S-1E section.

5.02 INT-2A motor runs while start voltage is present, but delivers no message and does not complete a cycle after start voltage is removed. Check for the following:

- (a) Tape loop not threaded between capstan and pressure roller.
- (b) Tape loop doesn't move freely.
- (c) Tape switch actuator improperly adjusted — doesn't operate S-5.
- (d) Tape loop parted.
- (e) Drive idler tension spring disconnected or broken.
- (f) Insufficient force of pressure roller on capstan; spring broken or stretched, bind in support arm or in pressure roller bearing.
- (g) Oil on capstan shaft or motor shaft and/or driven surfaces.
- (h) Flywheel does not rotate freely.
- (i) Relay K2 not energizing, or K2-A not closing or fouled.

5.03 INT-2A completes automatic electrical cycling properly but

delivers no message. Check for the following:

- (a) Record-play head plug P-2 not in socket J-2.
- (b) No message on tape or tape threaded with oxide facing away from head or re-threaded inverted from previous installation.
- (c) Foreign material on record-play head PU-1.
- (d) Out message level control set at full counter clockwise.
- (e) Poor connection at TB-1.
- (f) K1-B contact not closing if telephone connection is made at L1-A on TB-1. Adjust or clean contacts.
- (g) Substitute known good transistors for Q1, Q2 and Q3.
- (h) Discontinuity in amplifier — check S-1 sections, voltages, components and connections.
- (i) K2-B contact not making. Clean or adjust.

5.04 INT-2A outgoing message weak, distorted or varying in level or speed. Check for the following:

- (a) Recording weak or tape improperly re-threaded. Foreign material on tape.
- (b) Outgoing message level control set too low.
- (c) Foreign material on playback head PU-1.
- (d) Poor contact of tape with head PU-1, tension roller adjustment improperly set, or tape loop stretched.
- (e) Record-Playback head PU-1 improperly aligned.
- (f) Amplifier weak. Substitute known good transistors for Q1, Q2, Q3.

- (g) Component trouble in amplifier. Check voltages, components and connections.
- 5.05 Malfunctions during other operations of the machine which exhibit symptoms and causes similar to those in automatic cycling will not be repeated.
- 5.06 INT-2A will not respond to closing of "START" switch S-2 during Record, Monitor or Erase. Check for the following:
 - (a) S-2 not making contact.
 - (b) Poor contact in S-1E.
 - (c) See 5.01 in this section.
- 5.07 INT-2A motor runs when "START" button is depressed while set is in "RECORD" or "MONITOR" but does not complete a cycle when start switch is released. See 5.02 in this section.
- 5.08 INT-2A completes electrical cycle in "RECORD" but will not deliver a message in "MONITOR" or "AUTOMATIC". Check for the following:
 - (a) Microphone plug P-1 not fully seated in jack J-1.
 - (b) Defective microphone, poor connection in cord, plug or jack.
 - (c) See applicable points under 5.03 in this section.
- 5.09 INT-2A recordings produce weak and/or distorted payout in "AUTOMATIC," and/or "MONITOR." Check for the following:
 - (a) Defective microphone or poor connection in microphone circuits.
 - (b) Insufficient or no high frequency bias delivered to record head PU-1. Check condition of Q4 by substitution with known good 2N265.
 - (c) Check S-1D, other sections of S-1, and voltage readings at Q4. Check C-8, T-2 and other associated components.

- (d) Recording made without erasing previous message.
 - (e) See applicable points under 5.04 in this section.
- 5.10 INT-2A does not erase tape cleanly or will not erase at all. Check for the following:
- (a) Erase operation performed with switch in "RECORD" position and microphone left connected, recording background noise during erase. Erase with the selector switch in "MONITOR" position.
 - (b) Erase switch S-3 not held during length of erase cycle.
 - (c) Open circuited erase coil PU-2.
 - (d) PU-2 not properly positioned — should be located 1/32" away from tape.
 - (e) S-3 not making contact.
- 5.11 The preceding outline is intended to serve as a guide to expedite location and repair of trouble which may possibly occur in the INT-2A. For reasons of space and clarity additional detailed descriptions of trouble characteristics and repair instructions are not included.

5.12 DC Voltage Measurements:

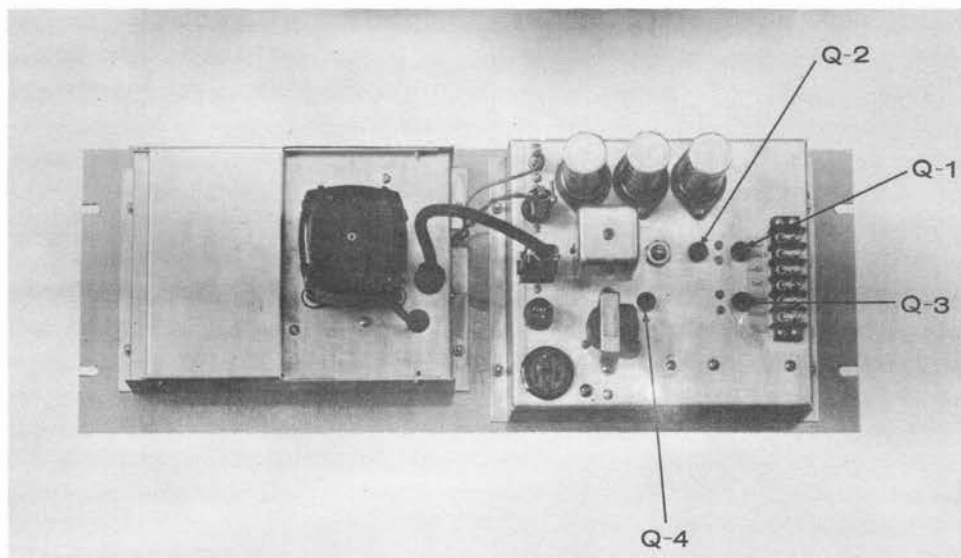
11 meg ohm input VTVM used. No signal in.

