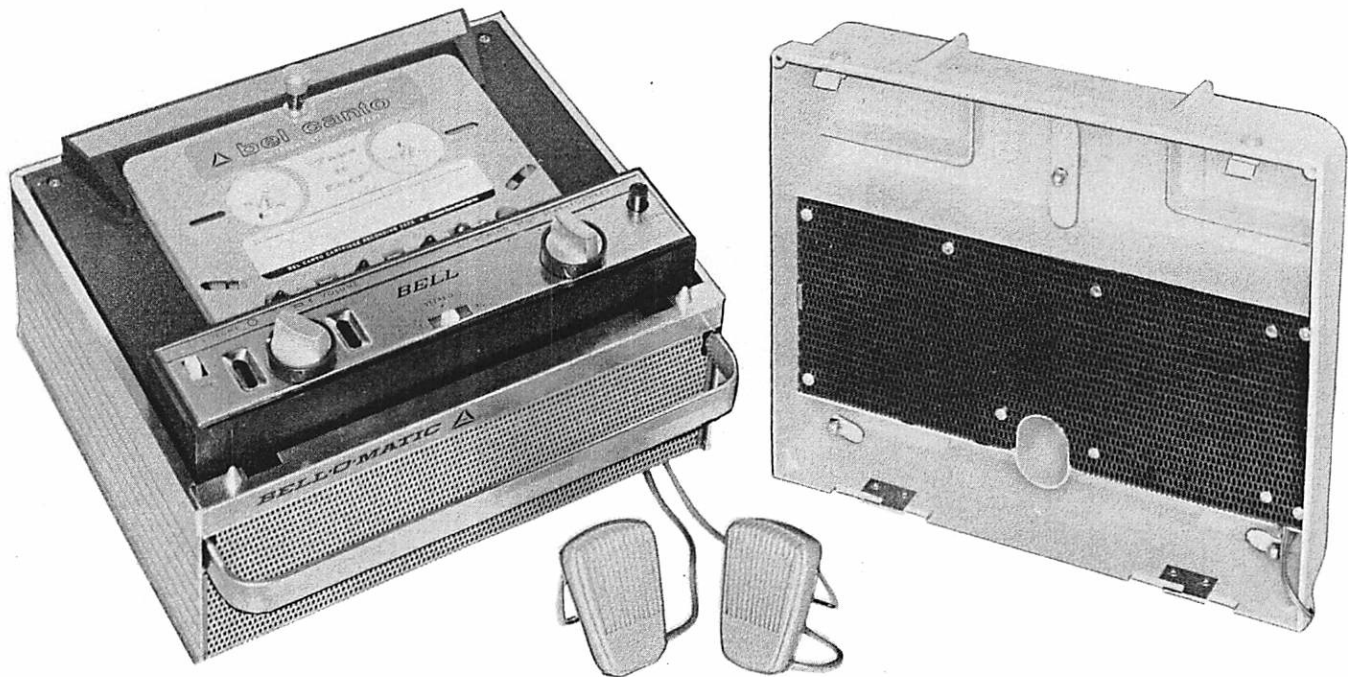


BELL-O-MATIC

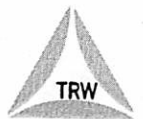
Tape Cartridge Recorder

SERVICE MANUAL



MODELS 601 and 603

Bell SOUND DIVISION
Thompson Ramo Wooldridge Inc.



6325 HUNTLEY ROAD

COLUMBUS 24, OHIO

WORLD RENOWNED FOR THE BEST IN SOUND

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GENERAL INFORMATION

The Bell Sound Models 601 and 603 are 4-track cartridge loaded tape recorders which can be operated at either 3 3/4 ips or 1 7/8 ips.

Model 601 records and plays back four monaural tracks. A record level indicator (1N3) is provided for adjusting the volume while a recording is being made. The internal speaker may be disconnected by means of a slide switch while recording, or it may be used as a monitor.

Model 603 is a completely self-contained stereo unit. It records and plays back two stereo tracks or four monaural tracks without requiring any additional equipment. Preamp output jacks are provided so this unit may be used to drive an external amplifier and speaker system. Dual concentric volume controls regulate each channel independently. Two level indicators (1N3) are provided. The left channel speaker is mounted in the recorder, and the right channel speaker is fastened in the case lid. A cable is pro-

vided to connect this speaker to the external speaker jack on the back of the recorder.

Use of a cartridge simplifies the handling of recording tape; when the cartridge is inserted into the recorder the tape is automatically threaded correctly. The cartridge can be opened easily if it is necessary to splice or edit the recording.

The same tape transport is used for Models 601 and 603. An auto stop switch turns off the power to the recorder at the end of the tape when operating in "Play" ("Record") mode. Power is restored when the Operating control is returned to "Stop" position. Since the ends of the tape are securely fastened to the reels in the cartridge, the tape stops automatically in either "Rewind" or "Forward" position when the end is reached. Clutches on the rewind and takeup shafts prevent excessive stretching of the tape. The lower element in the play/record head and in the erase head handles the Channel 1 (Left Channel) signal.

FUNCTION OF CONTROLS

Speed Control Lever

NOTE: This control should be used only when the unit is turned "on" and the motor is running.

When the speed control lever is depressed the drive belt (111) is pushed down onto the large diameter groove of the motor pulley, driving the tape at 3 3/4 ips. When the speed control lever is pulled, the drive belt is flipped onto the small diameter groove of the motor pulley, resulting in a tape speed of 1 7/8 ips.

On-Off Switch

Power to both the amplifier and the tape transport is controlled by the on-off switch. The tape transport motor runs when this switch is in "On" position unless the auto stop switch (44) has been tripped.

Operating Control

The operating control selects one of four modes of operation of the tape transport. "Rewind" and "Forward" positions move the tape at high speed; the muting switch is closed by this control during these operations. In "Stop" position, the idler (105) is removed from contact with the flywheel (90), and brakes are applied to both spindles (40) stopping all movement of the tape. In "Play" position the pinch roller (22) presses against the capstan (90), driving the tape at a uniform speed, and the pressure pad arm assembly (3) holds the tape against the heads (58 and 59). "Play" position is used for recording (when the Record button is depressed) and for tape playback.

Record Button

To make a recording the Record button (61) must be held down until the Operating control is turned to "Play" position. This locks the play-record switch in "Record" position. Returning the Operating control to

"Stop" position releases the Record button and allows the play-record switch to return to "Play" position.

Track Selector Switch (Model 601)

When four monaural tracks are recorded or played back, two tracks are recorded with the "A" side of the cartridge up, and two tracks are recorded with the "B" side of the cartridge up. The play/record head (59) has two elements, one working at the bottom edge of the tape, and one just above the center of the tape. When the track selector switch is in position "1" only the bottom element is used; when it is in position "2" the upper element is used.

The track selector switch also controls the erase head in a similar manner.

Track Selector Switch (Model 603)

The track selector switch serves a useful purpose during recording only. When it is desired to record on channel 1 (A or B side) this switch applies erase current to the channel 1 portion of the record head, and grounds the channel 2 record signal. In "Stereo" position, erase current is applied to both portions of the erase head. In "2" position erase current is applied to the channel 2 portion of the erase head, and the channel 1 record signal is grounded.

Volume Control

Volume is regulated during both record and playback operations by the volume control. A level indicator gives a visual signal to aid in adjusting the volume while recording.

Model 601 has a single volume control. Model 603 uses dual concentric volume controls with separate level indicators for each channel.

Speaker Switch

The speaker switch can be used to disable the speaker(s) in order to prevent feedback when recording.

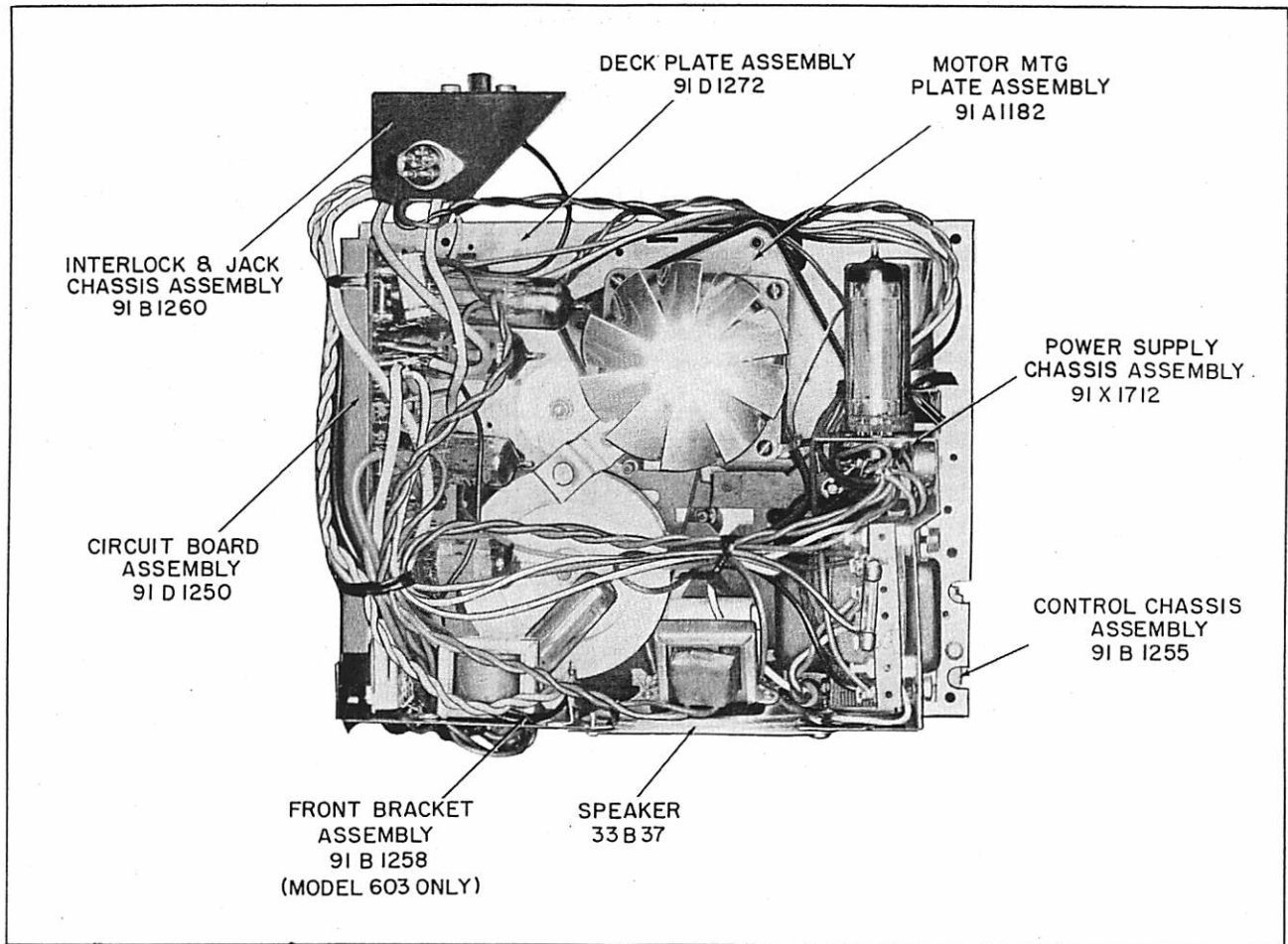


Figure 1. Location of Sub-Chassis

OPERATING INSTRUCTIONS

To Play a Monophonic Cartridge

1. Turn recorder "On". Be sure operating control is in "Stop" position, and speaker switch is "On". Push or pull speed control lever to obtain desired tape speed. Set track selector to channel "1" position.
2. Tighten tape in cartridge before placing it on the recorder by turning the left reel clockwise and the right reel counterclockwise.
3. Insert rear of tape cartridge ("A" side up) under cartridge retainer (39) on speed change shaft (37) and press down firmly. If tape is not visible on left hub in cartridge, turn operating control to "Rewind" until tape stops.
4. Turn Operating control to "Play" position and adjust volume control. (Model 603 only: outside volume knob controls channel 1, inside knob controls channel 2). Tape will stop automatically at the end of the cartridge. Before removing cartridge, however, turn operating control to "Stop" position.
5. To play the second monaural track, turn the cartridge over ("B" side up) and turn operating control to "Play".

