

GEI-19658

INSTRUCTION BOOK

FOR

MAGNETIC WIRE RECORDER

AND

REPRODUCER

MODEL 51

ELECTRONICS DEPARTMENT
BRIDGEPORT, CONN.

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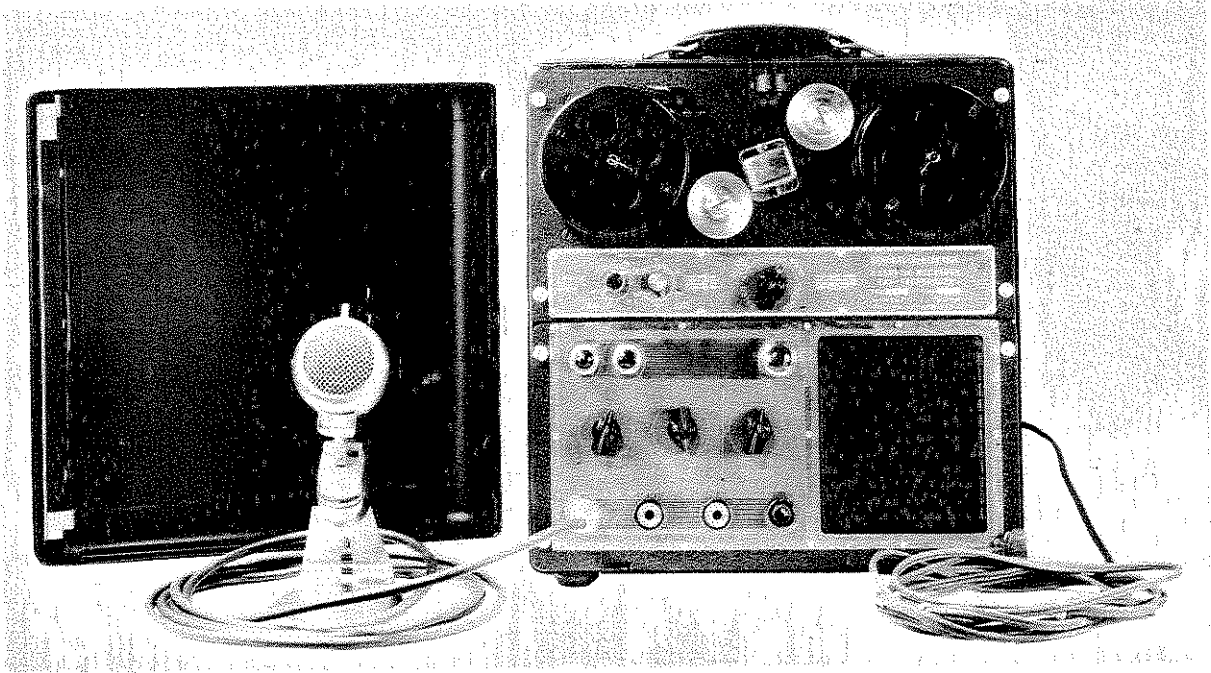


Figure 1 Wire Recorder and Reproducer
Model 51 with Accessories

SECTION I—DESCRIPTION

A. GENERAL

The Recorder and Reproducer Model 51 is a portable wire-recording device capable of making permanent recordings on steel wire and playing them back immediately. The machine simultaneously erases a previous recording while a new recording is being made. The unit is contained in a metal black crackle finish case having a removable lid which is quite similar in appearance to a portable typewriter. The unit is designed for operation on a 115 v., 60 cycles, a-c supply. Provision is made at the rear of the unit for connecting to the power source through a removable line cord.

The recorder and reproducer consists of a full-wave rectifier, a three stage audio amplifier, a 30 kc oscillator, a recording mechanism, a drive motor and associated mechanism, and accessories. The rectifier is necessary to supply plate voltage for the audio amplifier and oscillator. During a recording period the output of the audio amplifier is connected in series with the oscillator transformer to the coil in the recording head. The head is a device which produces small magnets along the wire according to the frequency and intensity of the audio signal. During a play-back period the audio output of the third stage is connected to the coil in the loudspeaker. If it is desirable to use earphones, these may be connected to the audio output jack located at the control panel.

In addition to the recording head, the recording mechanism consists of a wire guiding assembly provided with braking, an erase coil, and an automatic stop device. The purpose of the wire guiding assembly is to lace the wire evenly on the take-up spool. This is accomplished by means of lacing guide shafts and a traverse-screw and gear mechanism synchronized with the motor-drive system. The braking is provided to keep the proper tension in wire when the drive mechanism stops. It consists of brake ratchets and pawls which operate by means of relays directly from the Motor Control switch. The erase coil is wired to the oscillator-transformer and brings the wire to a demagnetized condition. The two dials at the upper-left corner of the front panel indicate minutes and seconds of running time. These dials are parts of the timing and the automatic stop assembly which is an indexing assembly geared to the right-hand spool. It is used as a means for locating previous recordings and also for setting recording time limits.

A shaded-pole induction drive motor supplies the motivating force which moves the wire through the recording head. The motor is coupled to a

pair of frictional drive pulleys, each of which transmits power to a spool. However, only one pulley and its associated spool can supply power for rotation at a time. The operation of either pulley is controlled by the Motor Control switch, the function of which is described in detail under the heading "F. Construction".

The accessories include the spools, wire, microphone, etc. For full details, consult the list of accessories.

B. COMPONENT UNITS AND ACCESSORIES

The Wire Recorder and Reproducer Model 51 consists of two separable units with the following components and accessories.

1. COMPONENTS:

- One—set of (5) vacuum tubes
- One—case finished in black-crackled finish
- One—2 amp. fuse

2. ACCESSORIES:

- One—High Impedance Dynamic Microphone Model 22D made by Turner Co., equipped with 10 ft. of shielded cord with an Amphenol No. MC1F female connector on each end, and a Microphone Desk Stand.
- One—12 ft. power cord with standard connectors (male plug on one end and female receptacle on other).
- One—spool for holding recording wire.
- One—spool same as above, with approximately $\frac{1}{2}$ pound of 4 mil. recording wire (wire is medium carbon, and covered with rust-preventing film of grease).
- Two—fuses (2 amp., 250 volt).
- One—roll of Cellulose Scotch Tape, No. 134, made by Minnesota Mining Co. ($\frac{1}{2}$ in. wide x 180 in. long).
- One—tube of gear lubricant, No. M285, made by Colonial Beacon Oil Co. ($\frac{1}{2}$ oz. size).
- One—set of Bristol Wrenches, including one #4, one #6, and one #8.
- One—Allen Wrench #8.

C. ELECTRICAL SPECIFICATIONS

Power Requirements:

Input 100 watts
Supply

105 v. a-c min. to 120 v. a-c max., 60 cps.
Osc. Frequency 24 to 30 kc.
Current Drain 1 amp.

Input Signal:

Microphone approx. 3 millivolts
First Stage approx. 0.25 v.
Motor (115 v., 60 cycle) . . . 1/150 hp. at 1600 rpm.
Wire Speeds . . . 200 or 400 rpm at rated line volts

D. DIMENSIONS AND WEIGHTS

Dimensions of Unit and Case in Inches:

	Overall
1. Unit	Depth $10\frac{3}{8}$
	Width $12\frac{1}{8}$
	Height $13\frac{3}{4}$

Weight of Recorder - Reproducer Model 51 and Accessories:

1. Unit approx. 32 pounds
2. Assembly with Accessories. approx. 35 pounds

E. TUBE COMPLEMENT

Two—6SJ7—functioning as:
(V101) first stage amplifier and
(V102) second stage amplifier

Two—6V6GT—functioning as:
(V103) output amplifier and
(V104) oscillator

One—5Y3GT—functioning as:
(V105) full wave rectifier

F. CONSTRUCTION OF UNIT

The Wire Recorder and Reproducer Model 51 is a portable recording and reproducing machine. The careful design of movable parts and the advantage of a portable case with a removable lid make the unit compact and readily operated. After the case is removed, all parts are accessible for servicing.

The Model 51 is made up of three major units: the case, the drive unit, and the amplifier unit. The case forms a protective cover for the other two units. The drive unit for the most part performs the mechanical functions. Its front panel forms the upper half of the operating panel. The amplifier unit performs the electrical functions. Its front panel forms the lower half of the operating panel.

The upper portion of the operating panel supports the drive and take-up spools, guide pulleys, the recording head and the erase coil assembly, see figure 1. All operating controls are located below the spools and are clearly marked as shown. There are two stages of input jacks, an output jack, a grill for the loudspeaker, an automatic stop, three control switches, a tone control, a volume indicator, and three indicator lights. The automatic stop device provides an accurate estimate of the recording period by means of an indexing mechanism which controls the action of the automatic stop assembly.

A tone control is employed to attenuate the high frequencies and improve the base response. It is a combination tone control, R116, and power ON-OFF switch, S101. Power is turned ON by a

slight clockwise rotation on the knob from its extreme counter-clockwise or OFF position.

The Motor Switch, S103, is a three position switch, the function of which is both mechanical and electrical. Electrically, it supplies power to the motor in either right or left position of the switch handle. Mechanically, it controls the record, listen, and rewind functions of the unit. This action is described in detail below.

The Selector switch, S102, is a ganged-wafer switch which makes or breaks contacts in the power supply, amplifier, and oscillator circuits. Two indicator lights are wired in the filament supply circuit as visual indicators of the record (red light) and listen (green light) operations.

A Volume control potentiometer, R115, controls the input or output level of the signal.