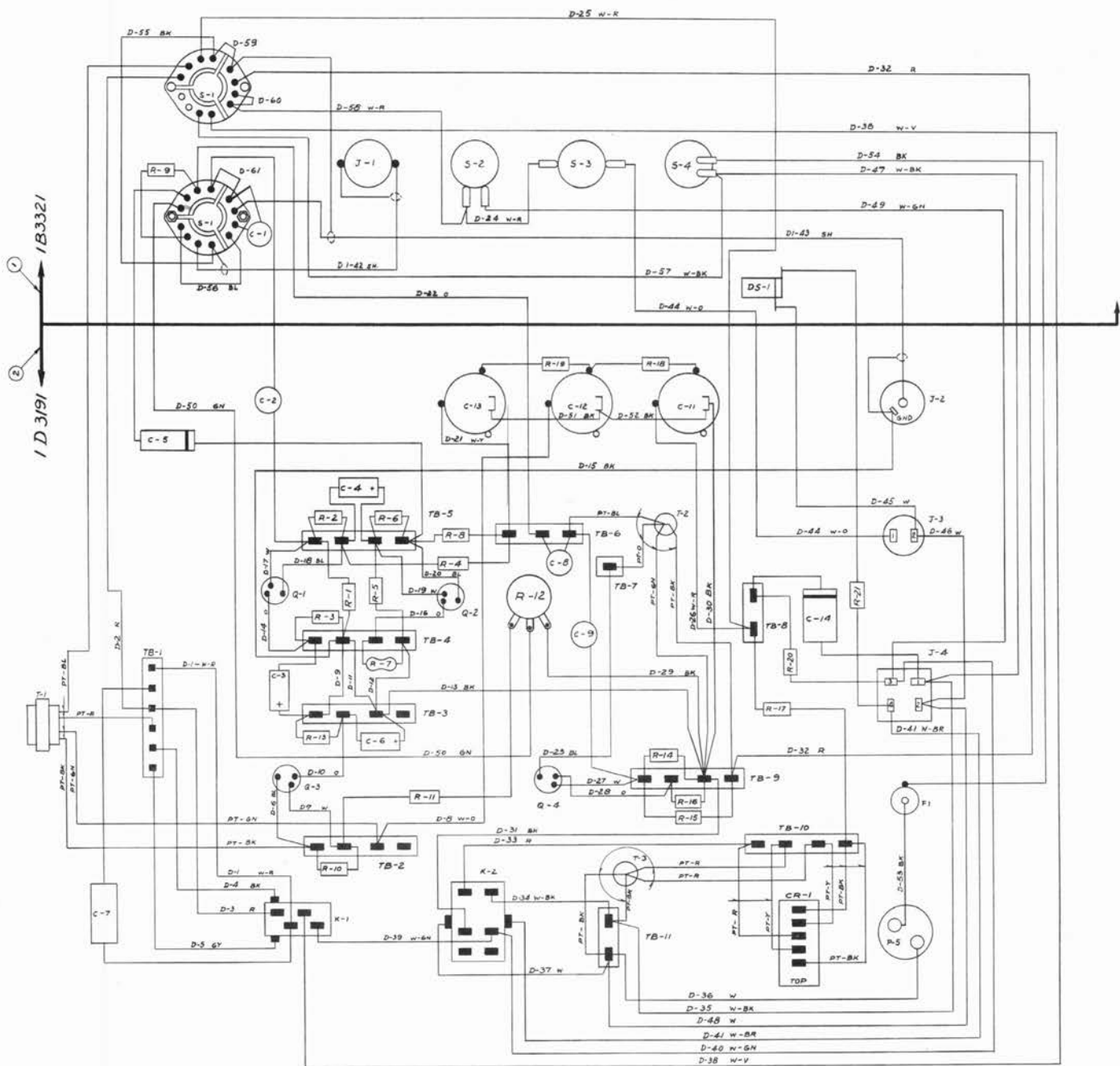
	<u>Automatic and Monitor</u>	<u>Record</u>
Rect. output (CR-1)	-25 to -28V	-23 to -26V
1st filter (C-11)	-23 to -25V	-20 to -22V
2nd filter (C-12)	-22 to -24V	-19 to -21V
3rd filter (C-13)	-20 to -22V	-18 to -20V
1st Stage (Q-1)		
Emitter	-.2 to -.3V	-1.8 to -2.8V
Base	-.3 to -.4V	-1.8 to -2.8V
Collector	-8 to -10V	-7.5 to -8.5V
2nd Stage (Q-2)		
Emitter	-.05 to -.1V	-.02 to -.06V
Base	-.15 to -.25V	-.08 to -.12V
Collector	-6 to -7V	-9.5 to -10.5V
3rd Stage (Q-3)		
Emitter	-5 to -6V	-3.8 to -4.8V
Base	-5 to -6V	-4 to -5V
Collector	-21 to -24V	-19 to -21V
Osc. (Q-4)		
Emitter	-----	-1.3 to -1.7V
Base	-----	+26 to +30V
Collector	-----	-20 to -22V

