



# PHOTOFACT<sup>®</sup> with

# CIRCUITRACE<sup>®</sup>

For Supplier Address See PHOTOFACT Index

Bell & Howell Models 2291, 2293, 2295, 2295S, 2297, 2297S

## CLEANING

## LUBRICATING

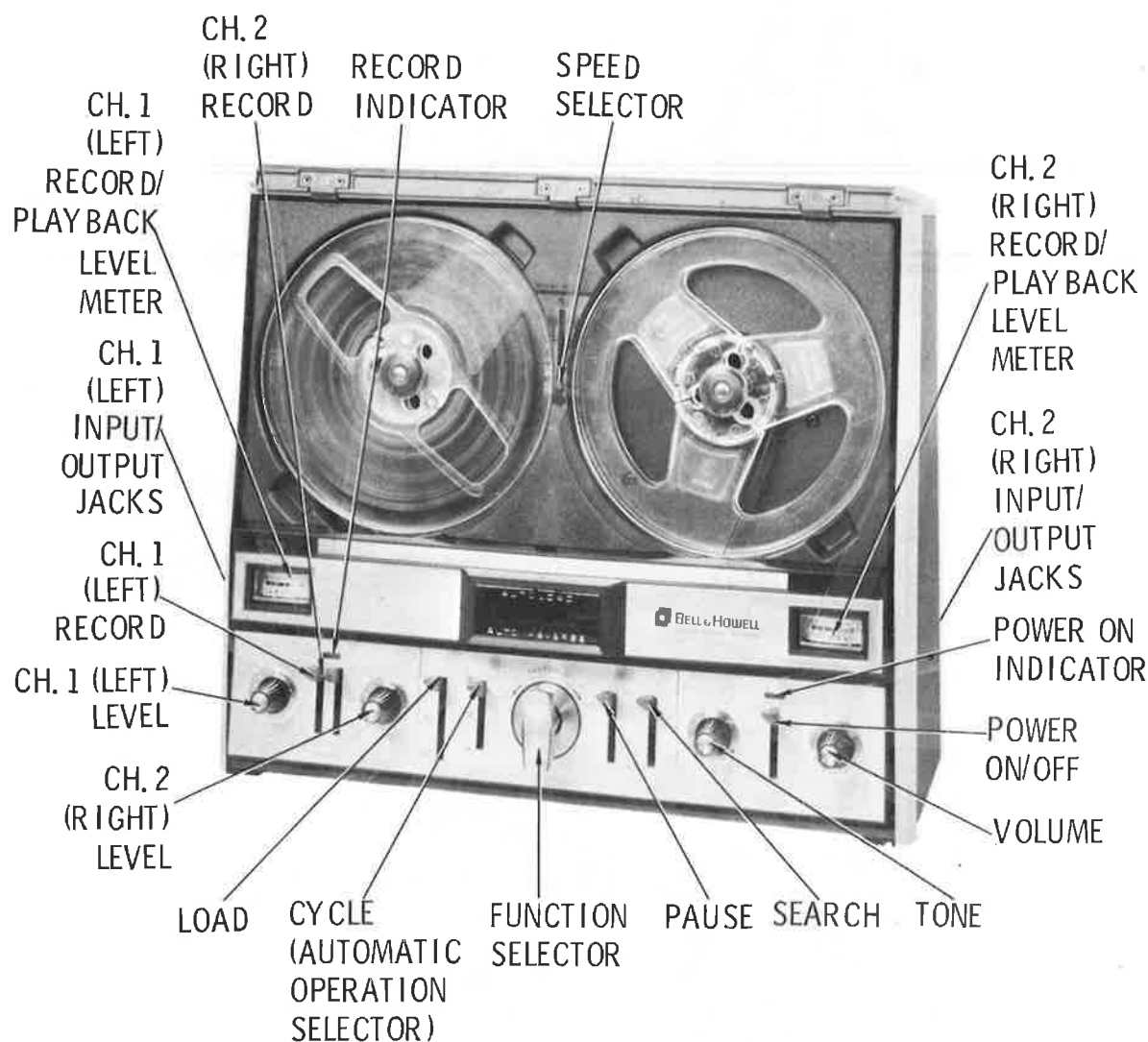
## HEAD DEMAGNETIZING

Refer to "General Servicing Information" on page 4.

These units are four-track monaural/stereo recorders having four speeds: 15/16, 1-7/8, 3-3/4, and 7-1/2 ips. Models 2291 and 2293 require an external amplifier/speaker system for playback. Automatic reversing is provided.

Jacks are provided for both low- and high-level inputs, preamp outputs, and external speakers.

A power source of 110-120 volts AC, 60 cycles is required.



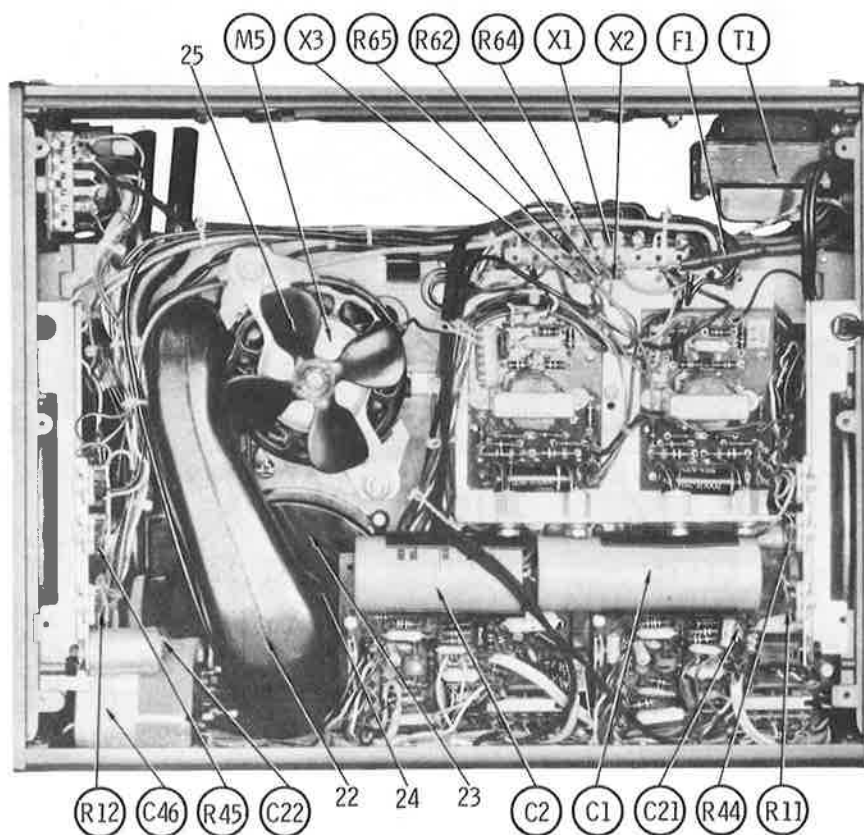
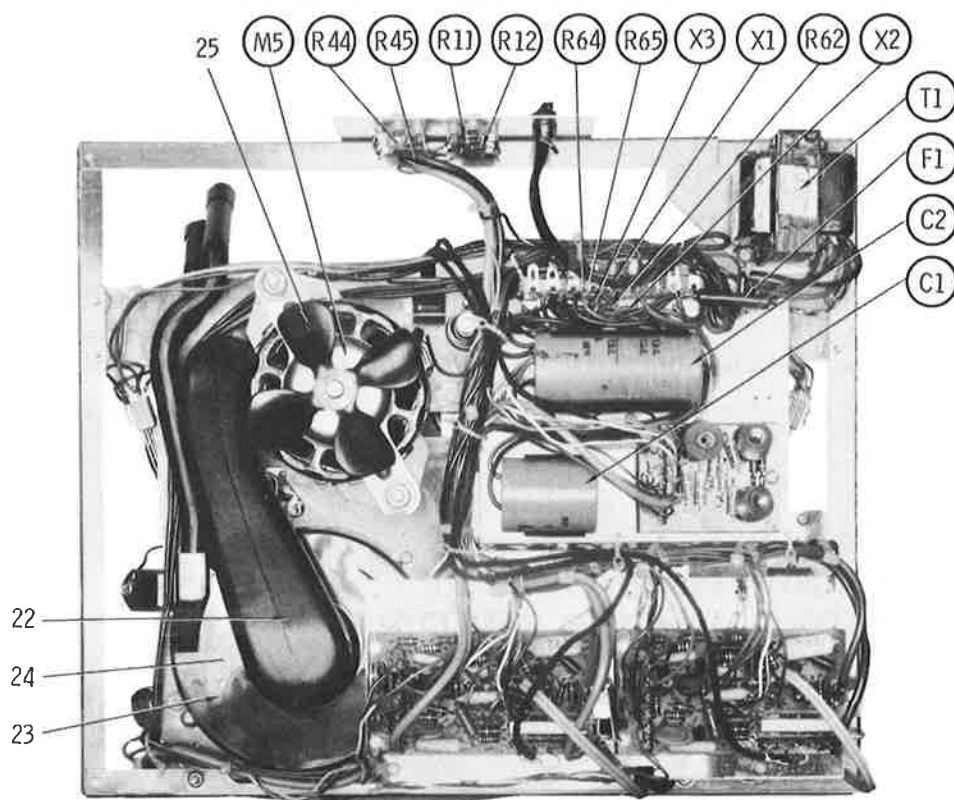
BELL & HOWELL MODELS 2291/93/95/95S/97/97S