6. To play the third monaural track, turn the cartridge over ("A" side up), set track selector to channel "2" position, and turn operating control to "Play".
7. To play the fourth monaural track, turn the cartridge over ("B" side up) and turn operating control to "Play". Normal playing sequence for 4-track monaural tape is cartridge side "A"-channel 1, B-1, A-2, and B-2.

NOTE: On Model 603 be sure the right channel speaker (in case lid) is connected. Channel 1 will be heard through the internal speaker, and channel 2 through the right channel speaker. Volume control for the undesired channel should be set to a minimum.

To Play a Stereophonic Cartridge (Model 603 only)

1. Turn recorder "On". Be sure operating control is in "Stop" position, and speaker switch is "On". Push or pull speed control lever to obtain desired tape speed. Set track selector to "Stereo" position.
2. Tighten tape in cartridge before placing it on the recorder by turning the left reel clockwise and the right reel counterclockwise.

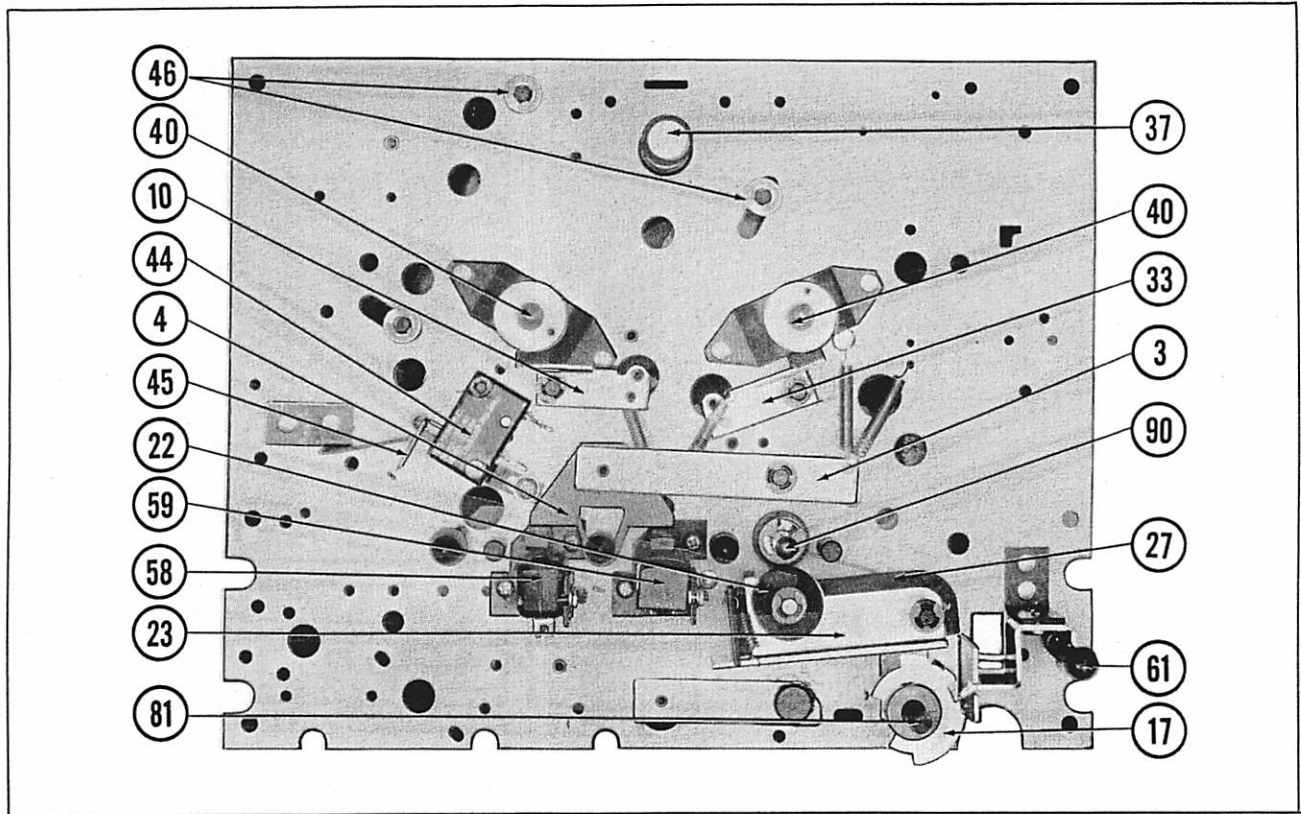


Figure 2. Top View of Tape Transport

OPERATING INSTRUCTIONS (CONT'D)

3. Insert rear of tape cartridge ("A" side up) under cartridge retainer (39) on speed change shaft (37), and press down firmly. If tape is not visible on left hub in cartridge, turn operating control to "Rewind" until tape stops.
4. Turn operating control to "Play" position and adjust volume control. Tape will stop automatically at the end of the cartridge. Before removing the cartridge, however, turn operating control to "Stop" position.
5. To play second stereo track, turn cartridge over ("B" side up) and turn operating control to "Play".
4. When end of tape is reached, recorder will stop automatically. Turn operating control to "Stop", and turn cartridge over.
5. Record channel 1 on "B" side of cartridge in the same manner as above.
6. When end of tape is reached, recorder will stop automatically. Turn operating control to "Stop", turn cartridge over ("A" side up), and set track selector switch to channel "2" position.
7. Record channel 2 on both A and B sides of cartridge.
8. You now have four monaural tracks recorded on the cartridge in normal sequence: cartridge side "A"-channel 1, B-1, A-2, B-2.

To Make a Monophonic Recording (Model 601)

1. Turn recorder "On". Be sure operating control is in "Stop" position. Push or pull speed control lever to obtain desired tape speed. Set track selector switch to channel "1". Connect microphone to Record Input jack.
2. Insert rear of cartridge ("A" side up) under cartridge retainer (39) on speed change shaft (37), and press down firmly. If tape is not visible on left hub in cartridge, turn operating control to "Rewind" until tape stops.
3. Hold record button down while turning operating control to "Play". Observe level indicator, and adjust volume control so that level indicator lights on loud passages.

To Make a Monophonic Recording (Model 603)

Procedure is the same as for Model 601 except for the following:

1. When recording channel 1, use a microphone plugged into Left Record Input, and regulate level with outside volume knob while watching left level indicator.
2. When recording channel 2, use a microphone plugged into Right Record Input, and regulate level with inside volume knob while watching right level indicator.

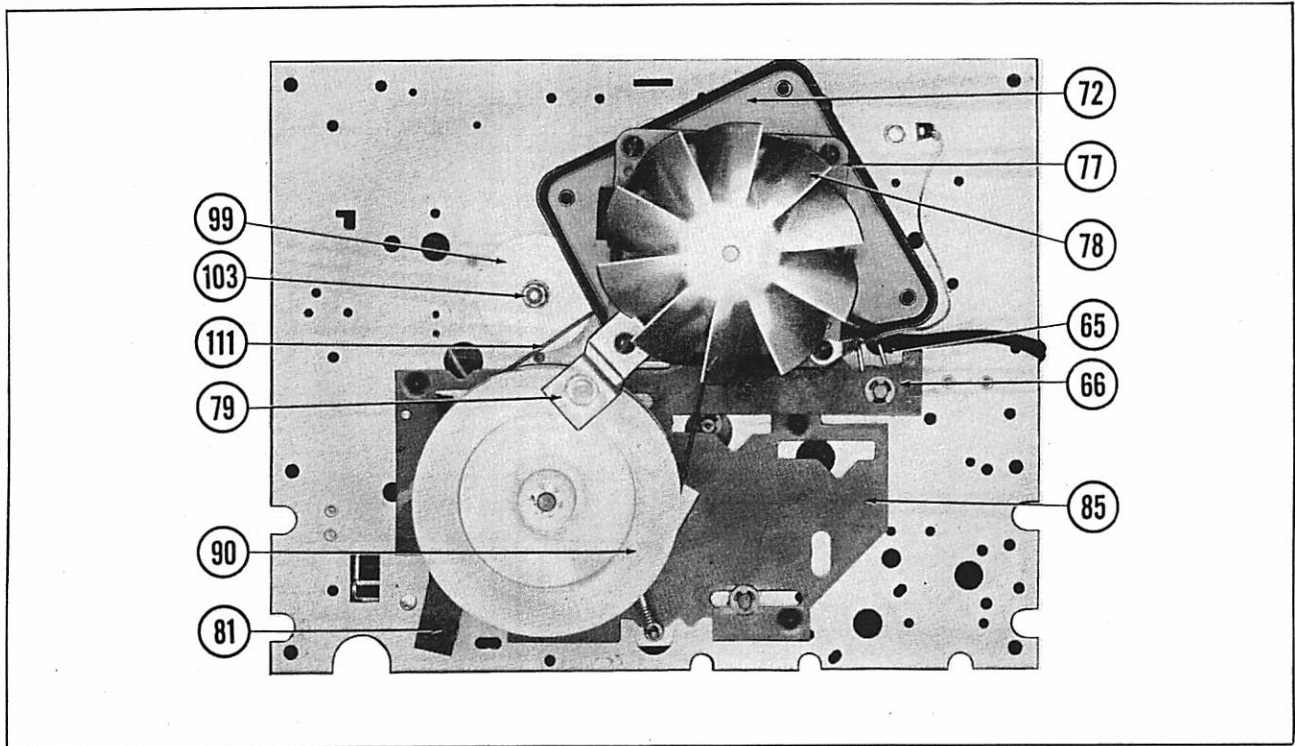


Figure 3. Bottom View of Tape Transport

To Make a Stereo Recording (Model 603 only)

1. Turn recorder "On". Be sure operating control is in "Stop" position. Push or pull speed control lever to obtain desired tape speed. Set track selector switch to "Stereo". Connect microphones to Record Input jacks.
2. Insert rear of cartridge ("A" side up) under cartridge retainer (39) on speed change shaft (37), and press down firmly. If tape is not visible on left hub in cartridge, turn operating control to "Rewind" until tape stops.
3. Hold record button down while turning operating control to "Play". Observe level indicators, and adjust volume controls so that level indicators light on loud passages. For best stereo effect, both volume controls should be set in about the same position.
4. When end of tape is reached, recorder will stop automatically. Turn operating control to "Stop", and turn cartridge over.
5. Make stereo recording on "B" side of cartridge in the same manner as above.
6. The cartridge is now completely recorded.

DISASSEMBLY INSTRUCTIONS

To Remove from Case

1. Remove 4 screws in rear name plate.
2. Remove volume and operating knobs. Take out four screws holding the top escutcheon, and lift off escutcheon.
3. Turn the unit upside-down on a soft pad. Take off bottom cover after removing 6 retaining screws. It may be necessary to gently pry off the corner where the power cord receptacle is located.
4. Lift off outside case with the unit still upside-down.

Replacement of Mechanical Parts

The motor assembly may be removed by taking off 3 retaining rings (46) and washers (47) for access to the tape drive mechanism. Most mechanical parts can be reached without further disassembly.

Before replacing motor assembly place drive belt (111) on flywheel (90) and motor pulley. Make sure speed changer lever is properly located in spring (74), and place spring (65) straddling the post on motor plate assembly (72).

