

GATES

W G M S



SEP 1961

WGMS - TRANSMITTER

INSTRUCTIONS FOR INSTALLING AND OPERATION
OF
THE GATES CARTRITAPE - M5944

4/28/61.

GATES RADIO COMPANY
QUINCY, ILLINOIS

CARTRITAPE - M5944

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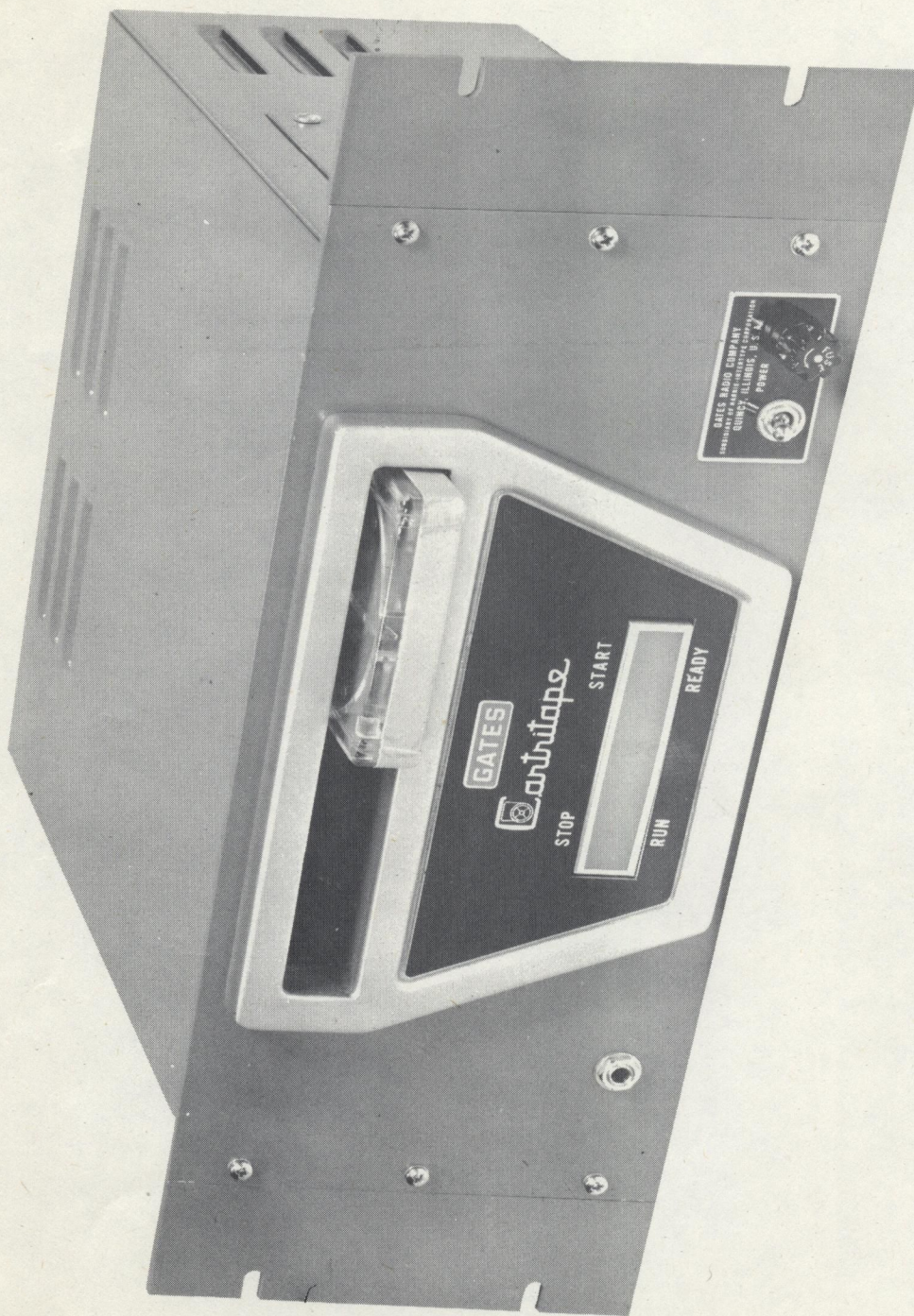
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CARTRITAPE
M5944

A-34855
(DR-195)

SECTION I
SPECIFICATION

M5944 CARTRITAPE PLAYBACK UNIT

FREQUENCY RESPONSE: Standard NAB playback curve, ± 2 db
50 to 12,000 cps., @ 7.5 IPS.

DISTORTION: 2% or less @ normal recording level.

NOISE: 60 db or lower below tape saturation level.
50 db or lower below normal recording level, 0 VU

WOW AND FLUTTER: 0.1% to 0.2% RMS.

TAPE SPEED: 7-1/2" per second.

EQUALIZATION: Standard NAB playback equalization for 7.5 IPS.

PLAYING TIME: 1 sec. to 46 min., in three basic cartridge sizes.

OUTPUT LEVEL: -15 dbm @ 500/600 ohms (factory connected),
may be strapped for 150/250 ohm output.
(Level set for -15 dbm at factory by R106.)

CUEING ACCURACY: Within 0.1 second.

START TIME: 0.1 second or less.

STOP TIME: Essentially instantaneous.

POWER SOURCE: 115 volts, 60 CPS, only.

POWER CONSUMPTION: 35 watts in the "ready" position
125 watts in the "Run" position

TUBE COMPLEMENT: (2) 12AX7, (1) 6X4, (1) 6X5, (1) 6X6, (1) 6X4.

MECHANICAL

HEIGHT: 7 inch rack or custom cabinet mounting.

WIDTH: 19 inch rack or 15 inch custom cabinet mounting.

DEPTH: 13 inch behind panel, excluding plugs.

MOUNTING: Standard 19 inch rack.
Custom 15 inch cabinet.
Desk top, with or without cabinet.

WEIGHT: Net 26 lbs., packed (domestic) 49 lbs., cubage 5.

AUXILIARY CONNECTIONS: Remote Start - Remote Stop
Remote Record Start - Remote Record Stop
Remote Cue Interlock-Remote Record Interlock
Synchronized Start Circuit
Synchronized Cue Controlled Stop Circuit
Synchronized Automatic Sequential Start
Circuit

SECTION II

INTRODUCTION

2.1 Gates Cartritape is a system that utilizes magnetic tape filled cartridges. It records and plays back using these cartridges with a quality equal to first rate reel to reel machines. The cartridge is plastic and contains a special lubricated recording tape which utilizes the principle of the endless loop. This means the tape will repeat itself if allowed to do so. This action is achieved by the tape being pulled from the center of a free turning hub by the capstan, past the heads and applied back on the outside edge of the reel of tape.

2.2 SYSTEM UNITS - (See Drawing 842 3246 001 for complete system diagram.)

The basic system includes:

1. Cartritape Playback Unit, M5944.
2. Cartritape Recording Amplifier, M5952.

Optional Accessories:

1. Automatic Switcher, M5953.
2. Remote Unit, M5960.
3. Cartridge Storage Rack, M5986

Units Needed -

To playback only

1 - M5944 Cartritape

To record only or record and playback

1 - M5944 Cartritape.
1 - M5952 Recording Amplifier

NOTE

When the recording amplifier/playback combination is not in the record mode, it is automatically in the playback condition.

SECTION III INSTALLATION

NOTE

Before operating the equipment read this Section, Section IV and Section V.

3.1 UNPACKING

The Cartritape unit will be received in one shipping carton. If the unit is to be rack mounted, the panel adaptor kit must be used. All units are shipped with the 19 inch adaptor kit. Unpack the contents carefully and examine thoroughly for shipping damage. If any such damage is found, File a claim report immediately with the Carrier.

CAUTION - Remove protective shipping fillers and shipping hardware.

To remove shipping protection -

- Step 1. Remove the top cover and remove sleeve from the capstan.
- Step 2. Remove the right access plate and remove the tie cord that holds down the lifter assembly.
- Step 3. Remove bottom cover and remove protective filler around motor.

3.2 MOUNTING

- Step 1. Assemble the adaptor plates to the front panel with the hardware provided, if 19" rack mounting is to be utilized.
- Step 2. Mount the unit in a standard rack with four rack panel screws.

The unit is complete as received. It was designed to allow its use without an external cabinet, if desired.

NOTE

The mounted equipment requires 7 inches of panel space and extends to a depth of 13 inches. Attention should be given to the location of the Cartritape units in the rack. Place them at a convenient height for cartridge insertion.

The recording amplifier should be mounted immediately above or below the playback unit to which it is to be interconnected. The recording amplifier requires 5-1/4 inches of panel space.

For INSTALLATION instructions for the recording amplifier, consult the Instruction Book on the Recording Amplifier, M5952.

3.3 AUDIO OUTPUT J105

NOTE

Before wiring P105 see drawing 813 5844 001 for pin numbering information. Insert plug into jack while wiring and observe above drawing.

The audio output appears between pins 2 and 3 of P105, with Pin 1 being ground. The amplifier is wired at the factory for 500/600 ohms at a -15 dbm output level from a normally recorded tape. This level is adjustable by R106, and is adjusted at the factory for -15 dbm.

Observing the schematic drawing C-79180, notice the output is balanced. It may be connected for 600 or 150 ohm, balanced or unbalanced output. (The output transformer is T102.)

3.4 TO CONNECT T102 FOR 150 OHM OUTPUT

- Step 1. Strap green and black/white together.
- Step 2. Strap black and yellow together.
- Step 3. The output is between the green and black leads.

3.5 CONTROL CIRCUIT JACK - J104 (P104 MATING PLUG)

NOTE

See Drawing 813 5844 001 for pin numbering information before wiring, shows numbering of P104.

Cartritape has many circuits brought out to this jack. Most of the interconnections and switching contacts are made from this termination point. See Drawing 842 3246 001 for system wiring diagram.

3.6 REMOTE STOP

If "Remote Stop" is desired the jumper between Pins 4 & 5 on J104 should be replaced with a N.C. switch. Normal operation, however, would be to allow the unit to recue and stop itself.

3.7 POWER CORD

The power cord should be connected between J101 and the 115 VAC 60 cps. power source.

3.8 CONNECTION FOR SYNCHRONIZED AUTOMATIC SEQUENTIAL START.

It is possible to interconnect the Cartritape playback units in such a manner that the stopping of one unit causes the starting of the next. This yields a form of automatic programming. See Section in Recording Amplifier Instruction Book for cartridge preparation.

To Interconnect Units

- Step 1. Interconnect the units, following wiring diagram 826 7750 001. The wiring shown is required in addition to that shown on 842 3246 001.

Drawing 826 7750 001 shows four units interconnected, any number may be used, more or less. If more are used, an extra switcher (M5953) is required for each group of four or less playback units.

Step 2. A switch (not supplied) makes the combination automatic or manual, depending on the position of the switch. A suitable ganged switch would be a Centralab 1419. This switch can be obtained from Gates.

SECTION IV PRE-OPERATION

4.1 GENERAL

The following section describes familiarization procedures that should be followed before attempting to operate the equipment.

4.2 A.C. POWER SWITCH - S101

Located on the lower right on the front panel.

Function: Turns power OFF and ON to the unit.

4.3 BAR SWITCH - S103-S104

Functions:

- (A) Indicates Power ON
- (B) Indicates Ready to Play
- (C) Starts Mechanism
- (D) Indicates Running Condition
- (E) Stops Mechanism.

As can be observed from the above, the switch provides the multiple functions of switching; and by use of lights, shows the operating status of the unit.

The following describes each function in detail.

4.3.1 INDICATES POWER "ON"

Step 1. Switch S101 (AC Power) to the ON position.

Step 2. Observe the center portion of the bar switch, it should glow red and green.

4.3.2 INDICATES "READY" TO PLAY

Step 1. Insert an erased cartridge into the slot, guiding to the right hand side. Push firmly forward until it comes to rest against the stop.

Step 2. Observe the bar switch, notice that the right half of the switch now glows green. This indicates the cartridge is ready to play.

4.3.3 START MECHANISM

Step 1. With the cartridge in place, press against the bar switch on the side marked "START".

Step 2. The unit will start, (the tape will begin to move) while the left side of the bar switch now glows red.

4.3.4 INDICATES RUNNING CONDITION

Step 1. As mentioned in 4.3.3 Step 2, the left side of the bar switch glows red. This indicates the unit is in the running condition.

4.3.5 STOP MECHANISM

Step 1. Press against the bar switch on the side marked STOP.

Step 2. The tape will stop, and the red light will go out.

Step 3. Notice the green light is still illuminated. This indicates the cartridge is again in the "Ready to Play" condition.

CAUTION - When removing the cartridge from the slot, a slow firm retrieve is necessary. If it is removed with a fast or jerking motion, the pressure roller may bind in the cartridge. If this occurs, press forward and repeat removal step.

4.4 RECORD PLAYBACK FUNCTION

In order to make a test recording, first study the Instruction Book for the Recording Amplifier M5952. Study the section on INSTALLATION and PRE-OPERATION in particular.

After the installation of the recording amplifier, a test recording should be made following the steps given in the Recording Amplifier Instruction Book.

4.5 AUDIO MONITOR JACK

Located on the front panel (lower left hand side).

Function: To allow monitoring of the audio by use of crystal phones. (-15 DBM level).

CAUTION - Only crystal phones should be used in this jack. Lower impedance phones may cause excessive circuit loading and/or a lower level than can be used.

SECTION V OPERATION

5.1 GENERAL

The operation of Cartritape M5944 is treated as a playback unit only. When the unit is connected as a record/playback combination the playback function still applies. However, all reference to the recording aspect is treated in the Recording Amplifier Instruction Book.

NOTE

It must be remembered there is a 3 second delay after "Start" is pressed before cue signals can be detected by the cue amplifier.

Therefore, recorded segments should be
at least 4 - 5 seconds long.

5.2 PLAYBACK

5.2.1 Playback of a Single Segment Recording

1. Cartridge should be recorded as explained in recording Instruction Book.
2. Insert cartridge into slot until "Ready" light comes on.
3. To play, press "Start" (bar switch) on the Cartritape.
4. Upon completion of the program material, the Cartritape will continue to run until the next cue signal is detected. The tape mechanism then stops automatically. The red "Run" light is extinguished, indicating the Cartritape is again ready for operation.

5.2.2 Multiple Segments

1. Play first segment as explained above in 5.2.1. Since the segments are recorded end to end, the cartridge will stop all cued up after the first segment has played.

5.2.3 Multiple Segments from More than one Cartritape, Using Single Segment Cartridges.

1. Start the first segment as in 5.2.1.
2. As the first segment ends, start the next unit, and so on until all the units have played their segment. Of course, any unit may be reloaded with a cartridge anytime after the previous cartridge has recued.

5.2.4 Automatic Sequential Start

A form of automatic programming can be attained by connecting the Cartritape for automatic sequential start. The cartridges are prepared such that a cue tone is applied at the end of each recorded segment. This cartridge will then cue up at the end of the recorded audio segment. This stopping will then start the next Cartritape, and so on.

The following points should be followed for correct use of this feature.

1. All cartridges must be prepared end to end as explained in the Recording Amplifier Instruction Book.
2. The Cartritape system should have the wiring complete as shown on drawing 836 7750 001 in addition to the wiring shown on 842 3246 001.

NOTE

842 3246 001 is a system wiring diagram for manual operation only.

It will become apparent there are many possible uses for a system such as this, tight programming, semi-automation, etc., could be used for -

1. Automatic programming of hit tunes, one, two or three on each cartridge.
2. When playing a series of spots end to end. They could be played automatically,
3. There are contacts available on K101 that could be used to start other equipment, slides, etc., (Pins 17-18 or K101).

The above is described to stimulate some ideas on how this feature could work for your programming.

SECTION VI

THEORY OF OPERATION

6.1 PLAY AMPLIFIER

The play amplifier is a three stage amplifier (with a gain of approximately 55 DB @ 1000 cycles) which utilizes the NAB playback curve for equalization. The playback head is connected directly to the input grid of the EF86 preamplifier. This tube is connected in a standard grounded cathode amplifier configuration with shunt type equalization in the plate circuit. R105 may be adjusted to compensate for variations in the components from machine to machine. R105 has been adjusted at the factory (approximately 5000 ohms) so that the response is within published specifications. The second stage is a conventional triode amplifier with about 18 DB of negative feedback applied to the cathode (from the following stage) through R110 and C108. This feedback reduces the distortion to a very low level. The last stage is a conventional amplifier with transformer output.

The normal output level of this amplifier (when playing back a tape that has been recorded at normal level) is about -15 DBM. This level is set at the factory by level control R106. However, the distortion of the amplifier at 0 DBM out is less than .5% maximum. Output transformer T102 is connected for 600 ohm output at the factory. If it is desired to reconnect the output for 150 ohms paragraph 3.4 should be consulted in Section III - INSTALLATION.

A level control (R106) used in the playback amplifier provides level adjustment to compensate for head and component differences. The level from a properly recorded tape will produce the correct level for feeding a medium level console input (without console preamplifier).

6.2 CUE AMPLIFIER

The cue amplifier consists of V104 and V105. The cue head is connected directly to the input grid of the first stage.

V104 is a conventional amplifier connected in cascade. However, note that there is no bass equalization because the cue tone is 1000 cycles. Any equalization would cause a loss in cue gain. C111 is connected from the plate of the second stage to ground to help shunt any high frequency switching transients (from other equipment) to ground before they can be applied to the grid of V105 (2D21). The two diodes CR102 & CR103 together with C120 and R119 in the grid circuit of V105 comprise another transient suppression device. This circuit rectifies the cue tone which then overcomes the DC bias on V105, this causes K102 to be activated. The 2D21 is a thyratron with a plate relay (K102) for its load, when activated the mechanism stops. R122 is a current limiting resistor used to protect the 2D21 during the conduction cycle. The grid has approximately 12 volts of negative bias applied during STOP, and about 5 volts in the RUN condition. This bias is derived from R123 and C115 in center tap ground return of the high voltage winding of T101.

On Pin 8 of V104 (12AX7) about 5 volts of positive voltage is applied during the STOP condition. The tube is cut off for approximately 3 seconds after the bar switch is pressed to run. This time delay is caused by the voltage leaking from C102B through R117 and R131. C102B is charged through R129 from the voltage supplied through contacts 6 and 7 on K102. This 3 second delay is to allow the use of tapes recorded on other manufacturer's units that may utilize a longer cue pulse.

6.3 POWER SUPPLY

The unit utilizes two DC power sources. The first uses a special low flux density preamplifier power transformer (T101), and is a conventional full wave type. A 6X4 tube is used for the rectifier, while the filter circuit is a Pi type network. L102 is the inductive element, C101A and C101B are the capacitive elements. The first stages of both amplifiers have the DC filtered further by R108 and C101C.

The second power supply is a half-wave type and provides DC for relay activation. This supply is comprised of CR101 and C116.

6.4 CUEING CYCLE - TONE APPLIED

At the beginning of the recording cycle at the instant the START switch is depressed, a 1000 cps. tone (approximately .1 second duration) is applied to the cue head. This puts the control tone on the cue track of the tape at the beginning of the recording. Program material is recorded on the other track, immediately after the start button is depressed. The more rapidly the program material is applied to the recording amplifier (after the START switch is pushed) the tighter the cue will be.

6.5 TONE STOPS UNIT

When the cue tone (applied at beginning of the recording on the tape) passes the cue head it causes the unit to stop. This is accomplished by the cue signal being amplified and causing V105 to fire. This activates K101 briefly, which operates the necessary control circuits.

SECTION VII MAINTENANCE

7.1 GENERAL

Routine maintenance should be followed if the equipment is to continue to perform properly. It is recommended that a routine maintenance schedule be enforced.

NOTE

When servicing equipment pull AC line plug because a shock hazard is present, this will prevent damage to components, as one side of line is hot.

7.2 CLEANING

Clean the capstan and head surfaces daily when subjected to heavy use. Clean the pressure roller once a week.

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M5944 Cartritape

Use Isopropyl Alcohol or Wood Alcohol on a soft cloth.

CAUTION - DO NOT USE ANY OTHER SOLVENT.

NOTE

Avoid as much as possible, touching the rubber part of the pressure roller with the fingers.

7.3 HEAD DEMAGNETIZING

Heads may become magnetized by large unbalanced pulses through the record head, as well as from strong magnetic fields. Do not saturate the record amplifier with abnormally high input signals. (Magnetized heads produce excessive noise on recorded tapes, and if severe enough will partially erase them).

It is a good idea while cleaning the heads to demagnetize the heads to remove any permanent magnetism that they may have acquired. Demagnetize the heads at least once a week.

7.3.1 TO DEMAGNETIZE THE HEADS

- Step 1. Turn the power off.
- Step 2. Plug the demagnetizer (a suitable demagnetizer is Audio Devices Model 400.) into the power source.
- Step 3. Bring the tips of the demagnetizer to within 1/16" of the heads, or contact them if the tips are protected to prevent scratching the head surface.
- Step 4. Let the tips straddle the head gap and pass them up and down about 3 times.
- Step 5. Remove the demagnetizer slowly from the head to a distance of about 3 feet.

CAUTION - This slow removal is extremely important. Do NOT remove power from the demagnetizer while in the proximity of the heads as the collapsing field may re-magnetize them.

7.4 AZIMUTH ADJUSTMENT

This adjustment is made at the Factory. This process is given for information in case it becomes necessary to make adjustment. Having the heads aligned with the head gap perpendicular to the tape travel is extremely important. Otherwise, tapes recorded on one machine will not have adequate high frequency response when played back on another machine. To avoid this, all machines should be aligned with an azimuth test tape periodically or when the very high frequencies appear to be attenuated.

7.4.1 PROGRAM HEAD ADJUSTMENT

- Step 1. Obtain a 10 KC cartridge azimuth test tape. *
- Step 2. Remove Cartritape enclosure top and V105 (2D21).
- Step 3. Insert the azimuth cartridge into the slot and apply power. (Press START).
- Step 4. Connect an audio VTVM across the output terminals (Pins 2-3 on J105).
- Step 5. Play the tape back and align head for maximum level.

* A 10 KC tape may be prepared on a reel to reel machine and then loaded into a blank cartridge. Use Minnesota Mining & Mfg. Co. Type 151A single lubricated tape.

NOTE

The necessary azimuth wrenches are supplied with the unit. It will be observed that one wrench has very thin walls. This should be used on the head proper (next to the support bracket) after slightly loosening lock nut with the conventional wrench. Then, working the two wrenches together, rock the head until the highest level is obtained with the nut locked.

CAUTION - Do not use pliers on heads or twist head body. Do not move the entire head assembly vertically or vertical track misplacement will occur. Readjust vertical height per drawing A-34843 if this adjustment is necessary.

7.4.2 CUE HEAD

- Step 1. Interchange the two head cables.
- Step 2. Repeat Steps 3 & 5. (7.4.1)
- Step 3. Put the head cables back into the original jacks.
- Step 4. Replace the 2D21 and the top cover.

7.5 AMPLIFIER RESPONSE

- Step 1. Set up equipment as shown in block diagram on drawing A-34610.
- Step 2. Vary the oscillator frequency and plot the amount of attenuation (in DB) added or subtracted to obtain constant output. The NAB playback curve should be obtained when the image is re-plotted. This will be the image of the amplifier response, see Drawing A-34610.

7.6 R125 ADJUSTMENT

R125 has its slider positioned so that 60-70 volts DC appear across the solenoid L101. (The resistor is adjusted at the factory).

7.7 TUBES

All tubes should be checked every 2 to 6 months; and when necessary, replaced.

7.8 RELAYS

The relays are located under protective covers to minimize dust collection on the contacts. They should be inspected periodically (every 2 to 4 weeks) and cleaned, if necessary.

7.9 LUBRICATION POINTS

The following points should be lubricated every 6 months. Oil the following points -

1. Linkage pivots. Photo DR201
2. Lifter can shaft. Photo DR201
3. Motor (both bearings). Every 1000 hours oil. Lubrication holes are located at each end of motor shaft bearing on the same side as the motor name plate.

Only one or two drops of oil is required in each place. Use only good quality machine oil (Gulfoil). This oil is available from Gates.

Lubricate the following points once a year with Molykote Type G which is available from Gates. Use a very small amount and rub into the metal.

1. Lifter can surface. Photo DR201
2. Linkage slide. Photo DR202
3. Solenoid plunger - (very small amount) L101.

7.10 PRESSURE ROLLER INSPECTION

Observe for:

1. Free turning on shaft.
2. Rubber tire not damaged, deformed or excessively dirty.

7.11 MECHANICAL ADJUSTMENTS.

Check adjustments once a year. These adjustments were all made at the Factory. However, an understanding of them is necessary if readjustment becomes necessary.

7.11.1 CARTRIDGE INSERT TIMING.

Adjustment for proper positioning of pressure roller by cartridge insertion. The nylon rollers that the cartridge engages (as it is inserted) are adjusted by their placement on the slotted lever arm.

Adjustment - (See Photo DR202)

Step 1. When the cartridge is inserted, the pressure roller should be engaged to within 3 to 5 degrees of the capstan (about 1/16" from capstan).

Step 2. Loosen the bolt through the nylon rollers and move the rollers out (or in) to achieve this adjustment.

NOTE

If this timing is incorrectly set, the cartridge will not insert or remove from the slot correctly, and/or a binding will occur.

7.11.2 LIFTER CAM STOP (See Photo DR202)

This is the metal piece that the lifter can rests upon when no cartridge is inserted.

Adjustment:

Step 1. Do not have a cartridge inserted.

Step 2. Adjust cam stop such that the pressure roller is 1/16" to 1/8" below the motor plate surface.

7.11.3 TOGGLE PIVOT -(Pressure Roller Force)
(See Photo DR203)

This pivot is located in the lower left hand corner of the mechanism plate. It is mounted in a slot and situated at the pivot end of the linkage. The position of this pivot governs how much force is exerted on the pressure roller.