MODEL 2295

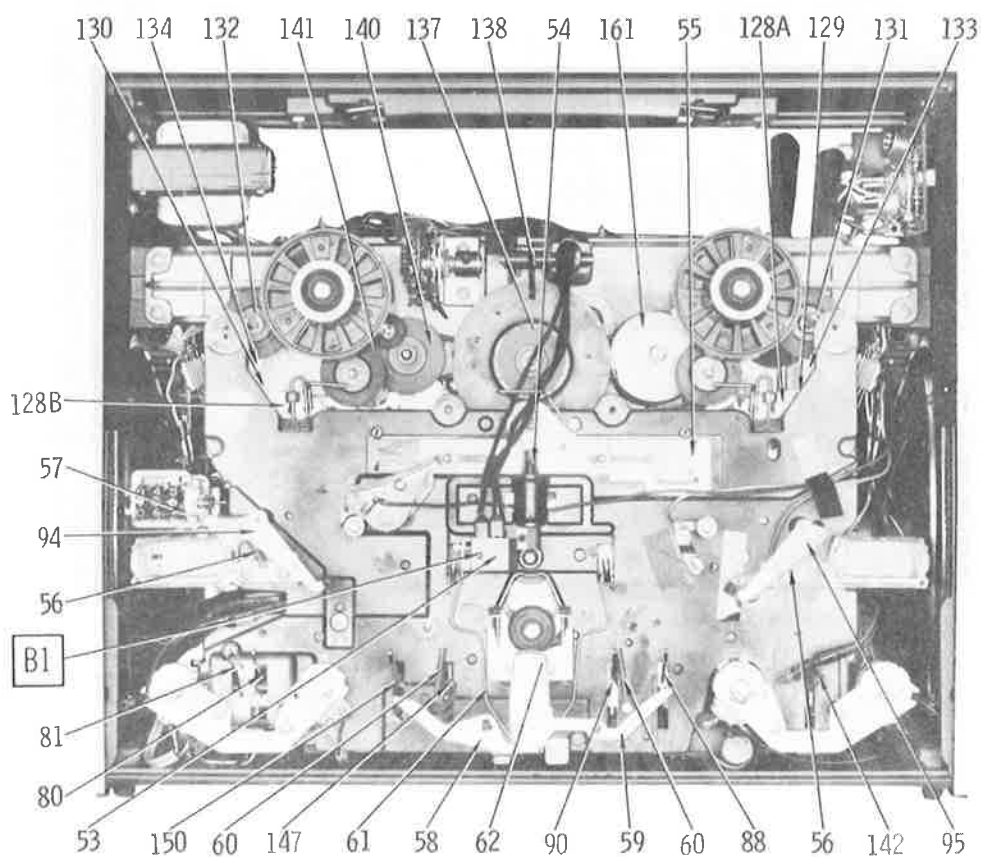
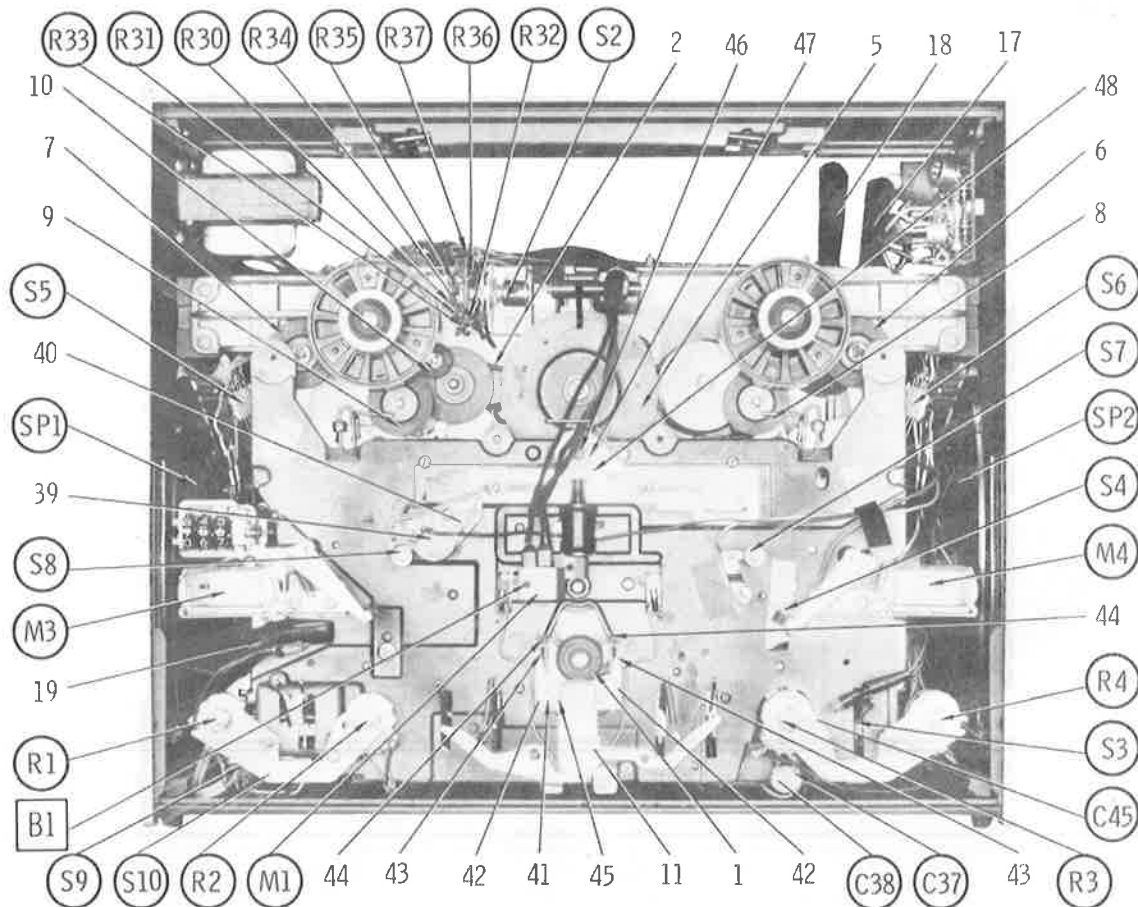
**HOWARD W. SAMS & CO., INC.** Indianapolis, Indiana 46206

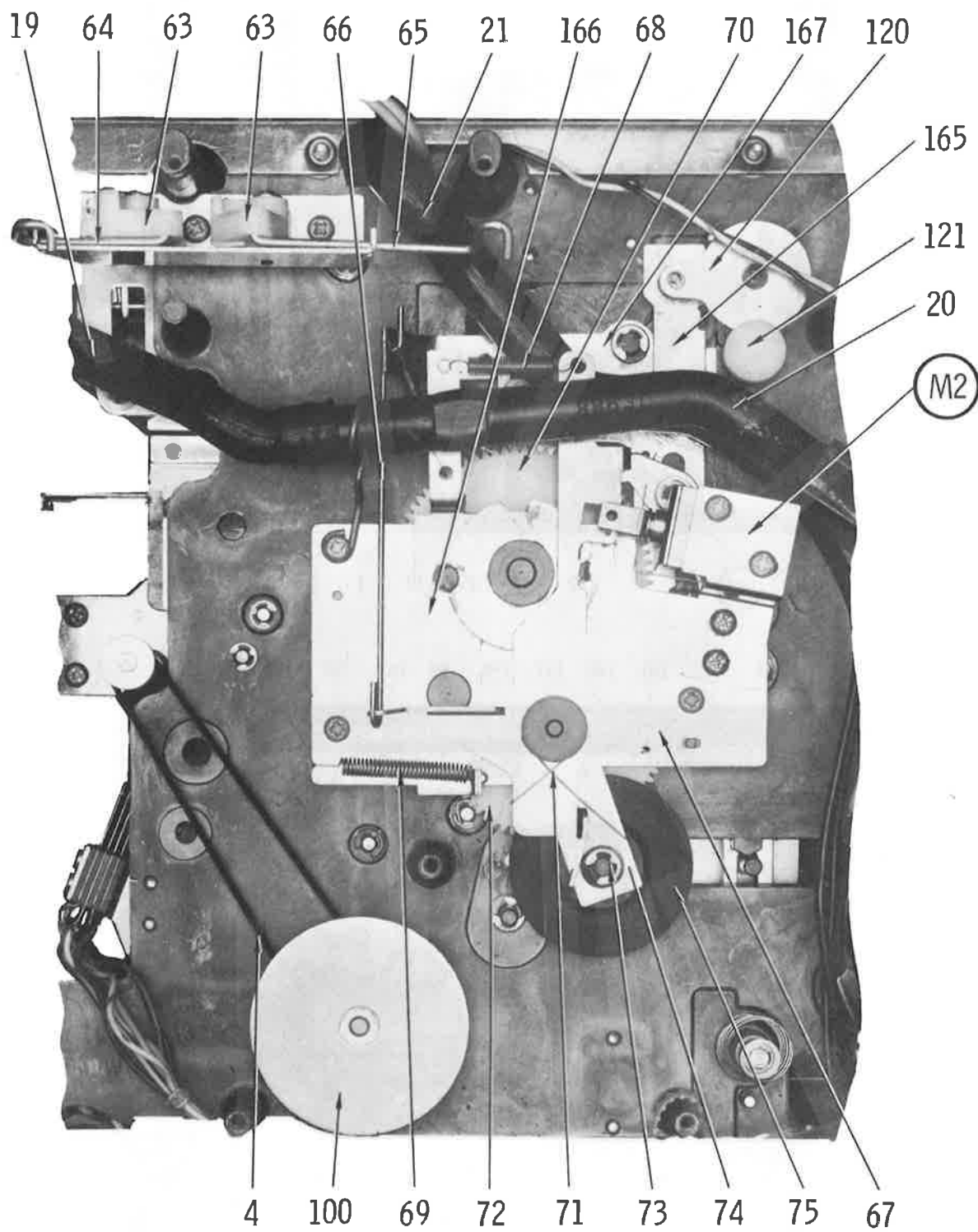
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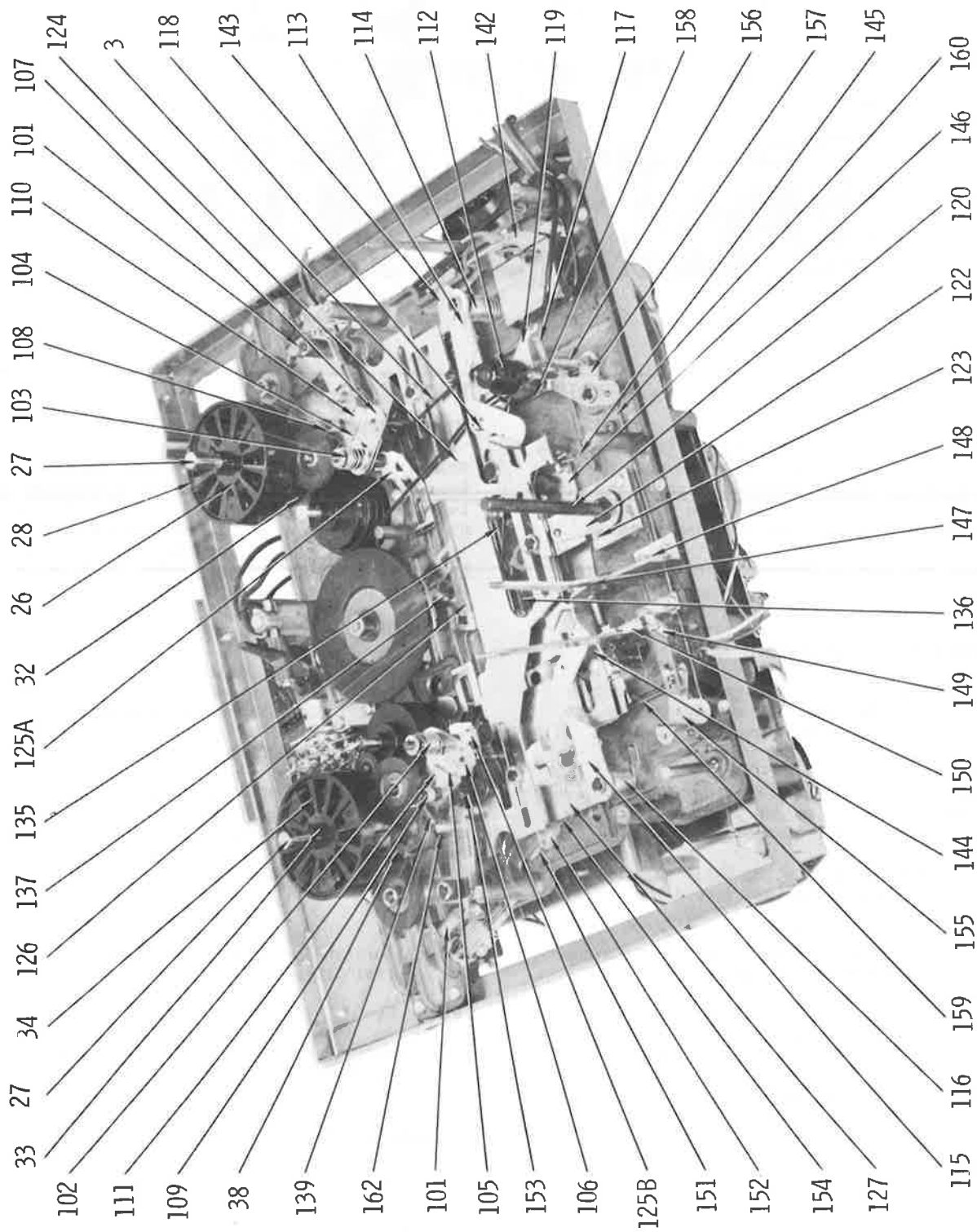
# MODELS 2291/93