5.13 AC Signal Measurements:

	Automatic	Monitor	Record
Input	IMV at 1 KC across rec. -play head PU-1. See Note 1	IMV at 1 KC across rec. play head PU-1	5 MV at 1 KC across micro- phone. See Note 3
1st Stage (Q-1) Collector	20 to 24 MV AC	18 to 22 MV	15 to 20 MV
2nd Stage (Q-2) Collector	1.3 to 1.8 V	1.7 to 2.3 V	1.5 to 2 V
3rd Stage (Q-3) Base	.3 to .5V	-----	-----
3rd Stage (Q-3) Collector	3.5 to 5.5 V	-----	-----
Across Monitor Jack	-----	1.7 to 2.3 V	-----
Across Recording Head	-----	-----	.35 to .45 V
Power Out	-15 DBM (3 to 5 V across 600 Ω load)	-----	-----

- NOTE: 1. Outgoing level control R-12 set at max. C. W.
2. The 50 KC bias in record should be 50 to 70 MV when measured across a 100 Ω series resistor inserted in ground side of record head.
3. When measuring AC voltages in Record position remove oscillator transistor (Q-4) and connect a 1500 Ω resistor across C-11.
4. All AC voltages measured with a VTVM having one meg ohm input.
5. Line voltage 117 V AC 60 cps.





WIRING DIAGRAM
FIGURE 7

PARTS LISTINGS

INDEX TO INT-2A PARTS LIST

BEARINGS
BRACKETS
CAPACITORS
COIL
COVERS
FUSE
GROMMETS
HARDWARE
HEAD
INSULATORS
LAMP (PILOT)
MOTOR
PILLARS
PLUGS
RECTIFIER
RELAYS
RESISTORS
SHAFTS
SOCKETS
SPRINGS
SWITCHES
TERMINAL STRIPS
TRANSFORMERS
TRANSISTORS
WHEELS
MISCELLANEOUS PARTS