Adjustment:

- Step 1. With no cartridge in place manually raise the pressure roller. (Raise lifter cam.)
- Step 2. Move the pivot up (or down) to a point that (with the solenoid energized) the pressure roller tire is compressed $1/32$ " by the capstan.

NOTE

This is a "cut and try operation" because the pivot must be tightened for each test.

7.11.4 TOGGLE STOP (See Photo DR203)

This is the metal piece that stops the linkage from going over center and locking the linkage.

Adjustment:

Adjust the toggle stop to a point that allows about 176° - 178° angle between the two linkage arms with the solenoid energized.

7.11.5 SOLENOID POSITION

The solenoid is mounted over slotted holes to permit lateral positioning.

Adjustment:

- Step 1. Loosen the screws holding the solenoid to the mechanism plate.

Step 2. Insert a cartridge to the "Ready" condition (no power on).

Step 3. Position and tighten the solenoid enough that (when the plunger is seated) it will cause the spring connected to it to be stretched about 1/16".

NOTE

The solenoid must be parallel to the plunger or it will bind.

7.11.6 LIFTER ASSEMBLY

The lifter cam assembly is mounted to the basic motor chassis with two screws. These screws are located under the two holes on the motor plate.

Adjustment:

Step 1. Loosen the two screws slightly. (They are in tapped holes.) (Photo DR196.)

7.11.7 SWITCH (S102)

This switch is located on the motor plate and is activated by the lever arm.

Adjustment:

Step 1. Insert cartridge (Power on).

Step 2. The "Ready" light should light and the capstan should turn. Adjust the "turn on" point of each switch, by use of the lock nuts and screws, until this action is achieved.

Step 3. Remove cartridge slightly to a point where the toggle pawl can not engage the roller lever.

Step 4. The "Ready" light should be out and the Capstan not turning.

NOTE

The switch should actuate only when the cartridge is in such a position that it can be operated when START is pressed. In all other conditions the "Ready" light and capstan should be inoperative.

7.11.8 LEAF SPRINGS

There are leaf springs used in the cartridge guide system. These springs may, after a long period of time or excessive abuse become misadjusted.

Adjustment:

Adjust to put the proper tension back into the spring.

7.12 TAPE CARTRIDGES

7.12.1 PRESSURE PADS

The ends of the pressure pads should be kept adjusted 1/8" from the cartridge edge. See drawing A-34659, Fig. 2.

7.12.2 LENGTH OF LOOP

If the tape becomes too loose in the cartridge, the following conditions will appear:

1. Tape appears to be looping out of capstan slot. Drawing A-34659, Fig. 3.
2. Tape is loose on the center hub.

To correct these faults the following procedure should be followed:

Step 1. On all sizes remove the center screw, and on the Model 1200, the four extra screws.

Step 2. Remove the plastic top, and lift out the wire guides. See Drawing A-34657, Fig. 1.

- Step 3. If the tape is too loose, cut the tape at the old splice, tighten reel of tape by pulling on the tape located on the outer edge. Tighten enough to add extra turns on the reel. Drawing A-34658, Fig. 5.
- Step 4. Re-splice with Mylar base splicing tape.
- Step 5. With one hand release reel brake, and pull tape from the center of the hub until slack is taken up. Drawing A-34658, Fig. 4.
- Step 6. Close the cartridge by replacing the wire guides and top cover, then secure with the previously removed hardware.
- Step 7. Place in the machine and allow the cartridge to complete the cycle through one to two times. In some instances, the tape will bind a bit on the hub until the slack has been taken up, and the tensions have equalized through the entire length of tape.
- Step 8. If the tape is too tight in the cartridge, it will wow or even cause the tape to break.

To Lengthen Loop

- Step 9. Open cartridge. Cut the tape at old splice. Remove one turn and re-splice. If the tape is still too tight, after running through once on the machine, remove another turn. The tape should pull easily from the hub but should not have slack hanging out of the capstan slot.

NOTE

If adding or removing one turn of tape is too large a step, it will be necessary to remove a 2 to 4 inch section from the tape. This, however, will change the playing time and should be avoided when possible.

CAUTION - On the large Model 1200 Cartridge, it is necessary to have a fairly loose reel of tape because of the large diameter differential between the pull hub and the outside diameter of the tape. Therefore, be careful not to tighten the tape to a point which will cause wow or breakage of the tape (because of high pulling friction).

TROUBLESHOOTING CHART

SYMPTOM	POSSIBLE CAUSE	CURE
Insert Cartridge -Ready Light ON- (Press Start) Tape does <u>NOT</u> move.	1. Broken belts. 2. S102 not adjusted properly - motor not running. 3. No D.C. to operate solenoid. 4. Toggle pawl not hitting roller level.	1. Replace belts. 2. Adjust switch or or replace switch if defective. 3. Check D.C. power supply or C116, CR101. 4. Adjust cartridge insert timing 7.10.1
-Run light ON- Tape does <u>NOT</u> move in Cartridge	1. Not enough pressure (roller pressure). 2. Dirty pressure roller. 3. Cartridge bad, tape binding inside cartridge.	1. Adjust toggle pivot. 2. Clean pressure roller. 3. Open cartridge and remove a few loops (See Section on Cartridges).
Machine does NOT Cue Cartridge	1. Cue amplifier defective. 2. Bad relays (dirty contacts or open coil). 3. No cue tone on tape.	1. Check amplifier (voltages, tubes, etc.) 2. Clean relay contacts or replace relay. 3. Recording amplifier defective.
False Cues or Stops	1. Switching transients from other equipment. 2. Bad diodes CR102 or CR103.	1. C111 may be increased to a value to reduce amplifier sensitivity but still operate on cue tone. 2. Replace diodes CR102 & CR103.
Program Quality Poor	1. Bad tubes. 2. Dirty heads. 3. Magnetized heads. 4. Defective recording amplifier. 5. Pressure pads in cartridges out of position. 6. Incorrect input connects to Recorder.	1. Replace. 2. Clean heads. 3. Demagnetize heads. 4. Check recording amplifier. 5. Adjust cartridge pads, see Section Maintenance (cartridges.) 6. Check input to recorder Sec. 3.6 in Record Amplifier I.B.

REPLACING COMPONENTS ON THE PRINTED CHASSIS

Since this is a destructive operation, the engineer must be reasonably sure that the part is defective before removing it. He may determine this from the D.C. and signal voltage measurements or by visual observation.

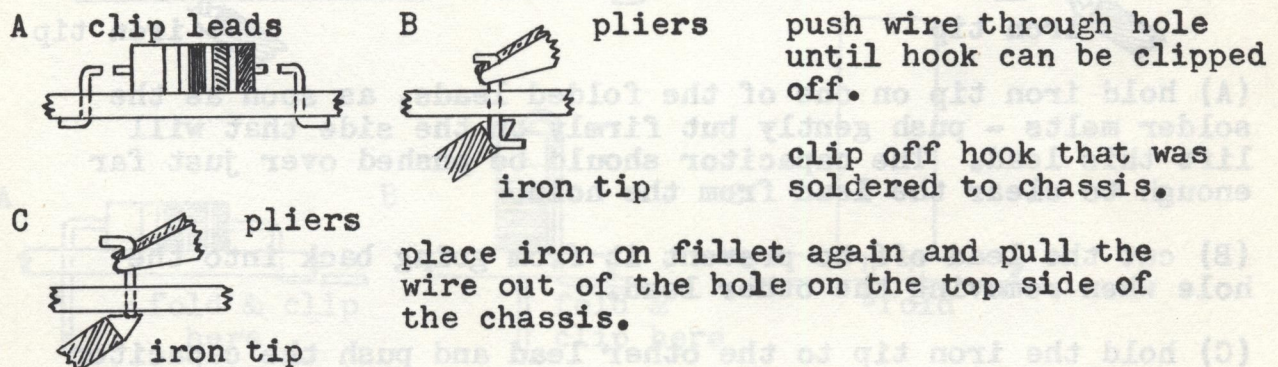
WARNING: The copper conductors are only .0027" thick on the printed chassis. They are easily damaged! Do not attempt to pull one component lead loose to check the component. Use only the approved procedure as outlined in the sketches and the sub-paragraphs listed below.

Use a small electric soldering iron (60 watts or less) and allow it to come up to full heat before starting the repair job. The tip must be clean and well tinned.

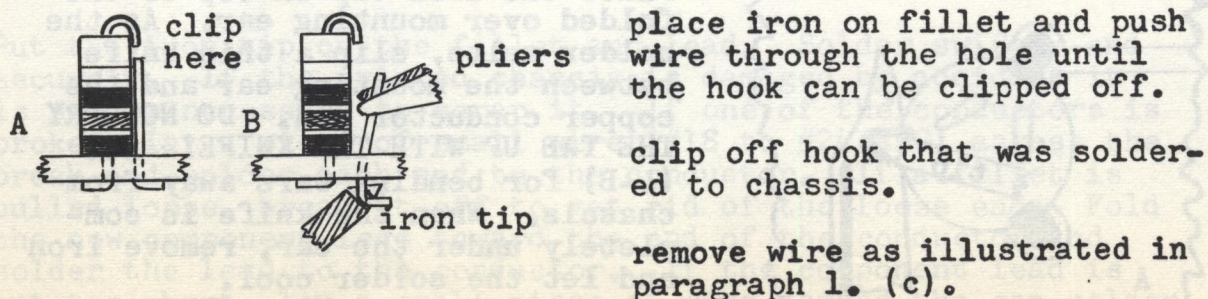
CAUTION: Do not use a soldering gun. The extremely high temperature of the tip will damage the phenolic board.

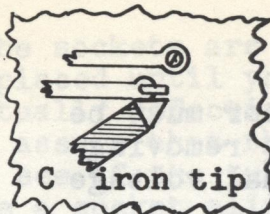
Put the iron tip on the fillet under the chassis, right beside the component lead being removed. Put a gentle, but firm pressure on all leads and components being moved while the heat is applied. Do not hold the iron to the printed chassis for long periods of time. If the lead or component is difficult to remove, make repeated short passes at it rather than one long period that may overheat the board.

1. REMOVING PARALLEL MOUNTED COMPONENTS WITH AXIAL LEADS:



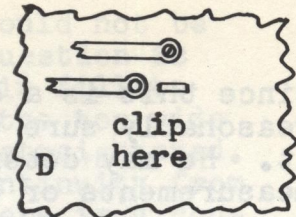
2. REMOVING VERTICALLY MOUNTED RESISTORS AND COMPONENTS WITH AXIAL LEADS:



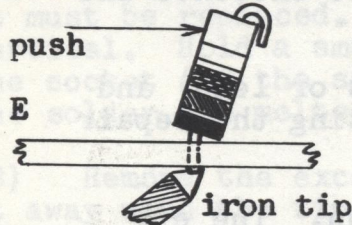


place the iron against the folded wire and rotate it away from the conductor leading into the fillet (2-c).

cut the wire as near the chassis as possible after

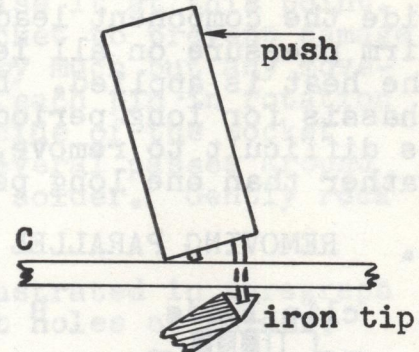
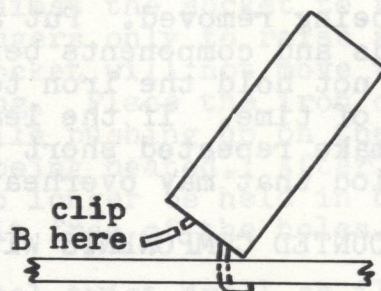
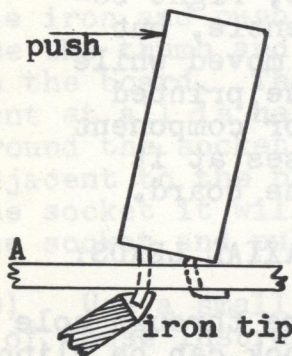


removing as much excess solder as possible. Remove solder by carrying it away with the iron tip and wiping the tip on a clean cloth. Repeat until the hook can be clipped with small sharp diagonal cutters, illustrated in (2-D).



place iron on fillet again and push the resistor body over until the lead comes out of the hole.

3. REMOVING PRINTED WIRING TYPE CAPACITORS:

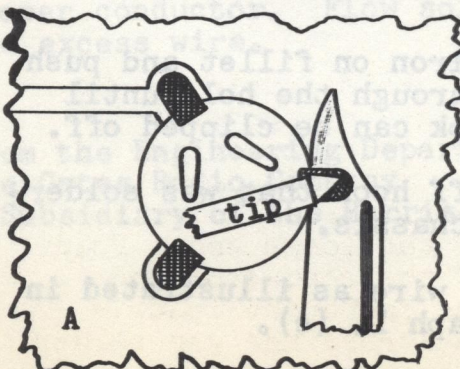


(A) hold iron tip on one of the folded leads, as soon as the solder melts - push gently but firmly on the side that will lift this lead. The capacitor should be pushed over just far enough to clear the lead from the hole.

(B) cut the lead off to prevent it from going back into the hole when removing the other lead.

(C) hold the iron tip to the other lead and push the capacitor over until it comes free.

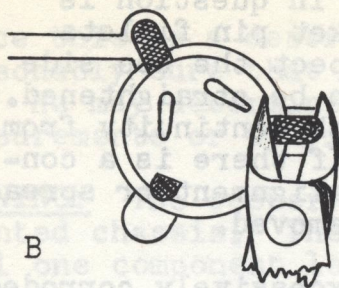
4. REMOVING SADDLE TYPE ELECTROLYTIC CAPACITORS:



Place the iron tip on top of the folded over mounting ear. As the solder melts, slip a thin knife between the mounting ear and the copper conductor pad. DO NOT PRY THE TAB UP WITH THE KNIFE! See (4-B) for bending ears away from chassis. When the knife is completely under the ear, remove iron and let the solder cool.

Repeat on other two mounting ears.

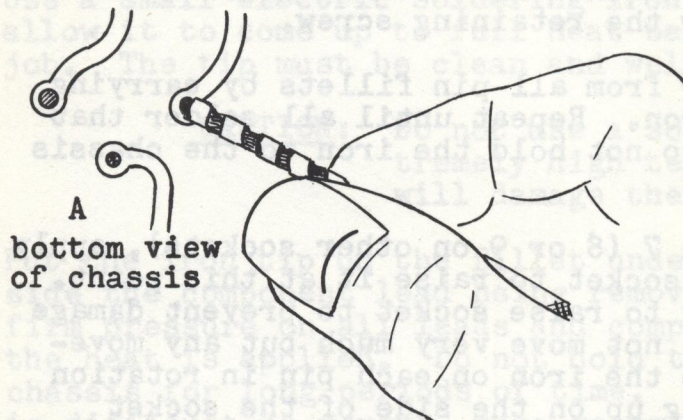
4. (continued)



Using a pair of small sharp diagonal cutters, bend the mounting ears up and away from the copper conductor pads. DO NOT PRY THE MOUNTING EARS UP WITH A KNIFE OR SCREWDRIVER!

Repeat the process on the other two mounting ears and drop the capacitor off the board.

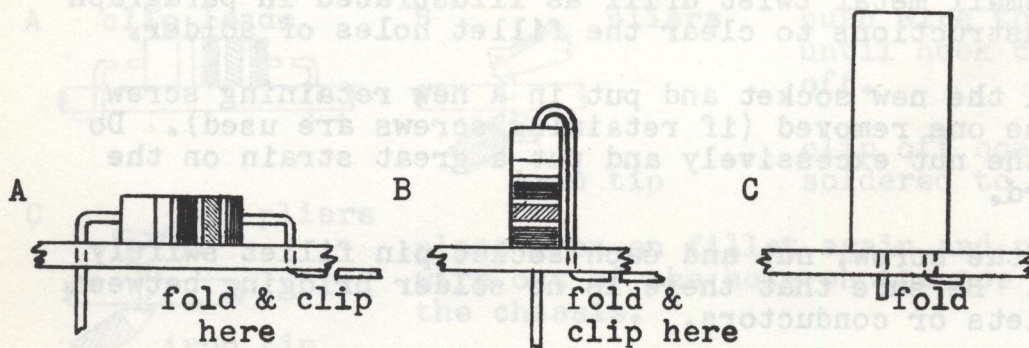
5. PREPARING THE HOLES FOR THE REPLACEMENT COMPONENT:



Use a small metal twist drill (1/8" dia. or less) to clear the hole only in the fillet of solder. Twirl the drill by hand. Do not attempt to remove all of the solder in one turn, do it slowly and carefully.

Do not attempt to increase the hole size, just remove the solder. It is soft and easily removed in this way.

6. REPLACING THE COMPONENTS:



(A) & (B) Fold the leads on the new part to the same spacing as the mounting holes. Insert the part and fold the leads under the chassis to hold the part tightly against the top of the chassis. Clip off the excess wire.

Put the iron tip on the fillet and lead. Solder swiftly and securely. If the printed chassis is damaged by accident it is seldom necessary to scrap it. If one of the conductors is broken, lay a piece of small wire (#18 to #24 AWG) across the break and solder each end to the conductor. If a fillet is pulled loose, break it off to get rid of the loose end. Fold the new component lead toward the end of the conductor and solder the lead to the conductor. If the component lead is cut too short, lay a small piece of wire across the gap solder it in.

REPLACING COMPONENTS ON THE PRINTED CHASSIS

Since this is a destructive operation, the engineer must be reasonably sure that the part is defective before removing it. He may determine this from the D.C. and signal voltage measurements or by visual observation.

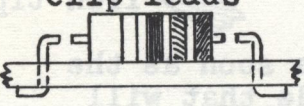
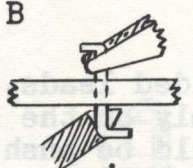
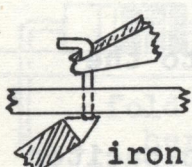
WARNING: The copper conductors are only .0027" thick on the printed chassis. They are easily damaged! Do not attempt to pull one component lead loose to check the component. Use only the approved procedure as outlined in the sketches and the sub-paragraphs listed below.

Use a small electric soldering iron (60 watts or less) and allow it to come up to full heat before starting the repair job. The tip must be clean and well tinned.

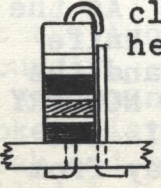
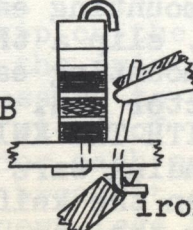
CAUTION: Do not use a soldering gun. The extremely high temperature of the tip will damage the phenolic board.

Put the iron tip on the fillet under the chassis, right beside the component lead being removed. Put a gentle, but firm pressure on all leads and components being moved while the heat is applied. Do not hold the iron to the printed chassis for long periods of time. If the lead or component is difficult to remove, make repeated short passes at it rather than one long period that may overheat the board.

1. REMOVING PARALLEL MOUNTED COMPONENTS WITH AXIAL LEADS:

- A clip leads
- 
- B pliers push wire through hole until hook can be clipped off.
- 
- clip off hook that was soldered to chassis.
- C pliers
- 
- iron tip place iron on fillet again and pull the wire out of the hole on the top side of the chassis.

2. REMOVING VERTICALLY MOUNTED RESISTORS AND COMPONENTS WITH AXIAL LEADS:

- A clip here
- 
- B pliers
- 
- place iron on fillet and push wire through the hole until the hook can be clipped off.
- clip off hook that was soldered to chassis.
- remove wire as illustrated in paragraph 1. (c).

SECTION IX
PARTS LIST

<u>Symbol No.</u>	<u>Drawing No.</u>	<u>Description</u>
A101,A102, A103	396 0827 000	Lamp, GE #12
C101,A-B-C	524 0087 000	Cap., 30-20-20 mfd., 350-300, 250 V.
C102A-B	524 0085 000	Cap., 30-30 mfd., 350-300 V.
C103	522 0290 000	Cap., 100 mfd., 6 V.
C104,C108, C110	506 0027 000	Cap., .47 mfd., 400 V.
C105	508 0184 000	Cap., .01 mfd., 400 V.
C106,C107	506 0028 001	Cap., .1 mfd., 400 V.
C109	522 0289 000	Cap., 25 mfd., 25 V.
C111	516 0321 000	Cap., 470 mmfd., 500 V.
C112,C113	508 0048 000	Cap., .047 mfd., 400 V.
C114	506 0007 000	Cap., .5 mfd., 200 V.
C115	522 0067 000	Cap., 100 mfd., 15 V.
C116	524 0090 000	Cap., 80 mfd., 250 V.
C117	522 0083 000	Cap., 8 uf., 150 V.
C118	506 0017 000	Cap., 1.0 mfd., 400 V.
C119	506 0015 000	Cap., .25 mfd., 400 V.
C120	506 0005 000	Cap., .1 mfd., 200 V.
CR101	384 0020 000	Silicon Rectifier
R102,CR103	384 0018 000	Silicon Rectifier
F101	398 0058 000	Fuse, 2 Amp., 250 V.
F102	398 0022 000	Fuse, 5 Amp., 250 V.
J101	250 0025 000	Receptacle & Cord
J102,J103		Receptacle, Phono (Part of Head Bracket)
J104	612 0335 000	Receptacle, 14 Terminal
J105,J106	612 0346 000	Receptacle, 4 Terminal
J107	612 0248 000	Jack, Phone J-2

5/3/61

-1-

M5944 Cartritape

<u>Symbol No.</u>	<u>Drawing No.</u>	<u>Description</u>
K101,K102	572 0094 000	Relay
L101	590 0008 000	Solenoid
L102	476 0003 000	Choke
P101		Part of J101
P102,P103	926 7064 001	Plug and Cable
P104	610 0318 000	Plug, 14 Terminal
P105 P106	610 0340 000	Plug, 4 Terminal
PU101,PU102	730 0101 000	Head
R101,R137, R108,R111	540 0114 000	Res., 510K Ohm, 1/2 W., 5%
R102	548 0044 000	Res., 3.3K Ohm, 1/2 W., 1%
R103	540 0045 000	Res., 330K Ohm, 1/2 W., 1%
R104	548 0047 000	Res., 1500 Ohm, 1/2 W., 1%
R105	550 0007 000	Potentiometer, 10K Ohm
R106	550 0219 000	Res., Control, 500 K
R107,R130	540 0057 000	Res., 2.2K Ohm, 1/2 W., 5%
R109	540 0105 000	Res., 220K Ohm, 1/2 W., 5%
R110	540 0103 000	Res., 180K Ohm, 1/2 W., 5%
R112	540 0089 000	Res., 47K Ohm, 1/2 W., 5%
R113,R117	540 0073 000	Res., 1000 Ohm, 1/2 W., 5%
R114,R116,R119	540 0097 000	Res., 1 megohm, 1/2 W., 5%
R115,R118,R120	540 0831 000	Res., 270K Ohm, 1/2 W., 5%
R121,R135	540 0079 000	Res., 18K, 1/2 W., 5%
R122,R136	540 0380 000	Res., 10K Ohm, 1 W., 5%
R123	540 0049 000	Res., 1000 Ohm, 1/2 W., 5%
R124	550 0055 000	Control, 100 Ohm
R125	552 0018 000	Res., 400 Ohm, 10 W. Wirewound, Adjustable
R126,R127	540 0044 000	Res., 620 Ohm, 1/2 W., 5%
R128	540 0033 000	Res., 220 Ohm, 1/2 W., 5%
R129	540 0177 000	Res., 820 Ohm, 1/2 W., 10%
R131	540 0647 000	Res., 33K Ohm, 2 W., 5%
R132	540 0077 000	Res., 10K Ohm, 1/2 W., 5%

<u>Symbol No.</u>	<u>Drawing No.</u>	<u>Description</u>
S101	604 0005 000	Switch
S102A/B	604 0159 000	Switch
S103A/B	598 0019 000	Switch
S104A/B	598 0020 000	Switch
T101	472 0284 000	Power Transformer
T102	478 0118 000	Output Transformer
V101	370 0105 000	Tube, 6X4
V102	370 0144 000	Tube, EF86
V103,V104	370 0116 000	Tube, 12AX7
V105	378 0001 000	Tube, 2D21
XA101,XA102, XA103	406 0264 000	Lamp Socket
XF101,XF102	402 0023 000	Fuseholder
XV101	404 0032 000	Socket
XV102,XV103, XV104	404 0059 000	Socket
XV105	404 0058 000	Socket

WARRANTY

This equipment is warranted by Gates Radio Company of Quincy, Illinois to be free from defects in workmanship and material and will be repaired or replaced in accordance with the terms and conditions set forth below:

1. Gates Radio Company believes that the purchaser has every right to expect first-class quality, materials and workmanship and has created rigid inspection and test procedures to that end, and excellent packing methods to assure arrival of equipment in good condition at destination.
2. Gates Radio Company will endeavor to make emergency shipments at the earliest possible time giving consideration to all conditions.
3. Gates Radio Company warrants new equipment of its manufacture for one (1) year and (six (6) months on moving parts), against breakage or failure of parts due to imperfection of workmanship or material, its obligation being limited to repair or replacement of defective parts upon return thereof f.o.b. Gates Radio Company's factory, within the applicable period of time stated. Electron tubes shall bear only the warranty of the manufacturer thereof in effect at the time of the shipment to the purchaser. Other manufacturers' equipment covered by a purchaser's order will carry only such manufacturers' standard warranty. These warranty periods commence from the date of invoice and continue in effect as to all notices, alleging a defect covered by this warranty, received by Gates Radio Company prior to the expiration of the applicable warranty period.

The following will illustrate features of the Gates Radio Company warranty:

Transmitter Parts: The main power or plate transformer, modulation transformer, modulation reactor, main tank variable condensers all bear the one (1) year warranty mentioned above.