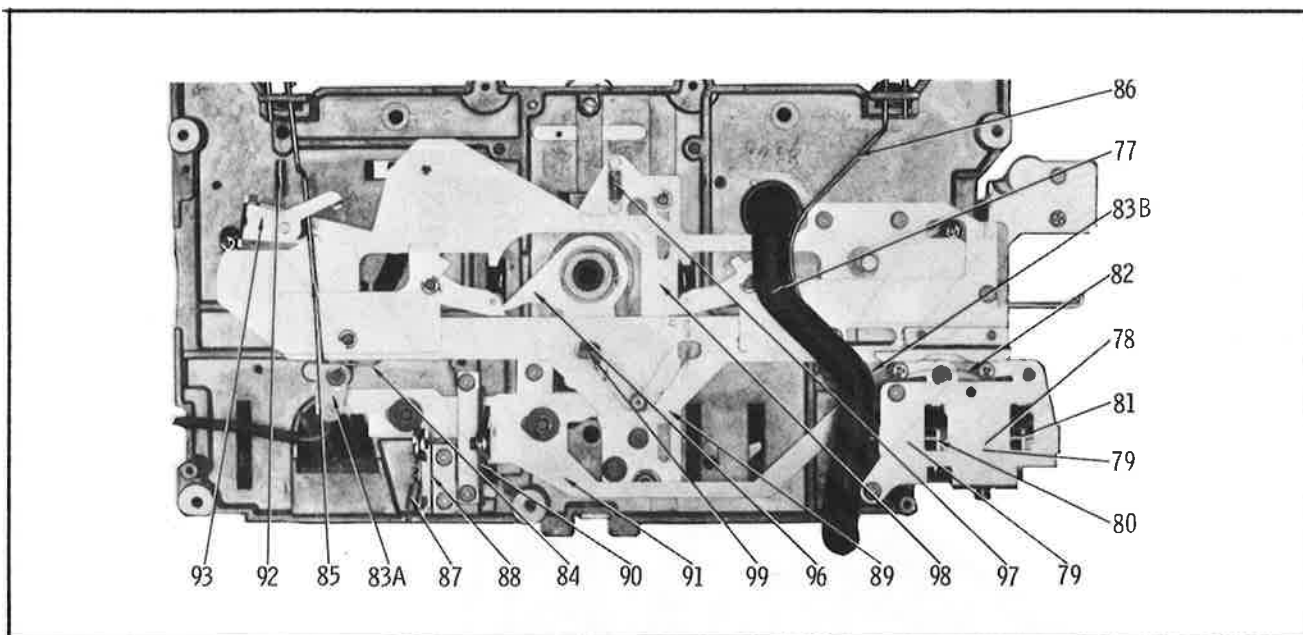
# MODELS 2295/97







**BELL & HOWELL MODELS 2291/93/95/96/97/97S**



## OPERATING INSTRUCTIONS

### Tape Loading

Place a reel of tape on the supply (left) spindle, move Power On/Off switch to On, and move Load lever to Wind. Allow supply reel to rotate clockwise for a few rotations, and then move Load lever to Load until the unit has threaded the tape.

To start the unit in Reverse mode, place a reel of tape on the take-up (right) spindle, open head panel, and manually thread the tape.

### Monaural Record (Forward)

Move Power switch to On, select the desired speed, thread the tape with supply reel on the left spindle, and turn Volume control fully counterclockwise.

Connect a microphone to Left Mic Input jack, move Left Record lever to On, and set the recording level with Left Level control.

Hold Left Record lever at On while turning Function Selector clockwise, and record the left-channel tracks.

To record the right-channel tracks, follow the procedure outlined above; except connect the microphone to Right Mic Input jack, move Right Record lever to On, set the recording level with Right Level control, and hold Right Record lever at On while turning Function Selector clockwise.

### Monaural Play (Forward)

Move Power switch to On, select the desired speed, and thread the tape with supply reel on the left spindle.

Turn Left Level control to mid-range, turn Right Level control fully counterclockwise, turn Function Selector clockwise, set the playback controls as desired, and play the left-channel tracks.

To play the right-channel tracks, follow the procedure outlined above, except turn Right Level control to mid-range and turn Left Level control fully counterclockwise.

### Stereo Record (Forward)

Follow the procedure outlined under "Monaural Record (Forward)"; except connect microphone to Left and Right Mic Input jacks, move Left and Right Record levers to On, set the recording levels with Left and Right Level controls, and hold Left and Right Record levers at On while turning Function Selector clockwise.

### Stereo Play (Forward)

Follow the procedure outlined under "Monaural Play (Forward)", except adjust Left and Right Level controls to balance the channel outputs.

### Record/Play (Reverse)

To record or play in Reverse mode, follow the appropriate procedure for record or play in Forward mode, except thread the tape with supply reel on the right spindle and turn Function Selector counterclockwise.

### Monitor

To monitor the source while recording, turn Volume control clockwise.

### Pause

Record or Play operation may be interrupted at any point on the tape by moving Pause lever to On. To resume operation, move Pause lever to Off.

### Manual Reverse

Tape travel direction may be reversed at any time during the operation by turning Function Selector either clockwise or counterclockwise. In Record mode, Record levers will automatically return to Off when tape travel direction is reversed.

### Automatic Cycling

Place a 3-inch piece of sensing foil on the dull side of the tape, approximately three feet from each end. Thread the tape with the supply reel



on the left spindle, and wind the tape onto the take-up reel until the sensing foil at the beginning of the tape has passed the right sensing poles.

For continuous play, move Cycle control to the top position, and turn Function Selector clockwise. The unit will automatically reverse tape-travel direction when the sensing foil at the end of the tape reaches the left sensing poles and will reverse again when the sensing foil at the beginning of the tape reaches the right sensing poles. This operation will continue until the unit is manually stopped by pressing Function Selector.

## DISASSEMBLY

Remove six Phillips screws from back panel of unit and remove back panel.

Loosen two setscrews on Function Selector and remove Function Selector.

Remove eleven push-on-type knobs, remove four, hex nuts (one from Volume, Tone, Right Level,

For one complete cycle, move Cycle lever to mid-position and turn Function Selector clockwise. The unit will automatically reverse tape-travel direction when the sensing foil at the end of the tape reaches the left sensing poles and will automatically stop when the sensing foil at the beginning of the tape reaches the right sensing poles.

For a single pass in either direction, move Cycle lever to the lower position, thread the tape, and select forward or reverse mode. The unit will automatically stop when the sensing foil at the beginning or at the end of the tape reaches the appropriate sensing poles.

and Left Level controls) and remove control panel.

Remove four Phillips screws from reel wells, remove four Phillips screws from bottom of reel panel, and remove reel panel.

## SEQUENCE OF OPERATION

### Tape Loading

Moving Load Lever (150) to the center position pivots Bracket (155) to push Wire (160), pivoting Bracket (157). Bracket (157) pulls Spring (117) to pivot Assembly (119), pressing Pulley (118) against Belt (3) to drive Pulley (112), rotating the blower fan.

Bracket (155) also pulls Wire (159) to pivot Cam (154), pivoting Actuator (152). Actuator (152) pivots Actuator (128B) to cause Spring (130) to pivot Bracket (133), moving Idler (7) from Pulley (38) to release Assembly (33). Simultaneously, Actuator (152) pivots Assembly (106) to cause Spring (105) to pivot Assembly (111), pressing Idler (9) against Pulley (38) and Pulley (140) to rotate Assembly (33) clockwise.

Moving Load Lever (150) to Load from the center position pivots Bracket (155) to push Wire (160), pivoting Bracket (157). Bracket (157) pulls Spring (117) to increase the pressure on Belt (3). Bracket (157) also pushes Wire (158) to pivot Actuator (128A), causing Spring (129) to pivot Bracket (133) which moves Idler (6) from Pulley (32) to release Assembly (26). Simultaneously, Wire (158) pivots Assembly (107) to cause Spring (104) to pivot Assembly (110), pressing Idler (8) against Pulley (32) and Pulley (161) to rotate Assembly (26) counterclockwise.

Bracket (155) moves Wire (159) to pivot Lever (162) and to pivot Cam (153). Lever (162) pulls Spring (139) to pivot Bracket (141), causing Idler (10) to press between Idler (9) and Pulley (38). Idler (10) then drives Assembly (33) counterclockwise to unroll the tape for threading.

The tape is threaded by air pressure from Tubes (17), (18), (19), (20), and (21) which picks up the loose end of the tape and threads the tape past the head to near the take-up reel. The vacuum from blower at Assembly (26) then pulls the tape around the take-up reel.

### Play Forward (From Stop)

Rotating the Function Selector clockwise for Forward rotates Shaft (120) to move Slide (165), pivoting Lever (167) to pull Link (66). Link (66) pivots Lever (166) to release Idler (75), pivoted by Spring (71), to press against the shaft of Assembly (140).

Slide (165) also moves Actuator (163) to tilt Bracket (164), engaging Assembly (127).

The motor -- through Pulley (161), Belt (2), Assembly (140), Idler (75), Gear (74), Gear (72), Gear (70), and Actuator (163) -- drives Bracket (164).

Bracket (164) slides Assembly (127) to the right, pivoting Lever (137) to press Idler (5) against Pulley (161) and Flywheel (76). Assembly (127) pivots Bracket (107) to cause Spring (104) to pivot Assembly (110), pressing Idler (8) against Pulley (32) and Pulley (161) to provide the take-up torque.

Assembly (127) also pivots Actuator (128). Actuator (128A) causes Spring (129) to pivot Bracket (133), moving Idler (6) from Pulley (32) to release Assembly (26). Actuator (128B) causes Spring (130) to pivot Bracket (134), moving Idler (7) from Pulley (38) to release Assembly (33).

Assembly (127) slides Assembly (89) to slide Assembly (98), pressing Roller (1) against the capstan. Assembly (89) moves Assembly (55) to rotate Plate (51), rotating Gear (48) to rotate Shaft (54) to flip Head (M1) to the left side of the capstan. Assembly (98) also moves Holder (45) forward to press Pads (44) against the head.

### Play Reverse (From Stop)

The Play Reverse sequence is the same as "Play Forward", except the Function Selector is rotated counterclockwise. Slide (165) tilts Bracket (164) in the opposite direction to slide Assembly (127)

to the left, pressing Idler (5) against Pulley (140) and Flywheel (76). Assembly (127) moves Assembly (89) to the left, rotating Plate (51) to flip Head (M1) to the right side of the capstan.

## Record

The Record sequence for Record Forward or Record Reverse is the same as "Play Forward" or "Play Reverse". However, moving Left Record Lever (81) to Record pivots Lever (63A) to pull Link (64), actuating Switch (S1). Moving Right Record Lever (80) to Record pivots Lever (63B) to pull Link (65), actuating Switch (S2).

## Fast Forward

Pressing the Function Selector disengages Shaft (120) from Slide (165) and engages Lever (122) with Slide (124). Rotating Shaft (120) clockwise (while depressed) causes Lever (122) to move Slide (124) to the right. Slide (124) releases Follower (125A) to allow Spring (103) to lower Assembly (110). Simultaneously, Slide (124) pivots Assembly (110) to press Idler (8) against Pulley (161) and Pulley (32), driving Assembly (26).