Replacement of Electrical Parts

Not all electrical parts are mounted on the printed circuit board. Be sure of the location of any defective parts before disassembling the chassis, and then loosen only the sub-chassis involved.

If possible, replace components on the printed board by clipping the leads of the defective components and soldering the new parts to these leads on the top side of the board. **DO NOT REMOVE THE PRINTED BOARD FROM ITS SUB-CHASSIS UNLESS ABSOLUTELY NECESSARY**, since the tabs holding the printed board in place are very easily broken.

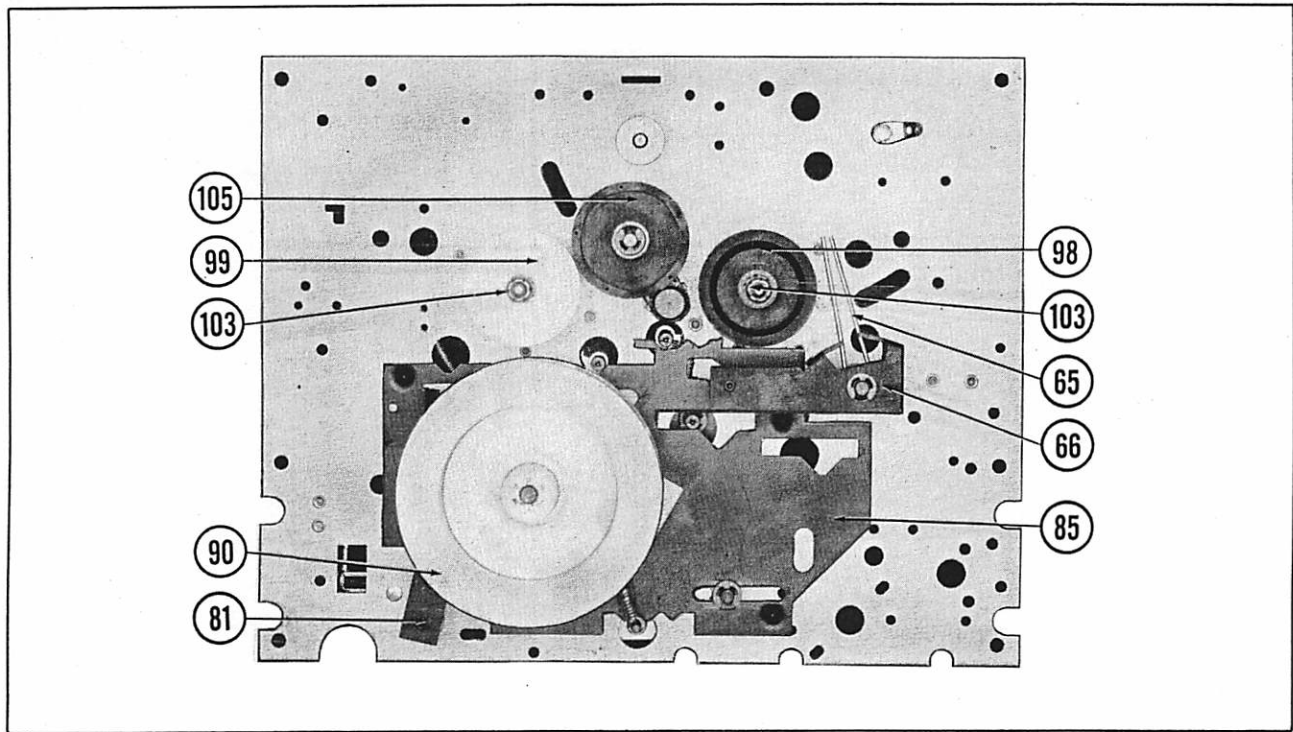


Figure 4. Bottom View of Tape Transport With Motor Removed

ADJUSTMENTS

Clutch Adjustment

Pressure on the clutch faces may be adjusted. Proceed as follows:

1. Measure the torque developed by the takeup pulley (operating in "Play" position) by attaching a spring scale to a lever arm fastened to the takeup turntable. The torque (in inch-ounces) is the scale reading in ounces multiplied by the distance (in inches) from the center of the hub to the point on the lever arm where the scale is attached. Torque may be read directly by using a torque screwdriver and an appropriate adapter.
2. Loosen or tighten hex nut (103) until a reading in Step 1 of 4 1/2 to 5 1/2 inch-ounces is obtained.
3. Apply a light coating of Pliobond cement to the threaded shaft (35), spring (102), lockwasher (101), and nut (103).
4. The rewind clutch may be adjusted for a torque of 5 1/2 to 7 1/2 inch-ounces (in "Rewind" position) in a similar manner. This adjustment is not critical and should not be attempted unless definite evidence of malfunction is present.

NOTE: Early production used a chrome-plated clutch disc (95) which has been superseded by a phenolic disc. If erratic operation of a clutch is encountered, both clutch disc (95) and takeup pulley (99) should be replaced. Impregnate the felt on the takeup pulley with Dow-Corning No. 3 compound.

Automatic Stop Switch

The position of the automatic stop switch may be adjusted by loosening screw (41). The switch is properly located when it is tripped by the tape at the end of the reel when operating in "Play" position, but is released when the operating control is turned to "Stop".

Cleaning

A coating of oxide may accumulate on the parts touched by the tape in normal operation - tape guides, play/record head (59), erase head (58), capstan (90), and pinch roller (22). This oxide should be removed occasionally by wiping the parts with a soft cloth moistened with alcohol or trichloroethylene. Do not allow the solvent to run down the capstan shaft into the bearings.

CAUTION: Keep metal objects away from the play/record head.

Drive surfaces (flywheel - 90, idler - 105, motor pulley - 77, idler pulley - 98, takeup pulley - 99) should be cleaned with a cloth moistened with alcohol to remove dirt and grease.

Lubrication

These instruments are lubricated at the factory and should not require further lubrication for a long time. If parts are replaced or there is evidence of binding, apply one drop of #10 motor oil to bearings, and apply visco grease, lubriplate, StaPut #2, or equivalent where metal slides on metal.