Moving Parts: As stated above, these are warranted for a period of six (6) months.

Electron Tubes: As stated, electron tubes will bear such warranty, if any, as provided by the manufacturer at the time of their shipment. Gates Radio Company will make such adjustments with purchasers as given to Gates Radio Company by the tube manufacturer.

All other component parts (except as otherwise stated): Warranted for one (1) year.

Abuse: Damage resulting from abuse, an Act of God, or by fire, wind, rain, hail, in transportation, or by reason of any other cause or condition, except normal usage, is not covered by this warranty.

4. Operational warranty - Gates Radio Company warrants that any new transmitter of its manufacture, when properly installed by purchaser and connected with a suitable electrical load, will deliver the specified radio frequency power output at the output terminal(s) of the transmitter, but Gates Radio Company makes no warranty or representation as to the

coverage or range of such apparatus. If a transmitter does not so perform, or in the event that any equipment sold by Gates Radio Company does not conform to any written statement in a contract of sale relative to its operating characteristics or capabilities, the sale liability of Gates Radio Company shall be, at the option of Gates Radio Company, either to demonstrate the operation of the equipment in conformance with its warranty, or to replace it with equipment conforming to its warranty, or to accept its return, f.o.b. purchaser's point of installation and refund to purchaser all payments made on the equipment, without interest. Gates Radio Company shall have no responsibility to the purchaser under a warranty with respect to operation of equipment unless purchaser shall give Gates Radio Company a written notice, within one (1) month after arrival of equipment at purchaser's shipping point, that the equipment does not conform to such warranty.

5. Any item alleged by a purchaser to be defective, and not in conformance with a warranty of Gates Radio Company shall not be returned to Gates Radio Company until after written permission has been first obtained from the Gates Radio Company home office for such return. Where a replacement part must be supplied under a warranty before the defective part can be returned for inspection, as might be required to determine the cause of a defect, purchaser will be invoiced in full for such part, and if it is determined that an adjustment in favor of the purchaser is required, a credit for an adjustment will be given by Gates Radio Company upon its receipt and inspection of a part so returned.

6. All shipments by Gates Radio Company under a warranty will be f.o.b. Quincy, Illinois or f.o.b. the applicable Gates Radio Company shipping point.

7. Gates Radio Company is not responsible for the loss of, or damage to, equipment during transportation or for injuries to persons or damage to property arising out of the use or operation of Gates equipment. If damage or loss during transportation occurs, or if the equipment supplied by Gates Radio Company is otherwise damaged, Gates will endeavor to make shipment of replacement parts at the earliest possible time giving consideration to all conditions. It is the responsibility of a purchaser to file any claim for loss or damage in transit with the transportation company and Gates will cooperate in the preparation of such claims to the extent feasible when so requested.

8. Gates Radio Company, in fulfilling its obligations under its warranties, shall not be responsible for delays in deliveries due to depleted stock, floods, wars, strikes, power failures, transportation delays, or failure of suppliers to deliver, acts of God, or for any condition beyond the control of Gates that may cause a delayed delivery.

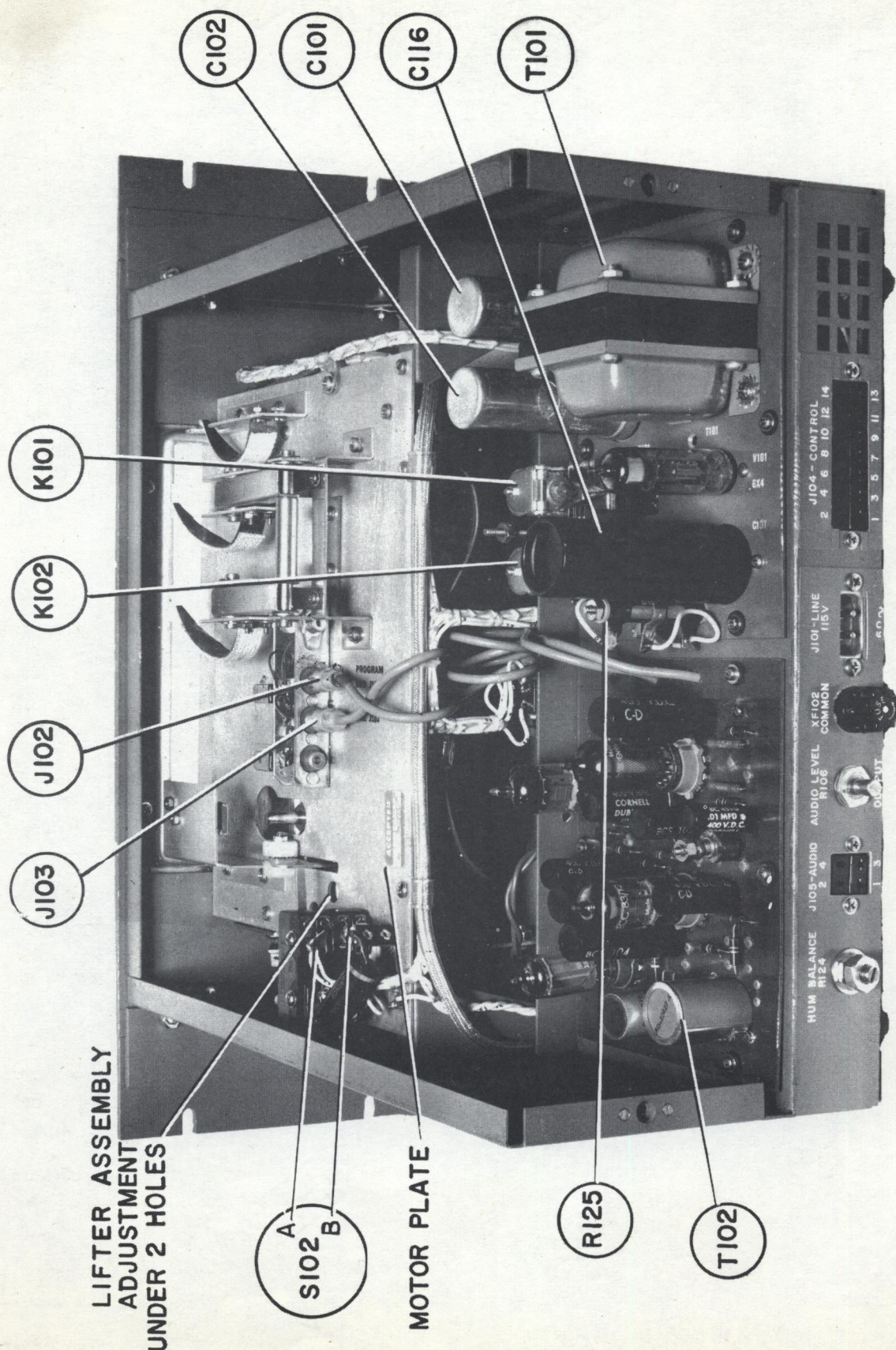
9. This warranty may not be transferred by the original purchaser and no party, except the original purchaser, whether by operation of law or otherwise, shall have or acquire any rights against Gates Radio Company by virtue of this warranty.

10. Gates Radio Company reserves the right to modify or rescind, without notice, any warranty herein except that such modification or rescission shall not affect a warranty in effect on equipment at the time of its shipment. In the event of a conflict between a warranty in a proposal and acceptance and a warranty herein, the warranty in the proposal and acceptance shall prevail.

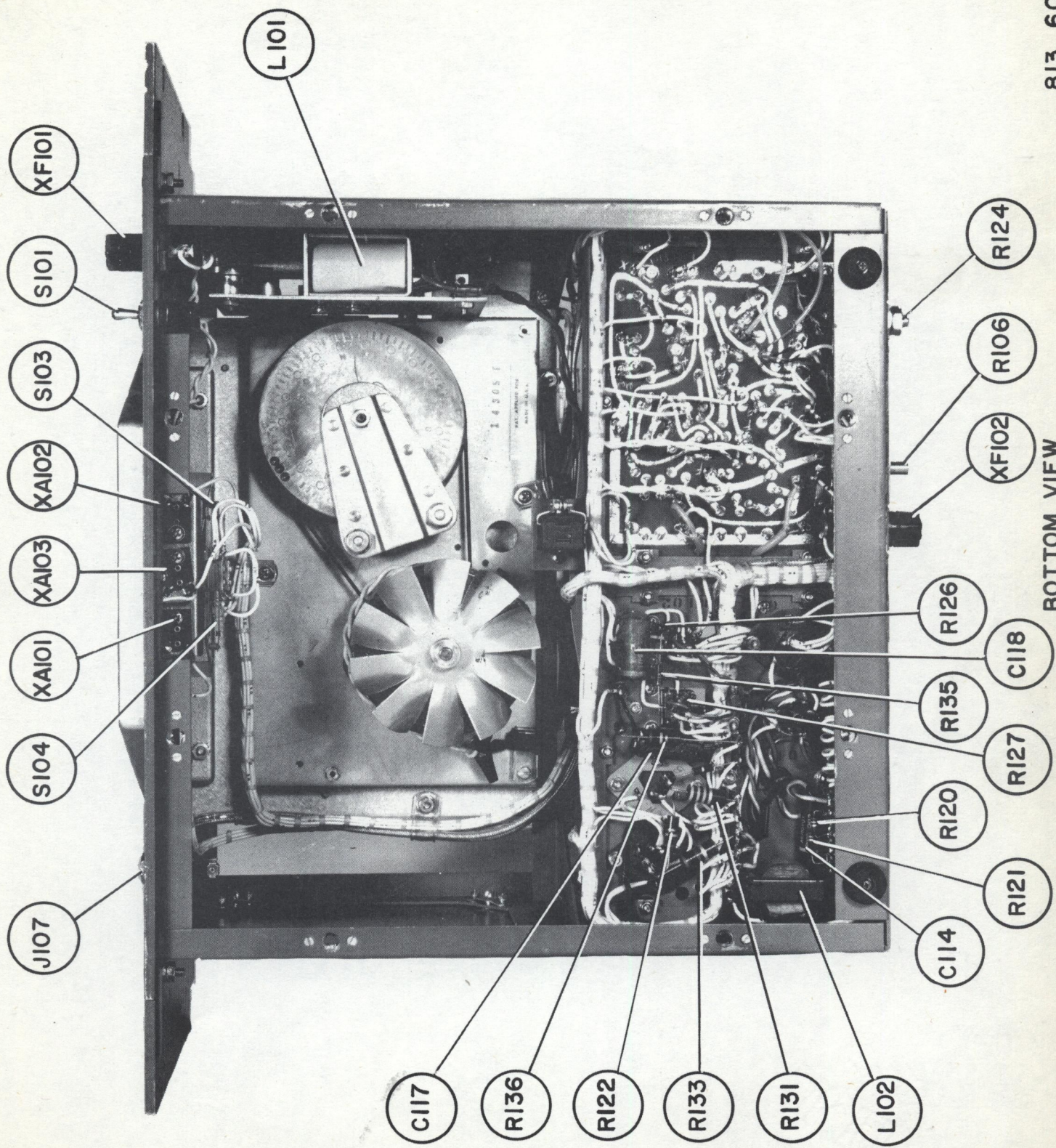
11. This warranty shall be applicable to all standard Gates catalog items sold on or after March 1, 1960.

Gates Radio Company
Quincy, Illinois

1/6/60



REAR VIEW SHOWING JACKS AND PARTS LOCATION

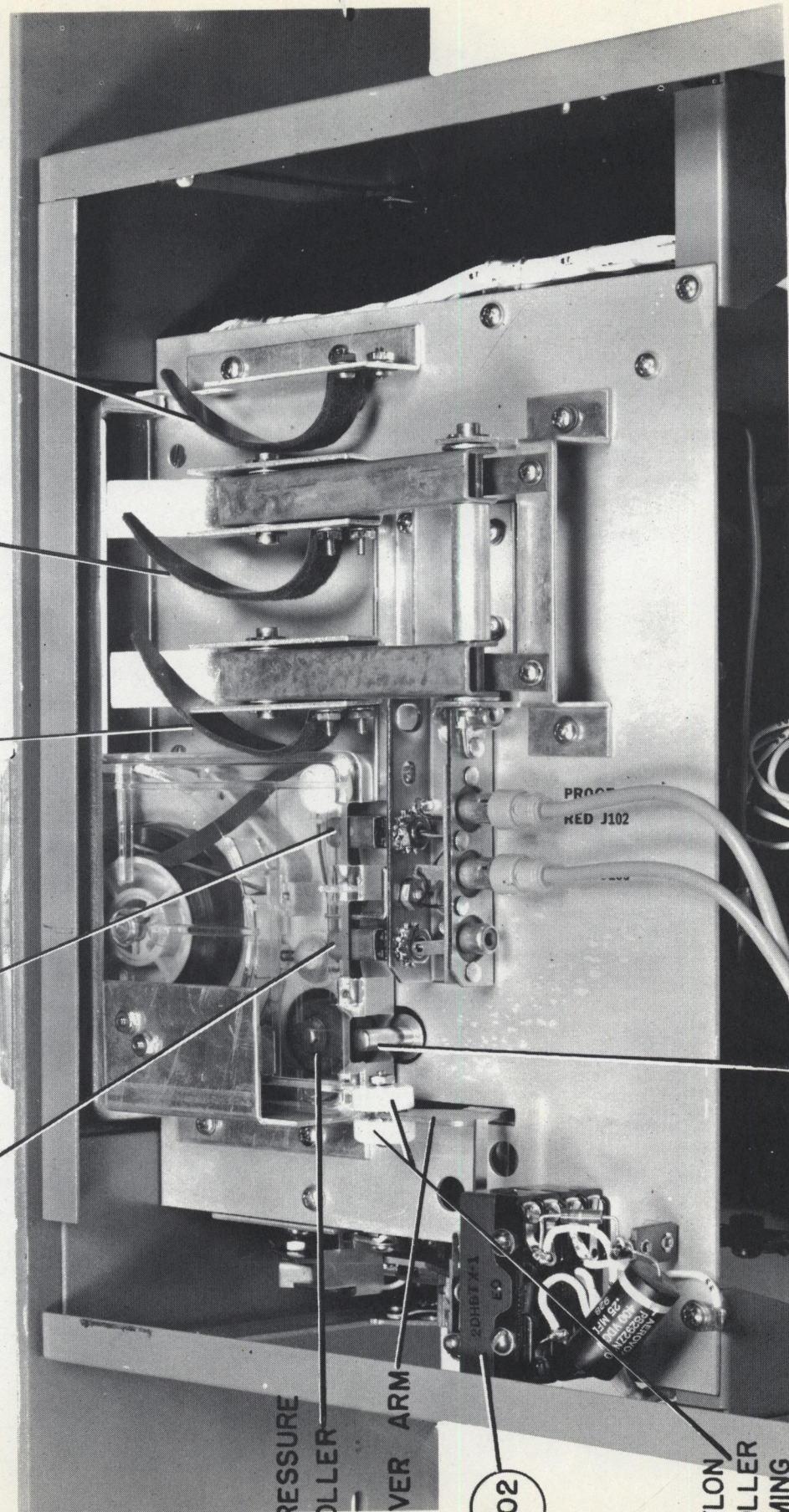


BOTTOM VIEW

813 6063 001

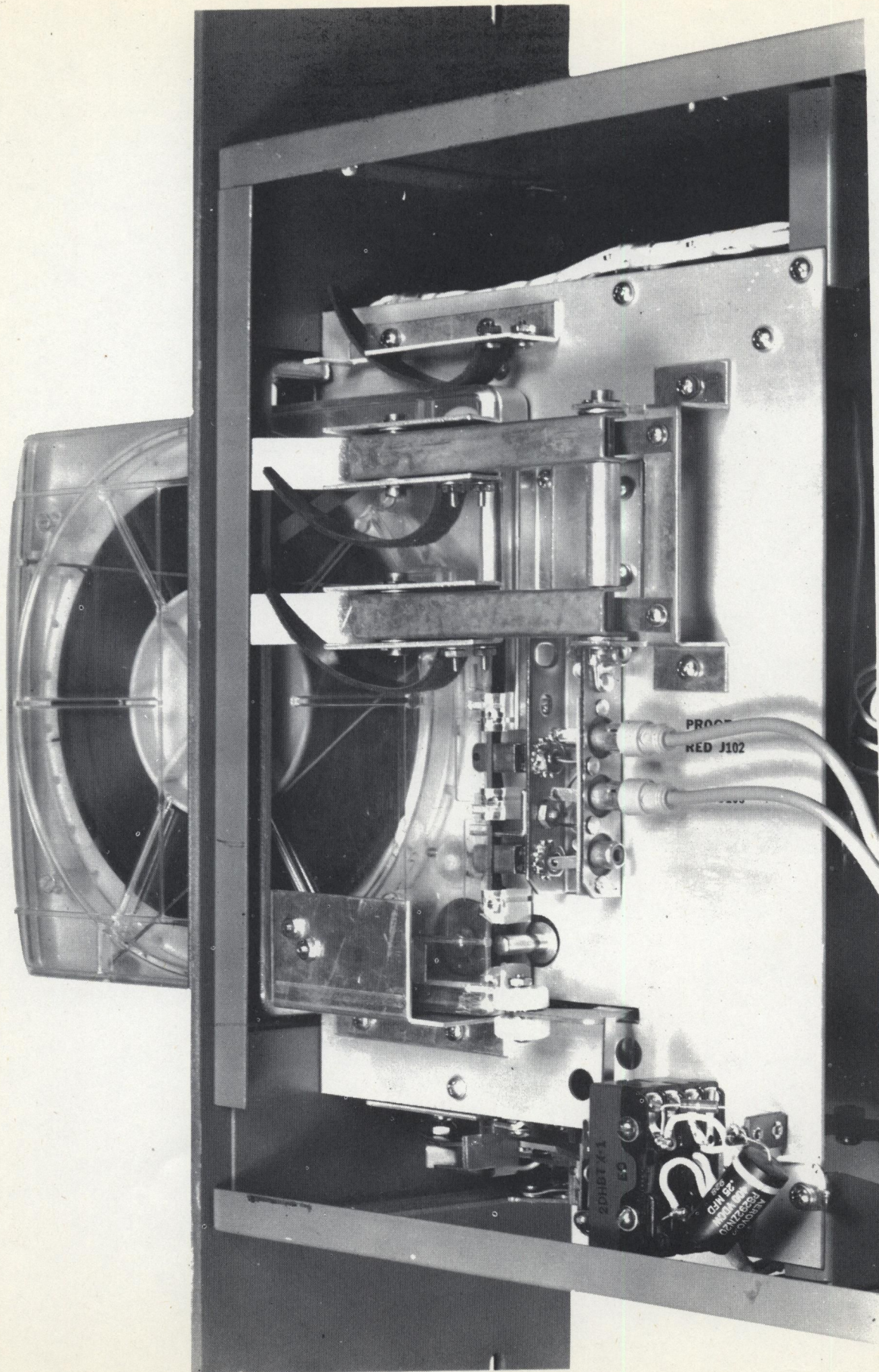
GUIDE FOR CARTRIDGE SIZE

CUE HEAD PROGRAM HEAD MODEL 300 MODEL 600 MODEL 1200



MODEL 300 CARTRIDGE
INSERTED

A-34859
(DR-198)



MODEL 1200 CARTRIDGE
INSERTED

A-34862
(DR-200)

LINKAGE SLIDE

ROLLER
LEVER

TOGGLE
PAWL

NYLON CONTACT
ROLLER

LIFTER CAM

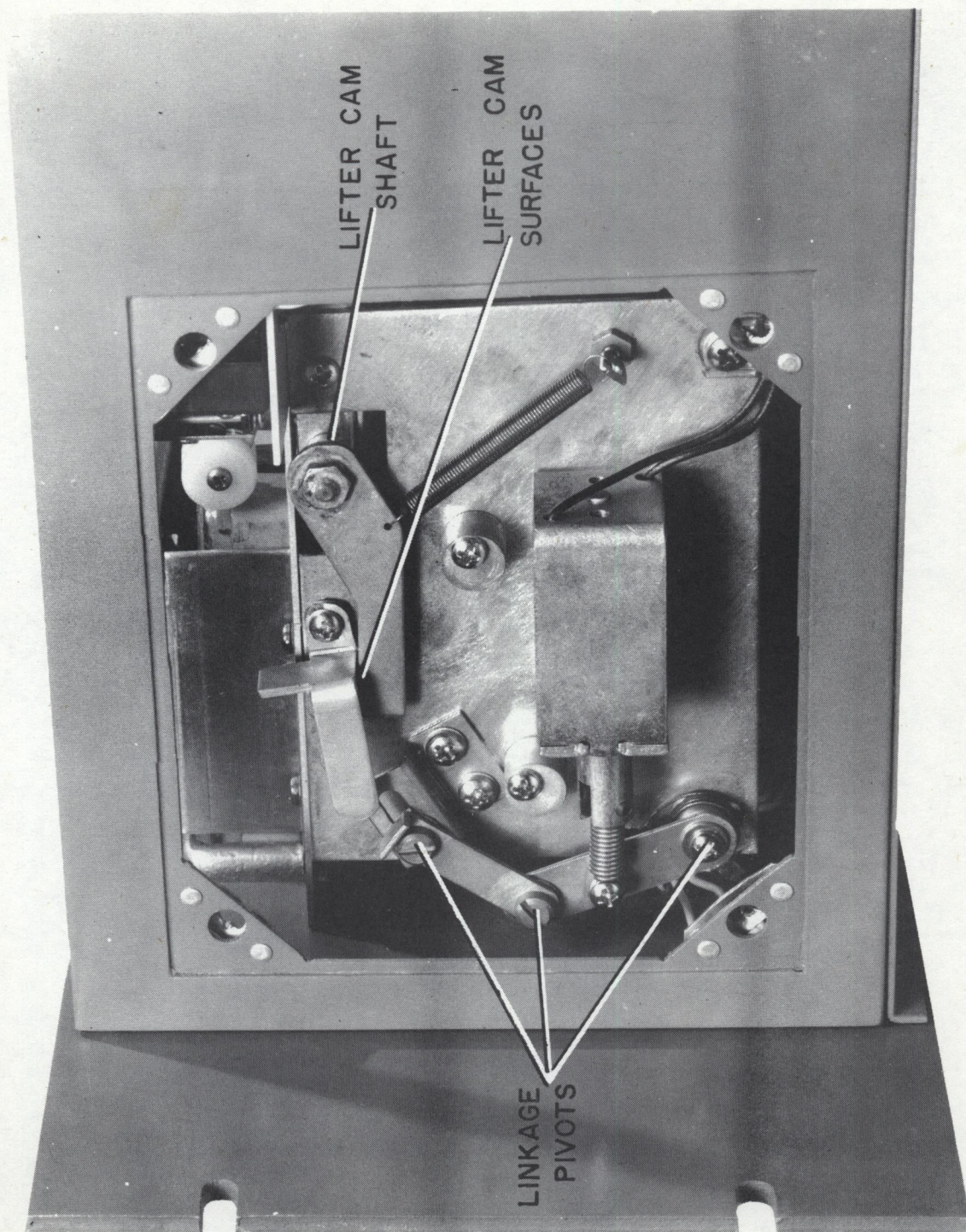
LIFTER CAM
STOP

(L101)

MECHANISM
PLATE

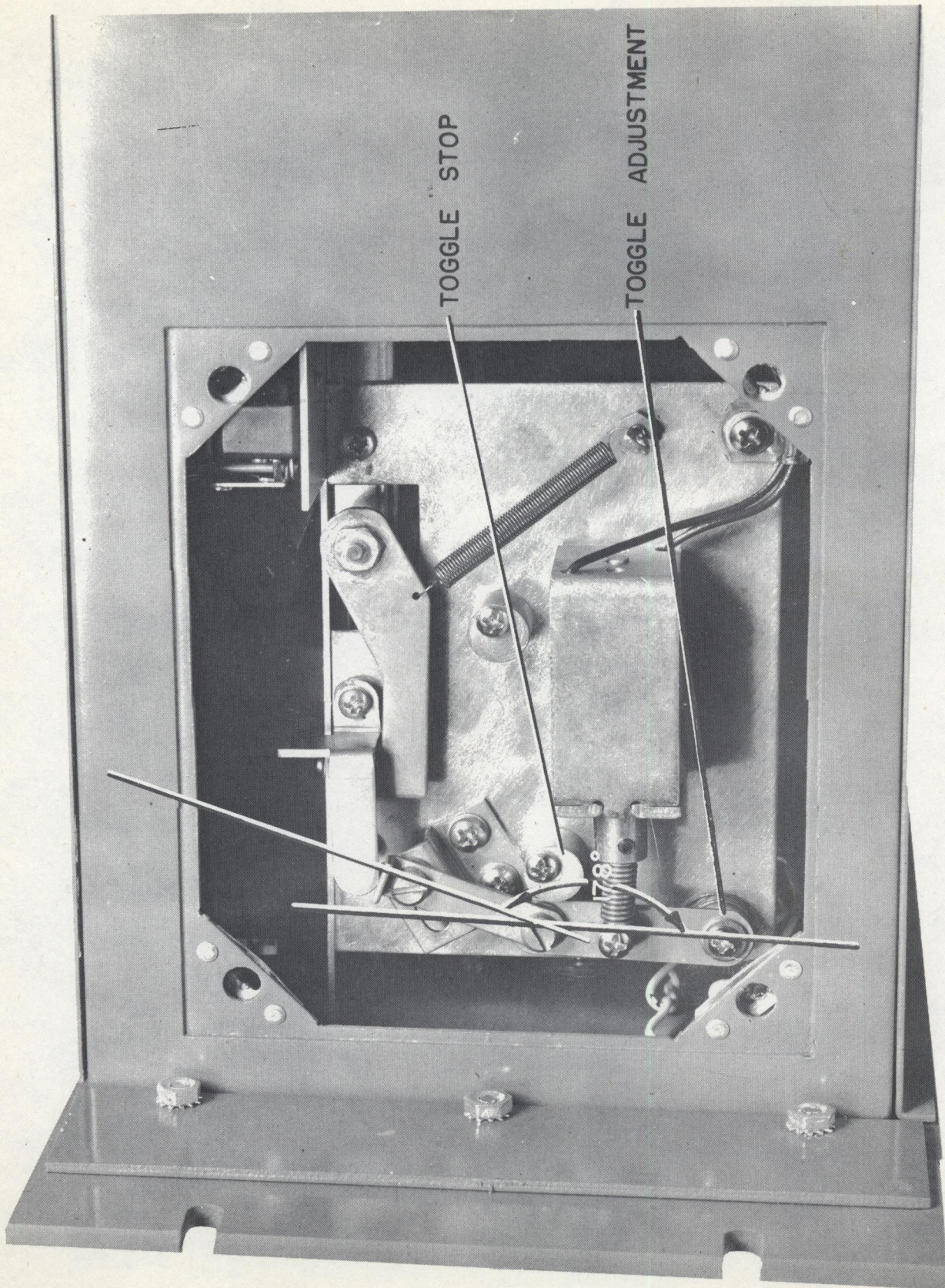
NO CARTRIDGE INSERTED

A-34861
(DR-202)