INT-2A PARTS LIST

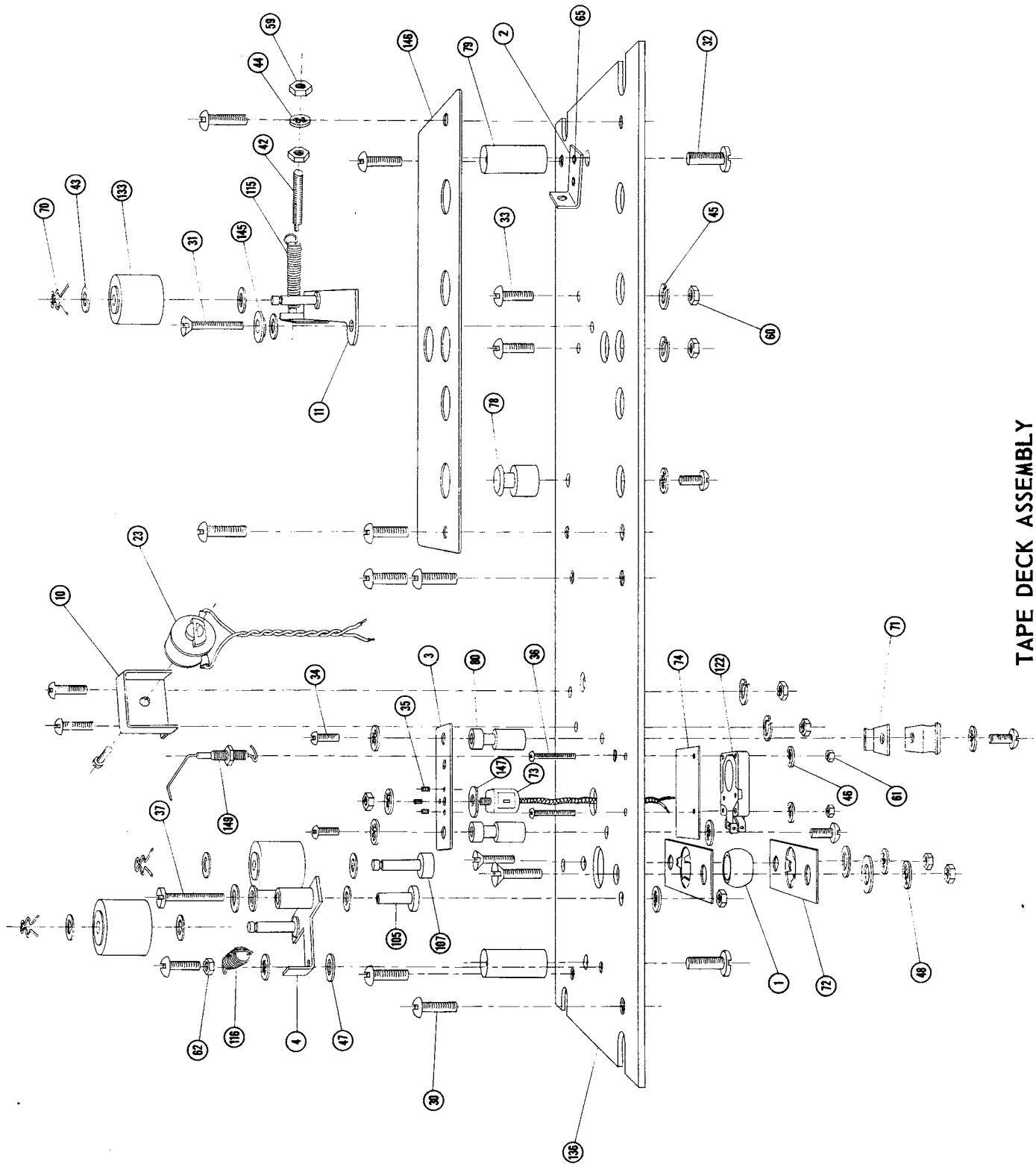
<u>REF.NO.</u>	<u>ESI PART NO.</u>	<u>DESCRIPTION</u>	<u>CIRCUIT DESIGNATION</u>
<u>BEARINGS</u>			
1	35-3238	Bearing, Self Aligning for Flywheel	
<u>BRACKETS</u>			
2	7-3276	Bracket, Tape Tension Adjust	
3	7-1124	Bracket, Recording Head	
4	1-3220	Bracket, Pressure Roller	
5	22-3193	Bracket, Motor Mtg.	
6	1-3223	Bracket, Pivot for Idler Drive	
7	1-3224	Bracket, Drive Idler Wheel Mtg. and Support	
8	7-3178	Bracket, Control Mtg.	
9	22-3176	Bracket, Amplifier Parts Mtg.	
10	11-3201	Bracket, Erase Coil Mtg. and Housing	
11	1-2245	Bracket, Tape Tension Support	
<u>CAPACITORS</u>			
12	17-1533	Ceramic Disc .01 MF $\pm 10\%$ 600V	C-1
13	17-3279	Ceramic Disc .1 MF $\pm 10\%$ 75V	C-2
14	18-3281	Electrolytic Tubular 10 MF 25V	C-3, C-4, C-6
15	18-3280	Electrolytic Tubular 1 MF 50V	C-5
16	17-3256	Paper Tubular 2 MF $\pm 10\%$ 200V	C-7
17	17-1547	Ceramic Disc 200 MMF $\pm 10\%$ 600V	C-8
18	17-1535	Ceramic Disc 100 MMF $\pm 10\%$ 600V	C-9
19	18-3167	Electrolytic Can 500 MF 25V	C-11, C-12, C-13
20	17-1530	Plastic Molded .05 MF $\pm 10\%$ 600V	C-14
21	17-3278	Plastic Molded .02 MF $\pm 10\%$ 600V	C-15
22	17-3274	Paper Tubular 1 MF $\pm 10\%$ 220V	C-16
<u>COIL</u>			
23	20-3277	Erase Coil	L-1
<u>COVERS</u>			
24	11-3207	Cover, Tape Transport (Front)	
25	11-3210	Cover, Motor Bracket	
<u>FUSE</u>			
26	46-3579	Fuse 1/4 Amp.	F-1
<u>GROMMETS</u>			
27	5-1068	Eyelet, Motor Mtg.	
28	5-2517	Grommet, Motor Mtg. Rubber	
29	5-1009	Grommet, 3/8 Hole x 1/4 Inside dia. Rubber	
<u>HARDWARE</u>			
30	3-1403	Screw, 6-32 x 1/2 R.H.	
31	3-1404	Screw, 6-32 x 1/2 F.H.	
32	3-1401	Screw, 10-32 x 3/8 B.H.	

<u>REF.NO.</u>	<u>ESI PART NO.</u>	<u>DESCRIPTION</u>	<u>CIRCUIT DESIGNATION</u>
<u>HARDWARE Cont'd</u>			
33	3-1402	Screw, 4-36 x 3/8 R.H.	
34	3-1438	Screw, 6-32 x 5/16 R.H.	
35	3-1433	Screw, Set 4-36 x 1/8	
36	3-1434	Screw, 2-56 x 3/4 R.H.	
37	3-2866	Screw, 6-32 x 1 B.H.	
38	3-1425	Screw, 6-32 x 1-1/4 R.H.	
39	3-1406	Screw, 6-32 x 1/4 RHMS	
40	3-1430	Screw, 3-32 x 1/4 R.H.	
41	3-3318	Screw, 10-32 x 1/2 P.H.	
42	3-3275	Stud, Tension Adjust	
43	4-2326	Washer, Fibre	
44	4-1393	Washer, Int. Star No. 8	
45	4-1351	Washer, Split Lock 1/8 x 3/16 No. 4	
46	4-1374	Washer, Int. Star 1/8 x 3/16 No. 2	
47	4-1362	Washer, Flat 3/8 O.D.	
48	4-1371	Washer, Int. Star No. 6	
49	4-1353	Washer, Flat 7/16 O.D. No. 6	
50	4-1375	Washer, Flat 9/16 O.D.	
51	4-2538	Washer, Fishpaper	
52	4-1356	Washer, Int. Star 3/8	
53	4-1363	Washer, Flat 3/8	
54	4-1354	Washer, Split Lock	
55	4-1372	Washer, Rubber 1/2 I.D.	
56	4-1373	Washer, Int. Star 1/2	
57	4-1355	Washer, Ext. Star No. 6	
58	4-2525	Washer, Tension	
59	2-1454	Nut, 8-32 x 1/4 Hex.	
60	2-1451	Nut, 4-36 x 1/4 Hex.	
61	2-1467	Nut, 2-56 x 3/16 Hex.	
62	2-1452	Nut, 6-32 x 1/4 Hex.	
63	2-1453	Nut, 3/8-32 x 9/16 Hex.	
64	2-1462	Nut, 1/2-24 x 11/16 Fuse Holder	
65	5-2296	Rivet, 1/8 x 7/32	
66	5-2295	Rivet, 1/8 x 3/16	
67	34-3244	Ring, Retaining for Transistor Sockets	
68	34-3248	Ring, Retaining for Chassis Mtg. Plug P-5	
69	34-2670	Clip, Capacitor Retaining	
70	34-1061	Clip, Hairpin Retaining	
71	34-1095	Cable Clamp	
72	34-3240	Bearing Retainer	
<u>HEAD</u>			
73	44-1318	Record Head	PU-1
<u>INSULATORS</u>			
74	53-1098	Insulator for Coin Switch S-5	
75	53-3297	Insulator for Terminal Strip TB-12	
<u>LAMP (PILOT)</u>			
76	51-1153	Tube, Neon No. 51	DS-1