Slide (124) also pivots Actuator (128A) to cause Spring (129) to pivot Bracket (133), moving Idler (6) from Pulley (32) to release Assembly (26). Slide (124) pivots Actuator (128B) to cause Spring (130) to pivot Bracket (134), moving Idler (7) from Pulley (38) to release Assembly (33).

## Rewind

Pressing the Function Selector disengages Shaft (120) from Slide (165) and engages Lever (122) with Slide (124). Rotating Shaft (120) counter-clockwise (while depressed) causes Lever (122) to move Slide (124) to the left.

Slide (124) releases Follower (125B) to allow Spring (102) to lower Assembly (111). Simultaneously, Slide (124) pivots Assembly (111) to press Idler (9) against Pulley (161) and Pulley (38), driving Assembly (33).

Slide (124) also pivots Actuator (128A) to cause Spring (129) to pivot Bracket (133), moving Idler

(7) from Pulley (32) to release Assembly (26). Slide (124) pivots Actuator (128B) to cause Spring (130) to pivot Bracket (134), moving Idler (7) from Pulley (38) to release Assembly (33).

## Pause

Moving Pause Lever (90) to Pause moves Slide (91) to slide Actuator (98), moving Roller (1) from the capstan. Slide (91) pivots Levers (83A) and (83B) to cause Lever (83A) to pull Link (85) and to cause Lever (83B) to pull Link (86). (Forward Mode) Link (85) presses Spring (108) to pivot Assembly (110), moving Idler (8) from Pulley (32). Link (85) also pivots Bracket (133) to press Idler (6) against Pulley (32). Link (86) pivots Bracket (134) to press Idler (7) against Pulley (38). (Reverse Mode) Link (85) pivots Bracket (133) to press Idler (6) against Pulley (32). Link (86) presses Spring (109) to pivot Assembly (111), moving Idler (9) from Pulley (38). Link (86) also pivots Bracket (134) to press Idler (7) against Pulley (38).

## Stop

Pressing the Function Selector moves Shaft (120) to cause Lever (122) to pivot Cam (123), pivoting Assembly (146). Assembly (146) pivots Lever (167) to pull Link (66), pivoting Lever (166) to release Idler (75). Idler (75), pivoted by Spring (71), presses against the shaft of Assembly (140) to drive Assembly (67).

The motor -- through Pulley (161), Belt (2), Assembly (140), Idler (75), Gear (74), Gear (72), Gear (70), and Actuator (163) -- drives Bracket (164).

Bracket (164) slides Assembly (127) to the center position to move Idler (5) from Flywheel (76). Assembly (127) releases Actuators (128A) and (128B) to allow Springs (101) to press Idler (6) against Pulley (32) and to press Idler (7) against Pulley (38). Assembly (127) releases Brackets (106) and (107) to allow Spring (103) to move Idler (8) from Pulley (32) and to allow Spring (102) to move Idler (9) from Pulley (38).

## TROUBLE CHART

**IMPORTANT:** Before consulting this chart, refer to "General Servicing Information" on page 4.

SYMPTOM	REMARKS
Take-up reel or supply reel revolves erratically or not at all in Play or Record.	Idler (5) dirty, worn, or binding. Disc (31) or (37) dirty, worn, or matted. Belt (2) dirty, worn, or broken. Pulley (140) binding. Idler (8) or (9) dirty, worn, or binding. Assembly (26) or (33) binding.
Take-up reel does not revolve in Fast Forward.	Idler (8) dirty, worn, or binding. Disc (31) dirty, worn, or matted. Assembly (26) binding.
Supply reel does not revolve in Rewind.	Idler (9) dirty, worn, or binding. Belt (2) dirty, worn, or broken. Disc (37) dirty, worn, or matted. Assembly (33) binding. Pulley (140) binding.



## TROUBLE CHART (Continued)

IMPORTANT: Before consulting this chart, refer to "General Servicing Information" on page 4.

SYMPTOM	REMARKS
Reels do not stop immediately when stop function is selected.	Springs (131) and (132) weak or broken. Idlers (6) and (7) dirty or worn. Springs (101) weak or missing. Assemblies (133) and (134) binding.
Capstan does not rotate in Play or Record.	Spring (126) weak or missing. Idler (5) dirty, worn, or binding. Flywheel (76) dirty or binding. Assembly (113) or (115) not releasing Flywheel (76). Motor defective or not supplied with power.
Wow or Flutter.	Spring (126) weak or missing. Roller (1) dirty, worn, or binding. Spring (97) weak or missing. Assembly (26) or (33) binding. Idler (8) or (9) dirty, worn, or binding. Belt (2) dirty or worn (Reverse Mode). Pulley (140) binding (Reverse Mode). Excessive take-up torque. Motor defective. Flywheel (76) binding.
Sound is weak or distorted.	Head (M1) dirty, misaligned, or defective. Pads on Holders (43) worn or matted. Bias misadjusted or bias oscillator defective. Amplifier defective.
Erase weak or inoperative.	Head (M1) dirty or defective. Inadequate erase current. Springs (42) weak or missing. Pads on Holders (43) worn or matted. Bias oscillator defective.
Auto tape load inoperative.	Belt (3) dirty, worn, or binding. Pulley (112) loose or dirty. Assembly (118) binding. Assembly (24) binding. Air Tubes (12) through (21) broken or air passage restricted. Idler (10) dirty, worn, or binding. Assembly (141) binding. Spring (139) weak or missing. Tube (77) broken or air restricted. Housing (22) broken. Belt (2) dirty, worn, or broken.
Does not start when Function Selector is rotated.	Idler (75) dirty, worn, or binding. Spring (71) weak or missing. Gear (70), (72), or (74) broken. Pawl on Shaft (120) worn or broken. Assembly (127) binding.
Head does not change when direction changes.	Ball (49) missing. Spring (50) weak or missing. Gear (48) worn or broken. Shaft (54) worn or binding.
Continuously reverses.	Spring (68) weak or missing. Solenoid (M2) defective. Switches (S7) and (S8) defective. Lever (166) binding. Link (66) bent.
Does not stop when Function Selector is pressed.	Cam (123) worn or bent. Lever (122) bent or loose. Gear Assembly (67) defective.

BELL & HOWELL MODELS 2291/93/95/95S/97/97S

## ADJUSTMENTS

**IMPORTANT:** Before making any adjustments, refer to "General Servicing Information" on page 4.

1. All voltage measurements referred to in this chart are made at a tape speed of 7-1/2 ips with an audio VTVM having a flat response to 100KC.
2. All torque measurements are made at a tape speed of 7-1/2 ips with a spring scale applied to a point 2 inches from spindle center.
3. All pressure measurements are made by using a spring scale to determine that point at which pressure is just removed.

ADJUST	REMARKS
Play Take-up Torque	Nominal value 3 oz. Controlled by condition of Felt (31) on Assembly (26) for forward or Felt (37) on Assembly (33) for reverse .
Fast Forward Take-up Torque	Nominal value 4 oz. Controlled by condition of Felt (31) and Idler (8).
Rewind Torque	Nominal value 4 oz. Controlled by condition of Felt (37) and Idler (9).
Supply Reel Drag	Dependent on reel weight.
Take-up Reel Drag	Dependent on reel weight.
Pressure Roller Pressure	Nominal value 4-3/4 lbs. Controlled by tension of Spring (97).
Braking Torque	Measured in Stop. Nominal value 3 oz. counterclockwise on the supply (left) spindle. Nominal value 2 oz. clockwise on the take-up (right) spindle. Controlled by the tension of Spring (101) on the appropriate brake bracket.
Pause Braking Torque	Measured counterclockwise on the supply spindle and measured clockwise on the take-up spindle. Nominal value 3-1/2 oz. Controlled by the position of collar on Link (85) for take-up spindle and position of collar on Link (86) for supply spindle.
Pressure Pad Pressure	Nominal value 1 oz. Controlled by tension of Springs (42).
Record/Play Head Azimuth	Connect an AC VTVM across left output, play an azimuth-test tape, and adjust B1 for maximum output in forward mode.
Erase Current	Nominal value 105ma (6.2V rms) in each section of erase head for stereo mode. No adjustment provided.
Record Bias	Nominal value 17.5V rms (.25ma) across each section of Play/Record head. Adjust R5 on left-channel preamp circuit board for left channel and R5 on right-channel preamp circuit board for the right channel.
Bias Oscillator Frequency	Nominal frequency 78KC. Controlled by setting of slug in L1. Connect an AC VTVM to point "A" on the left channel. Set the right channel in record mode, turn Right Level control fully counterclockwise, turn Left Level control 3/4 maximum clockwise, and adjust the bias frequency for MINIMUM indication on the AC VTVM. Connect the AC VTVM to point "B" on the right channel. Place the left channel in record mode, turn Left Level control fully counterclockwise, turn Right Level control 3/4 maximum clockwise, and adjust bias frequency for MINIMUM indication on the AC VTVM. Compromise a bias frequency setting to obtain MINIMUM on VTVM for each channel.
Record Level Indicator Calibration	Disable bias oscillator by disconnecting B+ (purple wire) to oscillator circuit board. Apply a 1000-cycle tone at .0015V rms to the Left (Right) Mic Input jack and adjust Left (Right) Level control for .059V rms across the left (right) play/record section of Head (M1). Adjust R6 (each channel) for an indication at the dividing line on the Left (Right) Record/Playback Level Meter.
Power Amplifier Bias	Adjust R7 (each channel) for .7 volts MINIMUM to .9 volts maximum across R48 (each channel).