READY POSITION

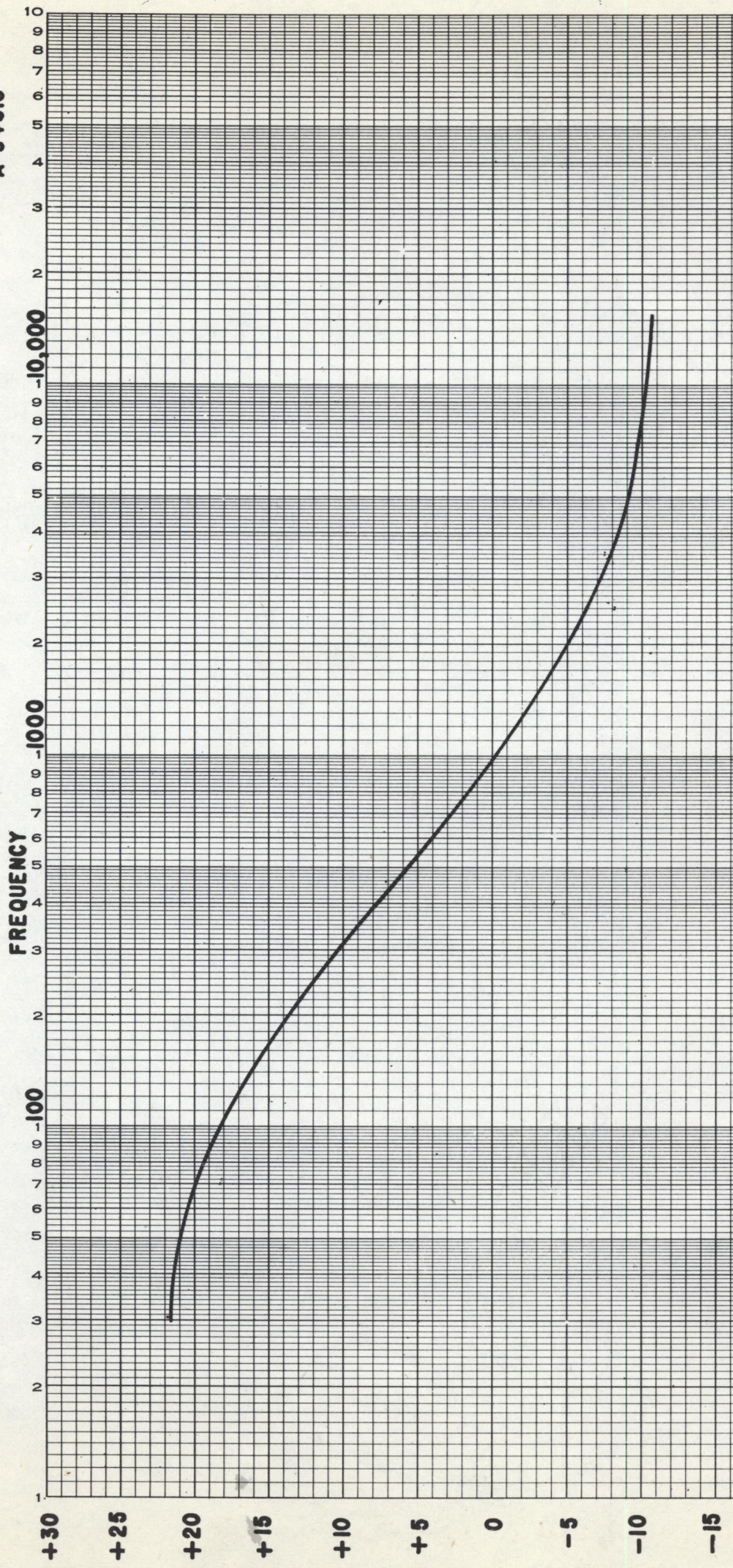
A-34860
(DR-201)



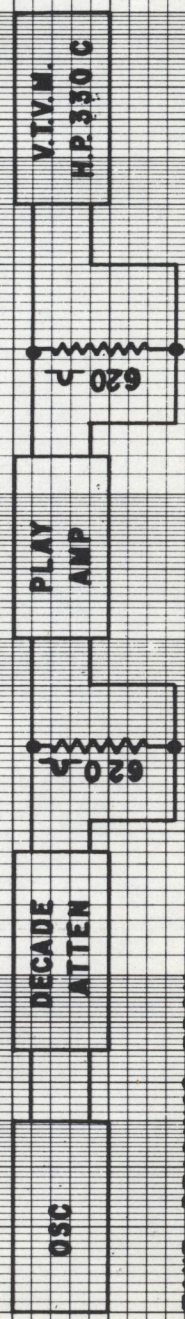
RUN POSITION

A-34856
(DR-203)

A-34610



TAPE SPEED 7 1/2 IPS



TAKE READINGS FROM
DECADE WITH CONSTANT
AMPLIFIER OUTPUT

PLAYBACK AMP
RESPONSE CURVE,
CARTRIDGE
M5944 A-34610

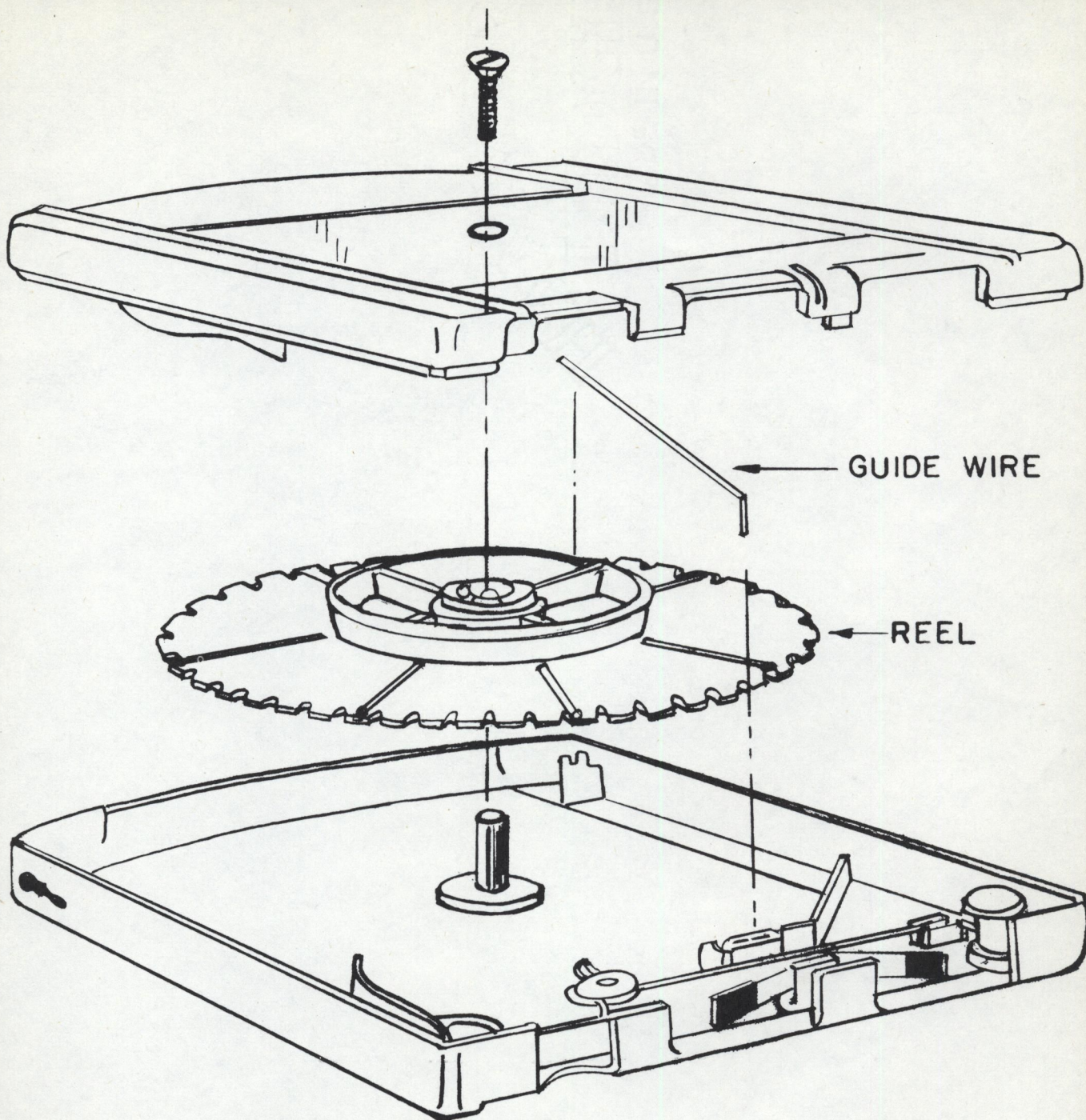


FIG 1.

A-34657 R14

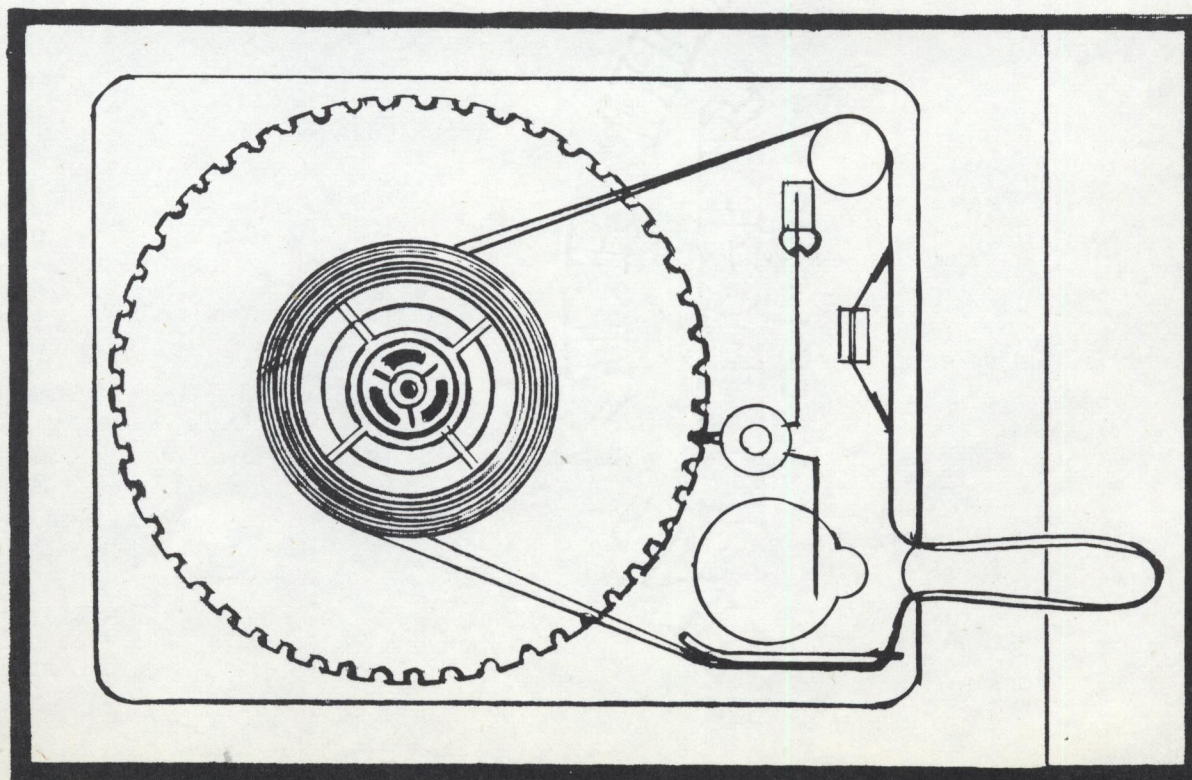
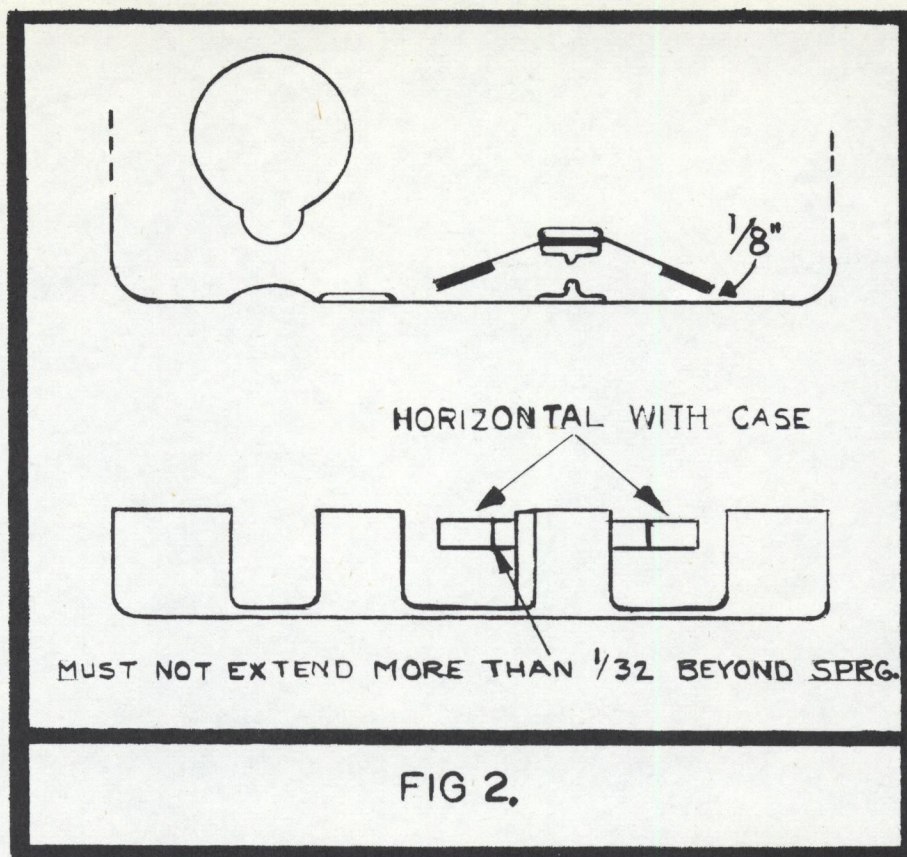


FIG 3.

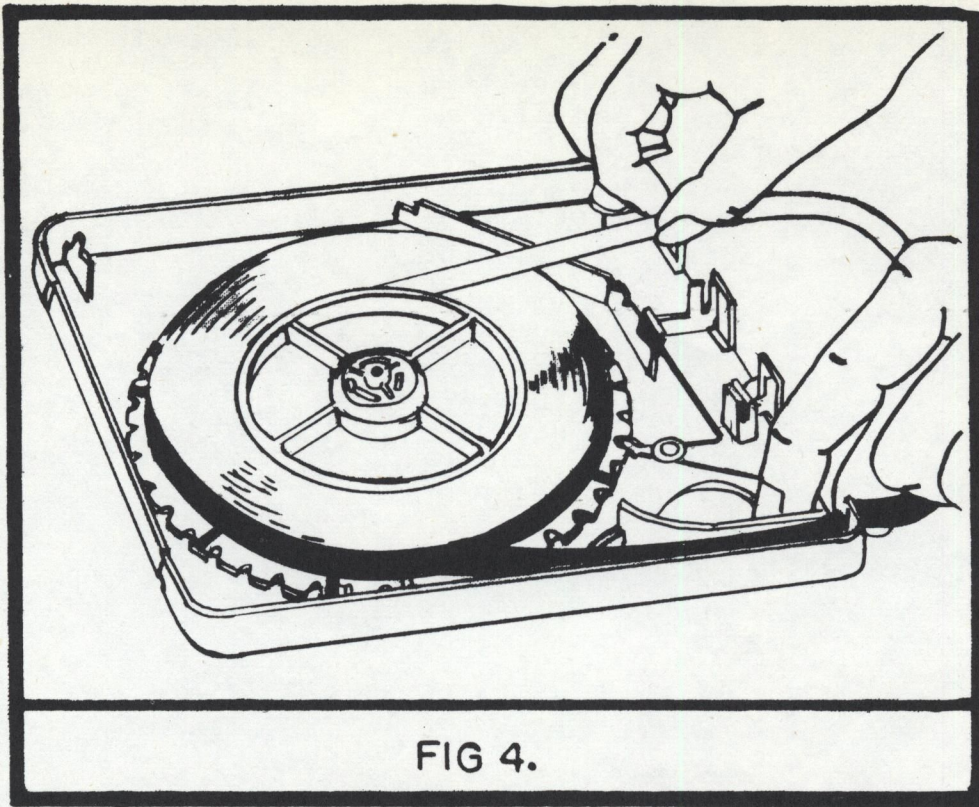


FIG 4.

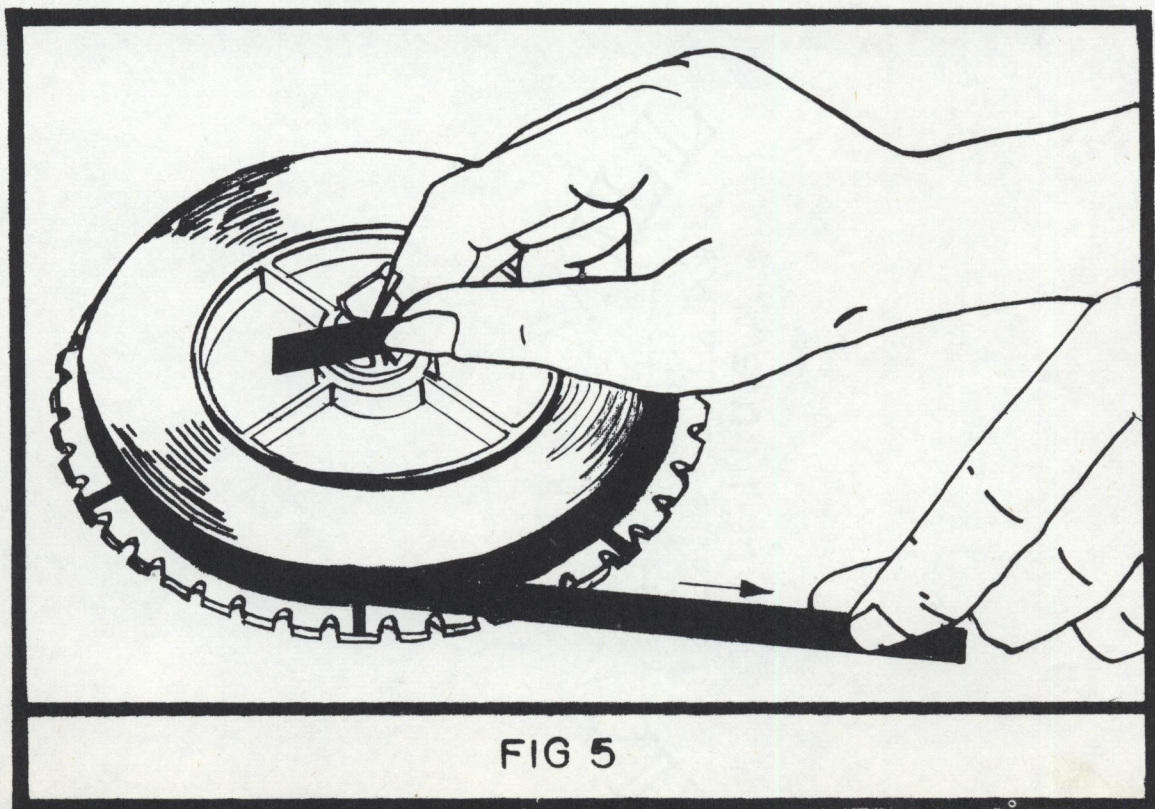
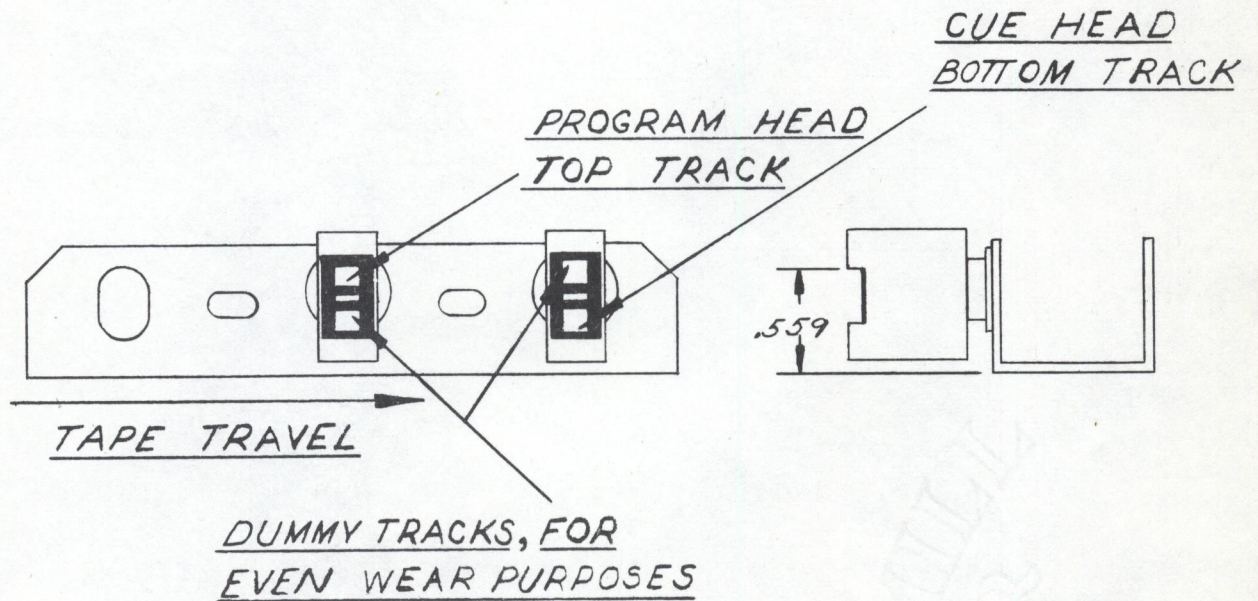


FIG 5

				FIRST MADE FOR GR. NO.	GATES RADIO COMPANY QUINCY, ILLINOIS		A-34843		
							SCALE /" = /"		
104	103	102	101		LIST OF PARTS				
QTY.	QTY.	QTY.	QTY.	ITEM	REFERENCE	PT. OR G.N.	FIN.	DESCRIPTION	MATL.