Each of the two spools mounted at the front panel is rotated by a belt and pulley drive system, see Fig. 5. The system is coupled to the motor by means of a frictional drive neoprene puck keyed to the shaft of the motor. Each pulley is alternately disengageable from the puck by the Motor Control switch.

For either a record or listen operation, the switch knob is moved to the left (counterclockwise) so that the right-hand spool will take up the wire. For a rewind operation, the switch is moved to the right (clockwise) so that the left-hand spool will take up the wire. The take-up spool always rotates counter-clockwise in respect to the control panel.

The mechanical function of the Motor Control switch is to ensure the delivery of mechanical power to the proper belt pulley and its associated spool. The means by which the switch engages the proper drive pulley is as follows. Connected to the switch shaft at the rear of the unit is a vertical motor switch lever. This lever is placed so that in the neutral position of the Motor Control switch, the pulleys associated with both spools do not touch the drive motor puck. When this switch is moved either to the right or left, the motor switch lever swings a small arc which is sufficient to move one pulley further from the drive puck and to allow the other to be pushed against the drive puck by its spring. When the Motor Control switch is turned in either direction, with the a-c power on, the a-c coils of the brake relays are electrically energized causing the braking device to release the spools. These relays are also electrically connected into the drive motor circuit and, therefore, start this motor to operate.

The braking device consists of two ratchet plates and two pawls. The ratchet plates are

mounted on each spool shaft and coupled to it through a friction clutch. The pawls are mounted on pivots near the ratchet plates and engage them when the brake relays are de-energized.

When the Motor Control switch is turned to the neutral position to stop the drive mechanism, the supply spool pawl catches a tooth on its ratchet plate, thus stopping the ratchet plate instantly. Since the rest of the system has some inertia, it will cause the clutch to slip. The force which causes the clutch to slip is less than that required to break the wire. Therefore, the slipping of this clutch is sufficient to keep the wire tight.

The structural members of the recording mechanism include a lacing apparatus and an automatic stop assembly. The lacing apparatus consists of a system of worm gears, guide shafts, traverse screw, and miscellaneous parts. The motivating force for this apparatus is furnished by the left-hand pulley assembly, Fig. 8. A worm located on the spool shaft of this pulley drives a worm gear keyed to a horizontal inter-connecting shaft.

The traverse screw, Fig. 8, is located at the center of this horizontal shaft and coupled to it by means of a pair of miter gears. As the traverse screw rotates, its follower, Fig. 8, actuates wire guide shafts to which are connected the wire guide fingers.

The horizontal interconnecting shaft, Fig. 8, does not terminate, however, with the traverse screw assembly of the lacing mechanism. It also supplies motivating force for the automatic stop assembly. Fig. 2, which is composed of a system of worm gears, associated shafts, and timing gears, a knurled indicator shaft and associated minute hand, a second hand, and an automatic-stop switch.

The motivating energy supplied by the horizontal interconnecting shaft is transferred to a vertical interconnecting shaft, Fig. 4, and to the drive shaft of the automatic stop by two worms and worm gears. This shaft terminates with the second hand mounted on the front panel.

The second hand revolves once every minute of operation on high speed; once every two minutes on low speed.

The drive shaft is also coupled to the minute hand. This is accomplished by means of a single tooth gear which makes contact with the timing gear coupled to the minute hand. Contact is made during only a small percentage of the time required for the second hand to make a complete revolution.

Every time the drive shaft makes a revolution, the single tooth turns the timing gear over a

fraction of a turn. The correct number of teeth on the timing gear insure $1/33$ turn of the gear and the minute hand for every revolution of the second hand. Stated in other terms, the minute hand makes a complete revolution during 33 minutes of operating time at high speed. At low speed the minute and second hands indicate $1/2$ the operating time, or since the second hand makes one revolution every two minutes, it requires 66 minutes for a complete revolution of the minute hand.

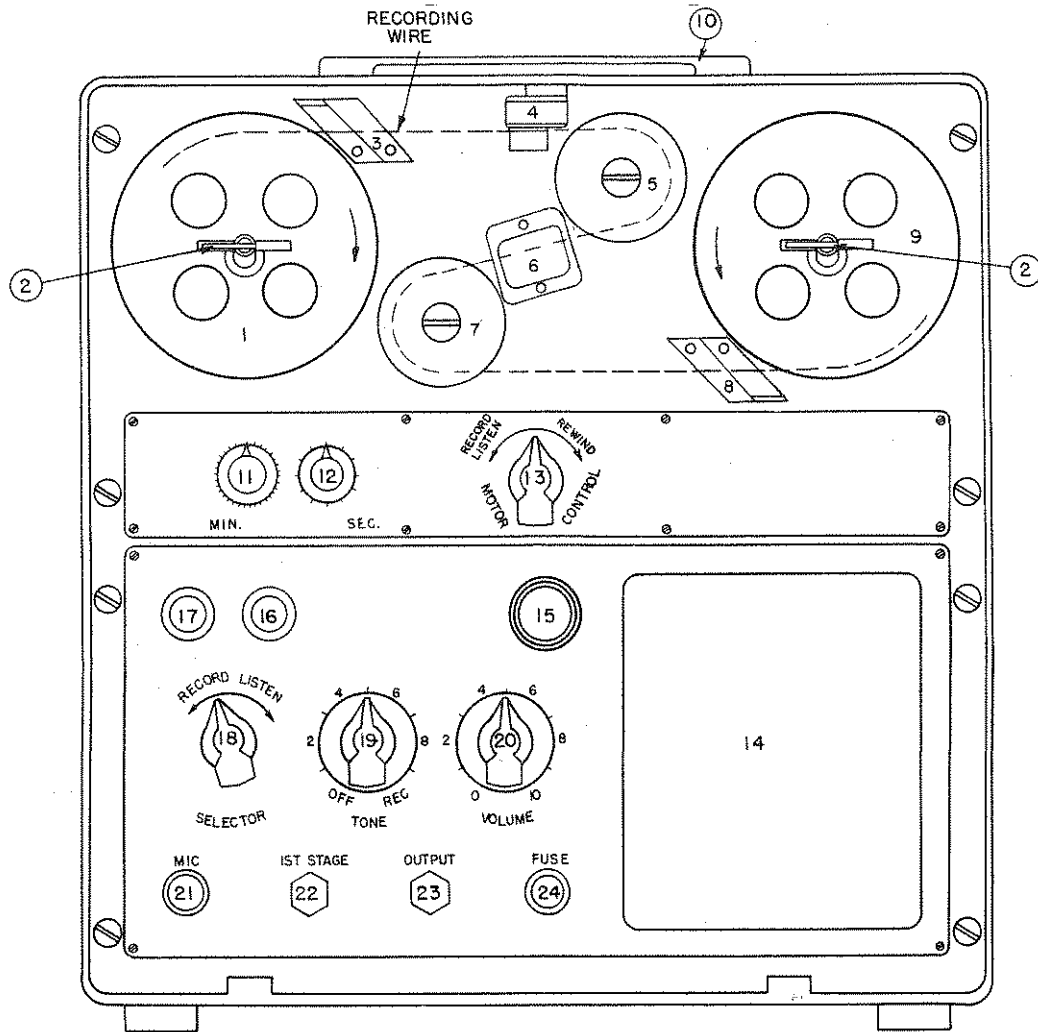
The Automatic Stop consists of a sprocket with a pin perpendicular to its face, which fits into a hole in the timing sprocket. This automatic stop sprocket is connected by means of a shaft, through the hollow minute hand shaft, to the knurled pointer just above the minute hand.

The knurled pointer is adjusted so that when it points in the same direction as the minute hand, the pin on the automatic stop sprocket slips into the hole in the timing gear. This action allows the knurled pointer to jump away from the front panel about $1/16$ in. At the same time this stops the drive motor and locks the knurled pointer to the minute hand. In this position the minute hand can be set, since the two pointers are locked together.

CAUTION: The minute hand cannot be set if the single tooth on the second hand gear is engaged with the timing gear. To do so will cause serious damage to the equipment.

In order to reset the Automatic Stop it is necessary to push the knurled knob in. This action will push the pin on the automatic stop sprocket out of the hole in the timing sprocket and allow a small plate on the timing sprocket to slip back to its neutral position over the hole. The action of this plate is governed by springs such that its neutral position is over the hole in the timing sprocket; however, it may be pushed away from the hole by the pin on the automatic stop sprocket when the stop is about to function.

The minimum operating time of two minutes of the Automatic Stop is determined by the width of this plate, or in other words the knurled pointer of the Automatic Stop must be set a minimum of two minutes in advance of the minute hand to allow the pin on the automatic stop sprocket to slip off the plate so that it can push the plate away from the hole in the timing sprocket. However, if it is not desirable to use the Automatic Stop for a timing device for individual recording, the knurled pointer may be simply pushed in at the beginning of the spool and the Automatic Stop will then only operate at the end of the spool.



ITEM	FUNCTION	ITEM	FUNCTION
1	SUPPLY SPOOL	14	LOUDSPEAKER
2	SPOOL FASTENER	15	LEVEL INDICATOR
3	WIRE GUIDE FINGER	16	LISTEN INDICATOR
4	ERASE COIL	17	RECORD INDICATOR
5	PULLEY	18	SELECTOR SWITCH
6	RECORDING HEAD	19	TONE CONTROL & POWER SWITCH
7	PULLEY	20	VOLUME CONTROL
8	WIRE GUIDE FINGER	21	MICROPHONE INPUT JACK
9	TAKE-UP SPOOL	22	1ST AUDIO STAGE OUTPUT
10	CARRYING HANDLE	23	AUDIO OUTPUT JACK
11	MINUTE INDICATOR & AUTOMATIC STOP	24	FUSE
12	SECOND INDICATOR		
13	MOTOR CONTROL		

Figure 2 Layout Diagram of the Front Panel

SECTION II—EMPLOYMENT

Reference for this discussion is the Front Panel Layout, Fig. 2, and the Schematic Diagram, Fig. 10.