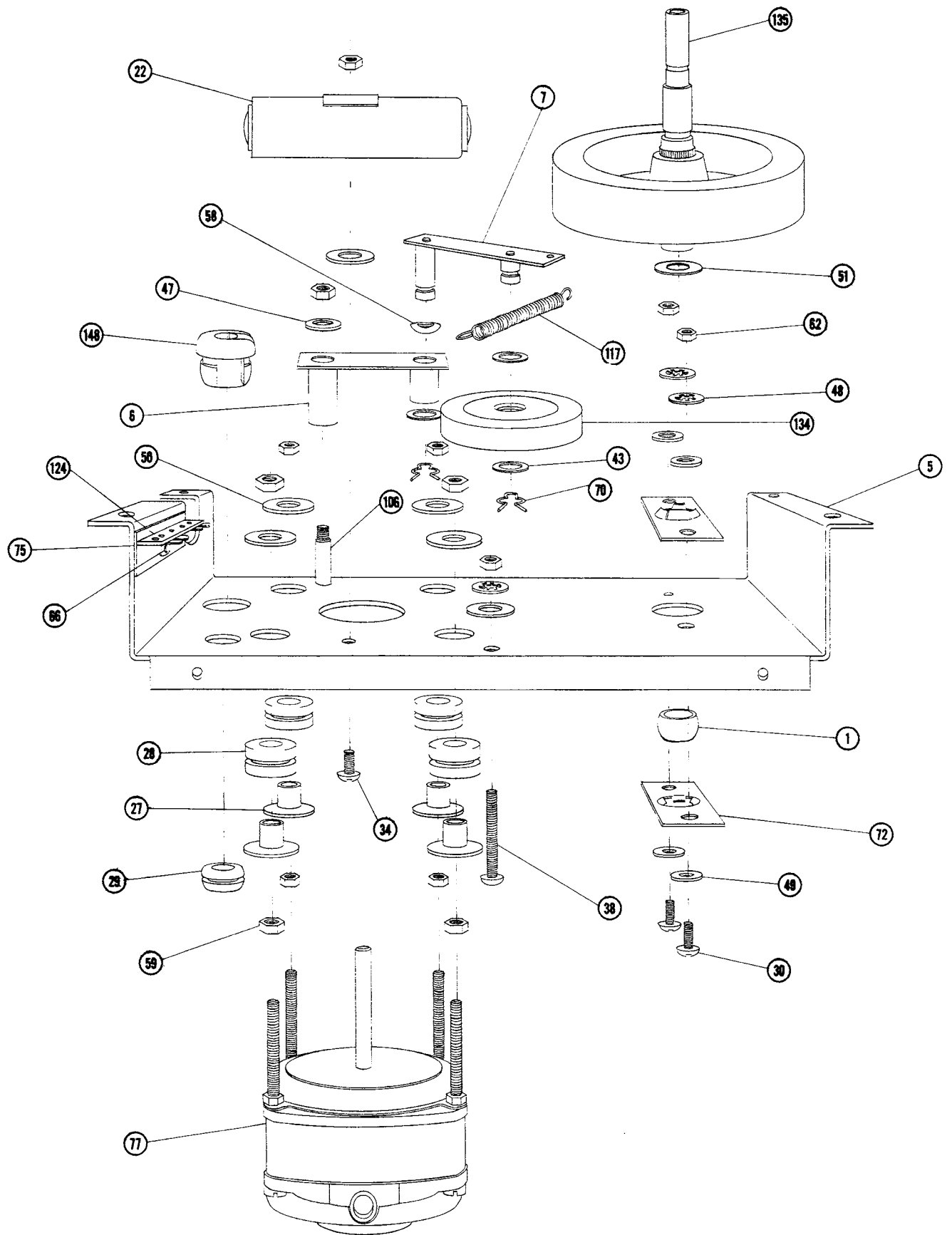
<u>REF.NO.</u>	<u>ESI PART NO.</u>	<u>DESCRIPTION</u>	<u>CIRCUIT DESIGNATION</u>
<u>MOTOR</u>			
77	44-3273	Motor, Synchronous	B-1
<u>PILLARS</u>			
78	36-1070	Pillar, Tape Loop Support	
79	36-3217	Pillar, Front Cover Support	
80	36-1125	Pillar, Record Head Bracket Support	
<u>PLUGS</u>			
81	31-1186	Plug, Microphone	P-1
82	31-1085	Plug, Recording Head	P-2
83	31-1642	Plug, 2 Prong Jones, Erase Coil	P-3
84	1-3330	Plug, Cable Assy., Motor	P-4
85	31-3247	Plug, A.C., Chassis Mtg.	P-5
<u>RECTIFIER</u>			
86	37-3255	Rectifier, Bridge	CR-1
<u>RELAYS</u>			
87	49-3300	Relay, 2500 ohm D.C. 1 Pole	K-1
88	49-1051	Relay, 115V A.C. 2 Pole	K-2
<u>RESISTORS</u>			
89	6-1834	Composition 10K ohms $\pm 10\%$ 1/2 watt	R-1, R-5
90	6-1844	Composition 220K ohms $\pm 10\%$ 1/2 watt	R-2, R-6
91	6-1826	Composition 100 ohms $\pm 10\%$ 1/2 watt	R-3, R-16, R-17
92	6-1855	Composition 4700 ohms $\pm 5\%$ 1/2 watt	R-4
93	13-3290	Wirewound 5 ohms 5% 3 watt	R-7
94	6-1829	Composition 1000 ohms $\pm 10\%$ 1/2 watt	R-8
95	6-1833	Composition 6800 ohms $\pm 10\%$ 1/2 watt	R-9
96	6-1838	Composition 47K ohms $\pm 10\%$ 1/2 watt	R-10
97	6-3283	Composition 8200 ohms $\pm 10\%$ 1/2 watt	R-11
98	6-2748	Composition 470 ohms $\pm 10\%$ 1/2 watt	R-13
99	6-1846	Composition 330K ohms $\pm 10\%$ 1/2 watt	R-14
100	6-1848	Composition 470K ohms $\pm 10\%$ 1/2 watt	R-15
101	6-3282	Composition 47 ohms $\pm 10\%$ 1/2 watt	R-18
102	6-1831	Composition 3300 ohms $\pm 10\%$ 1/2 watt	R-20
103	6-1841	Composition 100K ohms $\pm 10\%$ 1/2 watt	R-21
104	14-3251	Potentiometer, Composition 2000 ohms $\pm 20\%$	R-12
<u>SHAFTS</u>			
105	36-3214	Shaft, Swivel for Pressure Roller Assy.	
106	36-3215	Shaft, Swivel for Drive Idler Linkage	
107	36-3216	Shaft, Idler Wheel	
<u>SOCKETS</u>			
108	9-3382	Jack, Microphone	J-1
109	9-1108	Jack, Recording Head	J-2
110	9-1664	Socket, 2 Pin Jones, Erase Coil	J-3
111	9-1105	Socket, 4 Pin Jones, Motor	J-4