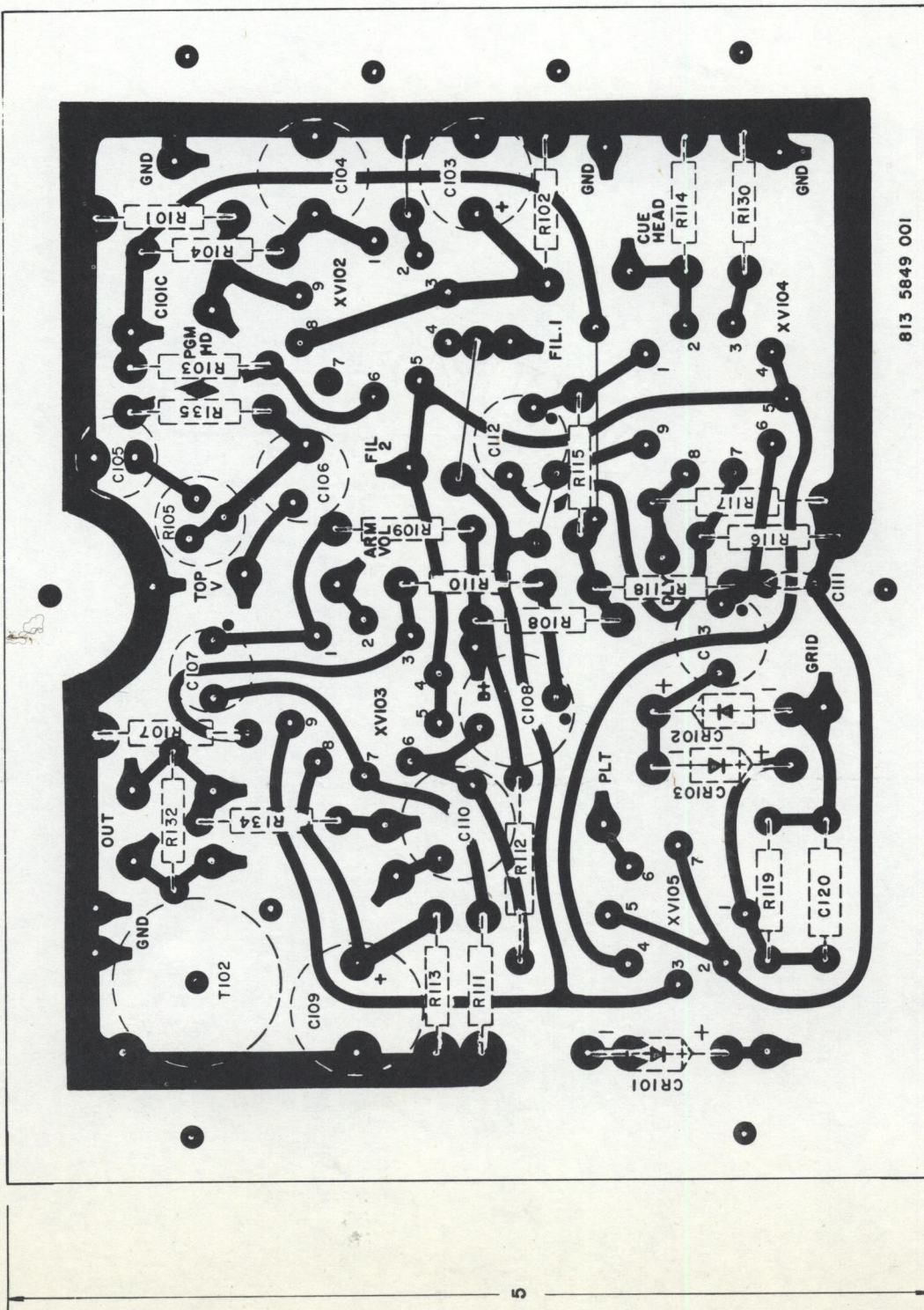


STATUS	
DEVELOPMENT	PRODUCTION
MECH. CHK. RJA	
U.S. RJA	
APPROV. PRODUCTION BY	

www.SteamPoweredRadio.Com

CH. BY DATE 7-21-60	MTL.	TITLE VERTICAL PLACEMENT OF HEADS M# 5944	UNLESS OTHERWISE SPECIFIED, ALL TOLERANCES PER GATES SPEC GSM102. A-34843
DR. BY R.A.U. DATE 7-21-60	ENG. FIN.		

6 3



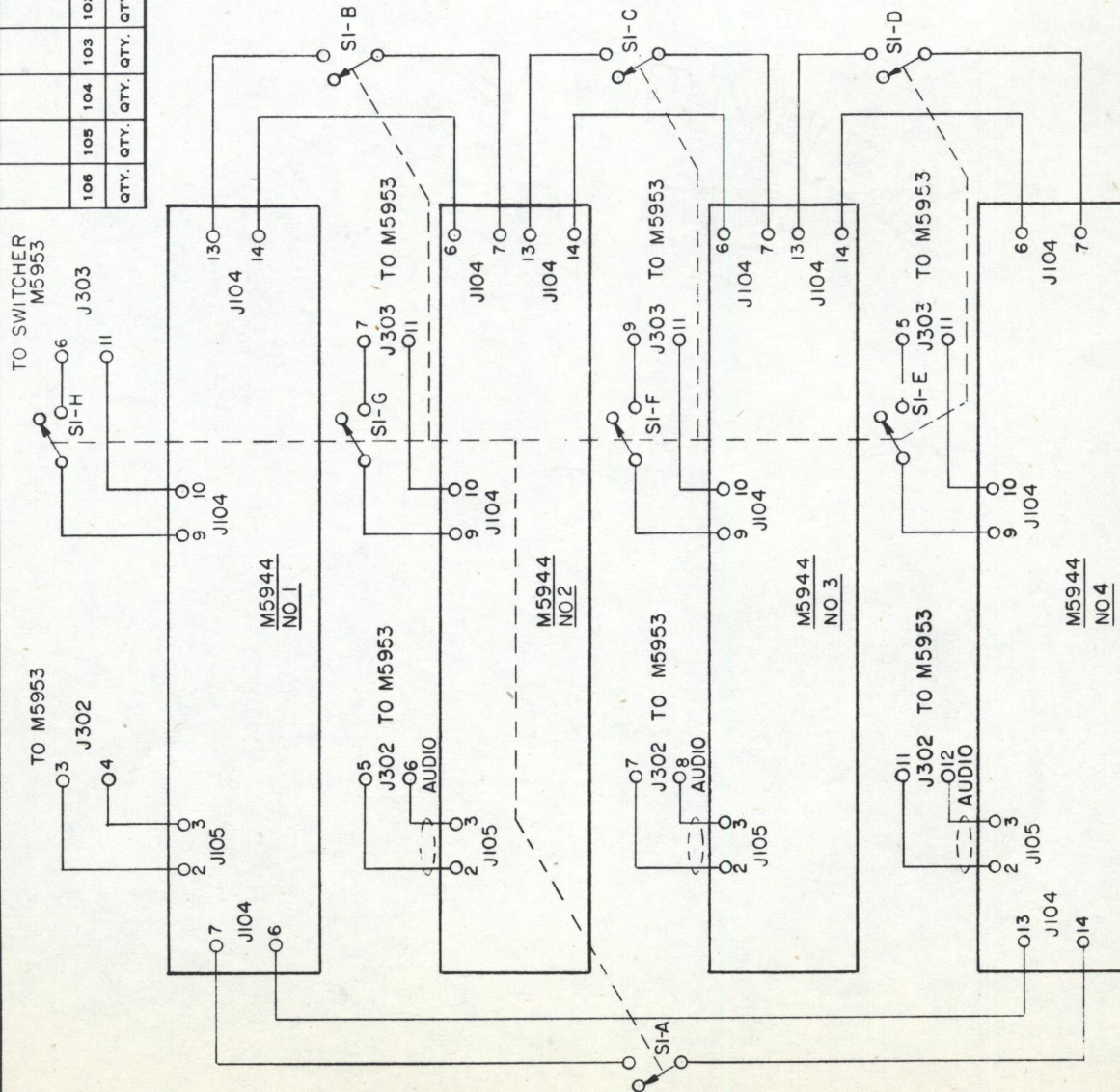
813 5849 001

COMPONENT PLACEMENT
VIEWED FROM PRINTED WIRING SIDE
OGRAM & CUE AMPLIFIER, CARTRIDGE, M5944

GATES RADIO COMPANY QUINCY, ILLINOIS		826 7750 001 SCALE	
LIST OF PARTS			
PT. OR G.N.	FIN.	DESCRIPTION	MATERIAL
REFERENCE	QTY.	ITEM	
106	QTY.	101	
105	QTY.	102	
104	QTY.	103	
103	QTY.	104	
102	QTY.	105	
101	QTY.	106	

NOTES:

- (1) SWITCH SHOWN IN MANUAL POSITION, CLOSED POSITION (AUTOMATIC OPERATION)
- (2) SUITABLE SWITCH, CENTRALAB 1419.
- (3) THIS CIRCUIT WIRING IS IN ADDITION TO THAT SHOWN ON DWG. 842 3246 001 (SYSTEM DRAWING FOR MANUAL OPERATION)
- (4) SEE DWG 813 5844 001 FOR PLUG & JACK PIN NUMBERING INFORMATION FOR THE CARTRIDGE M5944.
- (5) SEE DWG 813 5852 001 FOR PLUG & JACK PIN NUMBERING INFORMATION FOR THE SWITCHER M5953.



GATES RADIO COMPANY QUINCY, ILLINOIS		826 7750 001 SCALE	
LIST OF PARTS			
PT. OR G.N.	FIN.	DESCRIPTION	MATERIAL
REFERENCE	QTY.	ITEM	
106	QTY.	101	
105	QTY.	102	
104	QTY.	103	
103	QTY.	104	
102	QTY.	105	
101	QTY.	106	

TITLE: CONT CKT INTERCONNECTION BETWEEN PLAYBACK UNIT FOR SYNCHRONIZED AUTO SEQUENTIAL START CARTRIDGE M5944

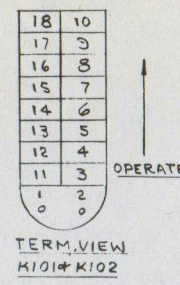
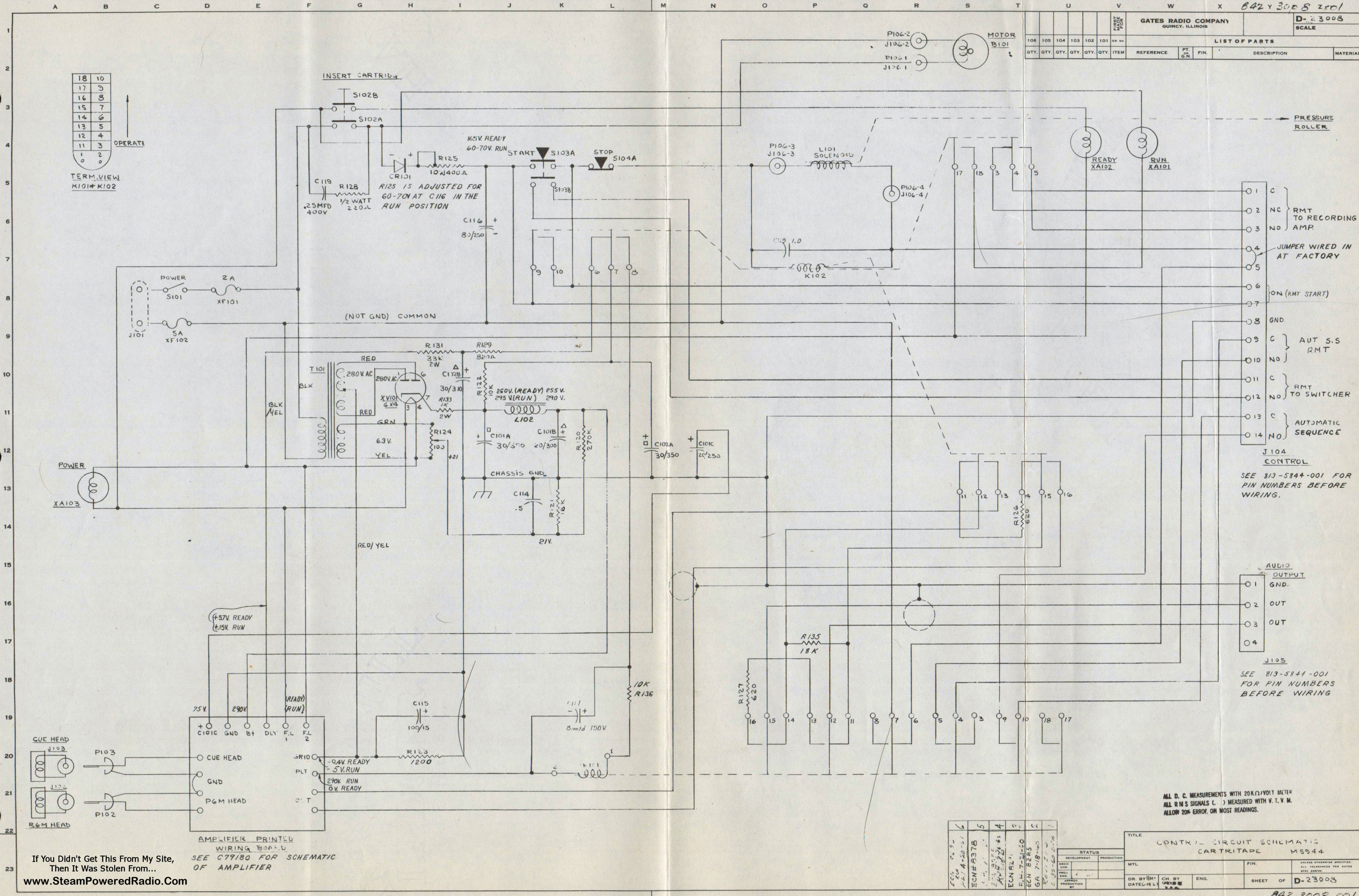
DR. BY: MTL CH. BY: ENG. DATE: 12/1/61

MTL FIN. SHEET OF 826 7750 001

STATUS: DEVELOPMENT PRODUCTION

MECH. CHK. PROJ. ENG. PRODUCTION BY

www.SteamPoweredRadio.Com



							FIRST MADE FOR	GATES RADIO COMPANY QUINCY, ILLINOIS				D-23008 SCALE	
106	105	104	103	102	101	GR. NO.		LIST OF PARTS					
QTY.	QTY.	QTY.	QTY.	QTY.	QTY.	ITEM	REFERENCE	PT. OR G.N.	FIN.	DESCRIPTION		MATERIAL	

- 1 C
 - 2 NC
 - 3 NO
 - 4 JUMPER WIRED IN AT FACTORY
 - 5
 - 6
 - 7 ON (RMT START)
 - 8 GND
 - 9 C
 - 10 NO
 - 11 C
 - 12 NO
 - 13 C
 - 14 NO
- J104 CONTROL

SEE 813-5844-001 FOR PIN NUMBERS BEFORE WIRING.

- 1 AUDIO OUTPUT
 - 2 GND.
 - 3 OUT
 - 4 OUT
- J105

SEE 813-5844-001 FOR PIN NUMBERS BEFORE WIRING

ALL D. C. MEASUREMENTS WITH 20K OHM VOLT METER
ALL R.M.S. SIGNALS () MEASURED WITH V.T.V.M.
ALLOW 20% ERROR ON MOST READINGS.

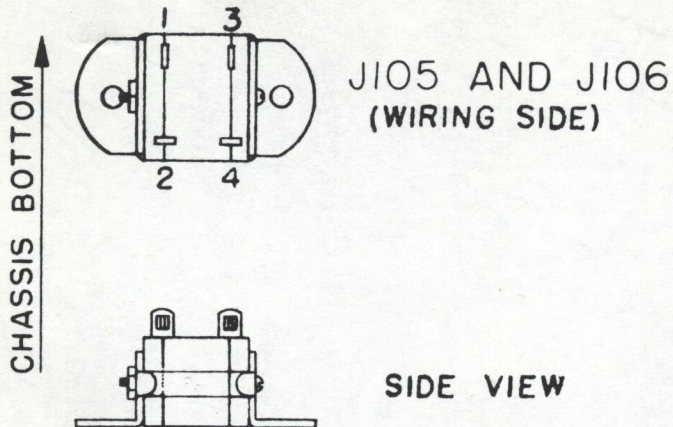
6	5	4	3	2	1
ECN# 8378	ECN# 8378	ECN# 8378	ECN# 8378	ECN# 8378	ECN# 8378

STATUS				TITLE			
DEVELOPMENT	PRODUCTION	TESTING	REVISION	MTL	FIN.	UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS PER GATES SPEC. DRAWING	
DR. BY JHM	CH. BY JHM	ENG.		DATE: 4-14-61		SHEET OF	D-23008

USE FOR WIRING INTERCONNECTING PLUGS

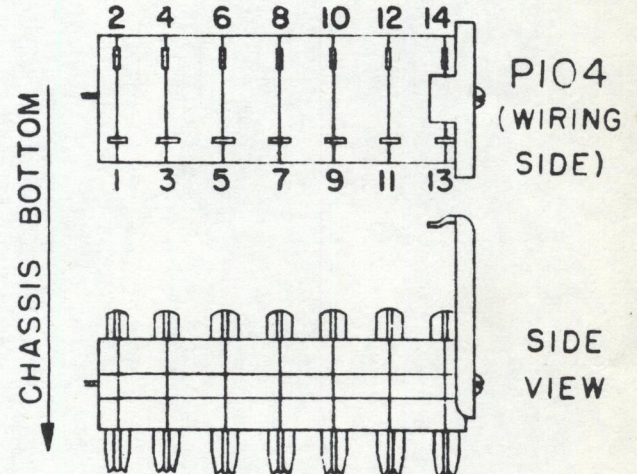
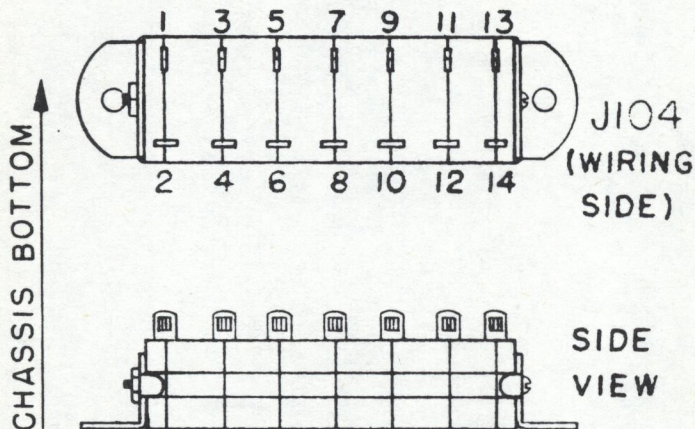
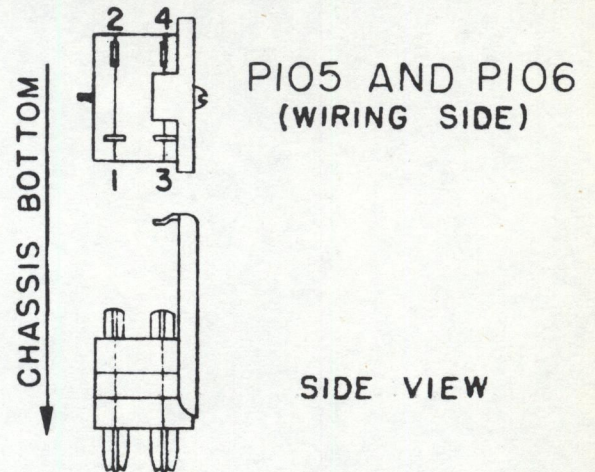
RECEPTACLE

SHOWN FOR CIRCUIT
TRACING ONLY



PLUGS

USE FOR WIRING INTERCONNECTIONS.
CAUTION: TO REMOVE HOUSING LOOSEN
NUT ON SIDE. DO NOT REMOVE SCREW,
OTHERWISE PLUG WILL COME APART.



NOTES:

- 1) MAKE ALL CONNECTIONS, NUMBERING FROM THE WIRING SIDE ONLY.
- 2) THE JACKS ARE SHOWN FOR REF., ONLY IN CIRCUIT TRACING (DO NOT WIRE TO JACKS).

CH. BY DATE	MTL.	TITLE TERMINAL NUMBER DESIGNATIONS FOR JACKS AND PLUGS CARTRITAPE M5944	813-5844-001
DR. BY G. A. DATE 1-17-61	ENG. <i>RAH</i> 3-20-61		

SEP 1961

WGMS-TRANSMITTER

INSTRUCTIONS FOR INSTALLING AND OPERATION
OF
GATES M5952 RECORDING AMPLIFIER

4/28/61

Gates Radio Company
Quincy, Illinois

M5952 RECORDING AMPLIFIER

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- D-23014A Schematic



A-34852
(DR-204)

M5952 RECORDING AMPLIFIER

SECTION I SPECIFICATIONS

FREQUENCY RESPONSE: Standard NAB Recording Curves,
± 2 db, 50 to 12,000 cps @ 7.5 IPS.

DISTORTION: 0.5% or less @ normal recording level.

NOISE: -120 dbm or lower, equivalent input noise with
microphone level into matching input circuit.

EQUALIZATION: Standard NAB Recording Curve for 7-1/2
inches per second.

INPUT LEVEL: -60 to -70 dbm matching (30/50-150/250 ohms,
balanced or unbalanced).
-35 dbm to +8 dbm bridging, (10,000 ohms,
balanced or unbalanced).

CUEING ACCURACY: Within 0.1 second.

POWER SOURCE: 115 volts, 50/60 cycles per second.

POWER CONSUMPTION: 25 Watts.

TUBE COMPLEMENT: (2) EF86
(2) 12AX7
(1) 12AU7
(1) 6X4

MECHANICAL

HEIGHT: 5-1/4 inch rack or custom cabinet mounting.

WIDTH: 19 inch rack or 15 inch custom cabinet mounting.

DEPTH: 11 inches behind panel, excluding plugs.

WEIGHT: Net 12 lbs.
Packed (domestic) 27 lbs.
Cubage 3.

SECTION II INTRODUCTION

2.1 GENERAL

The Gates Recording Amplifier, M5952 is an integral part of the Cartritape system. It provides the recording facilities to produce a recorded tape cartridge when connected to Cartritape, M5944. (Playback Unit)

The Recording Amplifier interconnects with one of the playback units, using cables supplied, to form a record/playback combination.

NOTE

A complete Cartritape system wiring diagram consisting of 4 Cartritapes, 1 Switcher, 1 Recording Amplifier and 1 Remote Unit is shown on Drawing 842 3246 001

Units required for recording only or record/playback are -

- 1 - M5944 Cartritape Playback Unit
- 1 - M5952 Recording Amplifier

SECTION III INSTALLATION

3.1 UNPACKING

The Recording Amplifier will be received in one shipping carton. The 19" rack mounted adaptor kit will be received with the unit. Unpack the contents carefully and examine thoroughly for shipping damage. If any such damage is found, file a claim report immediately with the Carrier.

3.2 MOUNTING (15") CUSTOM UNIT

The unit will be received as a 15" custom unit but supplied with adaptor plates to make the 19" version. The amplifier is designed to be used without an external cabinet, if desired. The other installation instructions apply to both 15" and 19" rack mounting.

3.3 MOUNTING THE (19") RACK UNIT

The unit will be received with an adaptor kit. These adaptors are metal extensions, which must be attached to the recorder front panel, to extend the front panel width to 19". Attach these units with the supplied hardware. The lockwasher should be placed under the screw head.

Mount the unit with four rack screws immediately above or below the Cartritape playback unit to which it is to be interconnected. The cables are long enough to reach the correct jacks and plugs.

3.4 INTERCONNECTING THE PLAYBACK UNIT AND THE RECORDING AMPLIFIER

With the units mounted in place, the following procedure should be followed. (See Drawing 842 3246 001 for system wiring diagram.)

- Step 1. Use the cable harness provided. (14 pin plug on one end and a 12 pin plug on the other end.) Plug the 14 pin plug into J104 (playback unit). Plug the other end (12 pin) into J204 on the recording amplifier.
- Step 2. Remove the phono plug from J102 (red) on the head mounting bracket (pgm head, playback unit). Plug into J202 on the rear of the recording amplifier.
- Step 3. Insert one end of the supplied shielded cable into J102 (playback unit). Plug the other end into J206 on the rear of the recording amplifier.
- Step 4. Remove the phono plug from J103 (cue head, playback unit) and plug into J203 on the rear of the recording amplifier.

- Step 5. Use the other shielded cable supplied and insert one end into J103 (cue head, playback unit). Plug the other end into J207 on the rear of the Recording Amplifier.
- Step 6. Plug the AC cord into J201 and plug the other end into the AC power source.

3.5 VU METER

The VU meter is located in the center of the front panel. This meter is for record level indication only. It does not read bias currents. Set the record level so that audio peaks read 100% or zero VU. The meter should be used for audio reference only. Do not use for frequency response tests, therefore, a gain set should be used for this testing.

3.6 RECORD INPUT FACILITIES (See Drawing 813 5911 001)

The audio input has facilities for bridging a line (-35 to +8 dbm) or mic input of 30/50-150/250 ohms at -60 to -70 dbm. These points are located on J205.

3.6.1 MIC INPUT -60 TO -70 DBM, 150/250 OHM

These input points are located on pins 1 & 3 of P205. (Pin 2 is ground.)

3.6.2 MIC INPUT -60 TO -70 DBM, 30/50 OHM

For 30/50 ohm input impedance the following procedure should be followed on T202.

- Step 1. Remove jumper between red/yellow and red.
- Step 2. Connect blue to red.
- Step 3. Connect red/yellow to brown.
- Step 4. The input is located across blue and brown. (Pins 1 and 3). P205.

3.6.3 BRIDGING INPUT -20 TO +8 DBM, 10K OHMS

This input is located between pins 4 and 6 of J205. Pin 2 is ground. Strap pins 5-3 to place

the 150 ohm load resistor, R219, on the pad. The transformer input must be left connected for 150/250 input as it is received from the factory.

3.6.4 BRIDGING INPUT -35 TO -20 DBM, 10K OHMS

This input appears at the same points as 3.6.3, but AT201 requires modification. Connect as explained in 3.6.3 and modify pad AT201 as follows:

- 1) Remove R240, 620 ohms from CKT.
- 2) Strap out R236 and R237, 4.7K ohm.

NOTE

If record/playback response is not to published specifications, adjust bias current as explained in paragraph 7.3 and 7.4.

SECTION IV PRE-OPERATION

The following is a familiarization procedure that should be followed before attempting to place the equipment into operation.

4.1 POWER SWITCH (S203)

The power OFF-ON switch is located on the right hand side of the front panel.

4.2 BAR SWITCH OPERATION (S201 & S202)

The bar switch located under the VU meter performs multiple functions. They are:

- 1) Indicates Power ON
- 2) Indicates CUE TONE
- 3) Indicates RECORD MODE
- 4) Actuates RECORD START
- 5) Stops RECORDING

4.2.1 INDICATES POWER ON

When the power is applied to unit the right side of the bar switch will glow green.

4.2.2 INDICATES CUE TONE

When the record "Start" side of the bar switch is pressed, the record amplifier is set to record. The green light is extinguished. When "Start" on the playback unit is pressed the green light will come back on in the recording amplifier. This tells the operator that the cue tone has been applied.

NOTE

The length of time required for the light to come on after playback "Start" is pressed is the length of time the cue tone is applied to the tape.

4.2.3 INDICATES RECORD AND ACTUATES RECORD START

Also when the bar switch is pressed on the side marked "Start" (as in paragraph 4.2.2) the switch will glow red on the left side. This indicates the unit is ready to record; that is, the bias is applied and the cue tone is ready to be applied, etc. Also pressing the switch on the side marked "Start" switches the recording amplifier to the "Ready" position. The heads are switched, etc.