A. SET-UP OF EQUIPMENT

The set-up procedure of the Model 51 Unit, preparatory to recording, is as follows:

1. TO LOAD NEW SPOOL

a. Turn MOTOR CONTROL switch (13) to neutral (center position).

b. Place the loaded (supply) spool (1) on the left-hand shaft and snap its fastener into position.

c. Pass wire through the upper wire guide finger (3).

d. Pass through erase coil (4).

e. Pass around the upper guide pulley (5).

f. Pass downward obliquely through the groove in the recording head (6).

g. Pass around the lower guide pulley (7).

h. Pass through the lower guide finger (8).

i. Anneal wire about an inch from end with either a soldering iron or a lighted cigarette and tie a knot. Insert knot in hole provided in take-up spool (9) and pull through slot in direction of wire travel. If no hole is provided in the spool, fix wire to the empty take-up spool (9) with a short piece of cellulose tape.

j. Rotate the take-up spool until the wire is tight and lock this spool.

2. TO RESET AUTOMATIC STOP

a. Turn MOTOR CONTROL switch (13) to RECORD-LISTEN, operate for one minute, and return MOTOR CONTROL switch to neutral.

b. Rotate the knurled knob until its pointer lines up with the minute hand. The knurled knob will jump away from the front panel about 1/16 in. The minute hand is now locked to the knurled knob. If the knurled knob does not jump away from the front panel, rotate this knob until there is a difference of about five minutes between its pointer and the minute hand. Return the pointer to the minute hand and it will jump away from the front panel.

c. Set the minute hand to zero.

CAUTION: If the minute hand cannot be turned, the second hand gear is engaged with the timing sprocket. Under this condition serious

damage will occur if the minute hand is forced unnecessarily. To overcome this condition, pull both spools forward to release their fasteners, push in the knurled knob, turn MOTOR CONTROL switch to RECORD-LISTEN, and operate the machine for about fifteen or twenty seconds. Repeat the above procedure.

d. Push in knurled knob to reset Automatic Stop. If the knurled knob is left at zero, the Automatic Stop will only operate at the end of the spool. However, it can also be used as a timing device to limit the length of each individual recording, remembering after each recording to reset and return its pointer to zero so that the recorder will automatically stop at the end of spool.

3. TO ADJUST THE SPEED

The wire speed may be adjusted to either 200 or 400 r.p.m. by changing the belt pulley setting at the rear of the unit, Fig. 8. High speed (400 r.p.m.) recording provides for somewhat better fidelity in recording and reproducing; while slow speed (200 r.p.m.) recording provides twice the recording time.

4. TO SUPPLY POWER

a. Fit the line cord into the receptacle, J104, at the lower rear part of the unit, Fig. 3. The type of power must be 115 volt, 60 cycles, a-c.

b. Turn the combination TONE control and power switch (19) to maximum clockwise position marked REC. Leave on for two minutes before attempting to record or listen.

B. OPERATION

1. TO RECORD

a. Screw the microphone plug onto the receptacle marked MIC. (21).

b. Turn the SELECTOR switch (18) to RECORD (red light) (17).

c. Set the VOLUME control (20) to about 4.

d. Adjust the TONE control (19) to suit the operator's individual taste.

Suggested Settings:

High Speed — 5

Low Speed — 8

e. Turn the MOTOR CONTROL switch (13) to RECORD-LISTEN.

f. Begin recording. Hold the microphone about one inch from the lips. Use a normal speaking voice. If necessary, readjust the VOLUME control so that the Level Indicator (15) just flashes occasionally while speaking. If set too high, the amplifier will be overloaded, causing distortion.

g. When the recording is finished, turn the MOTOR CONTROL switch to neutral.

h. Turn SELECTOR switch to LISTEN (green light) immediately after recording, to avoid accidental erasure of the recording.

2. TO REWIND

The wire must be rewound to the point where the recording started before listening.

a. See that the SELECTOR switch (18) is set to LISTEN (green light).

b. Turn the MOTOR CONTROL switch (13) to REWIND.

c. After the point is reached where the recording was started, then return the MOTOR CONTROL switch to neutral.

NOTE: When it is desired to listen to a recording made on the Model 20 series machines, rewind the wire on the Model 51 machine in the following manner:

d. Place the (supply) spool with the magnetized wire on the right-hand spool shaft and the take-up spool on the left-hand shaft. Loop the wire over the upper-guide pulley (5) and through the erase coil (4). Obviously for rewinding it is unnecessary to thread wire through the recording head.

CAUTION: BE CERTAIN THE SELECTOR SWITCH IS IN THE LISTEN (GREEN LIGHT) POSITION. IF, ACCIDENTALLY, LEFT IN THE RECORD POSITION WHILE ATTEMPTING TO LISTEN, THE RECORDING WILL BE ERASED.

3. TO LISTEN

a. Turn the SELECTOR switch (18) to LISTEN (green light).

b. Set VOLUME control (20) to about 5.

c. Set TONE control for REC.

d. Turn MOTOR CONTROL switch (13) to RECORD-LISTEN.

e. Regulate the VOLUME control and TONE control until the desired loudness and fidelity is obtained.

4. TO ERASE

While recording, any previous recording will be automatically erased. However, if it is desired to erase a previous recording without making a new one, the following procedure should be followed:

a. Rewind the wire onto the left-hand spool (1), if it is not already there.

b. Turn the SELECTOR switch (18) to RECORD (red light).

c. Set the VOLUME control (20) to zero.

d. Move the MOTOR CONTROL switch (13) to RECORD-LISTEN.

e. When through erasing, return MOTOR CONTROL switch to neutral.

5. TO CHANGE SPOOLS

a. If set at zero when starting, the Automatic Stop will operate at the end of the reel. Reset by pressing the knurled knob.

b. Continue running until only a few turns remain on the supply spool. Make last few turns by hand.

c. Turn combination TONE control and power switch (19) to OFF position and pull spool with wire forward to release the catch.

d. Put end of the wire through one of the holes in the fibre cover and secure the end with a small piece of cellulose tape and fasten the fiber cover over the spool.

e. Transfer the empty to the right-hand shaft (9).

f. Reload new spool of wire according to instruction A-2 above.

g. Reset Automatic Stop, if necessary; see instruction A-1 above.

SECTION III—FUNCTIONING OF ELECTRICAL PARTS

Reference for this discussion is the schematic diagram, Fig. 10. Physical locations of electrical parts are found in Figs. 6 and 7.

A. AMPLIFIER CIRCUIT

The Recorder and Reproducer Unit is equipped with a microphone jack, J102, which connects to the grid of tube V101. This provides a high impedance input for a high impedance dynamic or crystal microphone. The dynamic microphone is supplied because of its rugged construction.

The tube, V101, is a first stage resistance coupled (C103, R104) amplifier which feeds into the grid of V102 through the potentiometer, R115. Also feeding into the grid of this tube, V102, through the potentiometer, is the first stage input jack, J101. This jack serves as a high impedance input requiring about 0.25 volts for proper modulation. Thus, R115 is the volume control for both input jacks.

The second stage amplifier, V102, has its output fed into the third stage through a resistance coupling composed of R107, C107, and R108. The Tone Control, R116 and C106, varies the amount of feed-back at certain frequencies, depending upon Tone Control settings. R120 and R119 form a degenerative feed-back to prevent distortion and improve frequency response.

The third (output) stage, V103, has a transformer coupled output which matches it to the speaker voice coil. The output jack, J103, matches the output to a 3.5 ohm load. It is normally closed; however, when a 3.5 ohm load is connected by means of a PL55 plug (or equivalent), it opens and disconnects the speaker, LS101, that is in the unit.

Switch S102-2 connects the internal speaker and the output jack in the circuit. The external speaker is connected only in listen position. An external speaker may be used when switch is set for Record or Listen. By using an external speaker, the amplifier may be used as a P. A. system. In the Record position, S102-3 connects the compensating network to the circuit. This network is composed of R127, R125, C122, R126, C121 and L107. The audio is then fed through this compensating network and through one of the pick-up coils in transformer T103 which is coupled to the oscillator circuit. The audio passes to the recording head, L104, and then to ground.

When the Selector switch is turned to Listen

for play-back purposes, the head is connected to the first stage through the action of S102-1 and 4. Under this condition the internal speaker is in the amplifier circuit, thus permitting listening.

All tubes in this amplifier circuit receive their bias by means of individual cathode bias resistors.

B. OSCILLATOR CIRCUIT

The tube, V104, is a Type 6V6GT vacuum tube operated as a triode in a conventional Hartley type oscillator circuit, with B-plus applied to a tap on the oscillator coil in the transformer, T103. The capacitor, C109, is the capacity element of the tuned circuit. This circuit is tuned for approximately 30 kc. C111 is a blocking capacitor to keep B-plus from the grid. A bias voltage is developed across R112, while C112 acts as a filter for harmonics. V104 is operative only when S102 is tuned to Record.

When the Selector switch, S102, is in the Record position, the 30 kc signal is fed by means of the pickup coils in the transformer, T103, to the recording head, L104, and to the erase coil, L106. The superposition of the 30 kc on the recording wire controls the magnetization of the wire, thus eliminating the amplitude distortion of the audio signal that otherwise would result during a play-back period. However, the 30 kc signal is not recorded on the wire, and therefore cannot be reproduced.