# MECHANICAL PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
1	86748	Pinch (Pressure) Roller	65	87190 (15)	Right Record Switch Link
	(032172)	(May be substituted)	66	86863	Drive Puck Link
2	87093*	Drive Belt*	67	032077 (7)	Gear Train Assembly
3	86630	Blower Drive Belt	68	86972 (8)	Solenoid Return Spring
4	86850*	Counter Drive Belt*	69	86970 (8)	Detent Spring
5	032084	Flywheel Drive Idler	70	86897 (8)	Spur Gear
	(032142)	(Used in some versions)	71	86921 (8)	Puck Spring
6	032151	Take-up (Right) Spindle Idler	72	86920 (8)	Compound Gear
7	032151	Supply (Left) Spindle Idler	73	070044 (9)	Gear Train Drive Idler and Clutch Assembly
8	032032	Take-up (Right) Drive Idler			
	(032141)	(Used in some versions)	74	86941 (10)	Drive Puck Gear
9	032032	Supply (Left) Drive Idler	75	032097 (10)	Drive Idler
	(032141)	(Used in some versions)	76	032033 (17)	Flywheel Assembly
10	032003	Threading Idler	77	88626	Upper Center Air Tube
11	86980	Knob Spring	78	032057	Record Lever Plate and Latch Assembly
12	88624 (17)	Upper Air Tube	79	87019	Record Lever Spring
13	88629 (17)	Upper Right Air Tube	80	86880	Right Record Switch Lever
14	87078 (17)	Top Center Nozzle	81	87016	Left Record Switch Lever
15	87077 (17)	Top Left-hand Nozzle	82	87015	Latch Spring
16	87079 (17)	Bottom Left-hand Nozzle	83	86668	Pause Brake Lever
17	88625	Right-hand Air Tube	84	87220 (11)	Control Lever Spring (2 used)
18	88628	Left-hand Air Tube	85	87120	Right Control Link
19	88631	Upper Front Air Tube	86	87119	Left Brake Link
20	88630	Lower Front Air Tube	87	86960	Search Lever Spring
21	88627	Lower Center Air Tube	88	032085	Search Lever and Bracket Ass'y.
22	86888	Blower Housing Connector	89	032043	Upper Actuator Slide and Pin Assembly
23	88620	Blower Housing			
24	032083	Blower Fan and Shaft Assembly	90	032223	Pause Control Lever and Bracket Assembly
25	87144	Motor Fan	91	87217 (11)	Pause Slide
26	032014 (1)	Right-hand Take-up Reel Ass'y.	92	86961	Extension Spring
27	86733 (2)	Reel Cap (2 used)	93	032024	Tape Sensor Arm Assembly
28	032133 (2)	Reel Platform Assembly	94	032039	Left Tape Guide Arm Pad and Pin Assembly
29	86971 (17)(2)	Clutch Spring (3 used)			
30	87067 (17)(2)	Clutch Disc Plate	95	032038	Right Tape Guide Arm Pad and Pin Assembly
31	86649 (17)(2)	Felt Clutch Disc			
32	032013 (2)	Clutch Pulley Assembly	96	86871	Pinch Roller Cam
33	032082 (3)	Left-hand Supply Reel Ass'y.	97	86975	Pinch Roller Spring
34	032133 (4)	Reel Platform Assembly	98	032064	Pinch Roller Actuator Slide Assembly
35	86971 (17)(4)	Clutch Spring (3 used)	99	032042	Pinch Roller Slide and Shaft Assembly
36	87067 (17)(4)	Clutch Disc Plate	100	87149	Counter Drive Pulley
37	8649 (17)(4)	Felt Clutch Disc	101	86959	Brake Spring (2 used)
38	032013 (4)	Clutch Pulley Assembly	102	86953	Right Take-up Pressure Spring
39	87071	Air Distributor (Top)	103	86952	Left Take-up Pressure Spring
40	87070	Air Distributor (Bottom)	104	86965	Right Take-up Spring
41	86927	Slide Cover	105	86966	Left Take-up Spring
42	87191	Pressure Pad Spring (2 used)	106	032012	Right Take-up and Fast Forward Actuating Bracket Assembly
43	032089	Pressure Pad Holder (2 used)			
44	86747	Felt Head Pad (2 used)	107	032012	Left Take-up and Fast Forward Actuating Bracket Assembly
45	86820	Pressure Pad Slide Holder			
46	86768	Gear Segment Head Stud	108	87122	Right Take-up Retract Spring
47	032088 (5)	Head Face Gear Assembly	109	87121	Left Take-up Retract Spring
48	86878 (6)	Head Face Gear	110	032010	Right Take-up and Fast Forward Support Bracket Assembly
49	2569 (17)(6)	1/8-inch Steel Ball			
50	86939 (17)(6)	Gear Assembly Spring	111	032011	Left Take-up and Fast Forward Support Bracket Assembly
51	86936 (17)(6)	Gear Plate			
52	86767 (17)(6)	Head Clutch Bushing	112	86707	Blower Pulley
53	032225	Head and Mounting Block Ass'y.	113	032035	Right Brake Assembly
54	86817	Mounting Block Shaft	114	86969	Right Flywheel Brake Spring
55	032086	Head Slide and Stud Assembly	115	032034	Left Brake Assembly
56	86962	Tape Guide Arm Spring	116	86968	Left Flywheel Brake Spring
57	86711	Counter			
58	86818	Lifter Actuator Lever			
59	86819	Tape Lifter Lever			
60	86932	Tape Lift Spring			
61	86985	Tape Lifter Link			
62	86976	Pressure Roller Spring			
63	86823 (15)	Switch Lever			
64	87189 (15)	Left Record Switch Link			

BELL & HOWELL MODELS 2291/93/95/95S/97/97S

# MECHANICAL PARTS LIST (Continued)

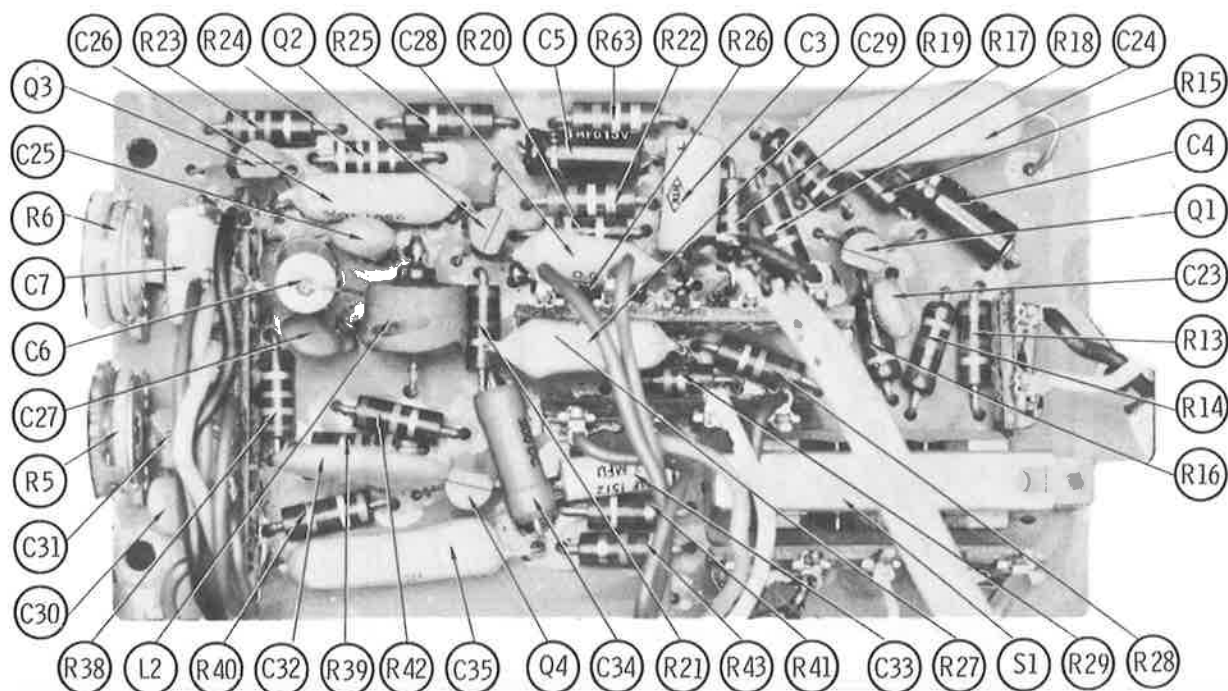
REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
117	86960	Extension Spring	142	032027	On/Off Switch Assembly
118	032025	Idler Pulley and Bearing Assembly	143	032062	Idler Lever Arm and Roller Assembly
119	032031	Blower Idler Bracket Assembly	144	86997	Slide Torsion Spring
120	032232 (12)	Main Control Shaft Assembly	145	86973	Release Lever Hold-down Spring
121	87244 (12)	Fast Forward Slide Pin	146	032231	Release Lever and Roller Ass'y.
122	032230 (12)	Fast Forward Lever and Collar Assembly	147	86648	Control Cycle Lever
123	032076	Release Lever Cam and Shaft Assembly	148	86859	Control Lever Mounting Bracket
124	86645	Fast Forward Slide	149	86959	Operating Lever Spring
125	86709	Cam Follower (2 used)	150	032026	Load Lever Assembly
126	86957	Idler Delay Spring	151	86954	Brake Lever Spring
127	032054	Play Slide and Cycle Control Slide Assembly	152	032017	Left Take-up Brake Actuator Assembly
128	032008	Brake Actuator (2 used)	153	032029	Load Cam and Shaft Assembly
129	86905	Right Brake Spring	154	032016	Brake Cam and Stud Assembly
130	86906	Left Brake Spring	155	(14)	Wire Actuator Bracket Ass'y.
131	87192	Right Brake Idler Spring	156	87133	Actuating Bracket Spring
132	87193	Left Brake Idler Spring	157	032169	Wire Actuating Bracket
133	032148	Right Brake Bracket Ass'y.	158	86647	Right Actuating Link Wire
134	032150	Left Brake Bracket Ass'y.	159	86844	Left Actuating Link Wire
135	032063	Lever Delay Bracket Ass'y.	160	86736	Actuating Link Connecting Wire
136	032052	Lever Delay Bracket Ass'y.	161	(16)	Motor Pulley
137	(13)	Idler Position Lever	162	032018	Differential Load Lever
138	87064	Speed Change Cam	163	86904 (6)	Tilt Plate Actuator
139	86958	Idler Spring	164	032036 (6)	Pin Tilt and Roller Bracket
140	032005	Drive Pulley Assembly	165	86892	Actuator Slide
141	032019	Threading Idler Bracket Assembly	166	86917 (6)	Puck Control Lever
			167	032051	Index Lever and Roller Ass'y.

\* Drive Belt -- WALSCO Replacement #1410-12.

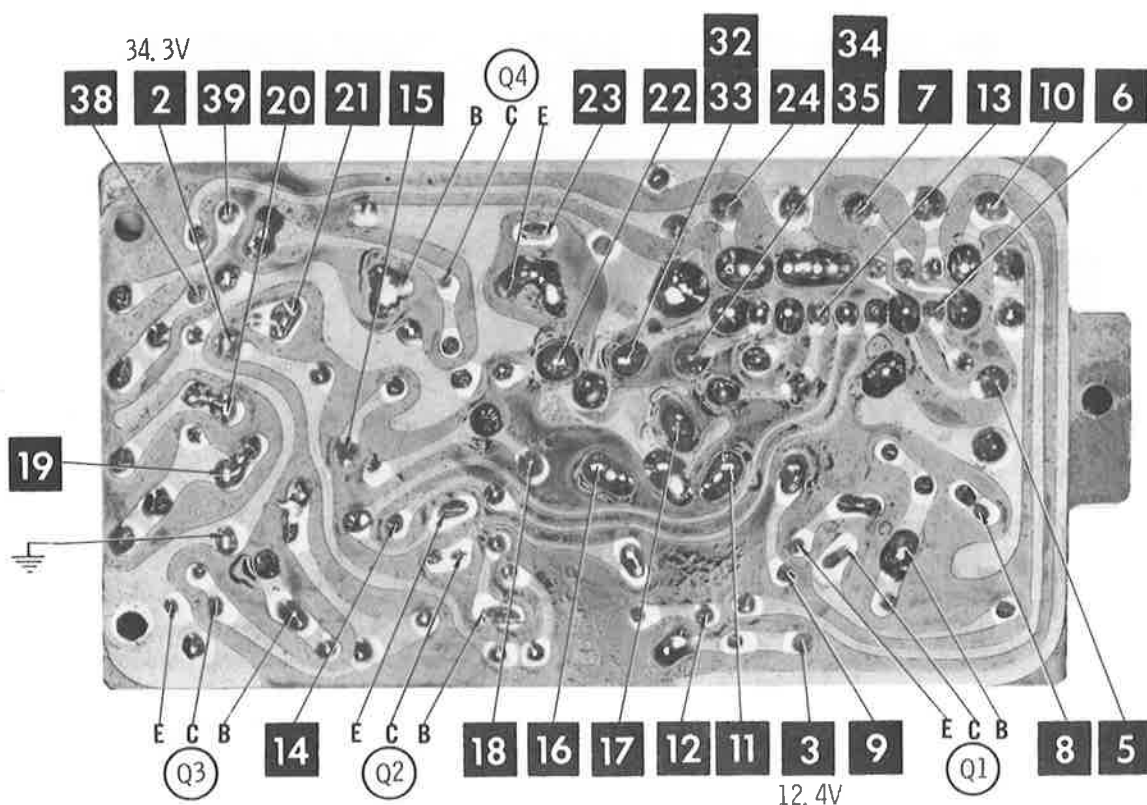
\* Counter Drive Belt -- WALSCO Replacement #1425-07.