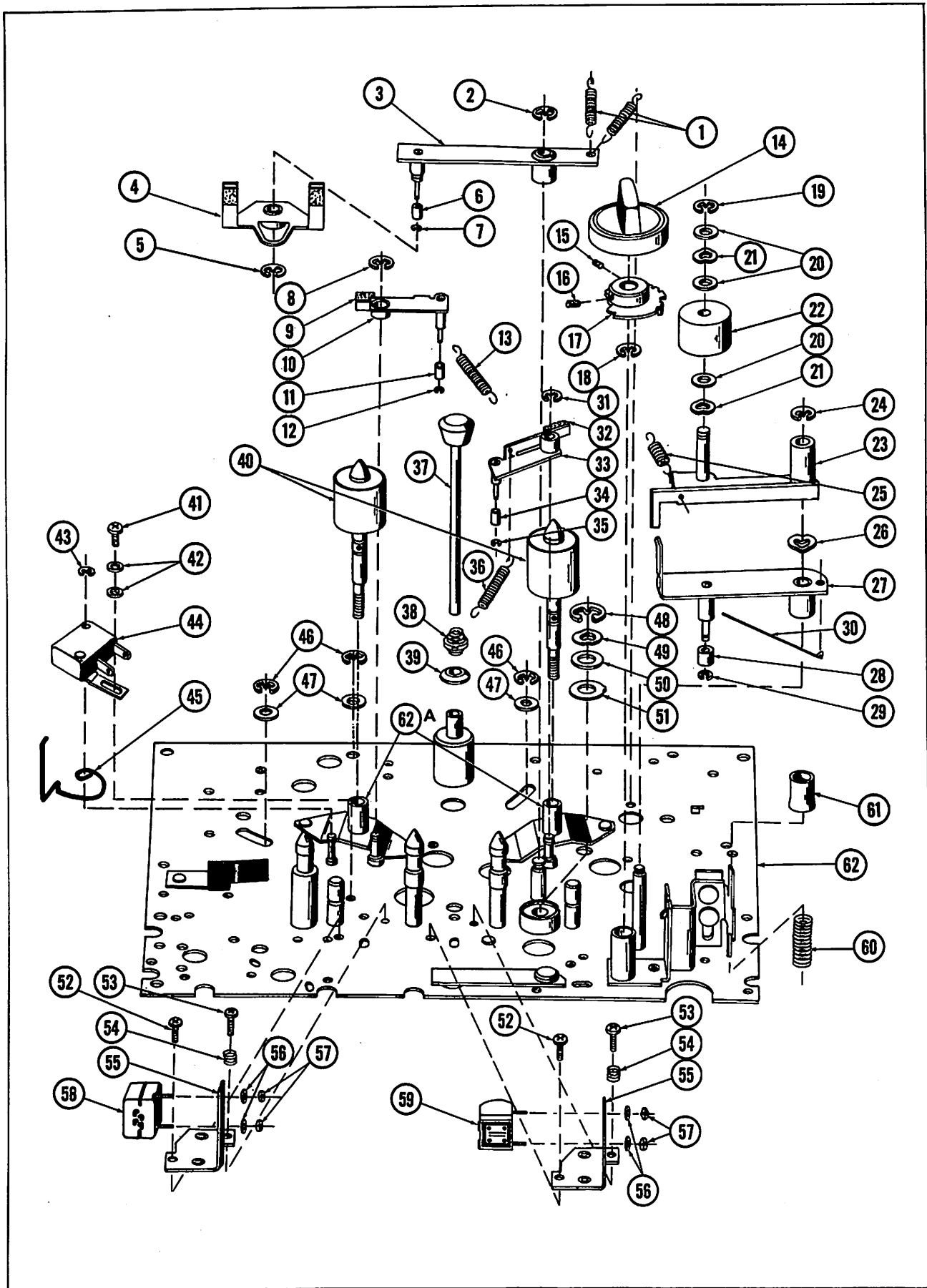


Figure 5. Exploded View of Tape Transport - Top

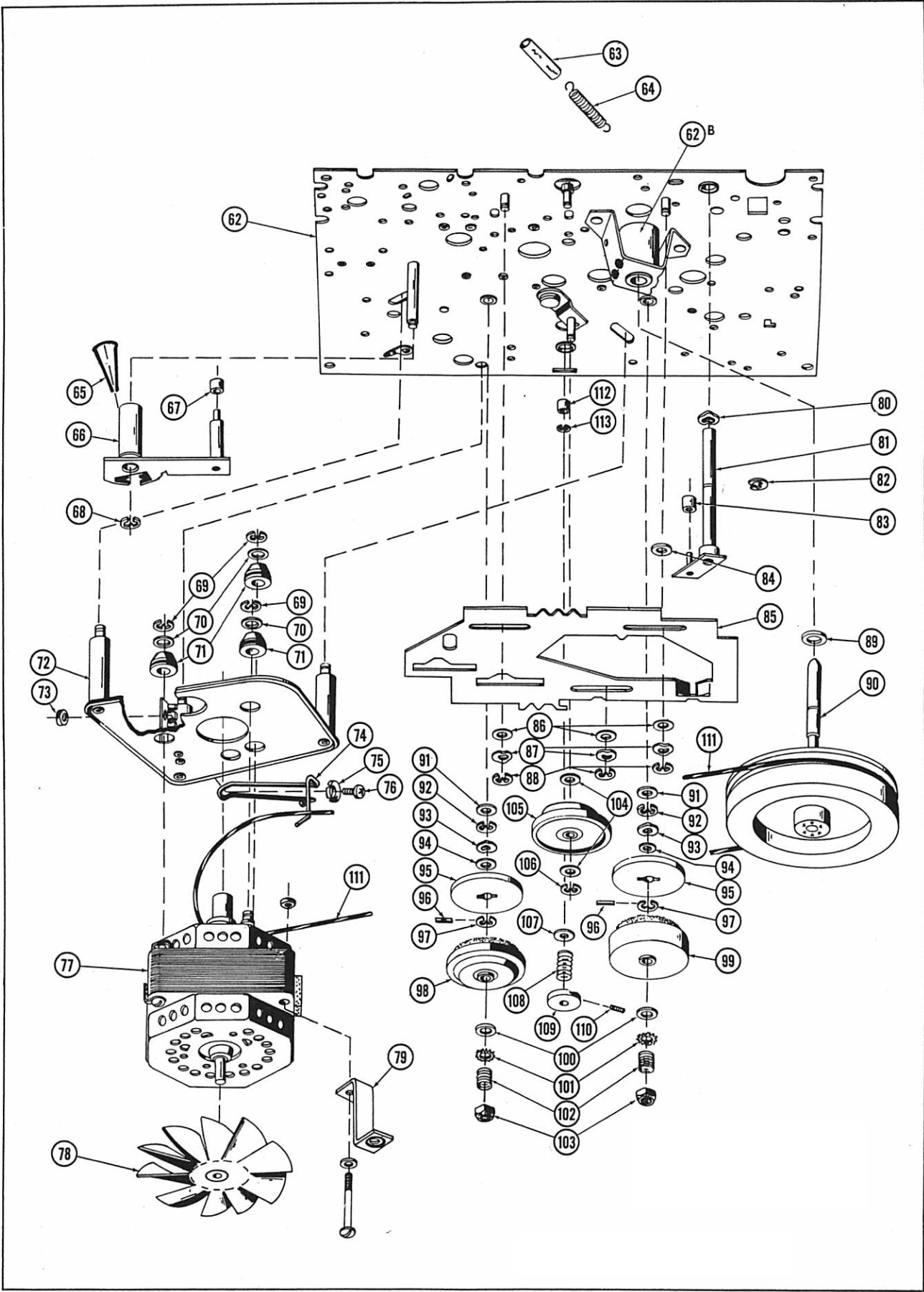


Figure 6. Exploded View of Tape Transport - Bottom

THE TAPE CARTRIDGE

Description

Tape cartridges eliminate the tedious and time-consuming task of threading reels of tape onto the recorder. A cartridge can be handled with less care than a phonograph record and it drops quickly into place on the tape deck. No empty reels are required; both supply and takeup hubs are contained in the cartridge.

Up to 600 feet of 1 mil x 1/2" magnetic-coated plastic tape is contained in a cartridge. The amount of tape on each hub at any time may be viewed through special windows in each side. Because of their small rectangular shape (7 1/4" x 5" x 1/2"), cartridges may be easily stored and filed on an average bookshelf.

A four-track monophonic cartridge will play up to two hours at 3 3/4 ips; a two-track stereo recording will play up to one hour. Twice as much playing or recording time is obtained at 1 7/8 ips.

Cartridge Assembly

The cartridge case, illustrated in Fig. 7, consists of two symmetrical sides labeled "A" and "B". The halves are held together by two screws which are easily removed to permit access to the tape. The tape is wound on two polystyrene hubs. Loops in the ends of the tape are hooked onto the hubs. Two thin transparent mylar spacers are inserted between the tape and the cartridge case in order to lower friction and reduce noise. A spring-loaded brake slide prevents tape from spilling by automatically pressing against both hubs when the cartridge is removed from the recorder.

Type Of Cartridges

Two types of cartridges are available. One type contains pre-recorded tape, and the other contains blank or unrecorded tape.

Blank or unrecorded tape is supplied in a cartridge with the record interlock actuating knockouts in place. As a safety feature tape recorders with a record interlock link will record and erase only when that link is actuated by the knockouts. If the knockouts are removed after recording, the recorder cannot erase the tape. Thus, to erase tape cartridges with the knockouts removed, cover the opening tightly with a piece of adhesive tape.

Pre-recorded tape is supplied in a cartridge with the knockouts removed. (See Figure 7). Thus the record interlock link cannot be actuated, and accidental erasure of pre-recorded tapes is prevented.

Cartridge Threading

A 3 1/2" loop in each end of the tape hooks over a post on each hub. The tape is wound onto the hub with the dull (oxide) side out. Passing the tape around the tape guides orients it properly in the cartridge. (See Figure 8).

Loops are made by folding back the tape, dull side out, and securing the end with a piece of splicing tape. Trim off excess even with edges of the recording tape.

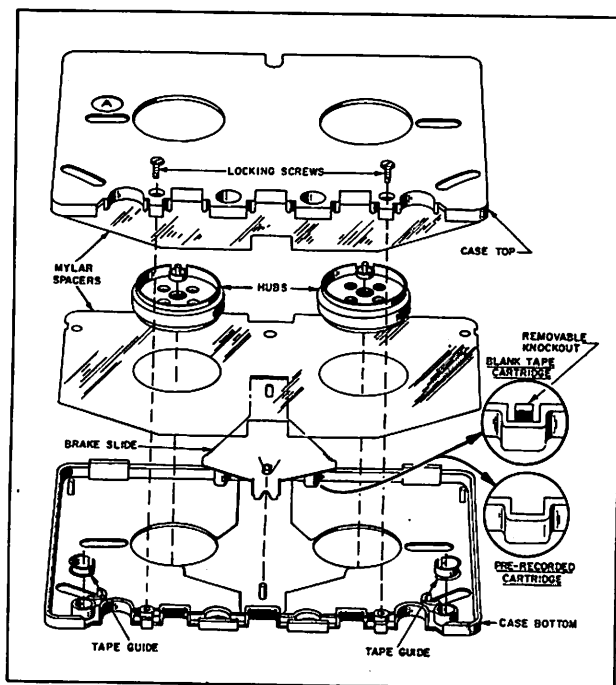


Figure 7. Exploded View of Cartridge

How To Splice Cartridge Tape

NOTE: Where more than one independent track is recorded on the width of the tape, it is not possible to cut a portion out of one track without disturbing the others. Recordings that will be edited should be recorded on one track (or two stereo tracks) only. Accidental breaks in pre-recorded tapes should be repaired if possible without eliminating any of the original tape.

Although cartridge tape is quite durable, it can be broken or torn. This is relatively simple to correct, and can often be done without opening the cartridge. When the cartridge remains assembled, push forward on the brake slide to release the hubs, and pull out as much tape as is necessary.

When repairing a broken tape that is not badly damaged, butt the broken ends together. Be sure the ends match and do not overlap. If the tape is badly damaged, overlap the ends and cut both pieces at once on an angle of about 60 degrees. Butt the ends together with the uncoated side up, and cover the joint with a small piece of splicing tape, pressing it securely into place. Trim off the splicing tape even with the edges of the recording tape. Do not cut into the recording tape.

CAUTION:

Do not use ordinary cellulose tape for splicing. It will bleed through causing layers of tape to stick together.

Automatic Shut-Off

Automatic shut-off at the end of the tape is provided in "PLAY" position.

The cartridge showing the tape in place is illustrated in Figure 8. The tape is attached to the hubs

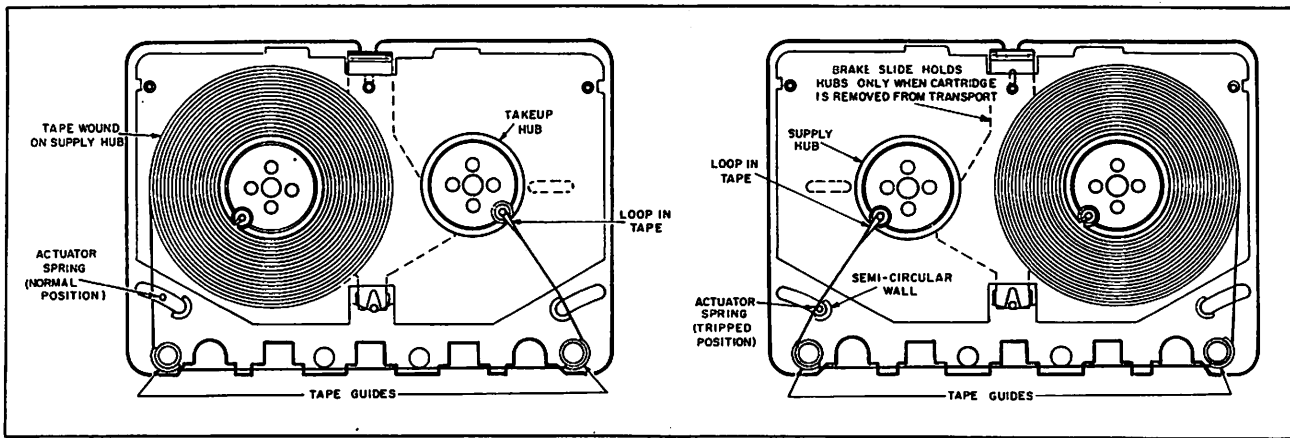


Figure 8. Position of Tape in Cartridge

in order to provide a simple tension tripping device. When the tape is completely transported from the supply hub of the cartridge, tape tension moves the actuator spring, tripping the auto stop switch. The semi-circular walls prevent the tape from going on the wrong side of the actuator spring when the cartridge is inserted in the receiver.

Track Placement

Four single tracks may be recorded on a standard 1/4" tape. Each track is .043" wide with .025" spacing between tracks. For convenience of identification, tracks A-1 and B-1 are adjacent to the edge of the tape. Track A-2 is adjacent to track B-1, while track B-2 is adjacent to track A-1, as shown in Figure 9. Position of the two elements in the play/record head is also shown.

The start of a selection is recorded with the "A" side of the cartridge facing up. To play a cartridge from start to finish (all four tracks) it is only necessary to remove the cartridge after each automatic

shut-off, set the track selector switch, and turn the operating control to "Play".

Monaural recordings are made by using a track sequence of A-1, B-1, A-2, B-2. It is necessary to set the track selector switch to "1" for tracks A-1 and B-1, and to "2" for tracks A-2 and B-2.

Stereo recordings are made by using track A-1 and A-2 simultaneously for the first part of the selection (side "A" up), and tracks B-1 and B-2 for the second part (side "B" up). Tracks A-1 and B-1 handle the left channel signal; tracks A-2 and B-2 handle the right channel signal.

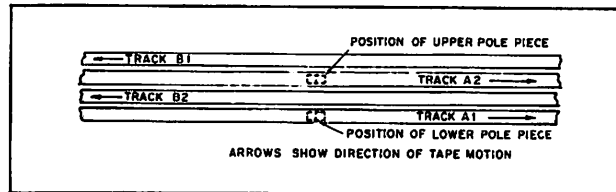


Figure 9. Location of Tracks on Tape

TROUBLE CHART

Symptom	Cause	Remedy
Motor does not run.	1. Fuse blown.	1. Replace fuse.
	2. Defective power switch.	2. Replace power switch.
	3. Auto stop switch (44) tripped.	3. See that actuator spring (45) is free.
Capstan does not turn.	1. Drive belt (111) broken, missing, or dirty.	1. Replace drive belt (111).
Tape does not move in "Play" position.	1. Grease on capstan (90) or pinch roller (22).	1. Clean capstan (90) and pinch roller (22).
	2. Pinch roller (22) binding.	2. Lubricate bearing.
	3. Defective tape cartridge.	3. Try another cartridge.
	4. Spring (25) broken or missing.	4. Replace spring (25).