<u>REF.NO.</u>	<u>ESI PART NO.</u>	<u>DESCRIPTION</u>	<u>CIRCUIT DESIGNATION</u>
<u>SOCKETS Cont'd</u>			
112	9-3252	Socket for Pilot Lamp DS-1	
113	9-3243	Socket for Transistors Q-1,Q-2,Q-3,Q-4	
114	9-1104	Socket, Fuse Extractor Post for fuse F-1	
<u>SPRINGS</u>			
115	33-3232	Spring, Tape Tension	
116	33-3231	Spring, Roller Tension	
117	33-3230	Spring, Drive Idler Tension	
<u>SWITCHES</u>			
118	32-3250	Switch, Rotary Wafer	S-1
119	32-1029	Switch, Momentary (Black) Start	S-2
120	32-1028	Switch, Momentary (Red) Erase	S-3
121	32-3311	Switch, Rotary - Power	S-4
122	32-1074	Switch, Coin	S-5
<u>TERMINAL STRIPS</u>			
123	26-3245	Terminal Block, Barrier	TB-1
124	26-1205	Terminal Strip, 5 lug AADAA	TB-2, TB-3, TB-4, TB-5, TB-9, TB-10, TB-12
125	26-1204	Terminal Strip, 4 lug AADA	TB-6
126	26-1209	Terminal Strip, 2 lug AD	TB-7
127	26-1213	Terminal Strip, 3 lug ADA	TB-8
128	26-1208	Terminal Strip, 3 lug DAA	TB-11
<u>TRANSFORMERS</u>			
129	20-3257	Transformer, Output	T-1
130	19-3249	Coil, Oscillator	T-2
131	20-3246	Transformer, Power	T-3
<u>TRANSISTORS</u>			
132	37-3206	Transistor, 2N265	Q-1, Q-2, Q-3, Q-4
<u>WHEELS</u>			
133	38-2297	Wheel, Roller, Pressure, Tape Tension	
134	38-3229	Wheel, Idler Drive	
135	1-3147	Flywheel Assy.	
<u>MISCELLANEOUS PARTS</u>			
136	45-3199	Panel, Front Mtg.	
137	29-1117	Knob for Power Switch S-4	
138	44-3319	Tape Loop, (12-1/2 Sec.)	
139	1-3356	Power Cable, Plug & Socket Assy.	
140	27-3359	Name Plate, Serial Number	
141	1-3375	Microphone Assy.	
142	46-2337	White Jewel for Pilot Lamp DS-1	
143	41-3357	Label for Terminal Block (TB-1)	
144	45-1860	Plate, Fibre, 3 lug for Mtg. capacitors C-11, C-12, C-13	