4.2.4 STOPS RECORDING

The recording process may be stopped at any time by pressing "Stop" on the recording amplifier. This unlatches relay, K201, which removes the recording amplifier from the head. This does not stop the Cartritape,

it only removes the audio from the record head. The Cartritape will continue to run until the cartridge has detected a cue tone and stops.

4.3 HUM BALANCE ADJUSTMENT

For best possible noise figure proceed as follows:

- 1) Remove V206 (the bias osc.) from its socket.
- 2) Remove V205 (the cue tone generator) from its socket.
- 3) Connect ground to pin 6 of J204.
- 4) Connect an audio VTVM across J202 the record head jack.
- 5) Connect power to unit and place in the record mode. Be sure level control is maximum clockwise. Input circuit should be terminated with a 150 ohm resistor.
- 6) Adjust R201 for minimum noise and hum. It will be necessary to polarize the AC plug for minimum hum and noise, between both units.

SECTION V OPERATION

5.1 GENERAL

Operation of the Recording Amplifier is very similar to any high quality recording unit, however, cartridges can be made up for different applications. This section deals with different methods of tape cartridge preparation.

NOTE

There must be at least 4-5 seconds between cue points because of the time delay in the playback unit, otherwise, a cue point may be missed.

5.2 ERASING

The Cartritape unit has no erase head. Therefore, a bulk erasing procedure should be followed.

5.2.1 TO BULK ERASE

- Step 1. Plug bulk eraser into power source.
- Step 2. Bring the erasing unit to the top of the cartridge and make circular motions around the top, bottom and front of the cartridge.
- Step 3. Remove the eraser or cartridge to a distance of about 3 ft. with a slow steady withdrawal.
- Step 4. Remove power to eraser at a 3 ft. distance from the cartridge so that its collapsing field will not re-magnetize the tape.

5.3 TO RECORD A SINGLE SEGMENT ON ONE CARTRIDGE

When one program segment is to be placed on one cartridge, the following procedure is recommended:

- Step 1. Select a completely erased cartridge whose playing time is slightly more than the program time to be recorded. (Nearest standard length).
- Step 2. Insert the cartridge into Cartritape.
- Step 3. Feed audio into the recording amplifier and adjust the gain control so that the audio peaks read 100% on the VU meter.
- Step 4. Press record "Start" on the recording amplifier and preset the program material to be recorded on the cartridge.
- Step 5. Press the "Start" switch on the Cartritape unit and feed the program material source to be recorded as soon after the "Start" switch is pressed as practical.

NOTE

The sooner audio is fed into the recording unit after the "Start" switch is pressed, the tighter the cue, because the instant the "Start" switch is pressed the cue tone is recorded on the tape.

Step 6. After the program material has been recorded, turn down the recording level and allow the cartridge to recue. This will occur when the original starting point is reduced, and will be indicated by the red "Run" light on the playback unit going out.

5.4 MULTIPLE PROGRAM SEGMENTS ON ONE CARTRIDGE

In some applications several segments may be desired on one tape, end to end.

In each case the above procedure applies, except at the end of each segment the STOP button is pressed on the Cartritape. Then the above recording procedure is followed again.

5.5 TO STOP AND START TAPE WITHOUT RECORDING THE CUE TONE

In some applications it may be desired, or necessary, to stop, then start the tape, while recording, without a cue tone being put on the tape. This is accomplished by pressing the START button on the Cartritape before pressing the record START button on the Recording Amplifier. This provision is handy for dubbing in voice and/or other program material into one continuous segment.

5.6 TAPE CARTRIDGE PREPARATION FOR SYNCHRONIZED AUTOMATIC SEQUENTIAL START OPERATION

The Cartritape units may be connected, as explained in the INSTALLATION SECTION, Paragraph 3.9 of this manual, in a

manner that results in one unit being started by the stopping of another.

To use this facility properly, the cartridges must be prepared in a certain manner.

5.5.1 The program material should be timed out (and the correct cartridge playing time selected) so there is little or no dead time between the last segment and the first cue point. "Dead" tape may be removed by editing and re-splicing to insure tight program switching.

5.5.2 No time should be lost between segments. This is accomplished by stopping the tape motion immediately after the segment is recorded on the cartridge by pressing stop on the Cartritape, then proceed with next segment.

5.7 USE OF THE RECORDING AMPLIFIER

The Recording Amplifier is identical in operation (except for cue tone application) to any high quality recording amplifier. Therefore, techniques which are used with standard reel to reel amplifiers can be used with the Cartritape Recording Amplifier.

NOTE

If a frequency response is to be taken it should be done -10 DB down from 100% to avoid tape saturation at high frequencies.

5.8 MAKE RECORDINGS WHILE OTHER CARTRITAPES IN THE SYSTEM ARE ON THE AIR

The Recording Amplifier has been designed so that when the Recording Amplifier is in the Record Mode the starting of that Cartritape interconnected to the Recording Amplifier does not activate the switcher. This feature permits recording while the other Cartritape, in the system, are being used on the air. The only requirement is that

"Record Start" be pressed before "Start" is pressed on the Cartritape.

NOTE

The above explanation applies only when a switcher is included in the system. If a switcher is not used the recording process has no effect on the other Cartritapes being utilized on the air.

SECTION VI

THEORY OF OPERATION

6.1 RECORD AMPLIFIER

The Recording Amplifier is a three stage amplifier with a gain control located after the first stage to facilitate adjusting the recording level. The gain of this amplifier is high enough to record standard level on the tape from a microphone input. The microphone input is 150 ohms or 50 ohms at a level of -60 dbm. -70 dbm will produce approximately 0 or 100% on VU meter. Bridging a -35 to +8 line is possible because of the pad located on the primary side of the audio input transformer, AT201. The first stage is a low noise EF86 tube and is conventional in its configuration. It should be noted that a .005 mfd., is located across the cathode resistor of the second stage. This produces a slight boost on the extreme high end, and is part of the record equalization.

Coupled from the plate of the second stage are two tubes, V204 and V203B. V204 is the last stage of the record amplifier and is connected as a grounded cathode amplifier. However, capacitors, C209 and C213 are wired into the circuit as a part of the record equalization. They provide a boost at the high end. The grid circuit includes an LCR combination to complete the record equalization curve. V203B is the meter driver stage, note that R242 isolates this stage from the previous stage so that circuit loading does not result.

6.2 BIAS OSCILLATOR

V205 is a conventional plate coupled push-pull bias oscillator. It is similar to most of the common ones in use today. This produces high level bias voltage to correctly bias the record head. The push-pull action is needed to give a good sine wave output while keeping the harmonic distortion content low.

6.3 CUE TONE GENERATOR

V206 is a multi-vibrator and is used to generate the cue tone (approximately 1 KC). This tone is applied, without bias, for .1 of a second at the instant the "Start" switch is pressed on the playback unit. This signal is switched through relay K202 to the cue head. Capacitor C225, 8 mfd., across the coil provides a .1 second release time for cue tone application.

6.4 POWER SUPPLIES

There are two power supplies used in the Recording Amplifier. One supplies B+ to the tubes, and the other supplies power to actuate the relays.

The DC source for all the tube circuits is derived from a conventional full wave power supply, using a 6X4 rectifier. Filtering is provided by C201A and C201B. L201, the choke, smooths the ripple further. The preamp tubes have this B+ filtered to an even greater extent by the RC combination of R206 and C201C.

The DC source to actuate the relays is a conventional half-wave type, connected directly to the AC line. The DC voltage is rectified by CR201 and appears across C202. R232 is a surge current limiting resistor.

B+ to the bias oscillator is applied only when the unit is in the record mode.

7.1 GENERAL

The tubes should be checked every 3 to 6 months and replaced when necessary. Dust and dirt should be removed periodically to insure proper operation at all times. A soft brush will facilitate this procedure.

NOTE

When servicing equipment pull AC line plug because a shock hazard is present, this will prevent damage to components as one side of line is hot.

7.2 RELAYS

The relays should be inspected periodically for dust and cleaned when necessary. A relay burnishing tool passed between the contacts (while manually actuated) is sufficient.

7.3 BIAS CURRENT ADJUSTMENT

The correct bias current is necessary to produce a high quality recording. The correct bias current is .8 ma at a frequency of 50 KC to 70 KC.

7.4 TO MEASURE BIAS CURRENT

- Step 1. Insert 100 ohm resistor into the ground return lead of the record/playback head.
- Step 2. Measure the voltage drop across this resistor.
- Step 3. Adjust R201 for .080 volts, measured across this 100 ohm resistor.

NOTE - #1

Be sure to connect the resistor in the ground lead, and connect the meter across the resistor with the ground side of the meter to the grounded side of the resistor, otherwise erroneous readings will occur.

NOTE - #2

HP 400 D is a suitable meter for this purpose.

SECTION VIII

PARTS LIST

<u>Symbol No.</u>	<u>Drawing No.</u>	<u>Description</u>
A201,A202	396 0076 000	Lamp, GE #12
C201	524 0087 000	Cap., 30-20-20 mfd., 350-300-250 V.
C202	522 0116 000	Cap., 40 mfd., @ 250 Volts
C210	500 0771 000	Cap., Variable, 50-380 uuf.
C203	506 0007 000	Cap., .5 mfd., 200 V.
C204,C211,C212	506 0027 000	Cap., .47 mfd., @ 400 Volts
C205,C207,C208	506 0028 000	Cap., .1 mfd., @ 400 Volts
C206	516 0074 000	Cap., .005 mfd., @ 1KV
C209	502 0071 000	Cap., 75 mmfd., @ 500 Volts
C213	502 0196 000	Cap., 400 mmfd., @ 500 Volts
C214	502 0093 000	Cap., 750 mmfd., @ 500 Volts
C215	506 0005 000	Cap., .1 mfd., @ 200 Volts
C217	502 0035 000	Cap., 270 mmfd., @ 500 Volts
C218,C227	516 0054 000	Cap., .001 mfd., @ 1000 Volts
C219,C221	502 0089 000	Cap., 600 mmfd., @ 500 Volts
C220	518 0011 000	Cap., 2.5-13 mmfd.
C222	506 0010 000	Cap., .01 mfd., 400 Volts
C224	522 0288 000	Cap., 10 mfd., @ 150(W) Volts
C225	522 0083 000	Cap., 8 mfd., @ 150 Volts
C226	506 0015 000	Cap., .25 mfd., @ 400 Volts
CR201	384 0020 000	Diode Silicon
F201	398 0019 000	Fuse, 2A, 250 Volt, 3 AG
F202	398 0022 000	Fuse, 5A, 250 Volt, 3 AG
J201	250 0025 000	A.C. Line Cord & Receptacle
(J202,J206), (J203,J207)		Single Phono Socket
J204	612 0247 000	Receptacle, 12 pin
J205	612 0245 000	Receptacle, 6 pin
K201	572 0098 000	Relay
K202	572 0094 000	Relay

5/3/61

-1-

M5952 Recording Amplifier

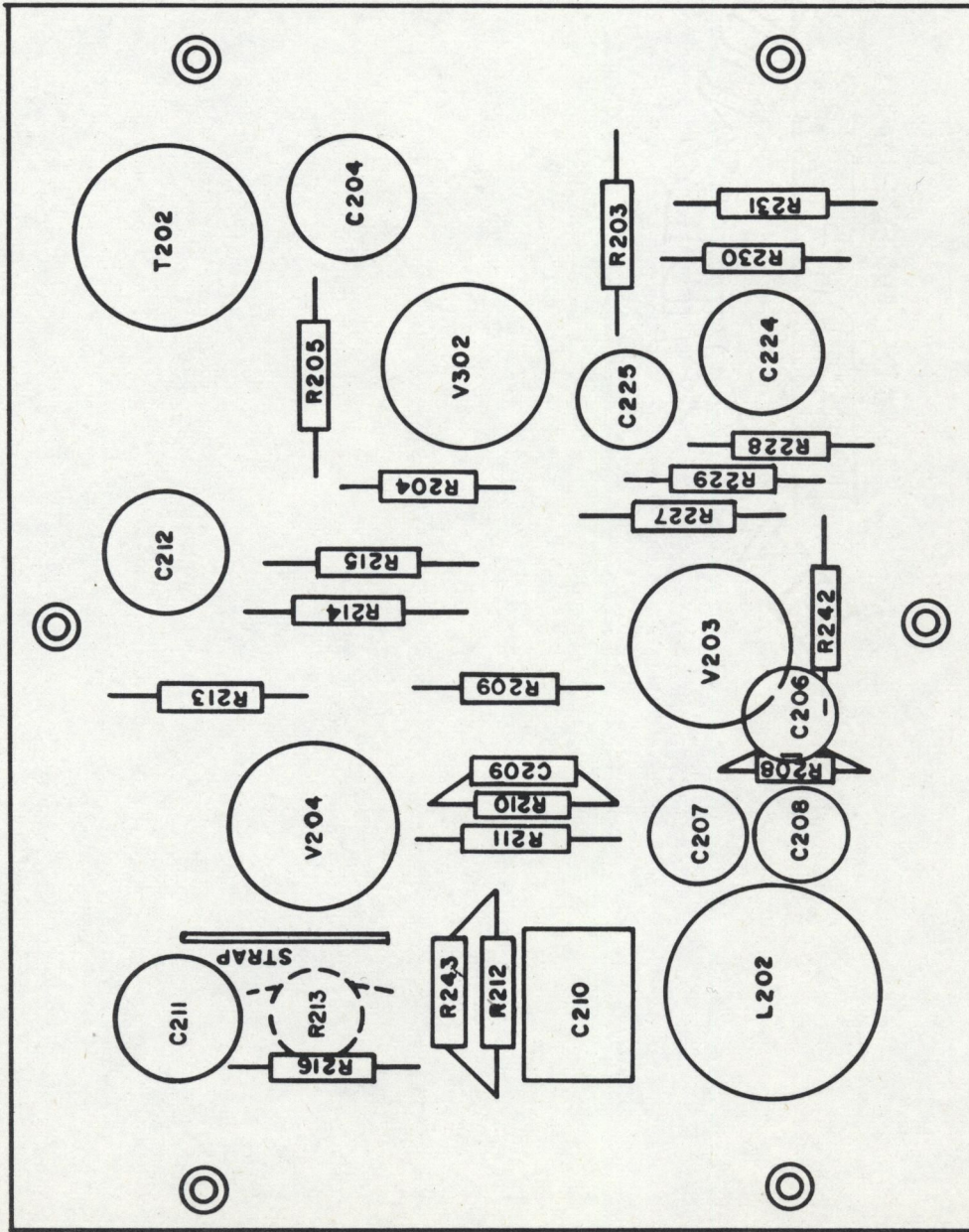
<u>Symbol No.</u>	<u>Drawing Mo.</u>	<u>Description</u>
L201	476 0003 000	Choke
L202	476 0192 001	Toroid Choke
M201	630 0069 000	VU Meter
(P202,P206), (P203,P207)	250 0034 000	Shielded Cable & Phono Plug
P204	610 0254 000	Plug, 12 pin
R201	550 0213 000	Potentiometer, 250K ohm, 2W.
R202	552 0541 000	Potentiometer, 100 ohm, 2W.
R203	540 0057 000	Res., 2.2K ohm, 1/2W. 5%
R204	548 0046 000	Res., 180K ohm, 1/2W. 1%
R205	540 0119 000	Res., 820K ohm, 1/2W. 1%
R206	540 0492 000	Res., 100K ohm, 1W. 10%
R207	550 0048 000	Potentiometer, 500K ohm
R208	540 0061 000	Res., 3.3K ohm, 1/2W. 5%
R209	540 0206 000	Res., 220K ohm, 1/2W. 10%
R210,R242	540 0214 000	Res., 1 megohm, 1/2W. 10%
R211,R216	540 0101 000	Res., 150K ohm, 1/2W. 5%
R212,R243	540 0109 000	Res., 330K ohm, 1/2W. 5%
R213	540 0180 000	Res., 1.5K ohm, 1/2W. 10%
R214	540 0097 000	Res., 100K ohm, 1/2W. 5%
R215	540 0115 000	Res., 560K ohm, 1/2W. 5%
R217,R233	540 0831 000	Res., 270K ohm, 1/2W. 5%
R218,R222	540 0057 000	Res., 2.2K ohm, 1/2W. 5%
R219	540 0029 000	Res., 150 ohm, 1/2W. 5%
R220	540 0097 000	Res., 100K ohm, 1/2W. 5%
R221	540 0105 000	Res., 220K ohm, 1/2W. 5%
R223	540 0121 000	Res., 1 megohm, 1/2W. 5%
R224,R226	540 0085 000	Res., 33K ohm, 1/2W. 5%
R225	540 0049 000	Res., 1000 ohm, 1/2W. 5%
R227	540 0054 000	Res., 1.6K ohm, 1/2W. 5%
R228	540 0196 000	Res., 33K ohm, 1/2W. 10%
R229	540 0114 000	Res., 510K ohm, 1/2W. 5%
R230,R238,R239	540 0067 000	Res., 5.6K ohm, 1/2W. 5%
R231	540 0073 000	Res., 10K ohm, 1/2W. 5%

5/3/61

-2-

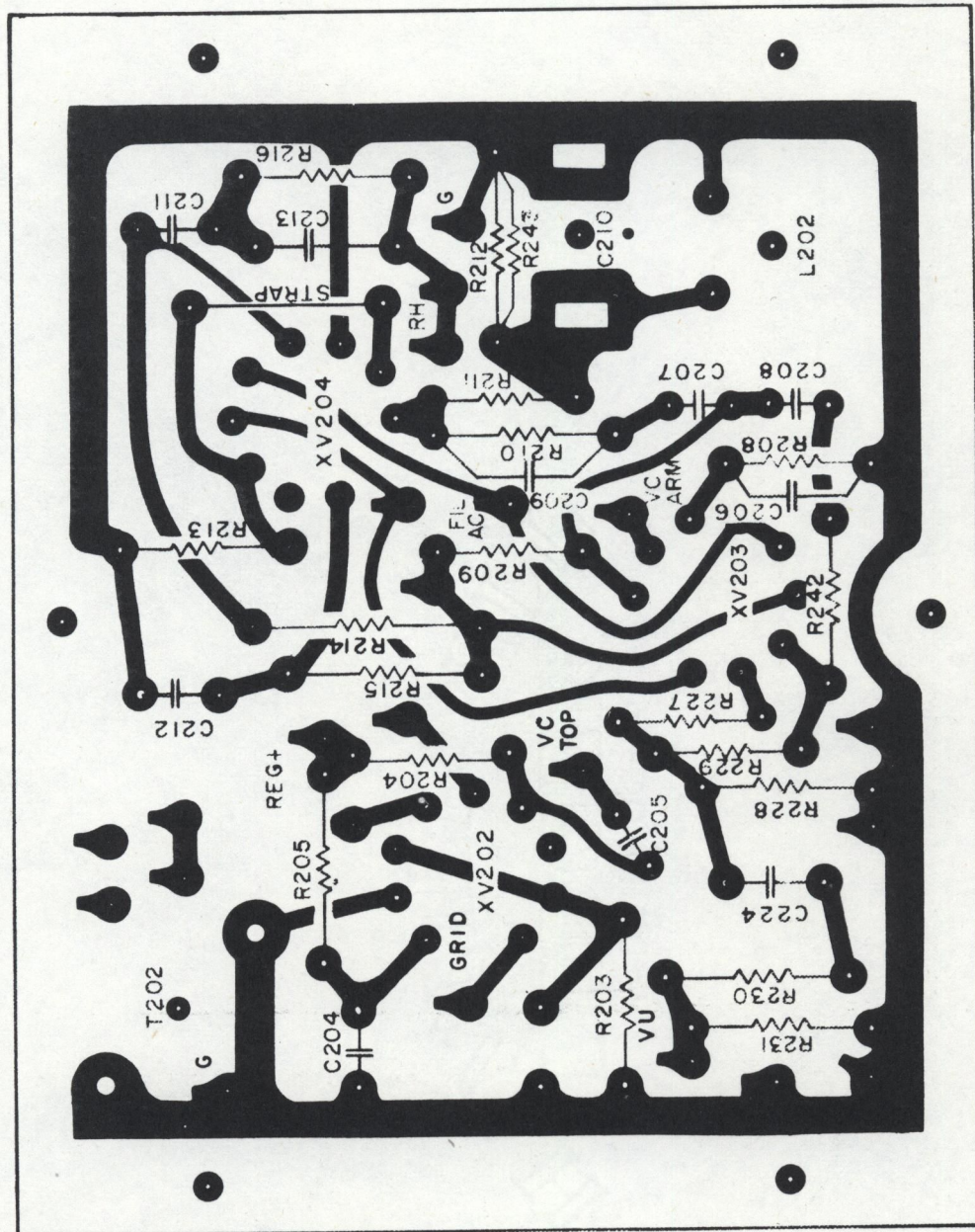
M5952 Recording Amplifier

<u>Symbol No.</u>	<u>Drawing No.</u>	<u>Description</u>
R232	540 0730 000	Res., 150 Ohm, 2 W., 5%
R235	540 0599 000	Res., 330 Ohm, 2 W., 5%
R236,R237	540 0065 000	Res., 4.7K Ohm, 1/2 W., 5%
R240	540 0044 000	Res., 620 Ohm, 1/2 W., 5%
R241	540 0079 000	Res., 18K ohm, 1/2 W., 5%
S201	598 0020 000	Switch Stack
S202	598 0019 000	Switch Stack
S203	604 0005 000	Power Switch
T201	472 0006 000	Power Transformer
T202	478 0145 000	Input Transformer
T203	478 0181 000	Oscillator Transformer
V201	370 0105 000	Tube, 6X4
V202,V204	370 0144 000	Tube, EF86
V203,V206	370 0116 000	Tube, 12AX7
V205	370 0195 000	Tube, 12AU7
XA201,XA202	406 0264 000	Socket
XF201,XF202	402 0023 000	Fuseholder
XV201	404 0032 000	Socket, 7 Pin
XV202,XV203, XV204	404 0059 000	Socket, 9 Pin
XV205,XV206	404 0040 000	Socket, 9 Pin
XCR201	913 4478 001	Diode Mounting Board



PRINTED CHASSIS COMPONENT LAYOUT
RECORDING AMPLIFIER

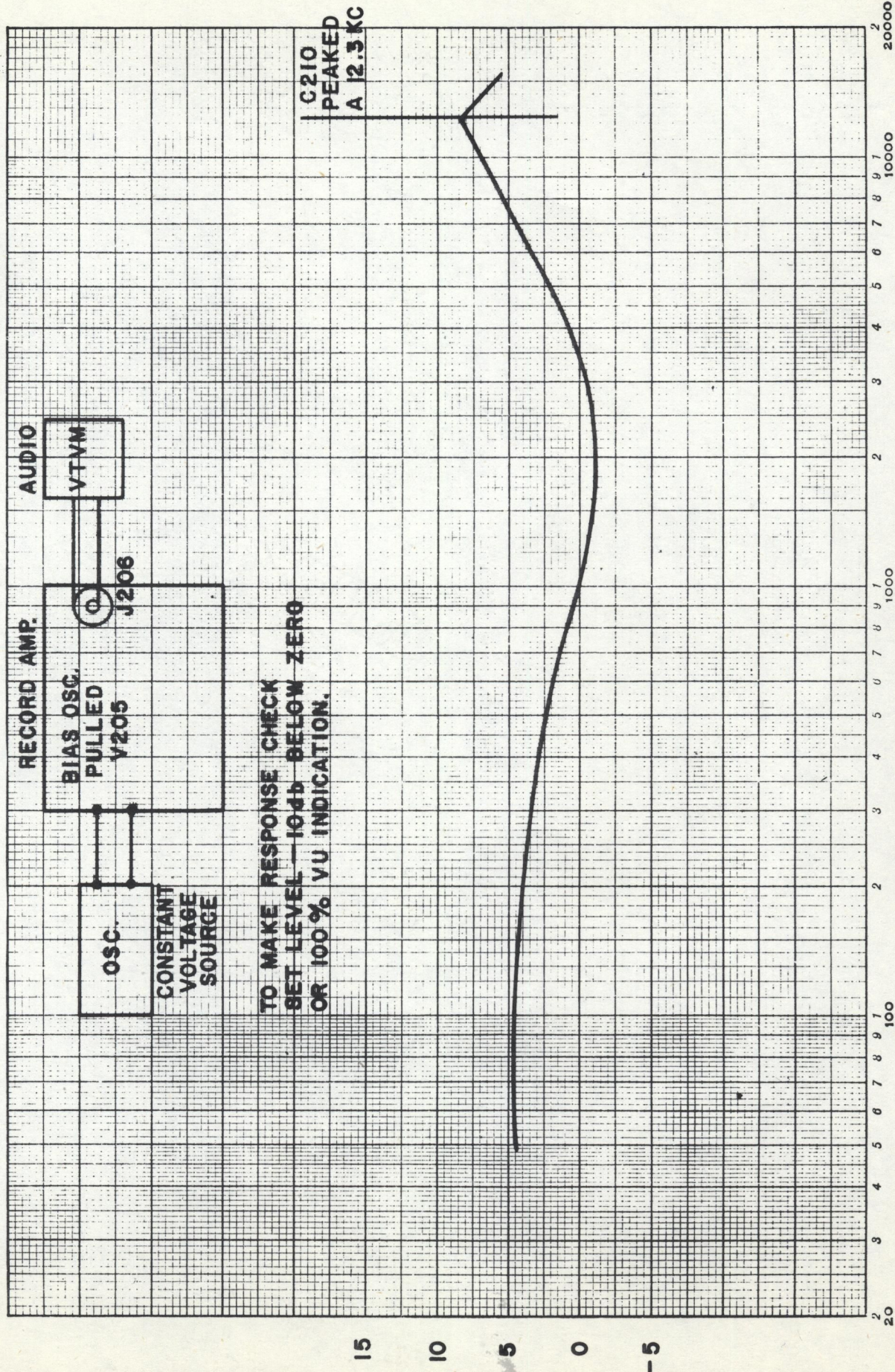
M5952



PRINTED CHASSIS LAYOUT SHOWING
COMPONENTS AND WIRE CONNECTION
RECORDING AMPLIFIER
M-5952

813 4518 001
A-34518

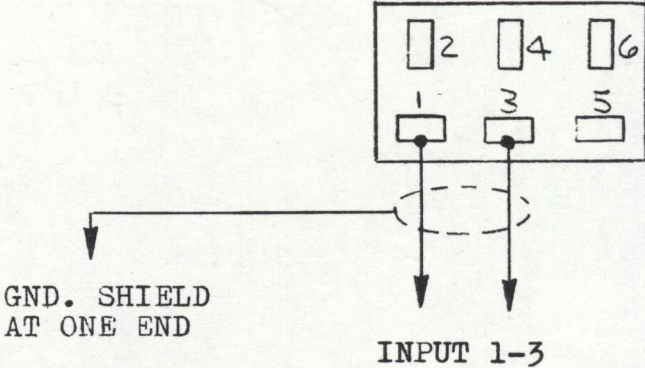
RECORD AMPLIFIER RESPONSE CURVE



FREQUENCY IN CYCLES PER SECOND

					GATES RADIO COMPANY QUINCY, ILLINOIS		A 813 5911 001 SCALE	
104	103	102	101	GR. NO.	LIST OF PARTS			
QTY.	QTY.	QTY.	QTY.	ITEM	REFERENCE	PT. OR G.N.	FIN.	DESCRIPTION

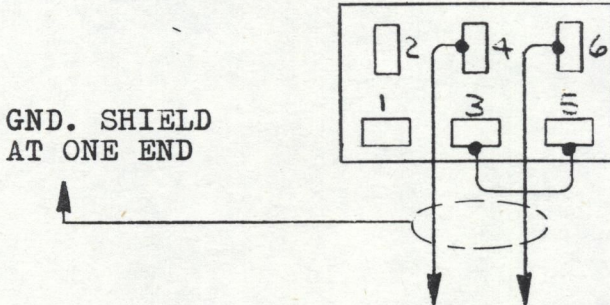
(1) FOR MIC. INPUT
-70 DBM to -50 DBM



P205
FIG. 1

Transformer T202 connected for 150 ohm at factory. T202 may be connected for 30/50 ohm by following instructions in SEC. III in Recording Amplifier Instruction Book.