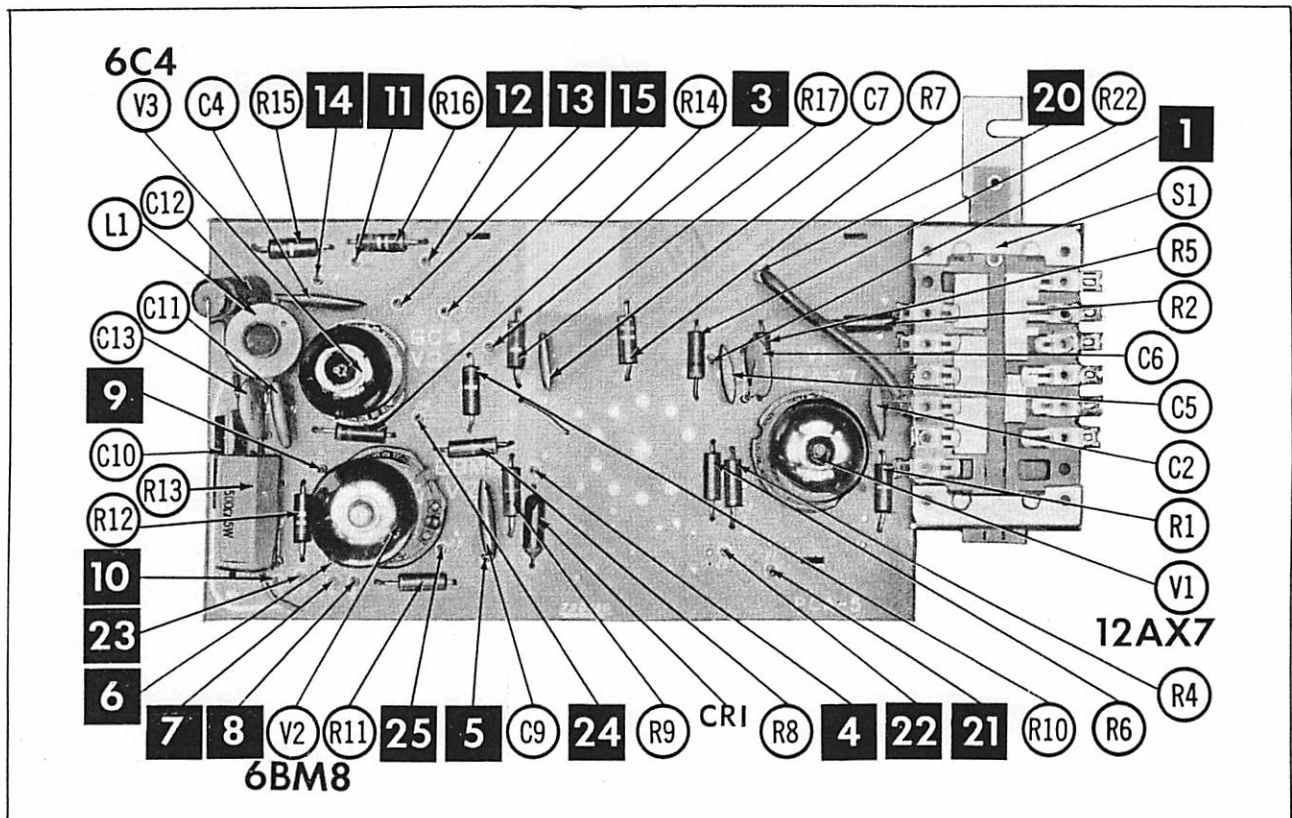


Figure 10. Component Location on Printed Circuit Board - Model 601

TROUBLE CHART (CONT'D)

Symptom	Cause	Remedy
Tape does not move in "Rewind" or "Forward" positions.	1. Grease or dirt on idler (105).	1. Clean or replace idler (105).
	2. Rewind clutch assembly defective or not properly adjusted.	2. Replace idler pulley (98) and clutch disc (95) if necessary. Adjust clutch.
	3. Take-up clutch assembly defective or not properly adjusted.	3. Replace takeup pulley (99) and clutch disc (95) if necessary. Adjust clutch.
Tape spills.	1. Worn brake pads (9 and 32).	1. Replace brake pads (9 and 32).
	2. Springs (13 and 36) weak or missing.	2. Replace springs (13 and 36).
Weak or no sound on playback.	1. Play/record head (59) dirty.	1. Clean head (59).
	2. Pressure pads worn.	2. Replace pad bracket (4).
	3. Spring (1) weak or missing.	3. Replace spring (1).
Record button is not locked down when Operating control is turned.	1. Hub assembly (17) loose and out of position.	1. Position hub assembly (17) properly, and tighten set screws (15 and 16).

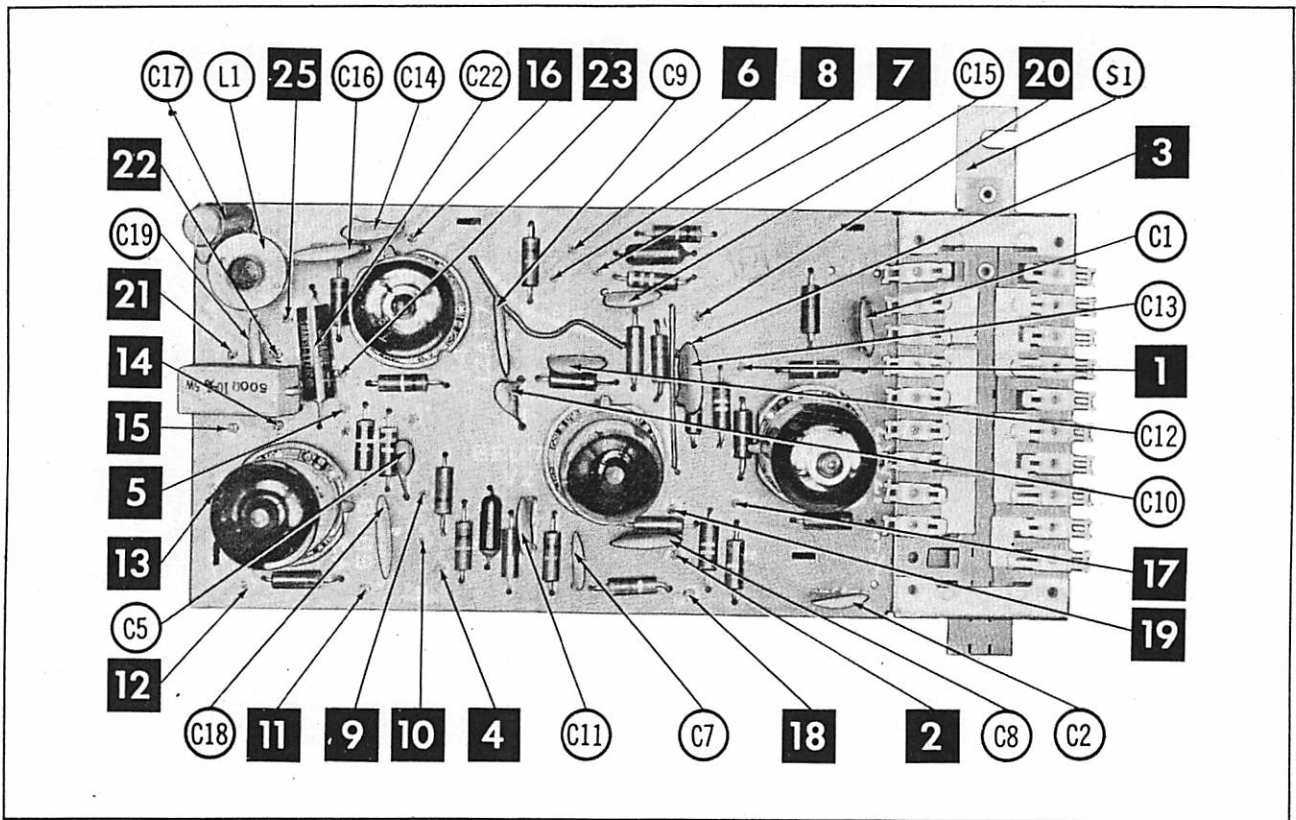


Figure 11. Component Location on Printed Circuit Board - Model 603

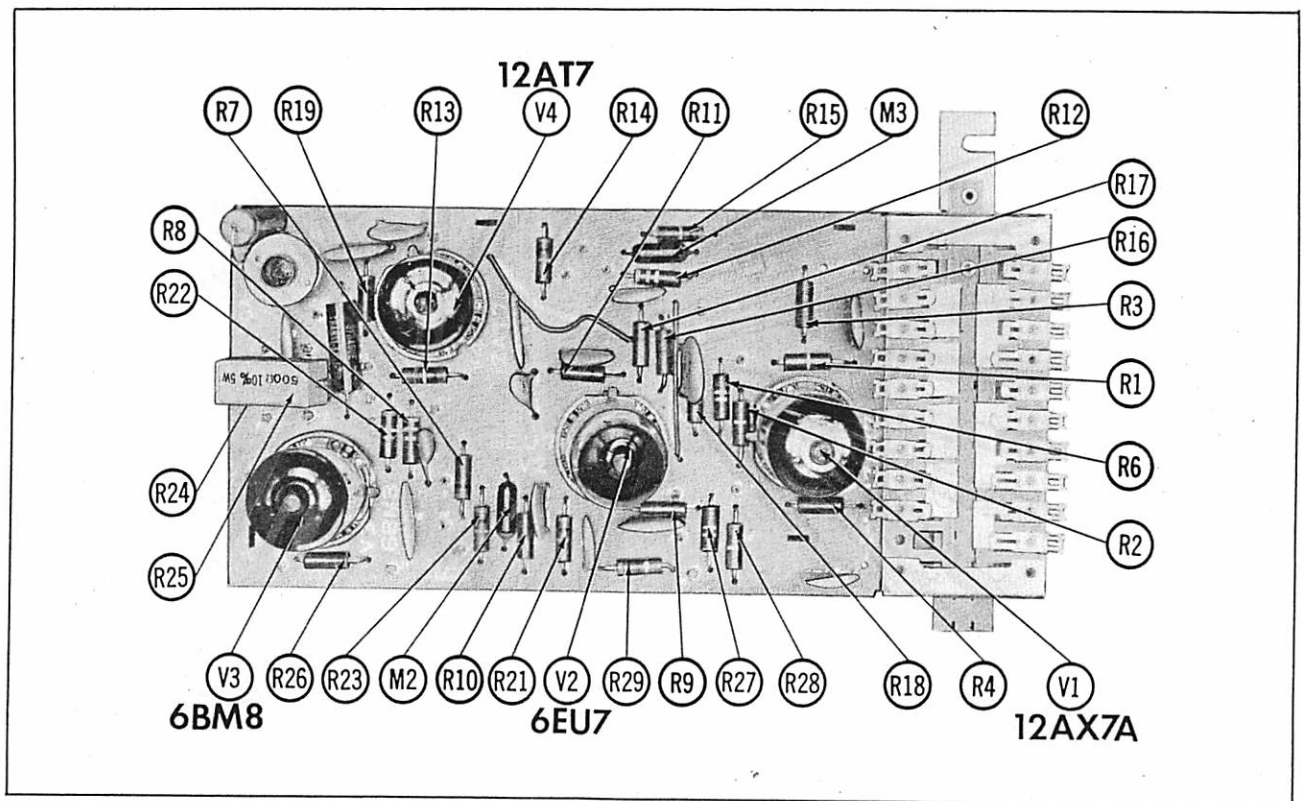


Figure 12. Component Location on Printed Circuit Board - Model 603

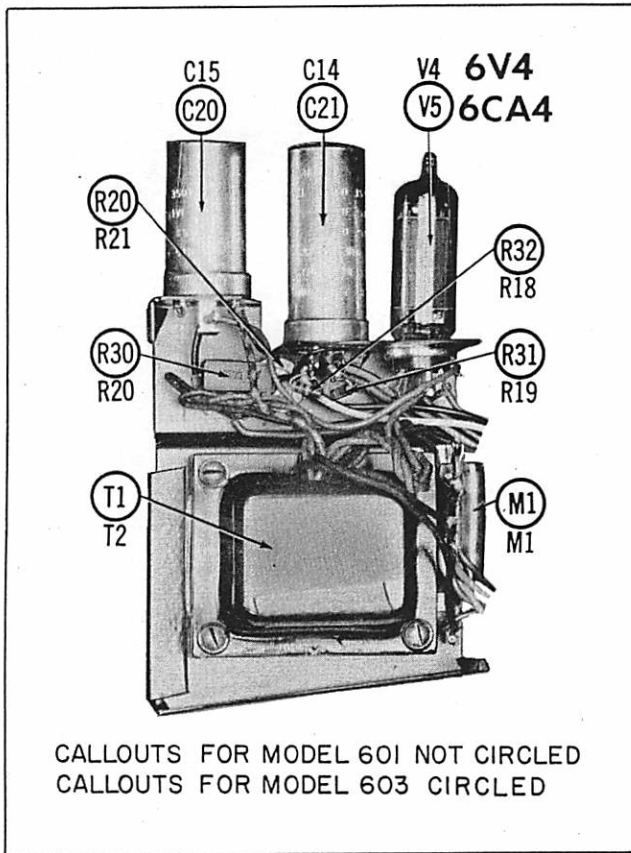


Figure 13. Component Location on Power Supply Chassis - Models 601 and 603.