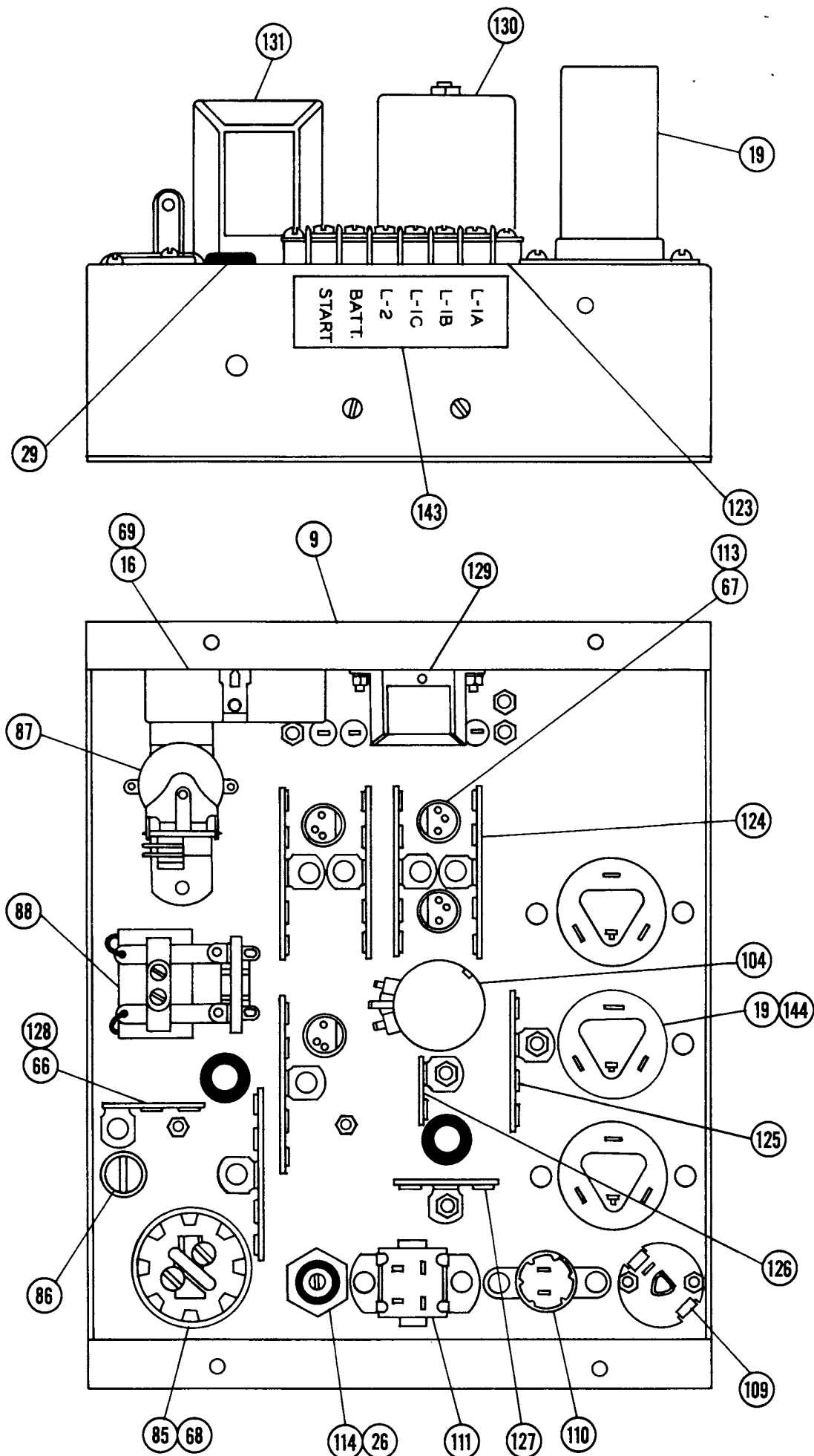
<u>REF.NO.</u>	<u>ESI PART NO.</u>	<u>DESCRIPTION</u>	<u>CIRCUIT DESIGNATION</u>
MISCELLANEOUS PARTS Cont'd			
145	35-1045	Spacer, Slide button for tension roller assy.	
146	45-3270	Plate, Control	
147	35-1552	Record Head Shim	
148	35-2054	Strain Relief Bushing for Motor B-1 Cable	
149	1-1627	Actuator assy. for Coin Switch S-5	