C. POWER SUPPLY

The power supply is a conventional full-wave rectifier. It includes T101, V105, and a filter consisting of C101-4, C101-3, C104-2, C104-3, L101, R113, R114 and bleeder resistor R124.

D. LEVEL INDICATOR LAMP

Voltage (d-c) is supplied to the potentiometer R117 through R118. An audio voltage is fed through C113 also to R117. The movable arm of the potentiometer is connected to a neon lamp; thus, by adjusting R117, the proper break-down level of the neon may be set. This level is set at the factory so that the neon bulb flashes only on voice peaks when recording.

E. SWITCH CONNECTIONS

The power switch, S101, supplies all power to the unit and is manually controlled at the Tone control, R116. It is connected in series with the

115 volt a-c supply. The automatic stop switch, S104, is connected in series with the 115 volt a-c supply to the motor. It opens and closes the motor circuit according to the setting of the Automatic Stop. Also in series with the motor circuit are the two switches of the brake relays. These relays are energized by the motor control switch, S103.

The Selector switch, S102, is a 2-wafer switch with interlocking connections which provide proper switching for the record and listen operation. Fig. 9 is a wiring diagram for this switch.

When the Motor Control Switch, S103, is turned either to Record-Listen or to Rewind, a-c voltage

is applied to the drive motor by means of the brake relays, K101 and K102. In each case the motor armature rotates counterclockwise when viewed from the rear of the unit. In the neutral position the switch disconnects coils on the brake relays and removes power from the drive motor.

In the Rewind position the cathode-to-ground circuit of the oscillator is broken and the audio output is grounded. Since the oscillator circuit is broken no erasing can be accomplished. In the Record-Listen position, the cathode circuit of the oscillator is grounded and the audio circuit is allowed to function.

SECTION IV—MAINTENANCE

A. SOCKET VOLTAGES

Unless otherwise stated, all voltages are d-c. The volume and tone controls are set at zero.

Tube	Point of Measurement	Selector Switch	
		Record	Listen
V101	Pin #1 to Gnd.	0	0
	Pin #2 to Pin #7	6.3 a-c	6.3 a-c
	Pin #3 to Gnd.	0.9	1.0
	Pin #4 to Gnd.	0	0
	Pin #5 to Gnd.	0.9	1.0
	Pin #6 to Gnd.	20	22
	Pin #8 to Gnd.	150	160
	V102	Pin #1 to Gnd.	1.75
Pin #2 to Pin #7		6.3 a-c	6.3 a-c
Pin #3 to Gnd.		1.75	1.9
Pin #4 to Gnd.		0	0
Pin #5 to Gnd.		1.75	1.9
Pin #6 to Gnd.		45	50
Pin #8 to Gnd.		55	60
V103		Pin #2 to Pin #7	6.3 a-c
	Pin #3 to Gnd.	260	280
	Pin #4 to Gnd.	265	290
	Pin #5 to Gnd.	0	0
	Pin #8 to Gnd.	15	16
V104	Pin #2 to Pin #7	6.3 a-c	6.3 a-c
	Pin #3 to Gnd.	265	0
	Pin #4 to Gnd.	265	0
	Pin #5 to Gnd.	-23*	0
	Pin #8 to Gnd.	0	0
V105	Pin #2 to Gnd.	280	300
	Pin #2 to Pin #8	5 a-c	5 a-c
	Pin #4 to Gnd.	300 a-c	310 a-c
	Pin #6 to Gnd.	300 a-c	310 a-c
	Pin #8 to Gnd.	280	300

*In order to read grid voltage a V.T.V.M. must be used. An ordinary analyzer (20,000 ohms per volt) will read approximately 50 V.

B. LUBRICATION

The following parts which require medium grease should be lubricated after approximately 100 hours of use, or at least every six months; those which require medium oil need only be lubricated once a year or when bearings become dry. Letters used below refer to Fig. 8.

LUBRICATION TABLE

Part	Location	Lubricant
V-shaped wire guide-pulley bearings (A)	Front panel	Medium oil
Spool shaft bearings (B)	Behind front panel	Medium grease
Guide finger shaft (C)	Behind front panel	Medium grease

LUBRICATION TABLE (CONT'D)

Part	Location	Lubricant
Traverse screw (D)	Behind front panel (top center)	Medium grease
Worm gears (E)	Behind front panel	Medium grease
Miter gears (F)	Behind front panel (top center)	Medium grease
Miscellaneous bearings (G)	Behind front panel	Medium oil

Medium grease — Colonial Beacon M285 (or equivalent).

Medium oil — Medium lubricant SAE 10.

The motor is lubricated for the life of the machine and need not be disturbed.

CAUTION: Great care must be exercised to keep the motor shaft friction roller and adjacent pulleys free from oil, as this will cause slippage of the drive. Bearings on the lower pulleys rarely need oiling; on such occasions remove the pulleys from their shafts, place a drop or two of medium oil inside, and replace, wiping all excess oil from the outside of the pulleys.

C. SERVICING

1. WIRE SPLICING.

To splice a wire, heat the broken ends with a soldering iron, and if not available, with a lighted cigarette. After the wire has cooled, tie the broken ends together in a small, neat knot. The knot should be small enough to pass over the groove in the recording head. It is desirable to reheat the finished knot after the tying process to relieve the internal strains caused by knotting. The free ends should be trimmed off so that they project no more than $\frac{1}{8}$ inch. Test the splice by running it through the recording head, turning first one spool, then the other by hand. The recording head is designed so that a splice in the wire will lift itself out of the slot.

2. RECORDING HEAD.

The recording head should be cleaned from time to time whenever recording sound weak and muffled and wire breakage occurs. As a suggestion, the slot can be cleaned with a stiff piece of paper,

such as cardboard, especially if excess grease from the wire accumulates. Avoid denting and scratching the slot with a sharp instrument.

The wire is coated with a rust-preventing grease. The grease on the wire is perfectly normal and should be left on the wire.

3. BELTS

The belts have been adjusted for proper tension at the factory. If adjustment becomes necessary, follow the procedure below:

- a. Turn TONE control to OFF.
- b. Turn MOTOR CONTROL switch to engage drive pulley with motor drive puck for belt that is being adjusted.
- c. Loosen the bolt holding the drive pulley bracket and slide up or down.
- d. Obtain proper tension for a belt-drive—leave a slight amount of slack.
- e. Tighten the bolt holding the drive pulley bracket.

When the adjustment has been made, the belt tension should be just tight enough so that no slippage occurs, but still loose enough so that no binding occurs when this belt is driving.

4. HUM

The pick-up head is well shielded so that the amplifier will not pick up hum in the Listen position. However, in the close vicinity of power transformers, motors, etc., which cause trouble it may be necessary to orient the machine or to move it in order to minimize such pick-up.

The dynamic microphone also will pick up hum. While making a recording it is necessary to take care that this microphone is removed from the influence of strong magnetic fields.

5. BRAKE ADJUSTMENT

The brake clutch has been adjusted for proper pressure at the factory. If, when turning off the drive mechanism, the wire becomes excessively loose or breaks, the braking system needs re-adjusting.

To readjust the braking clutch, loosen the Bristol set screw which locks the adjusting nut to the spool shaft. This nut may be tightened or loosened until a 1½-inch-pound torque causes the spool to turn when the brakes are on.

When tightening or loosening the adjusting nut, turn in increments of ¼ turn until the desired adjustment is obtained. At each trial, tighten the Bristol set screw to prevent the adjusting nut from turning.

To obtain the proper adjustment of the adjusting nut, turn it until a weight of one pound suspended from a string around a wire spool will cause the spool to turn when the brakes are on.

At the same time the brake clutch is adjusted, the pawls which engage the ratchet should be checked. To be working properly the pawls should engage their ratchet when the Motor Control switch is at neutral. The clearance between the pawl and ratchet should be 1/16 inch when the Motor Control switch is turned to either operate position.

6. SELECTOR SWITCH, S102

If it becomes necessary to replace the Selector switch Fig. 9 shows the actual wiring of the switch with each wire marked as to where it is connected into the circuit. When using this diagram, reference should also be made to Fig. 10 to insure that wiring is connected properly.