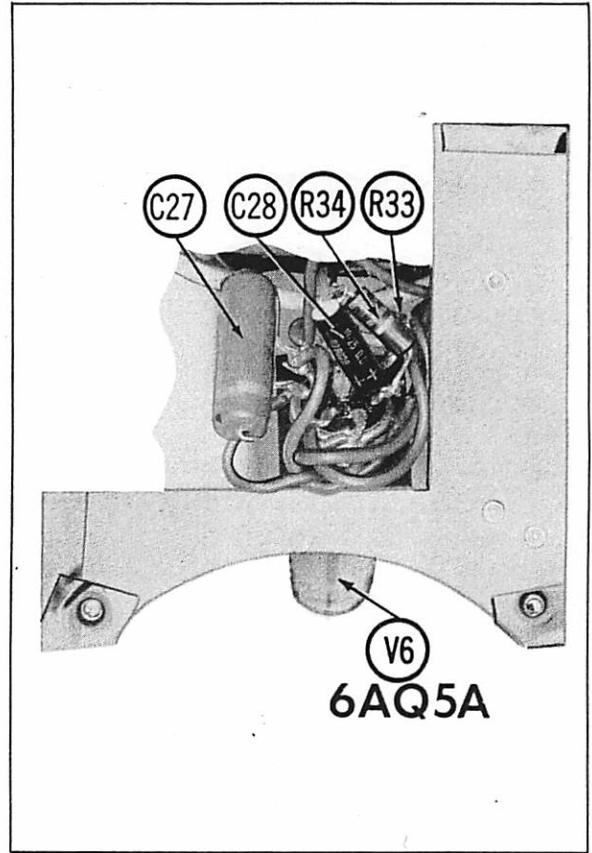


Figure 14. Component Location on Front Bracket Assembly - Model 603

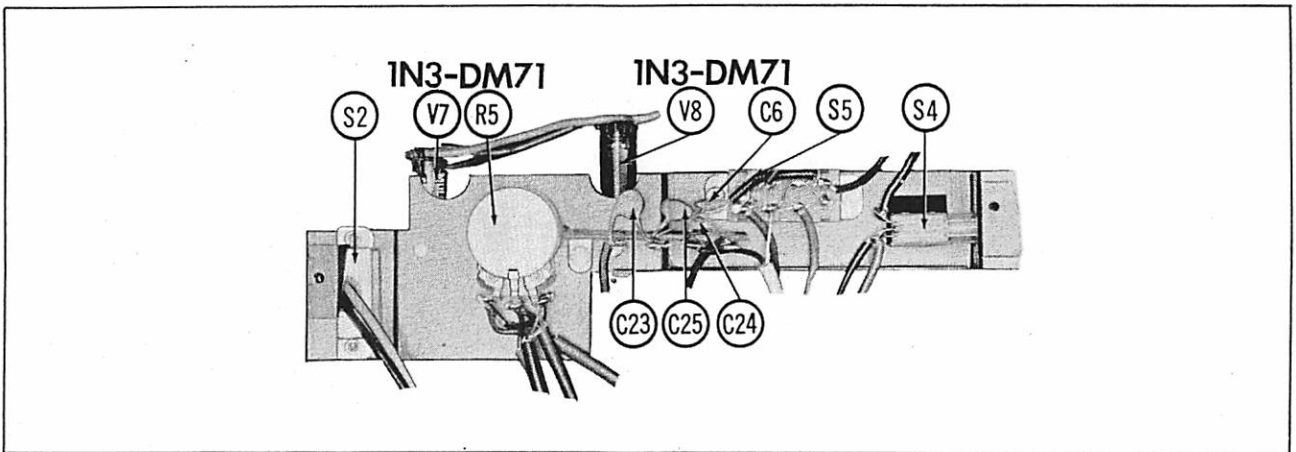
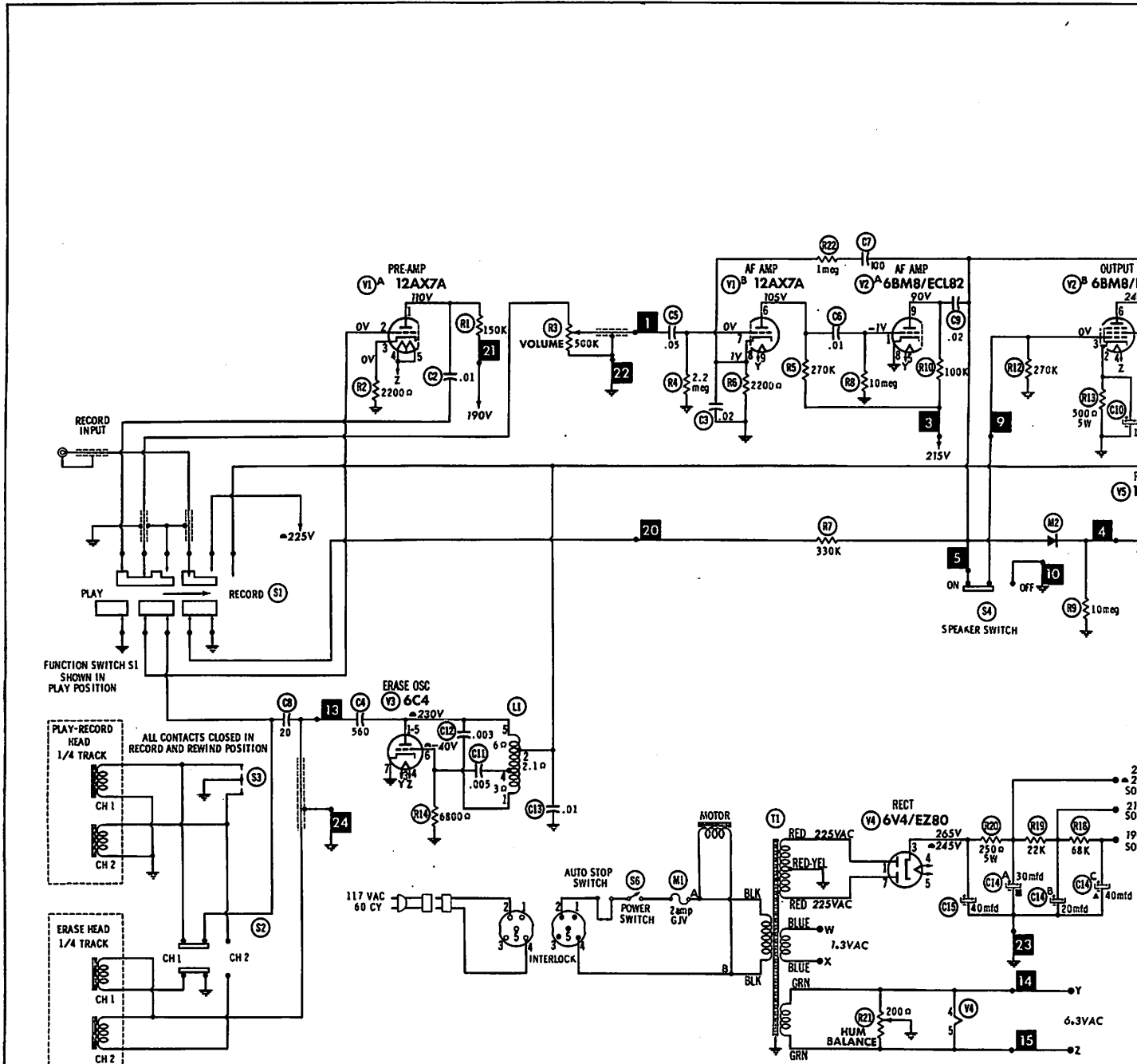


Figure 15. Component Location on Control Chassis - Model 603



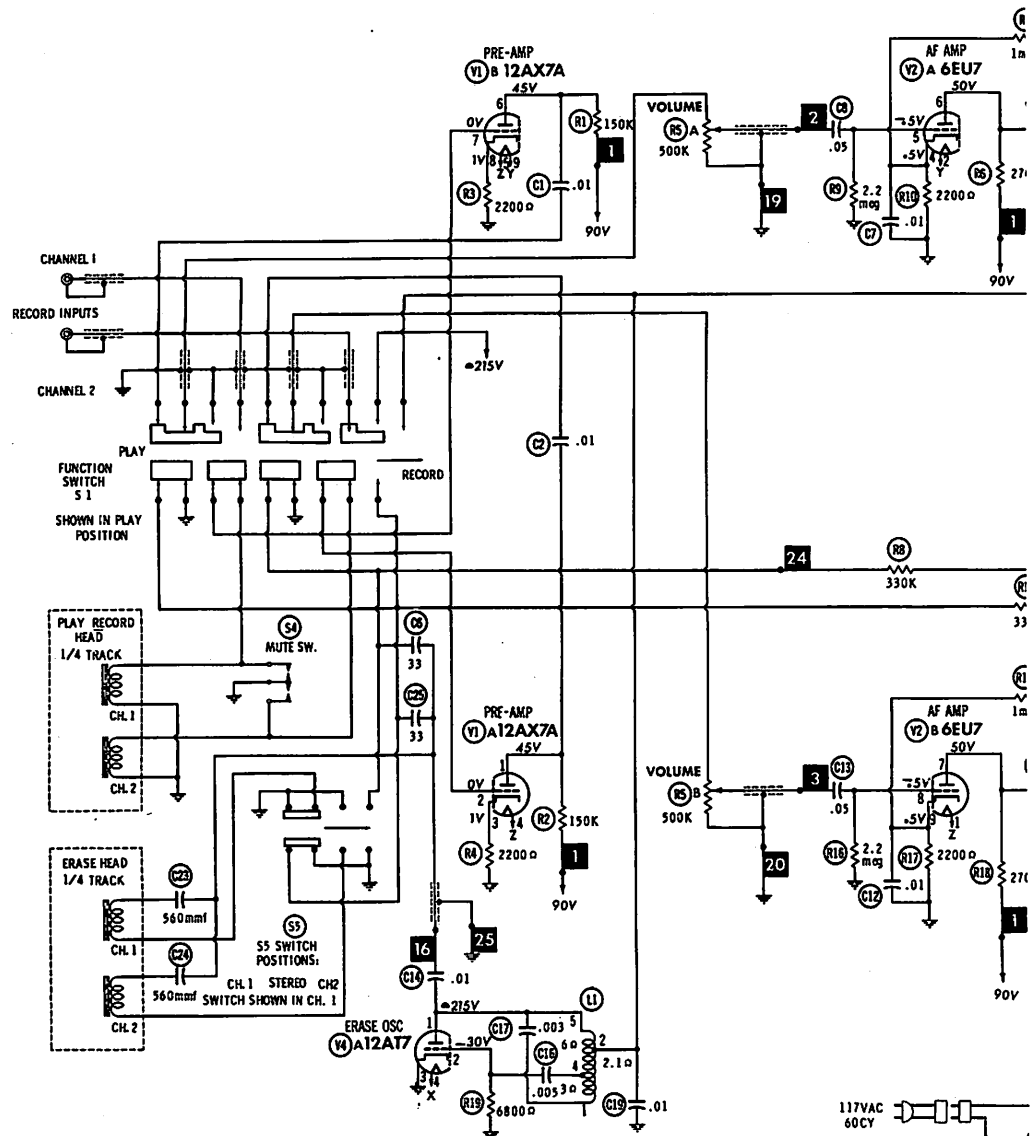
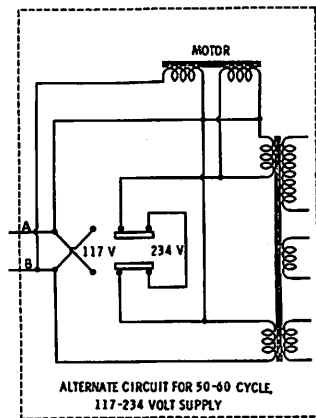
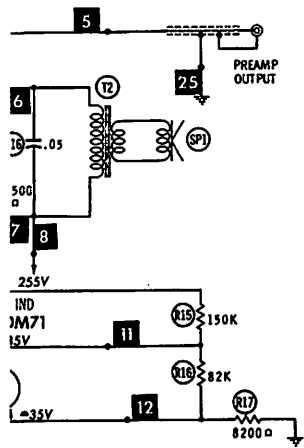
RESISTANCE READINGS - MODEL 601