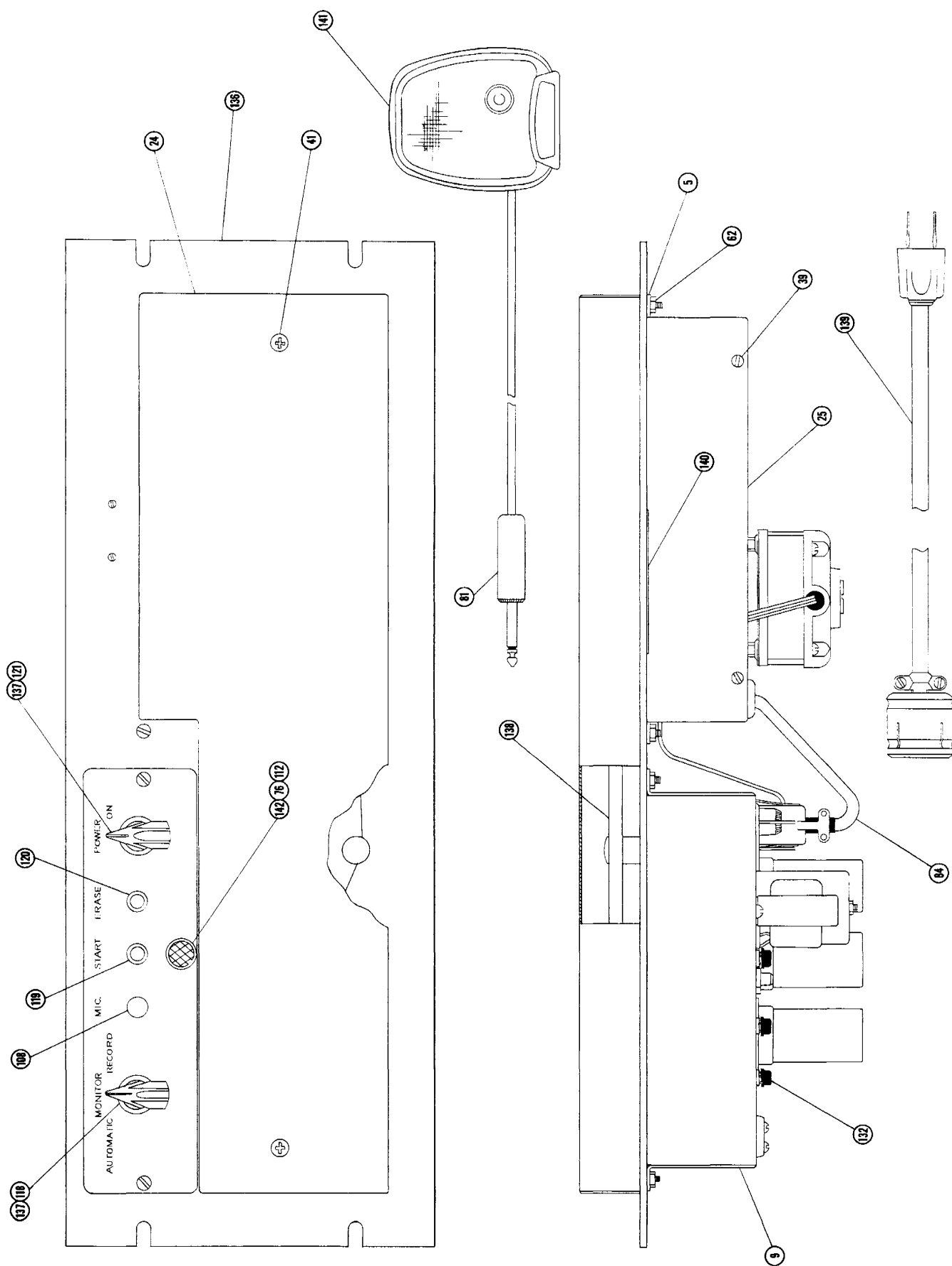
TAPE DECK ASSEMBLY
FIGURE 8



MOTOR BRACKET ASSEMBLY
FIGURE 9

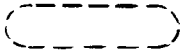
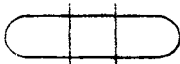
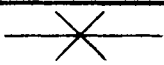
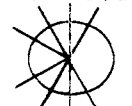
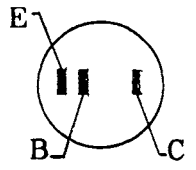


AMPLIFIER ASSEMBLY
FIGURE 10

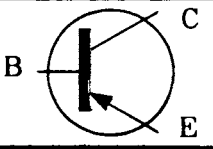
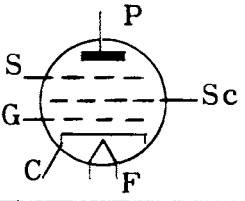





FINAL ASSEMBLY
FIGURE 11

GRAPHICAL AND LETTER SYMBOLS FOR
WIRING DIAGRAMS

	Shield
	Cable or Harness, CA1, CA2, etc.
	Splice
	Wires feeding through chassis
	Transistor Socket E - Emitter B - Base C - Collector
"PT"	Leads furnished as part of apparatus
"D"	Open formed wires which run from terminal to terminal in a path parallel or perpendicular to the edges and plane of the mounting surface and are kept as short as possible consistent with that practice

GRAPHICAL AND LETTER SYMBOLS FOR
SCHEMATIC DIAGRAMS

Symbol	Letter		
	Transistor	E - Emitter B - Base C - Collector	"Q"
	Typical Tube	P - Plate S - Suppressor Sc - Screen G - Grid C - Cathode F - Filament	"V"
	Thermistor		"RT"
	Potentiometer and Rheostat		"R"
	Rectifier and Varistor		"CR"

LN
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