(2) BRIDGING 10K
HIGH LEVEL -20 DBM to +8 DBM



P205
FIG. 2

(1) High Level Input - Pins 4 & 6

(2) Jumper Pins - 3 & 5

(3) MED. LEVEL BRIDGING
-35 to -20 DBM (P205)

(1) Input same as above
Pins 4 & 6 (See Fig. 2)

(2) Jumper Pins 3 & 5
(See Fig. 2)

(3) Jumper Out R236 & R237
(4.7K) on AT201
Remove R270, 620 ohms

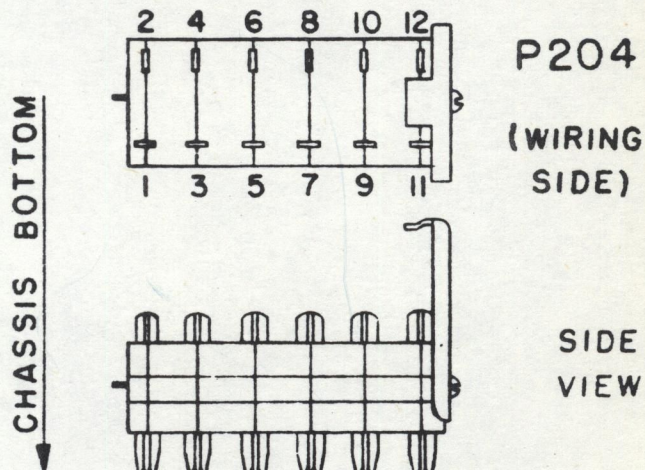
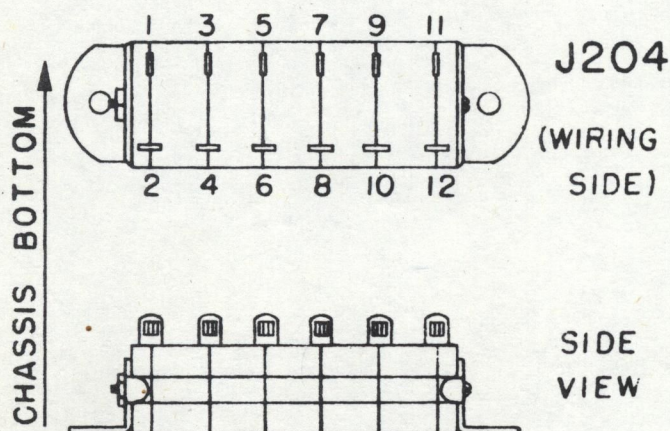
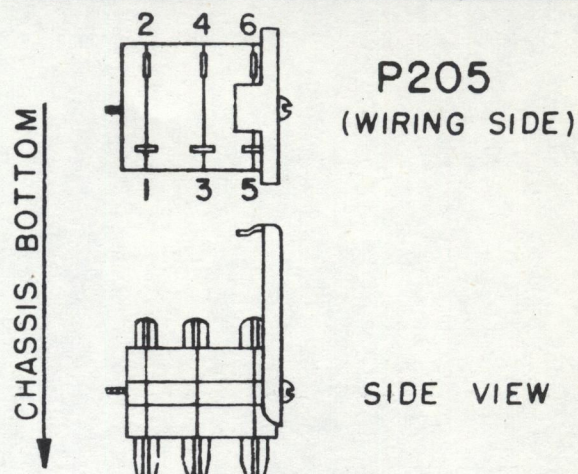
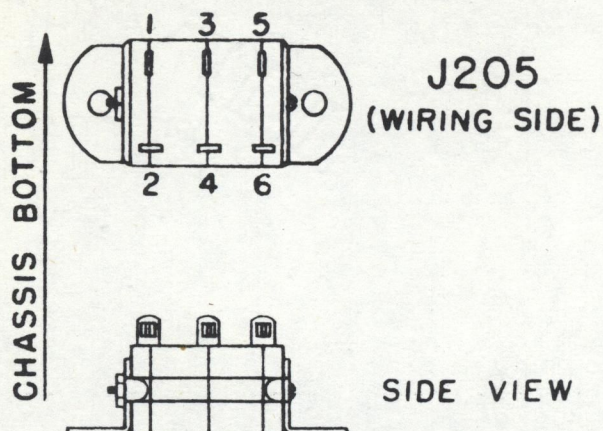
STATUS			
DEVELOPMENT		PRODUCTION	
MECH. CHK.			
PROJ. ENG.	RJA		
APPROV. PRODUCTION BY			

CH. BY	MTL.	TITLE AUDIO INPUT CONNECTION TO	
DATE	CHECKED BY	M5952 RECORDING AMPLIFIER (P205)	UNLESS OTHERWISE SPECIFIED, ALL TOLERANCES PER GATES SPEC GSM102. A 813 5911 001
DR. BY NMC	ENG.	M-5944 CARTRITAPE	
DATE 3-14-61	FIN.		

USE FOR WIRING INTERCONNECTING PLUGS

RECEPTACLE
SHOWN FOR CIRCUIT
TRACING ONLY

PLUGS
USE FOR WIRING INTERCONNECTIONS.
CAUTION: TO REMOVE HOUSING LOOSEN
NUT ON SIDE. DO NOT REMOVE SCREW,
OTHERWISE PLUG WILL COME APART.

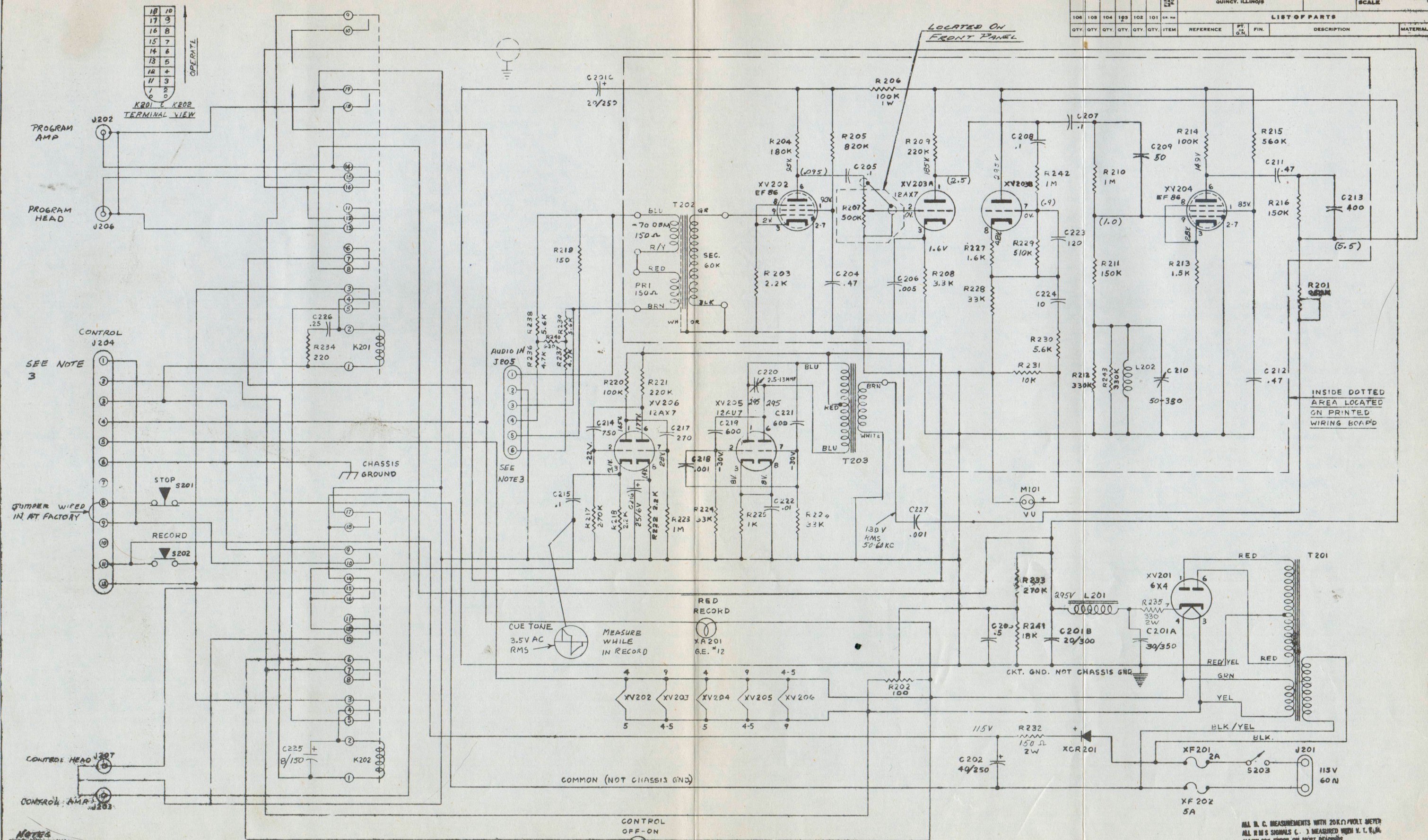


NOTES

- 1) MAKE ALL CONNECTIONS, NUMBERING FROM THE WIRING SIDE ONLY.
- 2) THE JACKS ARE SHOWN FOR REF., ONLY IN CIRCUIT TRACING (DO NOT WIRE TO JACKS).

CH. BY	MTL.	TITLE TERMINAL NUMBER DESIGNATIONS FOR JACKS AND PLUGS RECORDING AMP	M 5952	813-5851-001
DR. BY G.A. 3-2-61	ENG. RdH 3-20-61			

QTY.	QTY.	QTY.	QTY.	QTY.	QTY.	ITEM	REFERENCE	PT. C.N.	FIN.	DESCRIPTION	MATERIAL
------	------	------	------	------	------	------	-----------	----------	------	-------------	----------



NOTES

1. RMS SIGNAL VOLTAGES SHOWN ARE WITH -70DB AT 150Ω INPUT, LEVEL CONTROL MAX.
 2. DC VOLTAGES ON V205 MUST BE TAKEN WITH THE UNIT IN THE RECORD POSITION.
 3. BEFORE WIRING PLUGS SEE DRAWING 813-5851-001 FOR PIN NUMBERING INFORMATION.
- If You Didn't Get This From My Site,
Then It Was Stolen From...
www.SteamPoweredRadio.Com

DC VOLTAGES ON V205 & V206 MUST BE
TAKEN WITH THE UNIT IN THE RECORD POSITION

ALL R.C. MEASUREMENTS WITH 20KΩ PROBE METER
ALL R.M.S. SIGNALS (C. 3) MEASURED WITH V.T.U.M.
ALLOW 20% ERROR ON MOST READINGS.

TITLE SCHEMATIC, FOR RECORDING AMPLIFIER
CARTRITAPE M5952

DR. BY G.A. CH. BY ENG. SHEET OF 23014

WGMS — ^{TRANSMITTER}~~HARRINGTON~~ —

September 1961

INSTRUCTIONS FOR INSTALLING AND OPERATING
OF
GATES' M5953 SWITCHER

5/1/61

Book #888-0604-001

Gates Radio Company
Quincy, Illinois

M5953 SWITCHER

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DRAWINGS:	
B-67174	- Wiring Diagram for Multiple Switcher Connection
D-23020	- Schematic Diagram
B-67163A	- Wiring Diagram Switcher Only
842 3246 001	- System Wiring Diagram
813 5852 001	- Pin Numbering for Jacks and Plugs.



M5953 SWITCHER

SECTION I SPECIFICATIONS

INPUT CHANNELS: Four, 500/600 ohms (factory connected) 150/250 ohms by changing load resistor.

CROSSTALK: More than 65 db below normal recording level.

SWITCHING TIME: 0.02 seconds or less

POWER: 115 Volts, 50/60 cps., 7 watts.

RELAYS: Short telephone type (Type "J" or equivalent).

MECHANICAL

HEIGHT: 3-1/2 inch rack or custom cabinet mounting.

WIDTH: 19 inch rack or 15 inch custom cabinet mounting.

DEPTH: 4 inches behind panel, excluding plugs.

PANEL: Hinged and secured with 1/4 turn fasteners to permit quick access to dust protected relay contacts.

WEIGHT: Net 6 lbs., packed (domestic) 10 lbs., cubage 1.

SECTION II INTRODUCTION

2.1 GENERAL

The Gates Switcher, M5953 is a relay device that will switch four Cartritape audio outputs to one console

input. By connecting more than one Switcher in series, any number of Cartritape outputs may be accommodated by one console input.

NOTE

It is recommended that the complete Instruction Book be read before installation of this equipment.

SECTION III INSTALLATION

3.1 UNPACKING

The Switcher will be received in one shipping carton. Unpack the contents carefully and examine thoroughly for shipping damage. If any such damage is found, file a claim report immediately with the Carrier.

3.2 MOUNTING (ADAPTOR PLATES 15" & 19" MODEL)

The basic unit will be received for 15" custom installation. The 19" panel adaptors are enclosed. These should be installed to the panel mounting angle of the Switcher if rack mounting is planned.

3.3 MOUNTING THE 19" RACK MODEL

Mount the Switcher in a rack with four panel screws. The location of the Switcher in the rack is relatively unimportant, except that accessibility should be kept in mind to allow for routine maintenance and inspection.

3.4 MOUNTING THE 15" CUSTOM MODEL

The unit can be installed in a custom cabinet or located as a table top unit. In either case, the wiring and operation are the same.

3.5 WIRING (J303) CONTROL CIRCUITS

Study Drawing 842 3246 001, and B-67163A. Drawing 842 3246 001 is a system wiring diagram and should be used in wiring a complete Cartritape System. Drawing

B-67163A will be used for the Switcher wiring to an existing system.

NOTE

For ease of pin numbering identification use Drawing 813 5452 001 as reference. Insert plug into jack and observe pin numbers while wiring.

- 1) On each Cartritape, connect Pin 12 (J104) to the correct Pin on J303.
- 2) Pin 11 (J104) on each Cartritape, should be interconnected and this common point should be connected to Pin 11 on J303 of the Switcher.
- 3) Ground Pin 12, (J303) to the station ground.

3.6 WIRING P302 AUDIO JACK

NOTE

See Drawing 813 5852 001 for pin numbering information.

Observe diagram B-67163A, this diagram only shows Switcher wiring.

- 1) On each Cartritape, connect a shielded pair from Pins 1, 2, 3, (P105) to the correct terminals on P302 on the Switcher.
- 2) Ground Pin 14 to shield on P302.
- 3) Run a shielded pair from Pins 1-2 (P302) to the console input.

3.7 LOAD RESISTOR

The Switcher is wired for 500/600 ohm back at the factory. It can be changed to 150 ohm load by changing the load resistor R305 to 150 ohms.

3.8 CONNECTING MORE THAN ONE SWITCHER IN SERIES

By connecting more than one Switcher in series more than four Cartritapes can be fed into one console input.

To connect two or more switchers together the following procedure should be followed (See B-67174):

- Step 1. Remove jumper between Pins 3-4 (J303) on all units to be interconnected.
- Step 2. Remove all jumpers between Pins 1-2 (J303) on all units to be interconnected.
- Step 3. Connect Pin 4 (P303) on the first switcher to Pin 3 (P303) on the second switcher, Pin 4 on the second to Pin 3 of the third (or back to the first if only two switchers are used).
- Step 4. Connect Pin 8 of the first switcher to Pin 1 of the second (and so on), until the last unit. DO NOT connect Pin 8 of the last unit to Pin 1 of the first unit.
- Step 5. Pins 1-2 (J303) on the first unit should be jumpered. If a remote unit, M5960, is used, then the "OFF" switch will replace the jumper.
- Step 6. Connect a shielded pair from Pins 9-10 (P302) of the first switcher to Pins 1-2 (J302) of the second switcher (and so on) until the last unit is reached. Ground the shield to Pin 14 (P302 on all units.)
- Step 7. Diagram B-67174 shows eight audio inputs. If more than two switchers are used, the same pattern of connection should be followed.
- Step 8. The 620 ohm resistor, R305, located in each Switcher between pins 9-10 (J302) should be removed on all switchers except the last switcher in the series.

- Step 9. The output will appear at terminals 1-2 (P302) of the first unit, and should be connected to the console.

NOTE

The jumper between Pins 1-2 (J303) is removed in all units but the first, because only the first unit's power supply is utilized.

3.9 POWER CORD

Power is supplied to the unit through J301. Connect one end of the cord to J301 and plug the other end into a 115 volt 50/60 cps source.

SECTION IV
PRE-OPERATION

The following is a familiarization procedure that should be followed before attempting to place the unit into operation.

4.1 POWER SWITCH (S301)

The power OFF-ON switch is located on the front panel. When power is applied to the unit the neon indicator glows.

4.2 PLAYING BACK CARTRITAPE USING THE SWITCHER

With the Cartritapes installed to the Switcher, the following procedure should be followed to determine if they are wired and functioning properly.

- Step 1. Insert a pre-recorded tape cartridge into each playback unit connected to the Switcher.
- Step 2. Monitor the Switcher output. Pin 1-2 (J302).
- Step 3. Start the first unit. The program material from this unit should be monitored at the Switcher output.

- Step 4. Start all other Cartritapes in any order. In each case, the program material from the last unit started should be heard.

NOTE

It will be noted that this switching does not interfere with the re-cueing of the cartridges.

SECTION V
OPERATION

5.1 THE SWITCHER IN USE

Basic facts to remember about the Switcher:

1. Only one Playback unit is connected to the console input at one time through the Switcher.
2. The Cartritape that is switched to the console is the last unit started.
3. To remove all audio from the console input it is necessary to unlatch all the relays in the Switcher. Therefore, an "OFF" switch is provided as part of the remote unit, M5960.

5.2 TO PLAY BACK MULTIPLE CARTRIDGES, ONE AFTER THE OTHER

Start the first unit at the correct time in the program. When the first recorded program segment has been completed, start the next Cartritape. In each case, as the units are started, the Switcher will switch the program material from that unit to the console.

5.3 MULTIPLE SWITCHERS

If more than four Cartritapes are to feed one console input, multiple switcher operation will be necessary. (See INSTALLATION SECTION). By series connection of these switchers, any number of inputs may be handled. The operation of these units is exactly the same as for one Switcher; except, of course, more Cartritapes are handled.

SECTION VI
THEORY OF OPERATION

The relay circuits perform two basic switching functions. First, the DC control circuits and, second; the audio switching.

6.1 DC CONTROL CIRCUIT

The DC control circuit encompasses the relay switching necessary to activate the necessary relay to feed the correct audio to the console.

Refer to Drawing D-23020, note that many of the contacts on the relays are wired in series. The positive side of the DC source goes to terminal 7 on K301, and (with all relays de-energized) terminal 6 on K301, terminal 7 on K302, and so on until terminal 7 is reached on K304.

There is another set of series contacts from terminal 3 on K301 to terminal 4 on K302, and so on until K304 is reached. It then returns to terminal 4 on K301. These series contacts comprise the latching and releasing circuits that will allow any order of relay operation.

The contacts on terminals 6 and 7 on K301 are operated when that relay coil is activated. These contacts break the DC path to any relay energized above this relay and unlatch it.

Contacts located on terminal 3 and 4 break the DC path to any relay that is energized below the relay being activated.

This double series circuit path is necessary to allow operation of the relays in any sequence.

6.2 AUDIO SWITCHING

The audio output from the Switcher is located on terminals 10 and 13 of K301. The input of each Cartritape is located on Pins 11 and 14 of the relay wired to that Cartritape. When a relay is energized, the audio fed to

that relay is applied to the output line. If no relay is energized, the resistor K305 is placed on the output line to give the console a constant source impedance. This resistor may be changed to 150 ohms (1/2 watt) if the console and the Cartritapes output circuits are wired for that impedance.

6.3 POWER SUPPLY

The DC power to operate the relays is derived from a 6 volt transformer and rectified with a silicon rectifier bridge circuit with capacitor input (C305).

SECTION VII MAINTENANCE

7.1 GENERAL

Periodic preventative maintenance will keep this piece of equipment operating satisfactorily.

7.2 RELAYS

The relays should be inspected at least once a week and cleaned, if necessary, with a burnishing tool. Do not file (or in any way damage) the contacts. Gold alloy contacts are used in circuits where insufficient current flows to remove the oxide from the contacts. The enclosure itself is constructed to act as a large dust cover for the relays.

7.3 INSPECTION

The front panel is hinged and, by turning the thumb screw at the top of the panel, it can be lowered. The relays can then be cleaned and inspected from this point. Also, most of the wiring can be observed from this panel opening. The rear of the relays can be viewed by removing the back inspection plate.

SECTION VIII

PARTS LIST

<u>Symbol No.</u>	<u>Drawing No.</u>	<u>Description</u>
A301	406 0252 000	Neon Indicator
C301,C302, C303,C304	506 0008 000	Cap., 1.0 mfd., 200 V.
C305	522 0067 000	Cap., 100 mfd., 15 V.
CR301,CR302, CR303,CR304	384 0018 000	Rectifier
F301	398 0019 000	Fuse, 2 amp., 250 V.
J301	250 0025 000	Receptacle & Line Cord
J302	612 0247 000	Receptacle, 14 terminal
J303	612 0335 000	Receptacle, 12 terminal
K301,K302, K303,K304	572 0097 000	Relay
P302	610 0318 000	Plug, 14 terminal
P303	610 0254 000	Plug, 12 terminal
R301,R302, R303,R304	540 0170 000	Res., 220 ohm, 1/2 W., 10%
R305	540 0044 000	Res., 620 ohm, 1/2 W., 5%
S301	604 0005 000	Switch Toggle, SPST
T301	472 0316 000	Transformer
XF301	402 0023 000	Fuseholder
XCR301,XCR302, XCR303,XCR304	402 0039 000	Diode Mounting Board

WARRANTY

This equipment is warranted by Gates Radio Company of Quincy, Illinois to be free from defects in workmanship and material and will be repaired or replaced in accordance with the terms and conditions set forth below:

1. Gates Radio Company believes that the purchaser has every right to expect first-class quality, materials and workmanship and has created rigid inspection and test procedures to that end, and excellent packing methods to assure arrival of equipment in good condition at destination.
2. Gates Radio Company will endeavor to make emergency shipments at the earliest possible time giving consideration to all conditions.
3. Gates Radio Company warrants new equipment of its manufacture for one (1) year and (six (6) months on moving parts), against breakage or failure of parts due to imperfection of workmanship or material, its obligation being limited to repair or replacement of defective parts upon return thereof f.o.b. Gates Radio Company's factory, within the applicable period of time stated. Electron tubes shall bear only the warranty of the manufacturer thereof in effect at the time of the shipment to the purchaser. Other manufacturers' equipment covered by a purchaser's order will carry only such manufacturers' standard warranty. These warranty periods commence from the date of invoice and continue in effect as to all notices, alleging a defect covered by this warranty, received by Gates Radio Company prior to the expiration of the applicable warranty period.

The following will illustrate features of the Gates Radio Company warranty:

Transmitter Parts: The main power or plate transformer, modulation transformer, modulation reactor, main tank variable condensers all bear the one (1) year warranty mentioned above.

Moving Parts: As stated above, these are warranted for a period of six (6) months.

Electron Tubes: As stated, electron tubes will bear such warranty, if any, as provided by the manufacturer at the time of their shipment. Gates Radio Company will make such adjustments with purchasers as given to Gates Radio Company by the tube manufacturer.

All other component parts (except as otherwise stated): Warranted for one (1) year.