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7A	1240K	620 Ω	2200 Ω	FIL	FIL	1290K	2.2meg	2200 Ω	FIL
V2	6BM8/ECL82	10meg	500 Ω	140K	FIL	FIL	1410 Ω	11800 Ω	0 Ω	1120K
V3	6C4	1-250 Ω	NC	FIL	FIL	1-250 Ω	6800 Ω	0 Ω		
V4	6V4/EZ80	140 Ω	IC	1	FIL	FIL	IC	150 Ω	IC	IC

All measurements made in "Play" position unless otherwise designated.
 † Measured from Pin 3 of V4.
 * Measured in Record Position.
 ‡ This reading will vary depending on the condition of the electrolytic in the circuit
 IC - Internal connection
 NC - No connection
 Capacitance values greater than 1 are in mfd, less than 1 in mfd, unless otherwise indicated

16 Indicates terminals on printed circuit board.

Figure 16. Schematic - Model 601



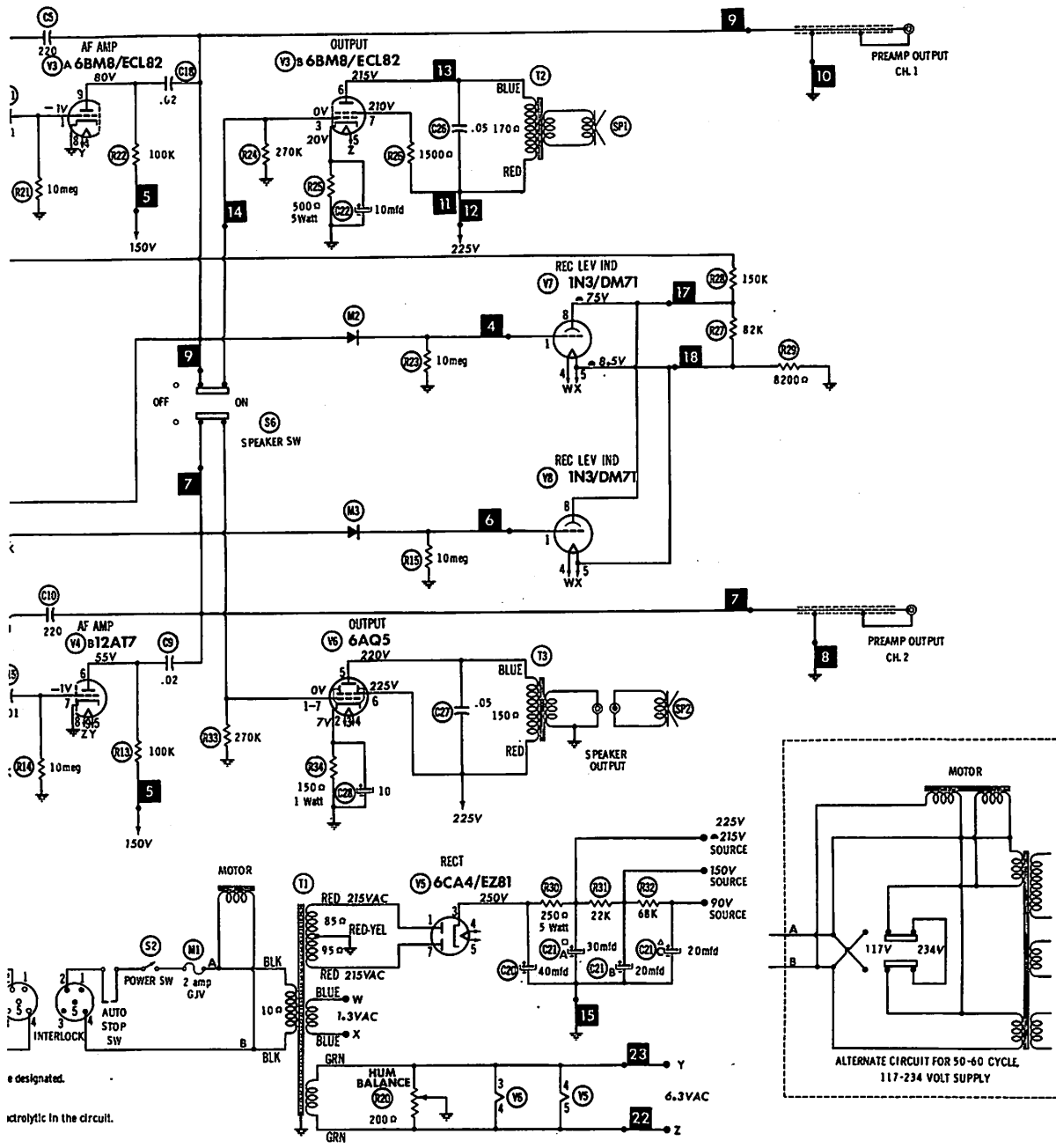
(S4) ALL CONTACTS CLOSED IN RECORD AND REWIND POSITION

RESISTANCE READINGS - MODEL 603

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	12AX7A	1240K	1000Ω	2200Ω	FIL	FIL	1240K	1000Ω	2200Ω	FIL
V2	6EU7	FIL	FIL	NC	2200Ω	2.2meg	1360K	1360K	2.2meg	2200Ω
V3	6BM8/ 6CL8Z	10meg	500Ω	270K	FIL	FIL	1400Ω	11700Ω	0Ω	1120K
V4	12AT7	1250Ω	9800Ω	0Ω	FIL	FIL	1120K	10meg	0Ω	FIL
V5	6CA4/ 6Z81	85Ω	IC	1	FIL	FIL	IC	95Ω	IC	IC
V6	6AQ5A	150K	150Ω	FIL	FIL	1380Ω	1250Ω	150K		

All measurements made in "Play" Position unless otherwise noted.
 † Measured from Pin 3 of V5
 ‡ Measured in Record Position
 † This reading will vary depending on the Condition of the tube
 NC No connection
 IC Internal connection
 Capacitance values greater than 1 are in mmf, less than 1 are in pf.
 19 indicates terminals on printed circuit board.

Figure 17



e designated.
 electrolytic in the circuit.
 in mfd unless otherwise indicated

Schematic - Model 603

ELECTRICAL PARTS LIST - MODEL 601

Ref. No.	Part No.	Description
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Capacitors

C2	24A179	.01 mfd, Ceramic
C3	24A147	.02 mfd, Ceramic
C4	24A176	560 mmfd, Ceramic
C5	24A173	.05 mfd, Ceramic
C6	24A179	.01 mfd, Ceramic
C7	24A177	100 mmfd, Ceramic
C8	24A89	20 mmfd, Ceramic
C9	24A147	.02 mfd, Ceramic
C10	23A121	10 mfd @ 25V, Electrolytic
C11	24A175	.005 mfd, Ceramic
C12	22A22	.003 mfd @ 400V, Paper
C13	24A179	.01 mfd, Ceramic
C14	23A122	40/30/20 mfd @ 350/250/250V, Electrolytic
C15	23A111	40 mfd @ 350V, Electrolytic
C16	28A19	.05 mfd @ 400V, Mylar

Coils

L1	31A62	Coil, Oscillator
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Controls & Resistors

R1	15A120	150K, 1/2 Watt, 20%, Carbon
R2		2200Ω, 1/2 Watt, 20%, Carbon
R3		500K, Variable, VOL. Control
R4		2.2 meg, 1/2 Watt, 20%, Carbon
R5		270K, 1/2 Watt, 10%, Carbon
R6		2200Ω, 1/2 Watt, 20%, Carbon
R7		330K, 1/2 Watt, 20%, Carbon
R8		10 meg, 1/2 Watt, 20%, Carbon
R9		10 meg, 1/2 Watt, 20%, Carbon
R10		100K, 1/2 Watt, 20%, Carbon
R11		1500Ω, 1/2 Watt, 20%, Carbon
R12		270K, 1/2 Watt, 10%, Carbon
R13	14A4	500Ω, 5 Watt, 10%, Wirewound
R14	14A5	6800Ω, 1/2 Watt, 20%, Carbon
R15		150K, 1/2 Watt, 20%, Carbon
R16		82K, 1/2 Watt, 10%, Carbon
R17		8200Ω, 1/2 Watt, 10%, Carbon
R18		68K, 1/2 Watt, 20%, Carbon
R19		22K, 1/2 Watt, 20%, Carbon
R20		250Ω, 5 Watt, 10%, Wirewound

Ref. No.	Part No.	Description
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Controls & Resistors (Cont'd)

R21	15A109	200Ω, Variable, Wirewound HUM Control
R22		1 meg, 1/2 Watt, 20%, Carbon

Speakers

SP1	33B37	4" PM, With Output Transformer
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Switches

S1	43B127	Switch, Slide, RECORD-PLAY
S2	43A130	Switch, Slide, 2 pole 2 position
S3	43A128	Switch, leaf, MUTING
S4	43A92	Switch, Slide, 1 pole 2 position, black
S6	43A131	Switch, slide, 1 pole 2 position, white

Transformers

T1	32P176	(Part of SP1 - Loudspeaker)
T2		Transformer, Power

Tubes

V1	97X29	12AX7A, Preamp & AF Amp. 6BM8/ECL82, AF Amp & Output 6C4, Bias Oscillator 6V4/EZ80, Rectifier 1N3/DM71, Indicator
V2	97X30	
V3	97X31	
V4	97X28	
V5		

Miscellaneous

M1	53A18	Fuse, Pigtail, 2 Amp, GJV Rectifier, Silicon Socket, Phono, Dual, RECORD INPUT & PREAMP OUTPUT Socket, 5 Pin, Interlock Socket, Line Cord Plug, 5 Pin, Interlock
M2	42A6	
	54A18	
	54A99	
	55A4	
	55A19	