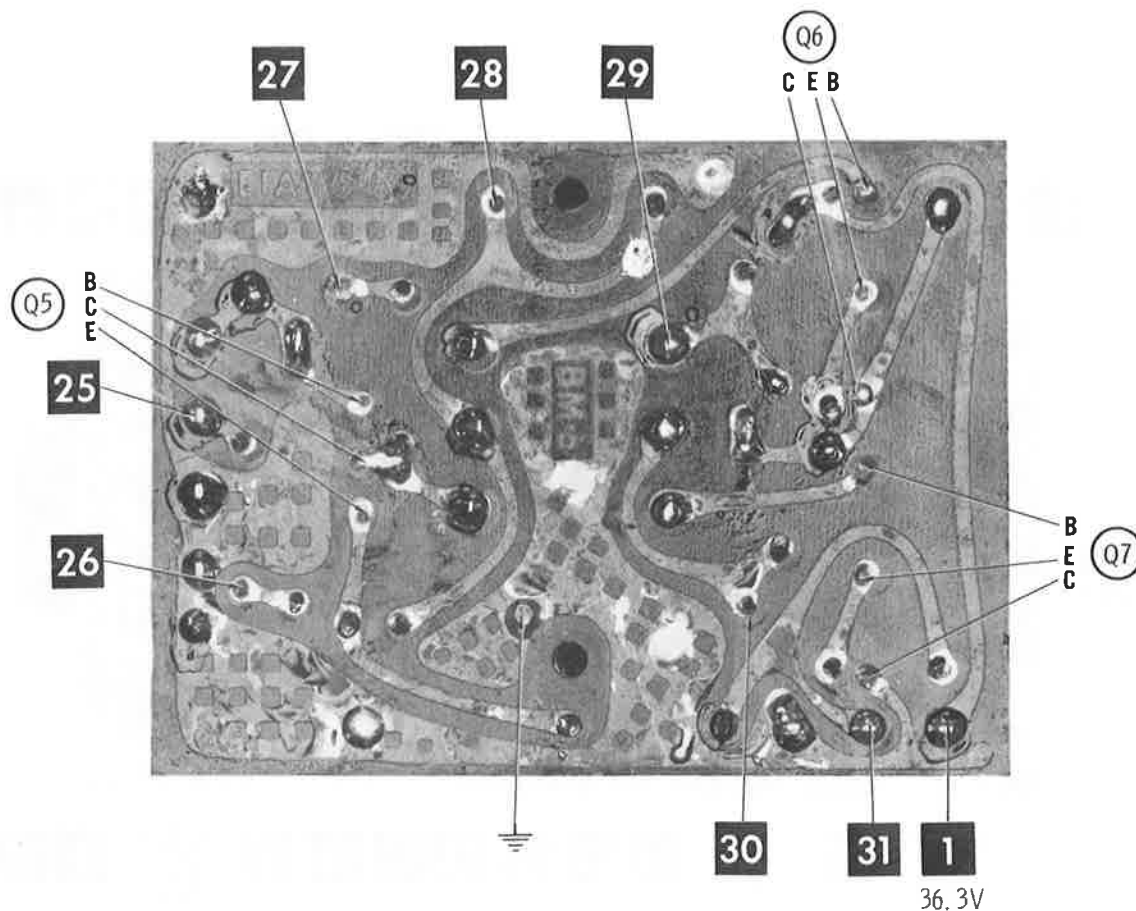
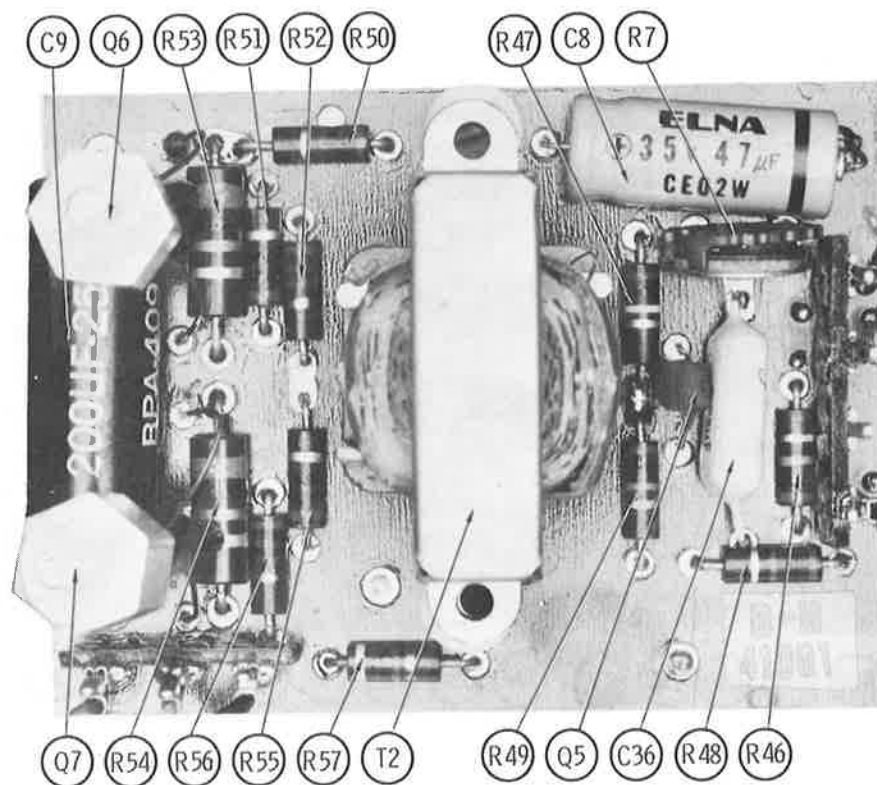
- (1) Includes Ref. Nos. (27) thru (32).
- (2) Part of Assembly (26).
- (3) Includes Ref. Nos. (34) thru (38).
- (4) Part of Assembly (33).
- (5) Includes Ref. Nos. (48) thru (52).
- (6) Part of Assembly (47).
- (7) Includes Ref. Nos. (68) thru (75).
- (8) Part of Assembly (67).
- (9) Subassembly, Part of Assembly (67) and includes Ref. Nos. (74) and (75).
- (10) Part of Assembly (73).
- (11) When changing Slide (91) the Pivot Shaft Part #87218, must be changed and two washers Part #33866, installed behind the Pause Lever Bracket. Spring (84) must also be added to Lever (83).

- (12) Changes made during production to incorporate a fast-forward interlock. Shaft (120), Pin (121), and Assembly (122) must be changed to incorporate these changes.
- (13) Early production uses Part Number 032065 with a 3/16-inch step. Current production uses Part Number 032229 with a 1/8-inch step.
- (14) Units with automatic reset counter use Bracket, Part Number 032032, units without automatic reset counter use Bracket Part Number 032176.
- (15) Part of Record Switch Bracket and Lever Assembly.
- (16) Part of Motor (M5).
- (17) Not shown on photos.



BELL & HOWELL MODELS 2291/93/95/955/97/975







## PARTS LIST AND DESCRIPTION

(When ordering parts, state Model, Part Number, and Description.)

### WIRING DATA

General-use Unshielded Hook-up Wire .....	Use BELDEN No. 8530 (Solid) Available in 12 Colors
Power Cord .....	8524 (Stranded) Available in 12 Colors
	17106 (Plastic) or 17126 (Rubber) - 6 Feet
	17109 (Plastic) or 17129 (Rubber) - 9 Feet
Low-loss Shielded Lead (Interconnecting) .....	Use BELDEN No. 8401 or 8421
Phono Pick-up Arm Cable .....	Use BELDEN No. 8430 (Two Conductor-Unshielded)
	8429 (Two Conductor-Shielded)
	8419 (Three Conductor-Shielded)

### TRANSISTORS

ITEM No.	TYPE No.	FUNCTION	REPLACEMENT DATA					
			MFGR. PART No.	GENERAL ELECTRIC PART No.	INTERNATIONAL RECTIFIER PART No.	MOTOROLA PART No.	RCA PART No.	SYLVANIA PART No.
Q1	2N3707	Preamp	88687	GE-17	TR-21	HEP723	SK3020	ECG 123A
Q2	2N3711	AF Amp	88682	GE-17	TR-21	HEP55	SK3020	ECG 123A
Q3	2N3711	AF Amp	88688	GE-17	TR-21	HEP55	SK3020	ECG 123A
Q4	2N3711	Record Output	88688	GE-17	TR-21	HEP55	SK3020	ECG 123A
Q5	2N3704	Driver	88803 (1)	GE-20	TR-25	HEP735	SK3024	ECG 128
Q5		Driver	88834 (2)	GE-20	TR-25	HEP735	SK3024	ECG 128
Q6	GC4213	Output	88700 (1)					
Q6		Output	88832 (2)	GE-3	TR-01	HEP232	SK3009	ECG 121
Q7	GC4213	Output	88700 (1)					
Q7		Output	88832 (2)	GE-3	TR-01	HEP232	SK3009	ECG 121
Q8	SG5013	Bias Oscillator	88686	GE-20	TR-21	HEP55	SK3020	ECG 123
Q9	SG5013	Bias Oscillator	88686	GE-20	TR-21	HEP55	SK3020	ECG 123

(1) Used in Model 2295 (2) Used in Model 2297

### POWER RECTIFIERS & SIGNAL DIODES

ITEM No.	MFGR. PART OR TYPE No.	REPLACEMENT RECTIFIERS & DIODES			REPLACEMENT RECTIFIERS	NOTES
		GENERAL ELECTRIC PART No.	INTERNATIONAL RECTIFIER PART No.	SYLVANIA PART No.	RCA PART No.	
X1	88641 (1N4002)	GE-504A	8D4 or 5A4-D	ECG 116 or ECG 117	SK3030 or SK3031	
X2	88641 (1N4002)	GE-504A	8D4 or 5A4-D	ECG 116 or ECG 117	SK3030 or SK3031	
X3	88641 (1N4002)	GE-504A	8D4 or 5A4-D	ECG 116 or ECG 117	SK3030 or SK3031	