V—TABLE OF ELECTRICAL COMPONENTS

DESIGNATION	DESCRIPTION	DRAWING REFERENCE
CAPACITORS		
C101-1-2	Cathode by-pass Elec. 40 mfd. 25 v.	K-12J33-416
C101-3	Filter Elec. 20 mfd. 450 v.	K-12J33-416
C101-4	Filter Elec. 15 mfd. 450 v.	K-12J33-416
C102	Screen by-pass Paper, 0.05 mfd. 400 v.	K-52J361-1
C103	Coupling Paper, 0.02 mfd. 600 v.	K-52J362-1
C104-1	Cathode by-pass Elec. 20 mfd. 25 v.	K-12J33-329
C104-2	Filter Elec. 30 mfd. 450 v.	K-12J33-329
C104-3	Filter Elec. 10 mfd. 450 v.	K-12J33-329
C105	Screen by-pass Paper, 0.05 mfd. 400 v.	K-52J361-1
C106	Low pass filter Paper, 0.05 mfd. 600 v.	K-52J362-1
C107	Coupling Paper, 0.02 mfd. 600 v.	K-52J362-1
C108	Coupling Paper, 0.25 mfd. 600 v.	K-27J688-6
C109	Tank Circuit Paper, 0.005 mfd. 600 v.	K-52J362-2
C110	Blocking Paper, 0.02 mfd. 600 v.	K-52J362-1
C111	Blocking Paper, 0.01 mfd. 600 v.	K-52J362-3
C112	Filter Mica, 470 mmfd. 500 v.	K-44J902-66
C113	Coupling Paper, 0.02 mfd. 600 v.	K-52J362-1
C117	Cathode by-pass Paper, 25 mfd. 50 v.	K-35J601-5
C118	Filter Paper, 0.01 mfd. 600 v.	K-43J211-4
C119	Filter Paper, 0.01 mfd. 600 v.	K-43J211-4
C121	Compensating Paper, 0.2 mfd. 600 v.	K-35J639-7
C122	Compensating Paper, 470 mmfd. 500 v.	K-44J902-66
FUSE		
F101	Power supply 2 amp. 250 v.	K-7883069-5
LAMPS		
I101	Indicating 6-8 v., 0.25 amp. (green)	K-52J355-2
I102	Indicating 6-8 v., 0.25 amp. (red)	K-52J355-1
I103	Indicating T4½-¼ w. (neon)	K-52J356-1
JACKS AND RECEPTACLES		
J101	First stage input Jack	K-52J357-1
J102	Microphone Receptacle	K-52J354-1
J103	Output Jack	K-52J357-2
J104	Power Receptacle	K-52J372-1
J106	Recording head Connector	K-52J870
J107	Motor, relay, erase coil Receptacle	K-35J414-9
J108	Recording head Receptacle	K-52J371-1
RELAYS		
K101	Relay and brake Solenoid	K-47J550-1
K102	Relay and brake Solenoid	K-47J550-1
COILS AND CHOKES		
L101	Filter Choke	K-52J358-1
L104	Recording Head Coil	P-64J92
L106	Erase Coil	K-47J866-1
L107	Compensation Coil	K-57J560

DESIGNATION	DESCRIPTION	DRAWING REFERENCE
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SPEAKER

LS101	Permanent magnet Speaker	K-52J353-1
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MOTOR

M101	Drive motor 115 v., 60 cycle, 1/100 hp at 1600 rpm	K-48J157-1
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PLUGS

P101	Motor, relay, erase coil Plug	K-52J370-1
P102	Recording head Plug (part of J106)	

RESISTORS

R100	Cathode bias Res. carbon, 330 ohms—1 w.	K-56J999-65
R101	Grid Res. carbon, 4.7 meg.—½ w.	M-31J707-106
R102	Cathode Bias Res. carbon, 1800 ohms—½ w.	M-31J707-65
R103	Screen Res. carbon, 1.8 meg.—½ w.	M-31J707-101
R104	Plate Res. carbon, 270,000 ohms—½ w.	M-31J707-91
R105	Cathode bias Res. carbon, 2700 ohms—½ w.	M-31J707-67
R106	Screen Res. carbon, 1 meg.—½ w.	M-31J707-31
R107	Plate Res. carbon, 270,000 ohms—½ w.	M-31J707-91
R108	Grid Res. carbon, 470,000 ohms—½ w.	M-31J707-94
R112	Cathode bias Res. carbon, 22,000 ohms—1 w.	M-31J708-78
R113	Filter Res. carbon, 27,000 ohms—½ w.	M-31J707-79
R114	Filter Res. carbon, 27,000 ohms—½ w.	M-31J707-79
R115	Volume control Pot., 500,000 ohms	K-52J865
R116	Tone control Pot., 250,000 ohms—with switch	K-52J867
R117	Neon adjustment Pot., 100,000 ohms	K-52J866
R118	Neon bulb bias Res. carbon, 270,000 ohms—1 w.	M-31J708-91
R119	Feedback Res. carbon, 39,000 ohms—½ w.	M-31J707-81
R120	Feedback Res. carbon, 22 ohms—½ w.	M-31J707-42
R124	Bleeder Res. carbon, 100,000 ohms—½ w.	M-31J707-86
R125	Compensating Res. carbon, 47,000 ohms—½ w.	K-56J998-156
R126	Compensating Res. carbon, 1,000 ohms—½ w.	K-56J998-86
R127	Compensating Res. w. w., 10,000 ohms—10 w.	K-52J872-2

SWITCHES

S101	Power switch (Combined with R116)	M-48J158-1 M-48J156-1 P-42J32-1
S102	Selector switch 2 position, 2 wafer	
S103	Motor control switch 3 position, 1 wafer	
S104	Automatic stop and counter switch 2 contact	

TRANSFORMERS

T101	Power	K-52J363-1 K-52J359-1 K-47J864-1
T102	Output	
T103	Oscillator	

VACUUM TUBES

V101	First AF Amplifier Type 6SJ7	
V102	Second AF Amplifier Type 6SJ7	
V103	AF Output Amplifier Type 6V6GT	
V104	30 KC Oscillator Type 6V6GT	
V105	Full-Wave Rectifier Type 5Y3GT	