ELECTRICAL PARTS LIST - MODEL 603

Ref. No.	Part No.	Description
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Capacitors

C1	24A174	.01 mfd, Ceramic
C2	24A174	.01 mfd, Ceramic
C5	24B23	220 mmf, Ceramic
C6	24B26	33 mmf, Ceramic
C7	24A174	.01 mfd, Ceramic
C8	24A173	.05 mfd, Ceramic
C9	24A147	.02 mfd, Ceramic
C10	24B23	220 mmf, Ceramic
C11	24A174	.01 mfd, Ceramic
C12	24A174	.01 mfd, Ceramic
C13	24A173	.05 mfd, Ceramic
C14	24A174	.01 mfd, Ceramic

Ref. No.	Part No.	Description
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Capacitors (Cont'd)

C15	24A174	.01 mfd, Ceramic
C16	24A175	.005 mfd, Ceramic
C17	22A22	.003 mfd @ 400V, Paper
C18	24A147	.02 mfd, Ceramic
C19	24A174	.01 mfd, Ceramic
C20	23A111	40 mfd @ 350V, Electrolytic
C21	23A122	40/30/20 mfd @ 350/250/250V, Electrolytic
C22	23A121	10 mfd @ 25V, Electrolytic
C23	24A109	560 mmf, Ceramic
C24	24A109	560 mmf, Ceramic
C25	24B26	33 mmf, Ceramic

ELECTRICAL PARTS LIST - MODEL 603 (CONT'D)

Ref. No.	Part No.	Description
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Capacitors (Cont'd)

C26	28A19	.05 mfd @ 400V, Mylar
C27	28A19	.05 mfd @ 400V, Mylar
C28	23A121	10 mfd @ 25V, Electrolytic

Coils

L1	31A62	Coil, Oscillator
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Controls & Resistors

R1	15A119	150K, 1/2 Watt, 20%, Carbon
R2		150K, 1/2 Watt, 20%, Carbon
R3		2200Ω, 1/2 Watt, 20%, Carbon
R4		2200Ω, 1/2 Watt, 20%, Carbon
R5		Dual Concentric, 500K Each Section, VOLUME control
R6		270K, 1/2 Watt, 10%, Carbon
R7		1 meg, 1/2 Watt, 20%, Carbon
R8		330K, 1/2 Watt, 20%, Carbon
R9		2.2 meg, 1/2 Watt, 20%, Carbon
R10		2200Ω, 1/2 Watt, 20%, Carbon
R11	1 meg, 1/2 Watt, 20%, Carbon	
R12	330K, 1/2 Watt, 20%, Carbon	
R13	100K, 1/2 Watt, 20%, Carbon	
R14	10 meg, 1/2 Watt, 20%, Carbon	
R15	10 meg, 1/2 Watt, 20%, Carbon	
R16	2.2 meg, 1/2 Watt, 20%, Carbon	
R17	2200Ω, 1/2 Watt, 20%, Carbon	
R18	270K, 1/2 Watt, 10%, Carbon	
R19	6800Ω, 1/2 Watt, 20%, Carbon	
R20	15A109	200Ω, Variable, Wirewound, HUM Control
R21		10 meg, 1/2 Watt, 20%, Carbon
R22		100K, 1/2 Watt, 20%, Carbon
R23		10 meg, 1/2 Watt, 20%, Carbon
R24	14A4	270K, 1/2 Watt, 10%, Carbon
R25		500Ω, 5 Watt, 10%, Wirewound
R26		1500Ω, 1/2 Watt, 20%, Carbon
R27		82K, 1/2 Watt, 10%, Carbon
R28		150K, 1/2 Watt, 20%, Carbon
R29	14A5	8200Ω, 1/2 Watt, 10%, Carbon
R30		250Ω, 5 Watt, 10%, Wirewound
R31		22K, 1/2 Watt, 20%, Carbon
R32		68K, 1/2 Watt, 20%, Carbon
R33		270K, 1/2 Watt, 10%, Carbon
R34		150Ω, 1 Watt, 10%, Carbon

Ref. No.	Part No.	Description
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Speakers

SP1	33B37	4" PM, With Output Transformer
SP2	33B38	4" PM, For Case Lid

Switches

S1	43B126	Switch, Slide, RECORD/ PLAY
S2	43A131	Switch, Slide, 1 pole 2 position, white
S4	43A128	Switch, Leaf, MUTING
S5	43A132	Switch, Slide, 2 pole 3 position, white
S6	43A45	Switch, 2 pole 2 position black

Transformers

T1	32B177	Transformer, Power (Part of SP1 - Loudspeaker)
T2	32A178	Transformer, output, right channel
T3		

Tubes

V1	97X29	12AX7A, Preamp
V2		6EU7, AF Amp
V3	97X30	6BM8/ECL82, L. Chan. Output
V4	97X32	12AT7, Osc, AF Amp
V5	97X34	6CA4/EZ81, Rectifier
V6	97X33	6AQ5A, R. Chan. Output
V7		1N3/DM71, Indicator
V8		1N3/DM71, Indicator

Miscellaneous

M1	53A18	Fuse, Pigtail, 2 Amp GJV
M2	42A6	Rectifier, Silicon
M3	42A6	Rectifier, Silicon
	54A18	Socket, Phono, Dual, RECORD INPUT
	54A67	Socket, Phono, Triple, PRE- AMP OUTPUTS and EXT. SPKR.
	54A99	Socket, 5 Pin, Interlock
	55A4	Socket, Line Cord
	55A19	Plug, 5 Pin, Interlock

MECHANICAL PARTS LIST

Ref. No.	Part No.	Description
1	77A58 91A1015	Spring (2 req'd) Pressure Pad Arm and Pad Bracket Assembly
2	67A20	Retaining Ring
3	*	Arm Pivot Shaft Assembly
4	91A1013	Bracket Assembly
4A	83A95	Sponge Pad
4B	86A92	Pressure Pad
5	67A20	Retaining Ring

Ref. No.	Part No.	Description
6	75A117	Roller
7	67A18	Retaining Ring
8	67A20	Retaining Ring
	91A1011	Left Brake Lever Ass'y
9	86A77	Cork Pad
10	*	Lever Ass'y
11	75A117	Roller
12	67A18	Retaining Ring
13	77A58	Spring

* If replacement is necessary, order complete ass'y.

MECHANICAL PARTS LIST (CONT'D)

Ref. No.	Part No.	Description
14	84A80	Knob, Control (Transport)
15	61X30	8-32 x 1/4" Allen Head Cup Point Set Screw
16	61X31	8-32 x 3/16" Allen Head Cup Point Set Screw
17	91A1306	Hub Assembly
18	67A21	Retaining Ring
	<u>91A423</u>	<u>Pinch Roller and Lever Ass'y</u>
19	67A20	Retaining Ring
20	63A42	Washer, Fish Paper (3 req'd)
21	63A44	"U"-Washer (2 req'd)
22	83A71	Pinch Roller
23	91A424	Pinch Roller Lever Ass'y
24	67A20	Retaining Ring
25	77A67	Spring, Pinch Roller
26	63A58	Washer, Tension
	<u>91A421</u>	<u>Actuator Lever and Bushing Assembly</u>
27	*	Actuator Lever Ass'y
28	75A116	Roller
29	67A19	Retaining Ring
30	77A57	Spring, Pinch Roller Return
31	67A20	Retaining Ring
	<u>91B1012</u>	<u>Right Brake Lever Ass'y</u>
32	86A77	Cork Pad
33	*	Lever Ass'y
34	75A117	Roller
35	67A18	Retaining Ring
36	77A58	Spring
37	91A1248	Speed Change Shaft and Knob Assembly
38	77A88	Speed Change Spring
39	75A167	Cartridge Retainer
40	91A425	Reel Hub and Shaft Ass'y (2 req'd)
41	61X13	6-32 x 1/4" Phillips Binder Head Metal Screw
42	63A17	Flat Washer (2 req'd)
43	67A19	Retaining Ring
44	91A1153	Auto Stop Switch and Bracket Ass'y
45	77A83	Actuator Spring
46	67A20	Retaining Ring (3 req'd)
47	63A57	Flat Washer (3 req'd)
48	67A21	Retaining Ring
49	63A81	Shakeproof Tension Washer
50	63A29	Spring Steel Washer
51	83A61	Thrust Bearing (Teflon)
52	61X15	4-40 x 1/4" Phillips Binder Head Metal Screw (2 req'd)
53	61X14	4-40 x 3/8" Phillips Binder Head Metal Screw (2 req'd)
54	77A64	Head Mount Spring (2 req'd)
55	72B412	Head Bracket (2 req'd)
56	63A6	Flat Washer (4 req'd)
57	62X12	2-56 Hex Nut (4 req'd)
58	36B32	Erase Head
59	36B12	Play/Record Head
60	77A94	Record Lock Spring
61	84A83	Record Knob

Ref. No.	Part No.	Description
62	91D1272	Deck Plate Assembly
62A	74A17	Reel Bearing (2 req'd)
62B	74A15	Capstan Bearing
63	51A211	Sleeving
64	77A60	Index Spring
	<u>91B1014</u>	<u>Motor Shaft Lever Ass'y</u>
65	77A42	Spring, Actuator
66	*	Motor Shaft Lever
67	75A116	Roller
68	67A20	Retaining Ring
	<u>91B1181</u>	<u>Mounting Plate & Motor Ass'y</u>
69	67A20	Retaining Ring (3 req'd)
70	63A57	Washer, Flat (3 req'd)
71	83A56	Vibration Isolator (3 req'd)
72	91A1182	Motor Mounting Plate Ass'y
73	62X14	6-32 Hex Nut
74	77A79	Shift Wire
75	63A87	Cup Washer
76	61X29	6-32 x 5/16" Phillips Binder Head Metal Screw
77	35B15	Motor
78	66A67	Fan
79	72A687	"Z" Bracket
80	63A58	Tension Washer
81	91A1016	Control Lever Ass'y
82	67A21	Retaining Ring
83	75A116	Roller
84	75A165	Slide Spacer
85	72C587	Actuator Slide
86	63A47	Washer (3 req'd)
87	63A59	Tension Washer (3 req'd)
88	67A20	Retaining Ring (3 req'd)
89	63A43	Washer
90	91A417	Flywheel and Capstan Ass'y
91	63A42	Washer, Fishpaper (2 req'd)
92	67A20	Retaining Ring (2 req'd)
93	63A47	Washer (2 req'd)
94	63A44	"U" Washer (2 req'd)
95	86A113	Clutch Disc (2 req'd)
96	67A23	Roll Pin (2 req'd)
97	67A20	Retaining Ring (2 req'd)
98	91A428	Idler Pulley Assembly
99	91A427	Take-up Pulley Assembly
100	63A46	Washer (2 req'd)
101		Lockwasher (2 req'd)
102	77A56	Clutch Spring (2 req'd)
103	62X13	8-32 Hex Nut (2 req'd)
104	63A42	Washer (2 req'd)
105	83B60	Idler
106	67A20	Retaining Ring
107	63A57	Washer, Flat
108	77A80	Compression Spring
109	75A159	Speed Shift Collet
110	61X24	4-40 x 3/16" Set Screw
111	<u>83A74</u>	<u>Drive Belt ("O" Ring)</u>
112	75A116	Roller
113	67A19	Retaining Ring
	84A80	Knob, Vol. (Model 601)
	84A81	Knob, Vol., (Model 603)
	84A82	Knob, Vol., Inner (Model 603)
		#4 Fiberglass Sleeving, 1/4" long, Fuse
		Vinyl Sleeving, 1/4" x 1", Auto, Stop Switch.

* If replacement is necessary, order complete ass'y.