### ELECTROLYTIC CAPACITORS

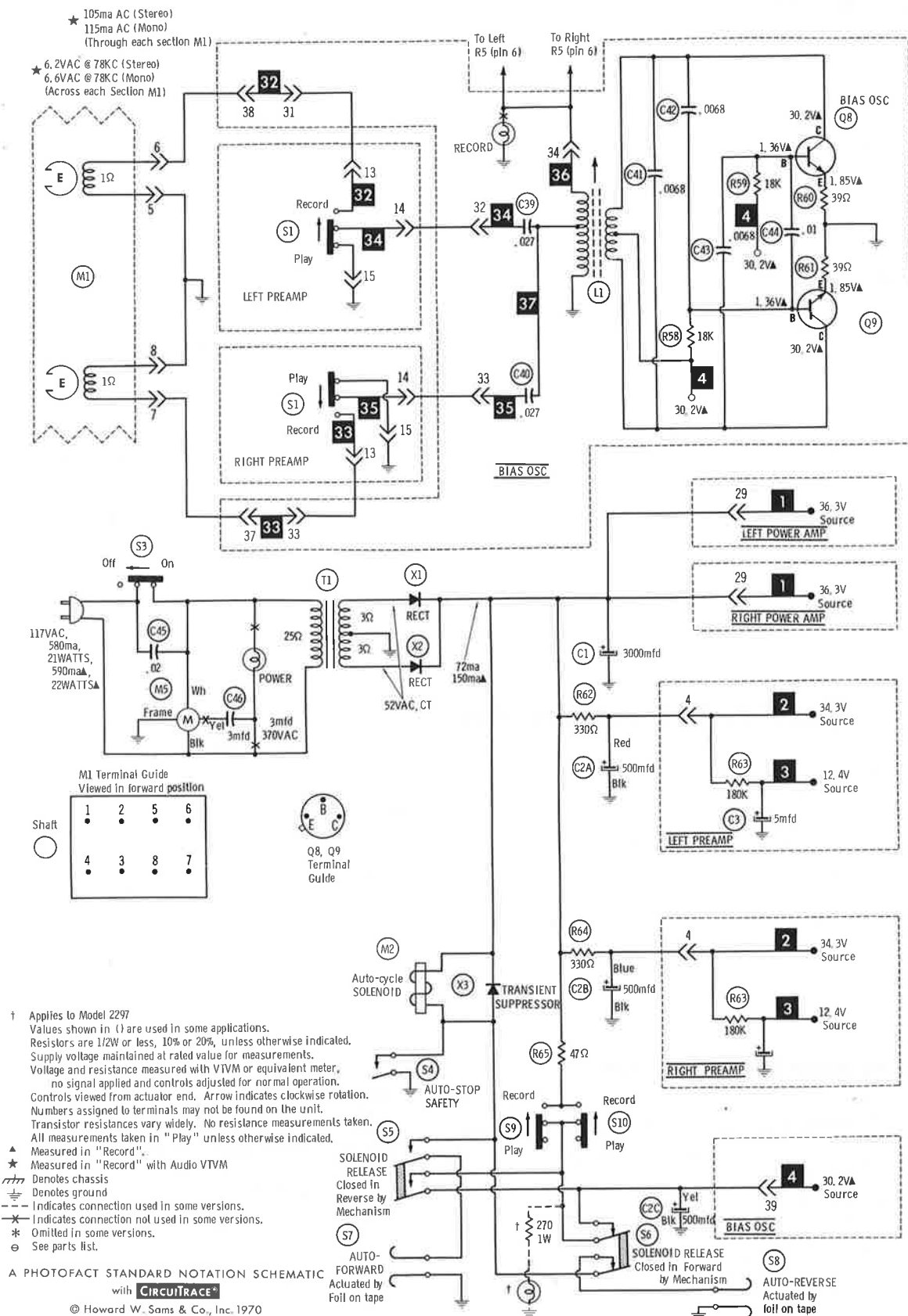
ITEM No.	RATING	REPLACEMENT DATA						
		Bell & Howell PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	GENERAL ELECTRIC PART No.	MALLORY PART No.	SPRAGUE PART No.
C1	3000 50V	88698	PRS1398		WBR3000-50		HC5030	
	650 50V	88858 (1)						
C2A	500 50V	88699			CC0035A (3)	XC1-26.1		
B	500 50V				CC0035A (3)			
C	500 50V				CC0035A (3)			
C3	5 35V	88671	CRE754A	EA50-5	PC5-100	MT1-3	MTV5CB50	TE-1303
C4	1 15V	88645	CRE750A		AL1-50	MT1-1	MTA1D50	TE-1148
C5	1 15V	88645	CRE750A		AL1-50	MT1-1	MTA1D50	TE-1148
C6	5 35V	88671	CRE754A	EA50-5	PC5-100	MT1-3	MTV5CB50	TE-1303
C7	5 35V	88671	CRE754A	EA50-5	PC5-100	MT1-3	MTV5CB50	TE-1303
C8	47 35V	88670	CRE767A	EA50-50		MT1-17	MTV50CF35	TE-1307
C9	200 25V	88669				MT1-23.5	MTV200DJ25	TL-1213
	500 25V	88831 (2)	PRS1290	EA30-500	WBR500-35	QT1-30A	TC2505B	TL-1217
C36	5 35V	88671 (2)	CRE754A	EA50-5	PC5-100	MT1-3	MTV50CF35	TE-1303

(1) Used in Models 2291, 2293. (2) Used in Model 2297. (3) Use Insulated Sleeve.

(CONTINUED ON PAGE 44)

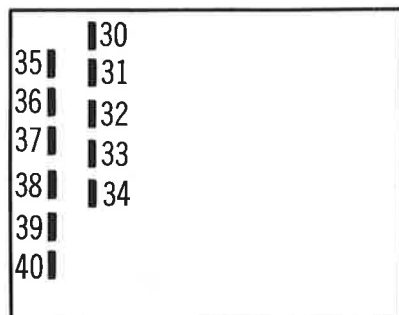
BELL & HOWELL MODELS 2291/93/95/95S/97/97S

**NOTE: DEMAGNETIZE HEADS AFTER SERVICING RECORDER**

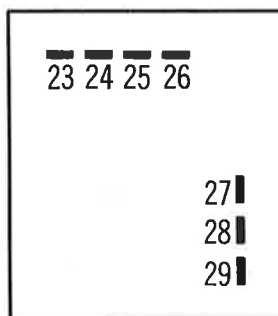


**BELL & HOWELL MODELS 2291/93/95/95S/97/97S**

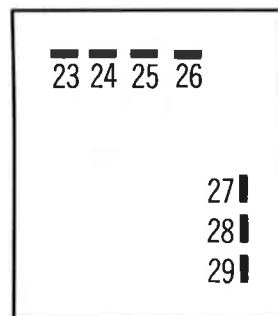
# Board Connectors Terminal Guide



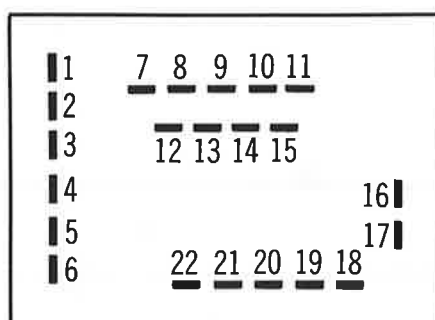
Bias Oscillator



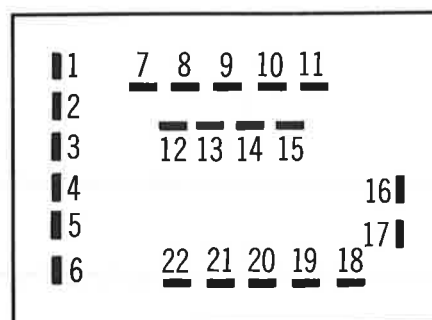
Right Ch Power Amp



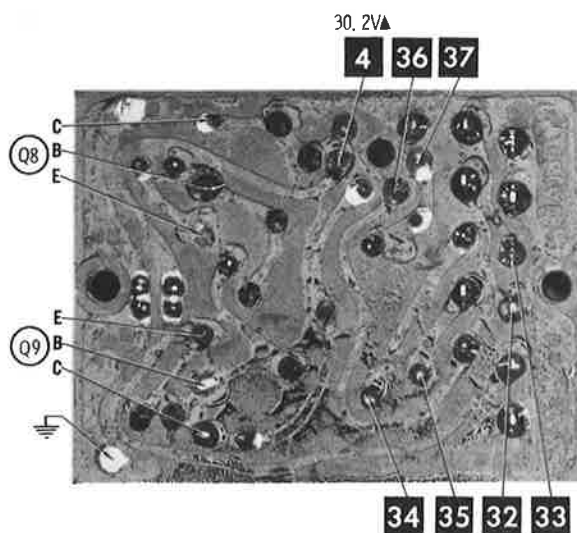
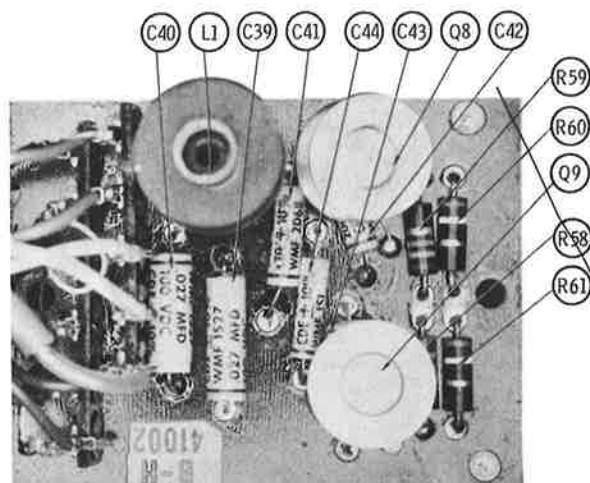
Left Ch Power Amp