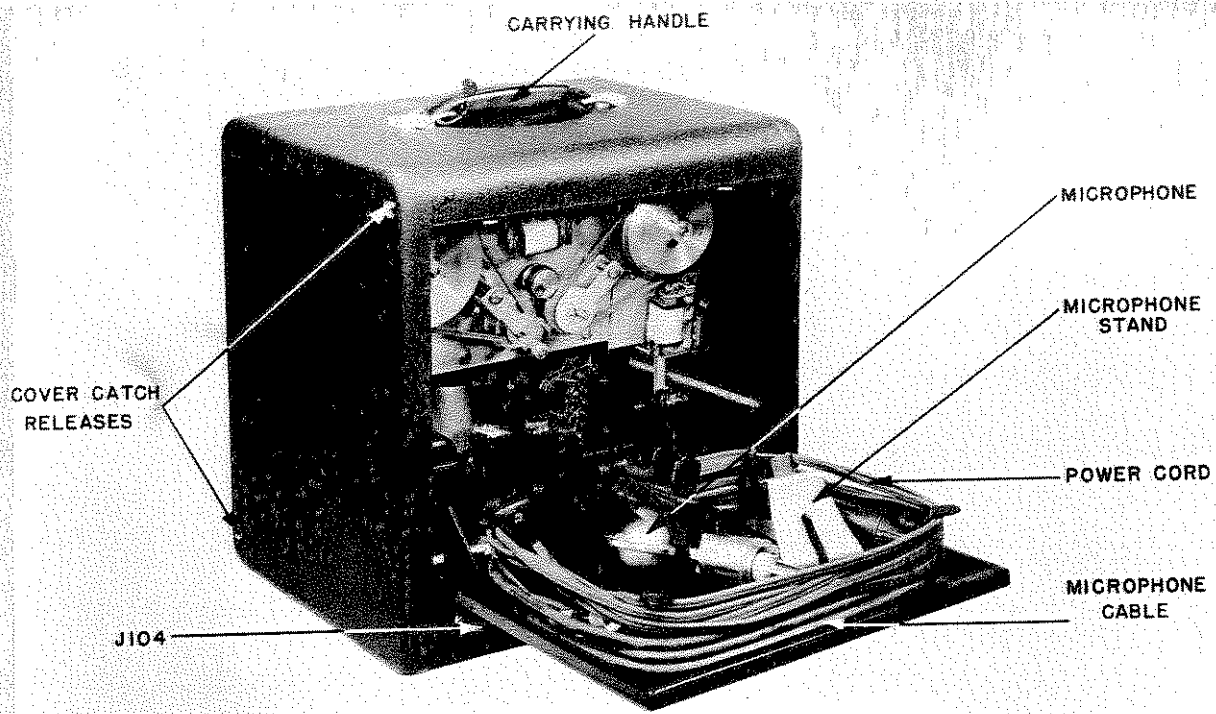


Figure 3. Oblique Rear View, Showing the Storage Space for Accessories

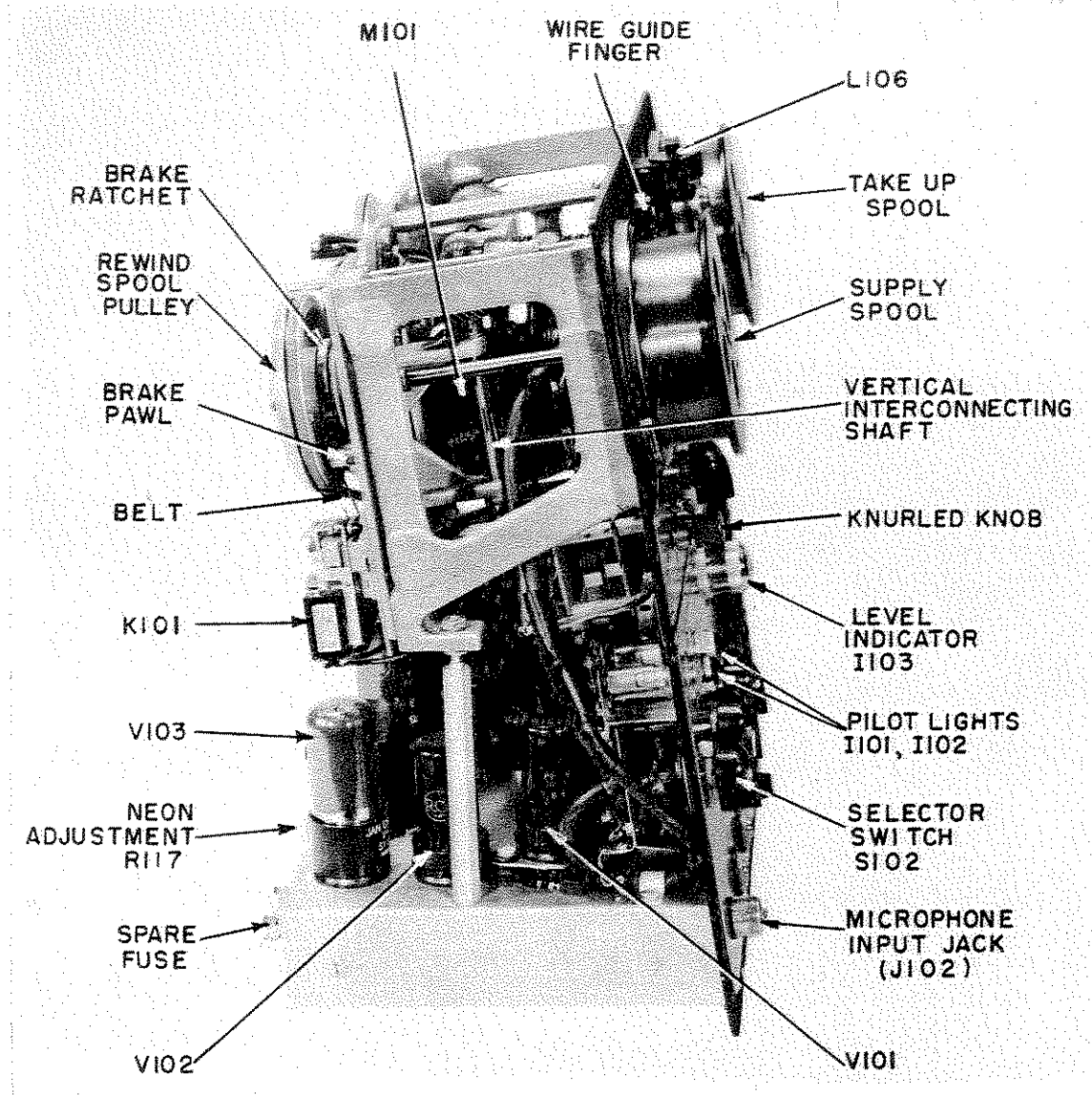


Figure 4 Side View, Showing the Amplifier and Drive Units

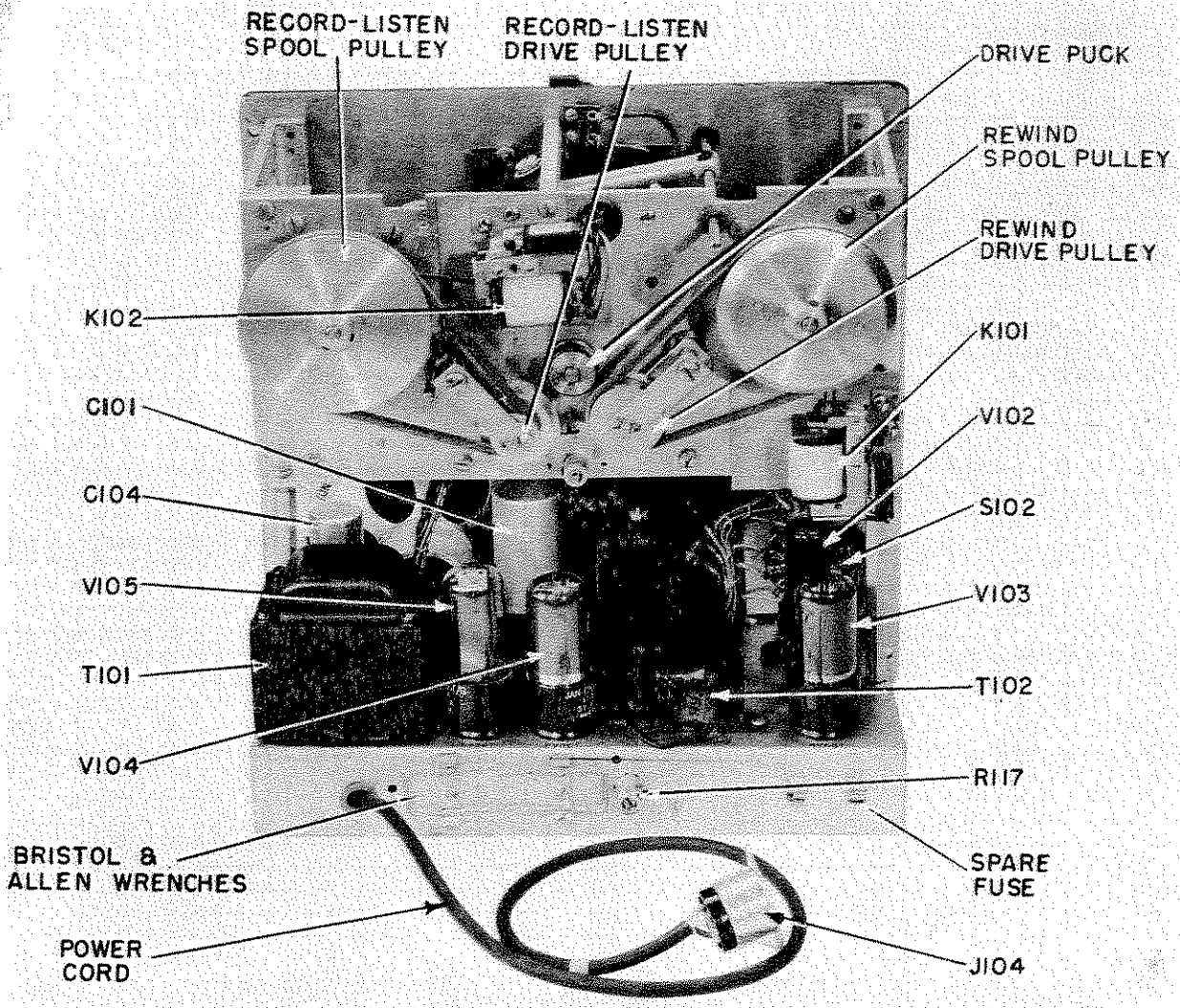


Figure 5 Back View, Showing the Amplifier and Drive Units