Abuse: Damage resulting from abuse, an Act of God, or by fire, wind, rain, hail, in transportation, or by reason of any other cause or condition, except normal usage, is not covered by this warranty.

4. Operational warranty - Gates Radio Company warrants that any new transmitter of its manufacture, when properly installed by purchaser and connected with a suitable electrical load, will deliver the specified radio frequency power output at the output terminal(s) of the transmitter, but Gates Radio Company makes no warranty or representation as to the

coverage or range of such apparatus. If a transmitter does not so perform, or in the event that any equipment sold by Gates Radio Company does not conform to any written statement in a contract of sale relative to its operating characteristics or capabilities, the sale liability of Gates Radio Company shall be, at the option of Gates Radio Company, either to demonstrate the operation of the equipment in conformance with its warranty, or to replace it with equipment conforming to its warranty, or to accept its return, f.o.b. purchaser's point of installation and refund to purchaser all payments made on the equipment, without interest. Gates Radio Company shall have no responsibility to the purchaser under a warranty with respect to operation of equipment unless purchaser shall give Gates Radio Company a written notice, within one (1) month after arrival of equipment at purchaser's shipping point, that the equipment does not conform to such warranty.

5. Any item alleged by a purchaser to be defective, and not in conformance with a warranty of Gates Radio Company shall not be returned to Gates Radio Company until after written permission has been first obtained from the Gates Radio Company home office for such return. Where a replacement part must be supplied under a warranty before the defective part can be returned for inspection, as might be required to determine the cause of a defect, purchaser will be invoiced in full for such part, and if it is determined that an adjustment in favor of the purchaser is required, a credit for an adjustment will be given by Gates Radio Company upon its receipt and inspection of a part so returned.

6. All shipments by Gates Radio Company under a warranty will be f.o.b. Quincy, Illinois or f.o.b. the applicable Gates Radio Company shipping point.

7. Gates Radio Company is not responsible for the loss of, or damage to, equipment during transportation or for injuries to persons or damage to property arising out of the use or operation of Gates equipment. If damage or loss during transportation occurs, or if the equipment supplied by Gates Radio Company is otherwise damaged, Gates will endeavor to make shipment of replacement parts at the earliest possible time giving consideration to all conditions. It is the responsibility of a purchaser to file any claim for loss or damage in transit with the transportation company and Gates will cooperate in the preparation of such claims to the extent feasible when so requested.

8. Gates Radio Company, in fulfilling its obligations under its warranties, shall not be responsible for delays in deliveries due to depleted stock, floods, wars, strikes, power failures, transportation delays, or failure of suppliers to deliver, acts of God, or for any condition beyond the control of Gates that may cause a delayed delivery.

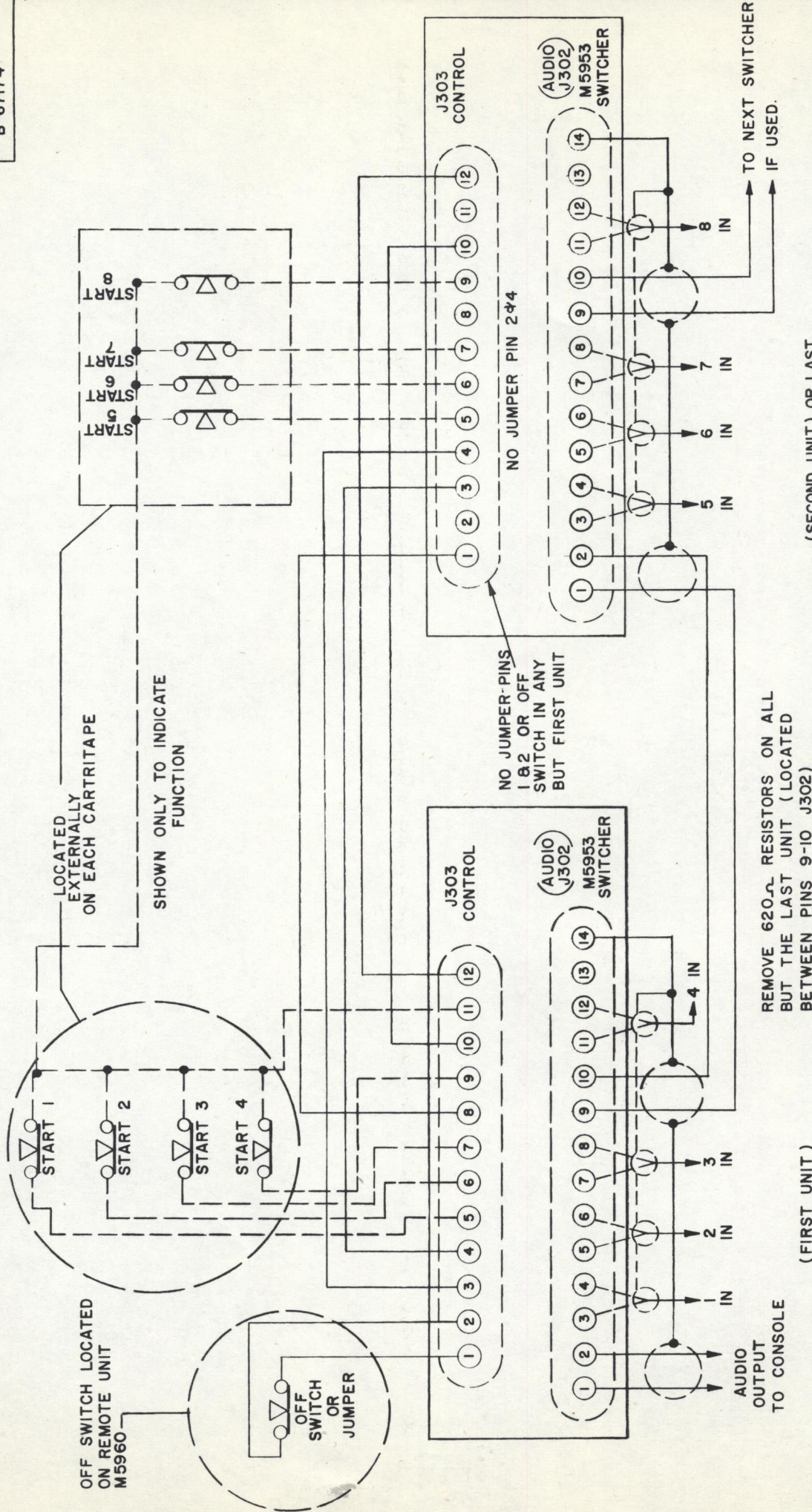
9. This warranty may not be transferred by the original purchaser and no party, except the original purchaser, whether by operation of law or otherwise, shall have or acquire any rights against Gates Radio Company by virtue of this warranty.

10. Gates Radio Company reserves the right to modify or rescind, without notice, any warranty herein except that such modification or rescission shall not affect a warranty in effect on equipment at the time of its shipment. In the event of a conflict between a warranty in a proposal and acceptance and a warranty herein, the warranty in the proposal and acceptance shall prevail.

11. This warranty shall be applicable to all standard Gates catalog items sold on or after March 1, 1960.

Gates Radio Company
Quincy, Illinois

1/6/60



REDRAWN G.A. 3-21-61

DR BY RLH CH BY W.K. 7-22-60

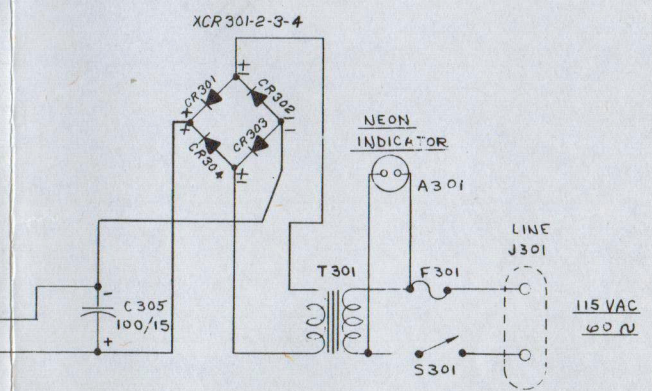
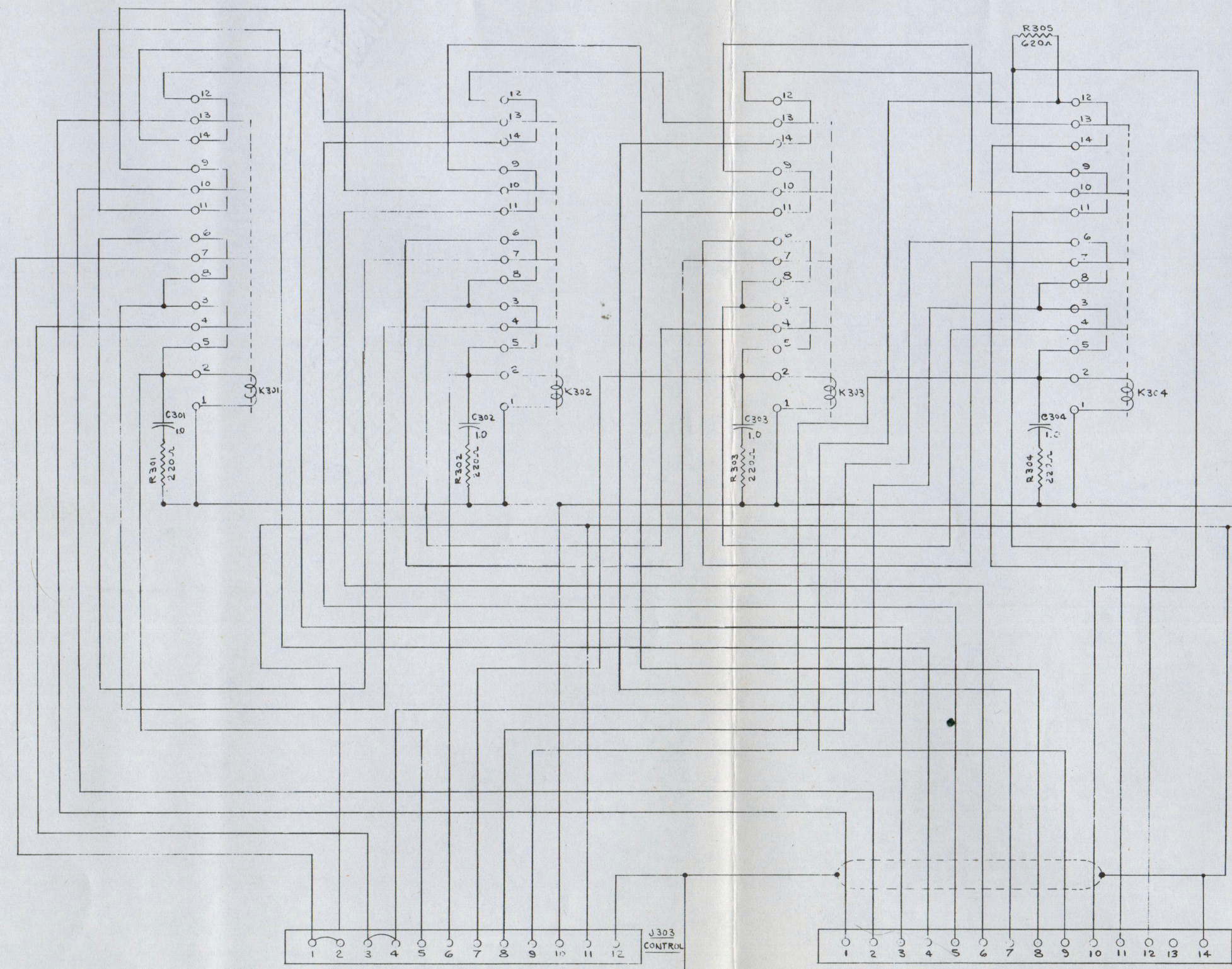
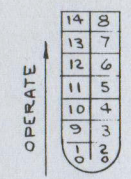
ENG. R.A.

MTL FIN. SHEET OF B-67174

826 7174 001

NOTE: BEFORE WIRING J302 & J303 SEE DRAWING 813-5852-001 FOR PIN NUMBERING INFORMATION.

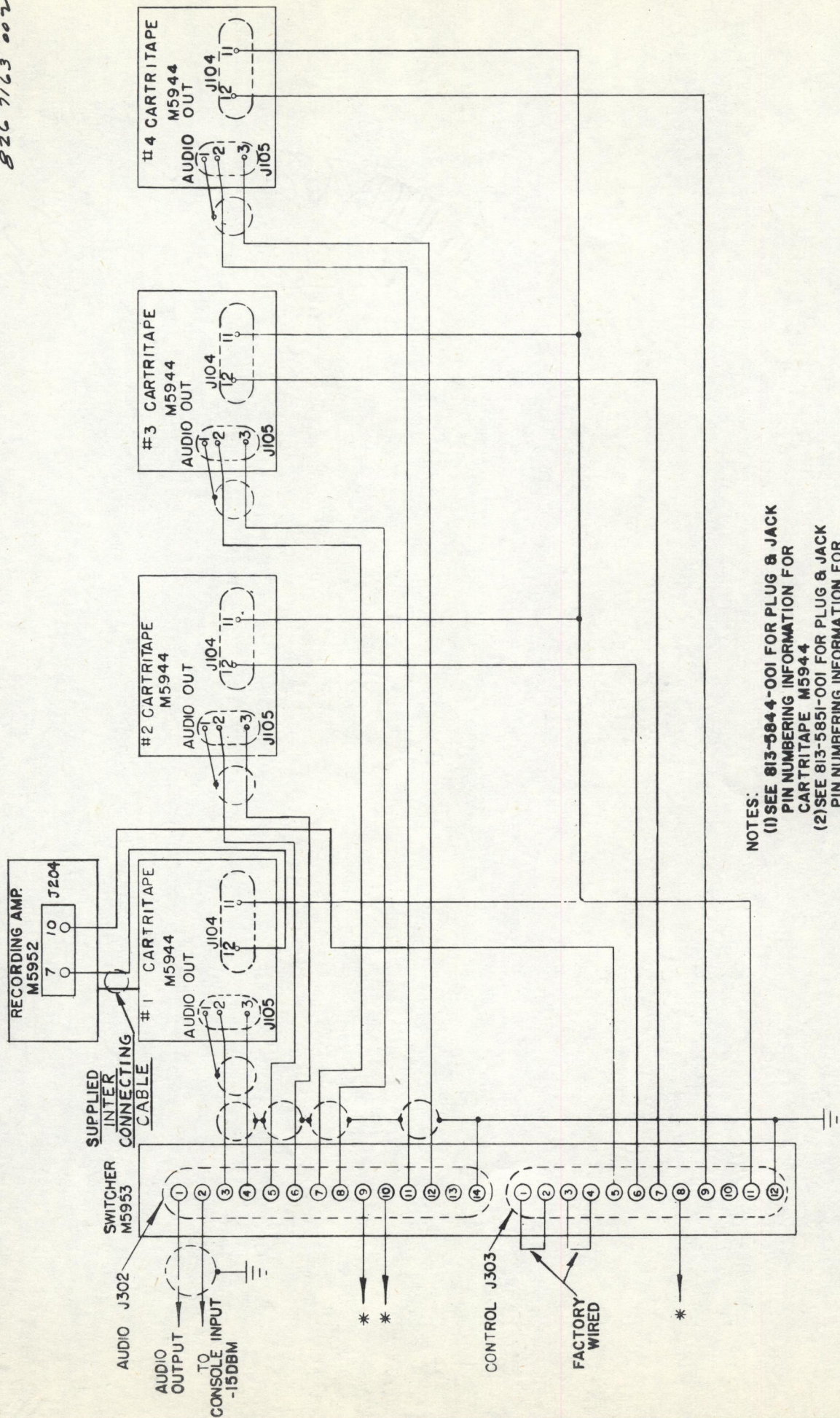
TERM VIEW K301-302-303-304



SEE DRAWING 813-5852-001 FOR
PIN NUMBERING INFORMATION

SEE DRAWING 813-5852-001 FOR
PIN NUMBERING INFORMATION

TITLE SCHEMATIC SWITCHER M5953			
STATUS		FIN.	
DEVELOPMENT	PRODUCTION	UNLESS OTHERWISE SPECIFIED: ALL TOLERANCES PER GATES SPEC. DRAWING	
CHK. CHK. END	DATE DATE DATE	DR. BY DATE	CH. BY DATE
SHEET OF		D-23020	



NOTES:

(1) SEE 813-5844-001 FOR PLUG & JACK
PIN NUMBERING INFORMATION FOR
CARTRIDGE M5944

(2) SEE 813-5851-001 FOR PLUG & JACK
PIN NUMBERING INFORMATION FOR
RECORDING AMPLIFIER M5952

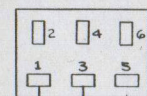
(3) SEE 813-5852-001 FOR PLUG & JACK
PIN NUMBERING INFORMATION FOR
SWITCHER M5953

*** THESE TERMINALS UTILIZED WHEN CONNECTING
MULTIPLE SWITCHERS**

CHART I

AUDIO INPUT CONNECTION TO RECORDING AMP P205

(I) FOR MIC. INPUT -70DBM TO -50DBM

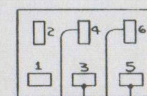


P205
FIG.1

TRANSFORMER T202
CONNECTED FOR 150 Ω
AT FACTORY.
T2R MAYBE CONNECT-
ED FOR 30/50 Ω
BY FOLLOWING IN-
STRUCTION IN SECIII
IN RECORDING
AMP. INSTR. BOOK.

(2) BRIDGING 10K

HIGH LEVEL -20DBM TO +8DBM



P205
FIG. 2

(I) HIGH LEVEL INPUT

PINS 4 & 6
(2) JUMPER PINS 3 & 5

(2) JUMPER PINS 3 & 5

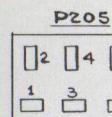
(3) MED. LEVEL BRIDGING
-35 TO -20 DBM P205

(1) INPUT SAME AS ABOVE
PINS 4 & 6 (SEE FIG 2)

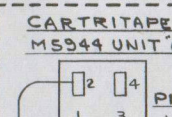
(2) JUMPER PINS 3 & 5
SEE FIG 2

(3) JUMPER OUT R236 &
R237 (4.7K) ON AT 201
REMOVE R270 620Ω

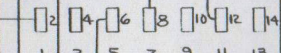
RECORDING AMP
M5952



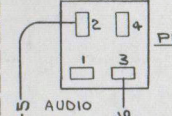
SEE CHART I
AT LEFT, AUDIO
CONNECTIONS
INPUT TO P205



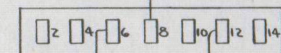
SEE NOTE 5



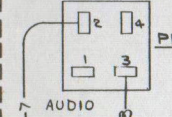
CARTRITAPE
M5944 UNIT



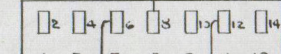
05



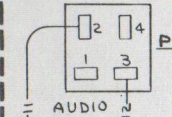
CARTRITAPE
M5944 UNIT C



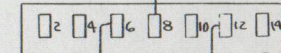
2



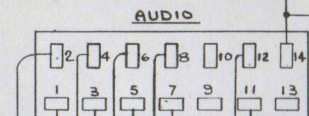
CARTRITAPE
M5944 UNIT D



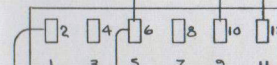
05



SWITCHER
M 5953



TO CONSOLE INPUT
←
LEVEL -15 DBM

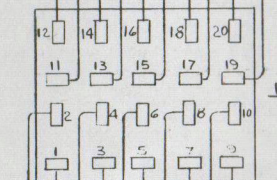
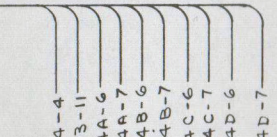


SEE NOTE 7

NOTES

- (1) DENOTES SHIELDED PAIR.
- (2) DENOTES #18 STRANDED HOOKUP WIRE.
- (3) PLUGS ARE SHOWN AS VIEWED FROM REAR OF UNIT
WHEN THEY ARE INSERTED. (WIRING VIEW)
- (4) GND. ONLY ONE END OF SHIELDED WIRE AS SHOWN
TO PREVENT GROUND LOOPS.
- (5) USE ONLY ROSIN CORE SOLDER.
- (6) NOTE THAT CHASSIS GND. FOR RECORD AMPLIFIER
COMES FROM PLAYBACK UNIT ONLY.
- (7) LETTER AFTER JACK NO. DESIGNATES UNIT A, B, C OR D.
CARTRITAPES M5944.
- (8) THE INTERCONNECTING CABLE PROVIDED WITH M5952
(REDCORDING AMP) CONTAINS THESE WIRES.
- (9) ALL J100'S ARE ON CARTRITAPES M5944.
- (10) ALL J200'S ARE ON RECORDING AMP M5952.
- (11) ALL J300'S ARE ON SWITCHER M5953.
- (12) ALL J400'S ARE ON REMOTE UNIT M5960.
- (13) SHIELDED WIRE CONNECTIONS FOR HEAD SWITCHING.
USE SUPPLIED SHIELDED CABLES. SEE SEC. III, PAR 3.4.
M5952 I.B.

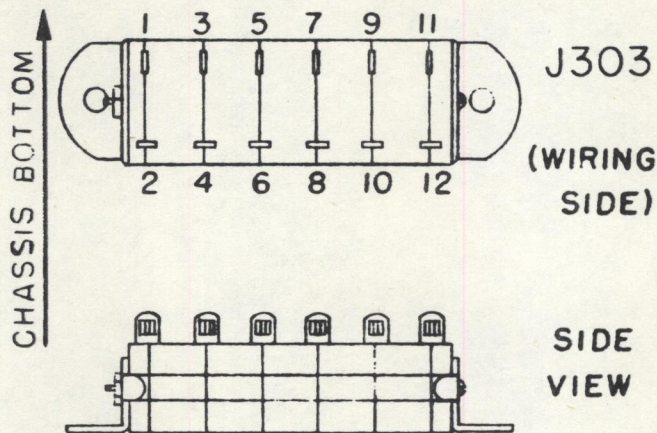
REMOTE UNIT
M5960



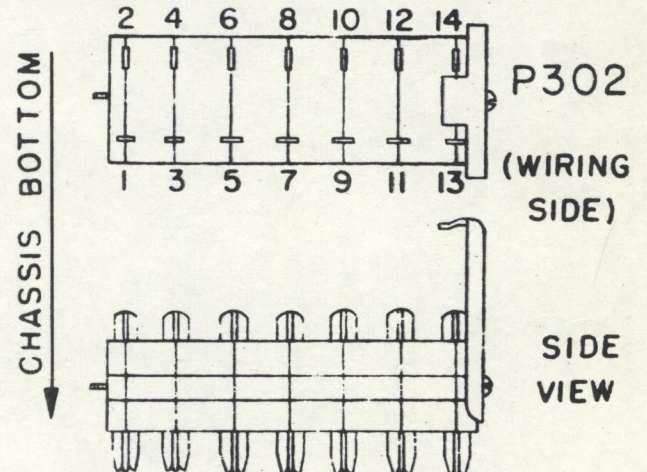
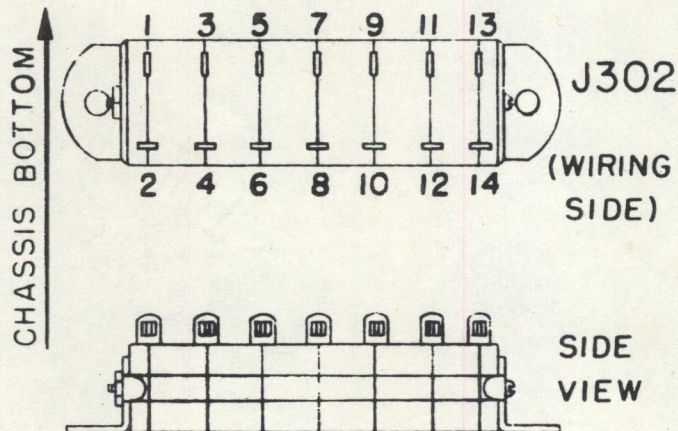
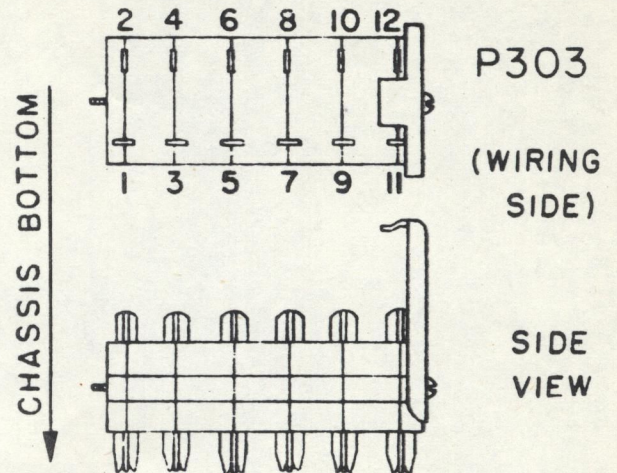
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www.SteamPoweredRadio.Com

USE FOR WIRING INTERCONNECTING PLUGS

RECEPTACLE SHOWN FOR CIRCUIT TRACING ONLY



PLUGS USE FOR WIRING INTERCONNECTIONS. **CAUTION:** TO REMOVE HOUSING LOOSEN NUT ON SIDE DO NOT REMOVE SCREW, OTHERWISE PLUG WILL COME APART.



NOTES

- 1) MAKE ALL CONNECTIONS, NUMBERING FROM THE WIRING SIDE ONLY.
- 2) THE JACKS ARE SHOWN FOR REF., ONLY IN CIRCUIT TRACING (DO NOT WIRE TO JACKS).

CH. BY	MTL.	TITLE TERMINAL NUMBER DESIGNATIONS FOR JACKS AND PLUGS SWITCHER	M5953	813-5852-001
DR. BY G.A. 3-2-61	ENG. R.L.H. 3-20-61			