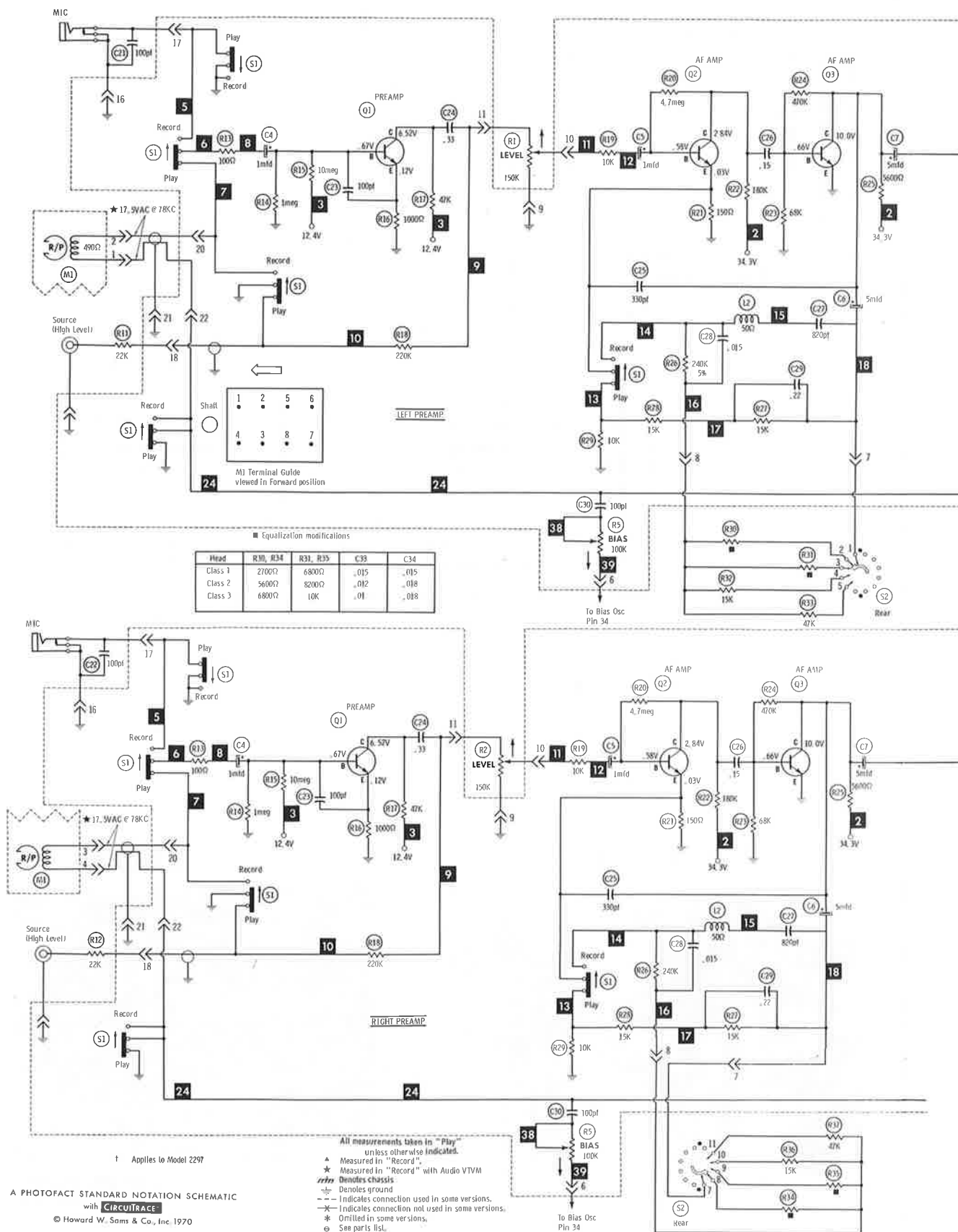
Right Ch Preamp



Left Ch Preamp



**NOTE: DEMAGNETIZE HEADS AFTER SERVICING RECORDER**





# PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

## CAPACITORS

ITEM No.	RATING	REMARKS	REPLACEMENT DATA					
			AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ELMENCO PART No.	MALLORY PART No.	SPRAGUE PART No.
C21	100		GPD X5F101K	DD-101	GP100	CCD-101	GP310	10TS-T10
C22	100		GPD X5F101K	DD-101	GP100	CCD-101	GP310	10TS-T10
C23	100		GPD X5F101K	DD-101	GP100	CCD-101	GP310	10TS-T10
C24	.33 250V		V1614P33		DPMS4P33	4DP-5-334		
C25	330		GPD X5F331K	DD-331	GP330	CCD-331	GP333	10TS-T33
C26	.15 250V		DBE6P15		DPMS4P15	4DP-4-154	PVC6015	4PS-P15
C27	820		GPD X5F821K	DD-821	GP820	CCD-821	GP382	10TS-T82
C28	.015 400V		DBE6S15		DPMS6S15	4DP-1-153	PVC6115	4PS-S15
C29	.22 250V				DPMS4P2	4DP-5-204		4PS-P20
C30	100		GPD X5F101K	DD-101	GP100	CCD-101	GP310	10TS-T10
C31	.001		GPD X5F102K	DD-102	GP1000	CCD-102	GP210	10TS-D10
C32	.05 100V		TTP-05	CK-503	MGPO5	CCD-503	TA150	T6L-S50
C33	.012 100V		V1612S15	DD-153	DPMS6S15	1DP-1-153	PVC2115	225P15391WD3
C34	.018 200V							10TS-S18
C35	.33 250V	(1)	V1614P33		DPMS4P33	4DP-5-334		
	.47 250V	(2)	V1614P47		DPMS4P47	4DP-6-474	PVC4047	
C36	.22 250V				DPMS4P2	4DP-5-204		4PS-P20
C37	.025	(3)	GPD Z5U203P	DD-203		CCD-203	GP120	10TS-S20
	.039			DD-403			GP140	
C38	.025	(3)	GPD Z5U203P	DD-203		CCD-203	GP120	10TS-S20
	.039			DD-403			GP140	
C39	.027 100V		DBE6S27		DPMS6S27	6DP-3-273	PVC6127	225P27391
C40	.027 100V		DBE6S27		DPMS6S27	6DP-3-273	PVC6127	225P27391
C41	.0068 200V		GPD X5R682K	DD-682		CCD-682	JF268	10TS-D68
C42	.0068		GPD X5R682K	DD-682		CCD-682	JF268	10TS-D68
C43	.0068 200V	(3)	GPD X5R682K	DD-682		CCD-682	JF268	10TS-D68
	.0047 200V		GPD X5R502K	DD-502		CCD-502	JF250	10TS-D50
C44	.01 100V		GPD X5S103K	DD-103	GP5000	CCD-103	JF110	10TS-S10
C45	.02		GPD Z5U203P	DD-203	GP10000	CCD-203	GP120	10TS-S20
C46	3 370V AC		RM0-960		KKL37P305Q		OP370	0V-3030

(1) Used in Models #2297 & 2293.

(2) Model #2295 uses 5mfd @ 35V electrolytic. (3) Used in Model #2297.

## CONTROLS (All wattages 1/2 watt, or less, unless listed)

ITEM No.	FUNCTION	RESIST-ANCE	REPLACEMENT DATA				
			MFGR. PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	CTS-IRC PART No.	MALLORY PART No.
R1	Level, Left	150K	88692	F2-250K, SF014	A47-250K-Z, FS-3 or [NP-250K-Z, UP-B-400]	B13-328, SK1 or [BU2, CF23, SS1, DC1]*	UA154A, SF1000 or [RU154A, SL38, SF1000] or U42
R2	Level, Right	150K	88692	F2-250K, SF014	A47-250K-Z, FS-3 or [NP-250K-Z, UP-B-400]	B13-328, SK1 or [BU2, CF23, SS1, DC1]*	UA154A, SF1000 or [RU154A, SL38, SF1000] or U42
R3A	Tone, Left	150K	88694	F2-250K, R2-250K, SF014, CPL-2	NP-250K-Z, NR-250K-Z, UP-B-400, DC-2	B13-328, B13-328, SK1, QCM or [BU2, CF23, CR18, SS1, SS7A, DC1]*	P25A, 3038, RU25A, CS3500
B	Tone, Right	150K					
A	Tone	50K	88865 (2)	F2-50K, R2-50K, SF014, CPL-2		B13-323, B13-323, SK1, QCM or [BU2, CF63, CR62, SS1, SS7A, DC1]*	P54A, 3038, RU54A, CS3500
B	Tone	50K					
R4A	Volume, Left	150K	88695 (1)	F1-150K, R1-150K, SF014, CPL-2	NP-150K-S, NR-150K-S, UP-B-400, DC-2	B11-328, B11-328, SK1, QCM or [BU2, CF14, CR9, SS1, SS7A, DC1]*	P154L, 3038, RU154L, CS3500
B	Volume, Right	150K					
A	Volume	15K	88870 (2)	F1-25K, R1-25K, SF014, CPL-2	NP-25K-S, NR-25K-S, UP-B-400, DC-2	B11-118, B11-118, SK1, QCM or [BU2, CF11, CR6, SS1, SS7A, DC1]*	P153L, 3038, RU153L, CS3500
B	Volume	15K					
R5	Bias Adjust	100K	88642	TSV-100K or T-100K		X201R104B	MTC15L1
R6	Meter Level Adjust	20K	88649	TSV-25K or T-20K		X201R253B	MTC24L1
R7	Bias Adjust	1meg	88674 (1)	TSV-1M or T-1meg		X201R105B	MTC16L1
	Bias Adjust	500K	88836 (2)	TSV-500K or T-500K		X201R504B	MTC55L1

\* "SNAPTROL"

(1) Used in Model 2295 (2) Used in Model 2297.



## PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

### COILS (RF-IF)

ITEM No.	USE	REPLACEMENT DATA			
		PART No.	MEISSNER PART No.	MILLER PART No.	WORKMAN PART No.
L1	Bias Oscillator	88689			
L2	Equalization Choke	88650		6304	

### TRANSFORMER (Power)

ITEM No.	RATING		REPLACEMENT DATA					NOTES
	PRI. 1	SEC. 1	MFGR. PART No.	MERIT PART No.	STANCOR PART No.	THORDARSON PART No.	TRIAD PART No.	
T1	117VAC @ .885 Amp	52VAC/CT @ .260A DC	41007 (1)					(1) Used with Models 2291, 2295, & 2297 (2) Used with Model 2293 only.
	PRI. 1	SEC. 2						
	117VAC @ .840 Amp	50VAC/CT @ .100A DC	88856 (2)					

### TRANSFORMER (Driver)

ITEM No.	TURNS RATIO			REPLACEMENT DATA					NOTES
	PRI.	SEC. 1	SEC. 2	MFGR. PART No.	MERIT PART No.	STANCOR PART No.	THORDARSON PART No.	TRIAD PART No.	
T2	7	1	1	41008 (1)					(1) Model 2295 (2) Model 2297
	3.1	1	1	88833 (2)					

### SPEAKER

ITEM No.	TYPE	REPLACEMENT DATA		NOTES
		MFGR. PART No.	QUAM PART No.	
SP1	4" x 8" PM 16 ohms	88709 (1) (2)		(1) Model 2295S uses Model 610 Speakers Model 2297S uses Model 630 Speakers (2) Used in Models 2295/97
SP2	4" x 8" PM 16 ohms	88709 (1) (2)		

### FUSE DEVICES

ITEM No.	DESCRIPTION	REPLACEMENT DATA					
		PART No.		BUSS PART No.		LITTELFUSE PART No.	
		DEVICE	HOLDER	DEVICE	HOLDER	DEVICE	HOLDER
F1	3AG, 1/2 Amp, 125V, (1) S10-B10, Pigtail			MDV 1/2		315.500	

(1) Some versions may use 1/4 Amp, Part #013165.

BELL & HOWELL MODELS 2291/93/95/95S/97/97S

## PARTS LIST AND DESCRIPTION (CONTINUED)

(When ordering parts, state Model, Part Number, and Description.)

### TAPE HEADS

ITEM No.	MEASURED			PART No.	NORTRONICS PART No.	DESCRIPTION
	INDUCTANCE	BIAS/ERASE VOLTS (RMS)	BIAS FREQ.			
M1	Record/Play 400mh Erase .2mh	17.5V rms  6.2V rms (105ma)	78KC  78KC	032225		4-Track Stereo Combination Record/Play/ Erase

### MISCELLANEOUS

ITEM No.	PART NAME	PART No.	NOTES
M2	Solenoid	41009	Automatic Cycle
M3	Meter	88822	Play/Record Level, Left Channel
M4	Meter	88822	Play/Record Level, Right Channel
M5	Motor	032143 (1)	Tape Transport
S1	Switch	41005	Play/Record
S2	Switch	013166	Speed Selector (Equalization)
S3	Switch	88648	Power On-Off
S4	Switch		Automatic Stop
S5	Switch	88682	Solenoid Release
S6	Switch	88682	Solenoid Release
S7	Switch		Automatic Forward
S8	Switch		Automatic Reverse
S9	Switch	88672	Record (Left)
S10	Switch	88672	Record (Right)
	Printed Circuit Board	013102	Bias Oscillator Assembly
	Printed Circuit Board	013101	Power Amp Model 2295 Only
	Printed Circuit Board	013181	Power Amp Model 2297 Only
	Printed Circuit Board	013100	Preamplifier (All Models)

(1) Motor (Model #AE2E002) used in Model 2295.

### CABINETS & CABINET PARTS (When ordering specify model, chassis & color)

ITEM	PART No.	ITEM	PART No.
Cabinet, Front - Models 2291/93/95	032068	Handle	87081
Cabinet, Front - Model 2297	032101	Knob, On/Off, Search, Pause, Cycle, Load	87073
Cabinet Back - Models 2291/95/97	032145	Knob, Volume, Tone & Record Level	032070

### ACCESSORIES

ITEM	MFGR. PART No.	REMARKS
Microphone (With Stand)	88823	