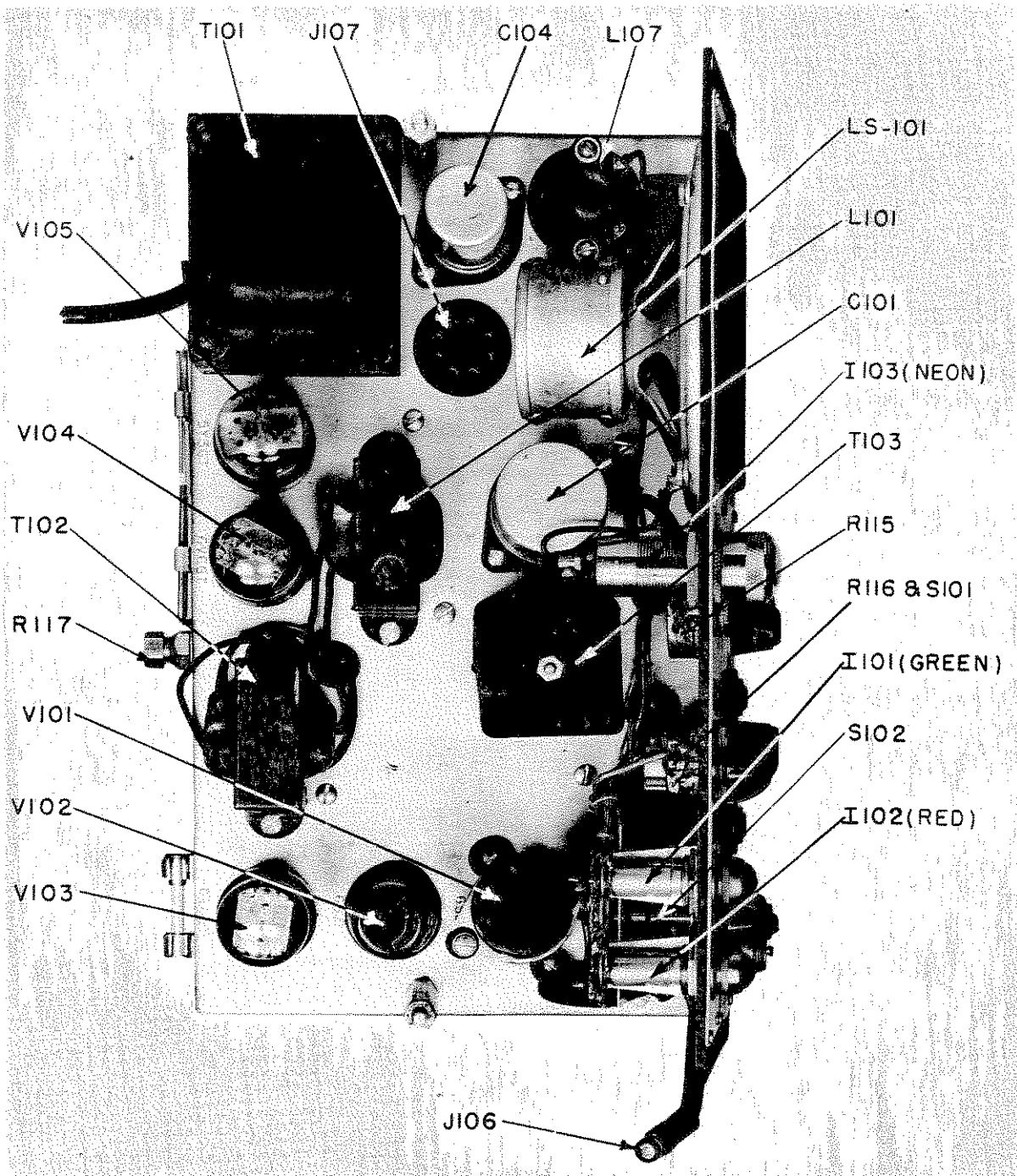


Figure 6 Top View of Amplifier Unit, Showing the Electrical Components

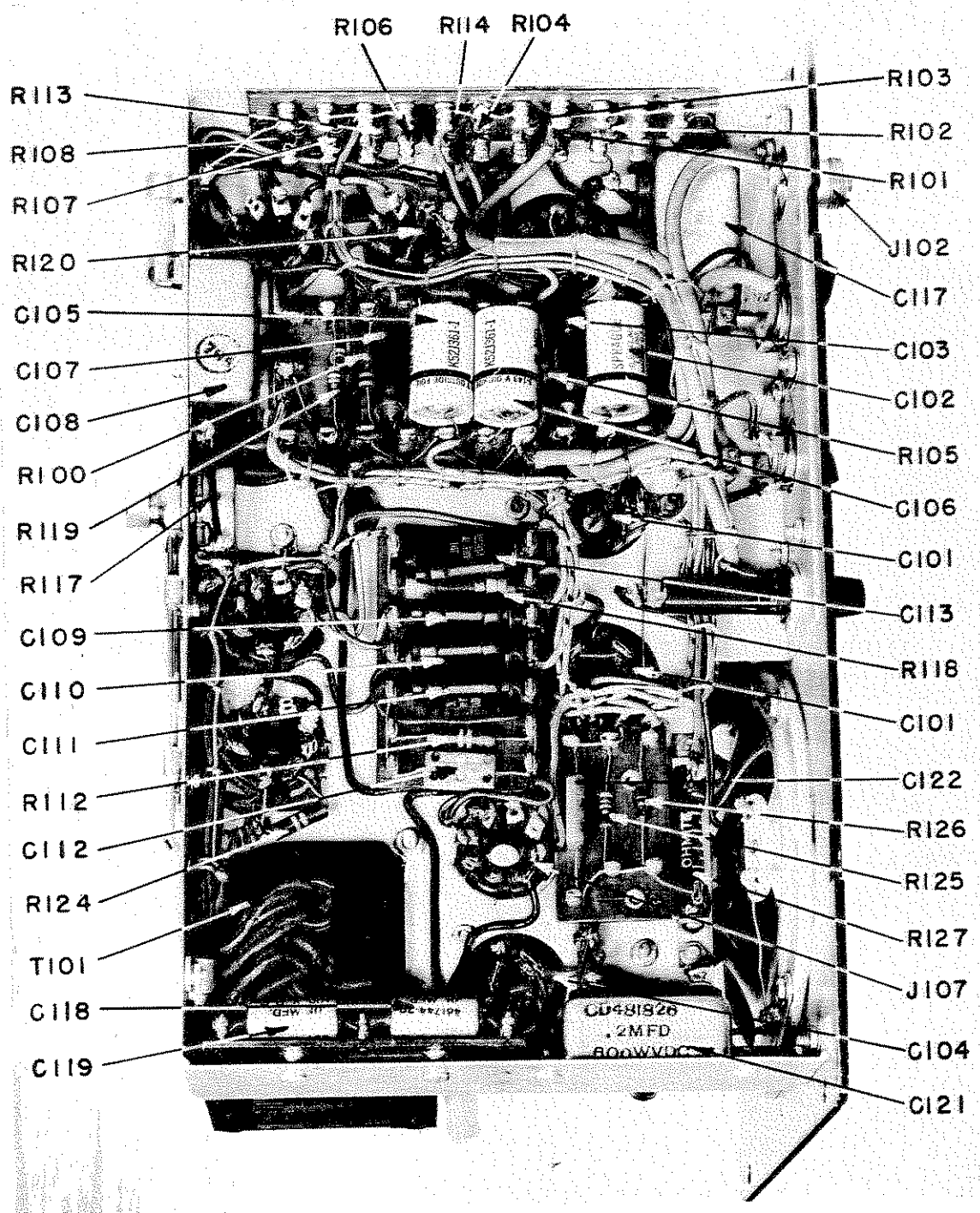


Figure 7 Bottom View of Amplifier Unit,
Showing the Electrical Components

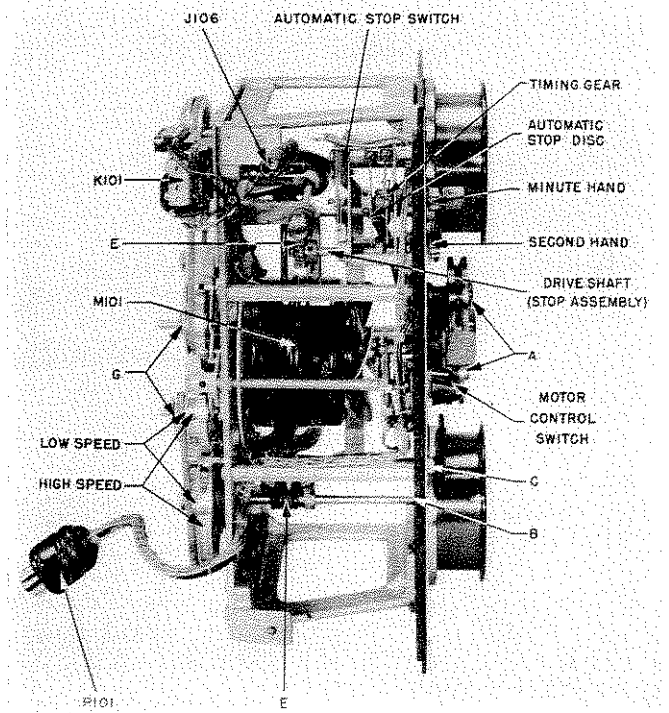
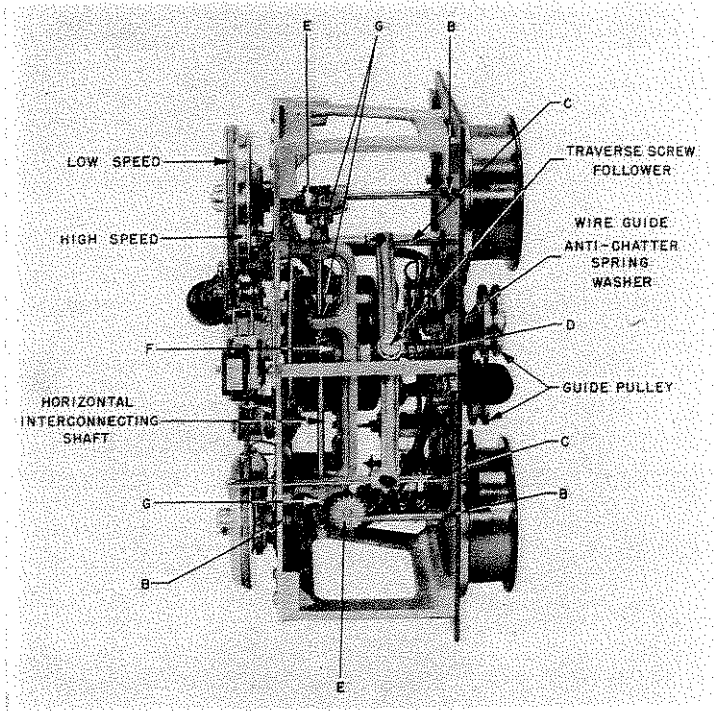


Figure 8 Top and Bottom Views, Showing Mechanical Mechanism

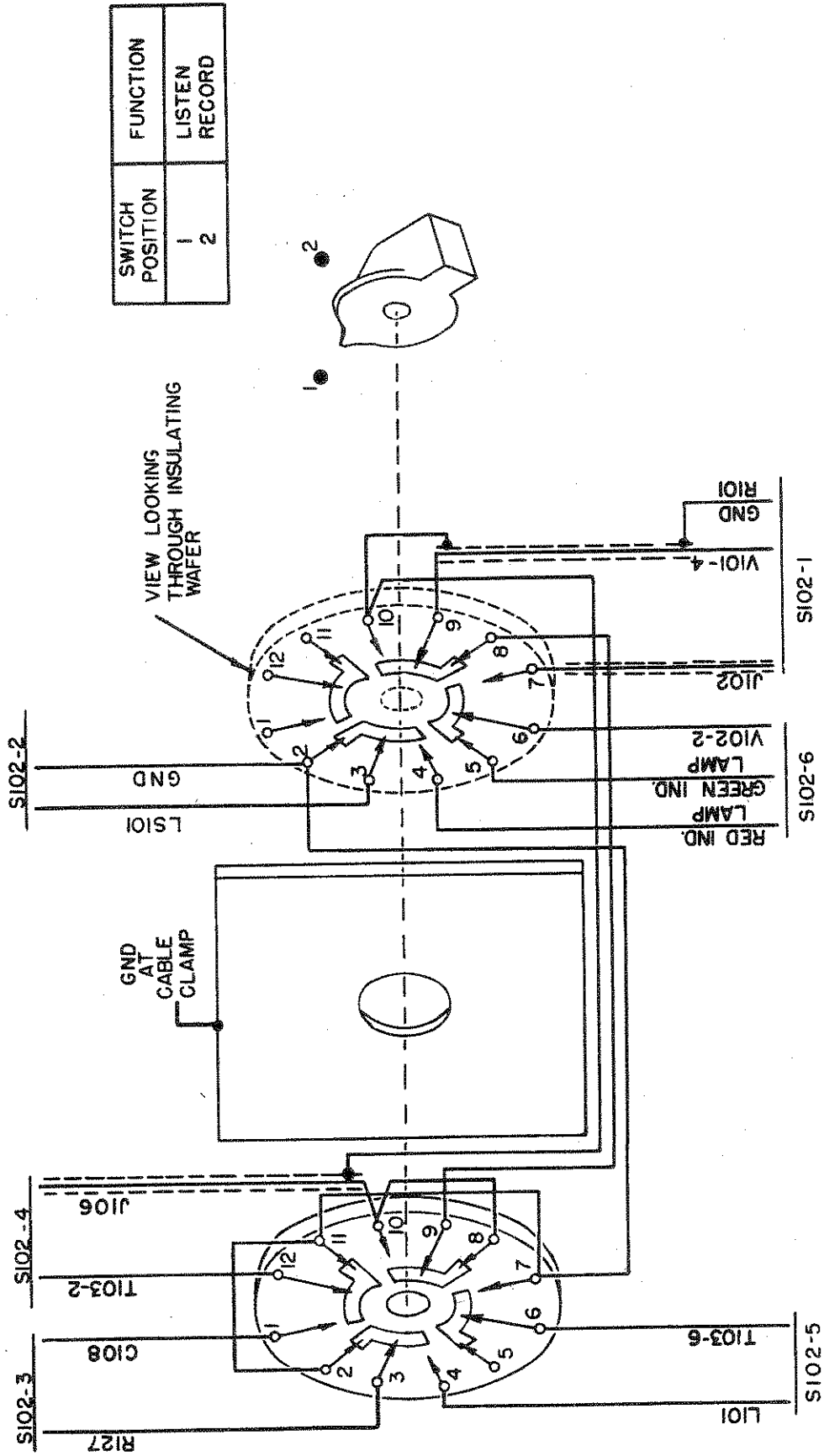


Figure 9 · Wiring Diagram of the Selector Switch, S102

V101
6SU7

V102
6SU7

V103
6V6GT

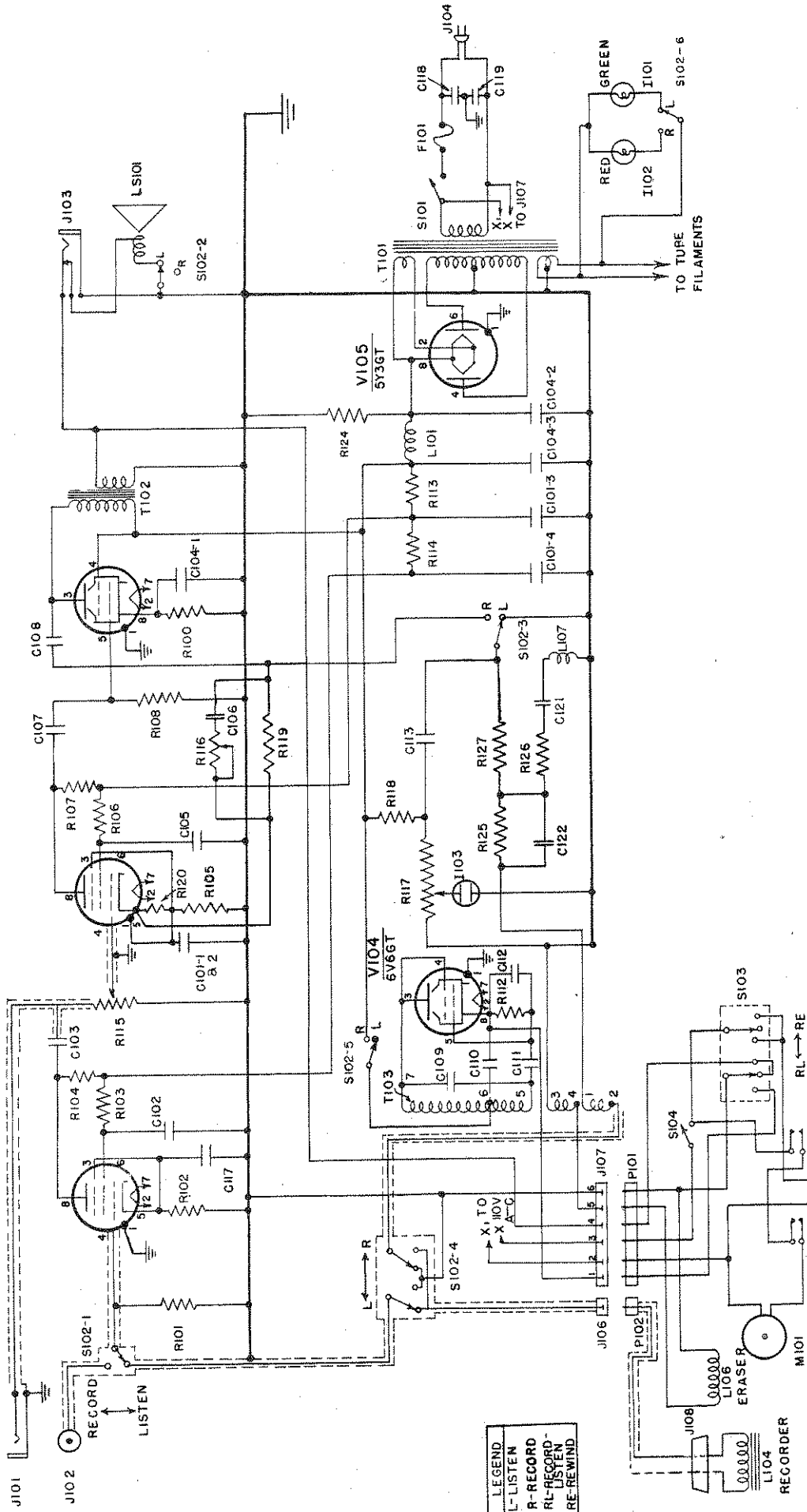


Figure 10 Schematic Diagram of the Model 51 Wire Recorder and Reproducer

PARTS LIST FOR SCHEMATIC DIAGRAM

SYMBOL	DESCRIPTION
CAPACITORS	
C101-1-2	Elec., 40 mfd., 25 v.
C101-3	Elec., 20 mfd., 450 v.
C101-4	Elec., 15 mfd., 450 v.
C102	Paper, 0.05 mfd., 400 v.
C103	Paper, 0.02 mfd., 600 v.
C104-1	Elec., 20 mfd., 25 v.
C104-2	Elec., 30 mfd., 450 v.
C104-3	Elec., 10 mfd., 450 v.
C105	Paper, 0.05 mfd., 400 v.
C106	Paper, 0.05 mfd., 400 v.
C107	Paper, 0.02 mfd., 600 v.
C108	Paper, 0.25 mfd., 600 v.
C109	Paper, 0.005 mfd., 600 v.
C110	Paper, 0.02 mfd., 600 v.
C111	Paper, 0.01 mfd., 600 v.
C112	Mica, 470 mmfd., 500 v.
C113	Paper, 0.02 mfd., 600 v.
C117	Paper, 25 mfd., 50 v.
C118	Paper, 0.01 mfd., 600 v.
C119	Paper, 0.01 mfd., 600 v.
C121	Paper, 0.2 mfd., 600 v.
C122	Mica, 470 mmfd., 500 v.
FUSE	
F101	2 amp., 250 v.
LAMPS	
I101	6-8 v., 0.25 amp. (green)
I102	6-8 v., 0.25 amp. (red)
I103	T4½-¼ w. (neon)
JACKS AND RECEPTACLES	
J101	Jack
J102	Receptacle
J103	Jack
J104	Receptacle
J106	Connector
J107	Receptacle
J108	Receptacle
RELAYS	
K101	Solenoid
K102	Solenoid
COILS AND CHOKES	
L101	Choke
L104	Recording head coil
L106	Erase Coil
L107	Coil

SYMBOL	DESCRIPTION
SPEAKER	
LS101	Speaker
MOTOR	
M101	115 v., 60 cycle, 1/100 hp at 1600 rpm
PLUGS	
P101	Plug
P102	Plug (part of J106)
RESISTORS	
R100	Res. carbon, 330 ohms—1 w.
R101	Res. carbon, 4.7 meg.—½ w.
R102	Res. carbon, 1800 ohms—½ w.
R103	Res. carbon, 1.8 meg.—½ w.
R104	Res. carbon, 270,000 ohms—½ w.
R105	Res. carbon, 2700 ohms—½ w.
R106	Res. carbon, 1 meg.—½ w.
R107	Res. carbon, 270,000 ohms—½ w.
R108	Res. carbon, 470,000 ohms—½ w.
R112	Res. carbon, 22,000 ohms, 1 w.
R113	Res. carbon, 27,000 ohms—½ w.
R114	Res. carbon, 27,000 ohms—½ w.
R115	Pot., 500,000 ohms
R116	Pot., 250,000 ohms, with switch
R117	Pot., 100,000 ohms
R118	Res. carbon, 270,000 ohms—1 w.
R119	Res. carbon, 39,000 ohms—½ w.
R120	Res. carbon, 22 ohms—½ w.
R124	Res. carbon, 100,000 ohms—½ w.
R125	Res. carbon, 47,000 ohms—½ w.
R126	Res. carbon, 1,000 ohms—½ w.
R127	Res. carbon, 10,000 ohms—10 w.
SWITCHES	
S101	(Combined with R116)
S102	2 position, 2 wafer
S103	3 position, 1 wafer
S104	2 contact
TRANSFORMERS	
T101	Power
T102	Output
T103	Oscillator
VACUUM TUBES	
V101	Type 6SJ7
V102	Type 6SJ7
V103	Type 6V6GT
V104	Type 6V6GT
V105	Type 5Y3GT