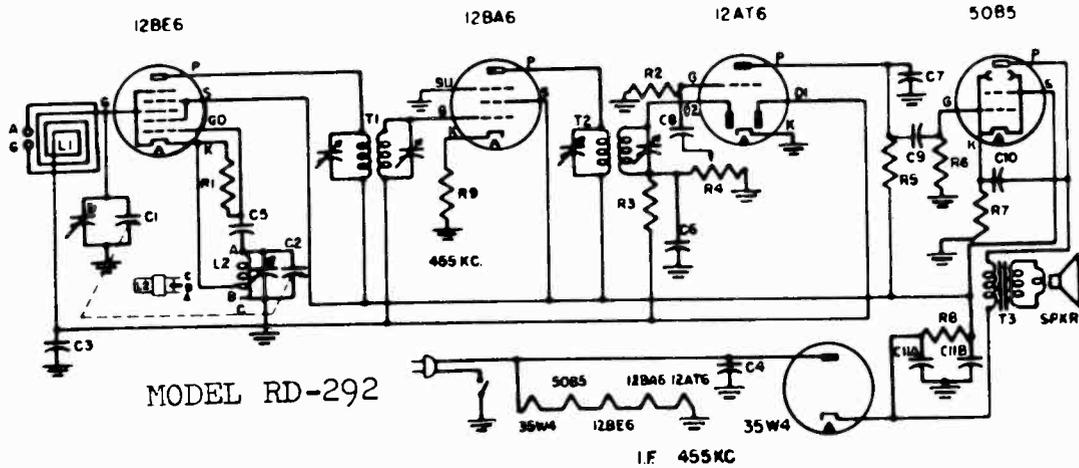


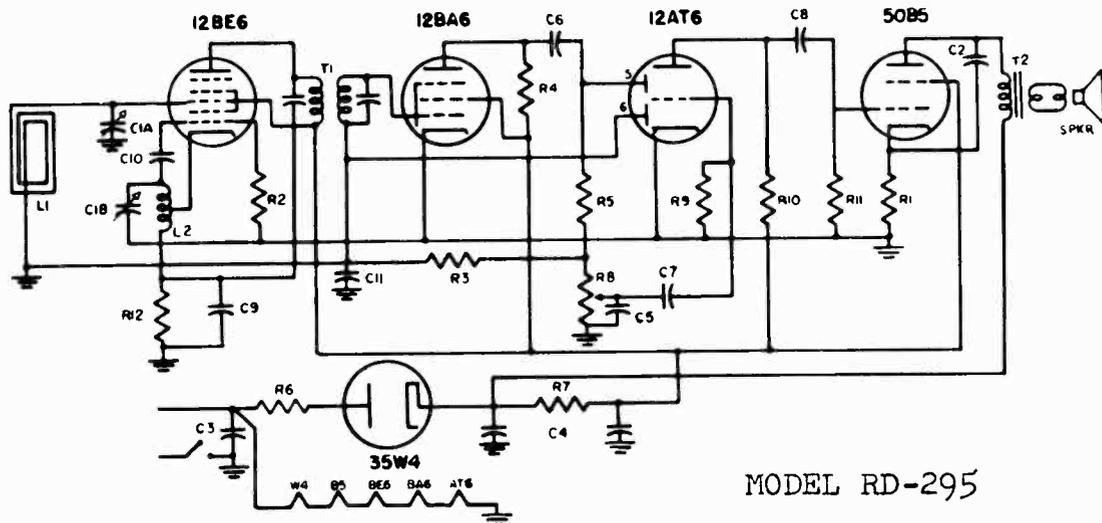


BUTLER BROTHERS

MODELS RD-292,  
RD-295



PART NO.	CIRC. SYM.	DESCRIPTION	PART NO.	CIRC. SYM.	DESCRIPTION
CV-10002-E	C1, C2	Condenser - Variable Tuning with Drum	RC-32503	R5	Resistor-Carbon 250,000 Ohms 1/2 watt
CP-14503	C3, C4	Condenser - .05 Mfd. 400 Volt	RC-35003	R6	Resistor-Carbon 500,000 Ohms 1/2 watt
CM-15500	C5	Condenser - .00005 Mfd. Mica	RC-31500	R7	Resistor-Carbon 150 Ohms 1/2 watt
CM-15251	C6, C7	Condenser - .00025 Mfd. Mica	RC-32000	R8	Resistor-Carbon 200 Ohms 1/2 watt
CP-14103	C8, C9	Condenser - .01 Mfd. 400 Volt	RC-31500	R9	Resistor-Carbon 150 Ohms 1/2 watt
CP-14503	C10	Condenser - .05 Mfd. 400 Volt	AL-10004	L1	Loop Antenna
CL-10001	C11A, C11B	Condenser - 20/20 Mfd. 150 Volt Elect.	TRC-10000-D	L2	Coil Oscillator
RC-32002	R1	Resistor-Carbon 20,000 ohms 1/2 watt	TS-10000	T1	Transformer 1st. I.F.
RC-31005	R2	Resistor-Carbon 10 Meg. 1/2 watt	TS-10001	T2	Transformer 2nd. I.F.
RC-32004	R3	Resistor-Carbon 2 Meg. 1/2 watt	TO-10000	T3	Transformer-Output for speaker
VC-10105	R4	Volume Control - 1 Meg. (with switch)	SR-10000	SPKR	Speaker, 4" P.M.



Part No.	Circuit Symbol	Description	Part No.	Circuit Symbol	Description
CV-10008	C1	Variable condenser for Model 5A7	RCP-30220	R6	Resistor carbon 22 ohm 1/2 watt
CPP-14203	C2	Condenser paper tub .02 mfd-400V	RCP-41001	R7	Resistor carbon 1000 ohm 1 watt
CPP-14503	C3	Condenser paper tub .05 mfd-400V	VCP-10105	R8	Volume control 1 megohm and switch
CLP-10007	C4	Condenser electrolytic 50-30 mfd-150V	VCP-12105	R8	Volume control for Model 5A7- 1 megohm
CHP-15251	C5, C6	Condenser mica 250 mmf-500V	RCP-31005	R9	Resistor carbon 10 megohm 1/2 watt
CPP-12103	C7, C8	Condenser paper tub .01 mfd-200V	RCP-32203	R10	Resistor carbon 220,000 ohm 1/2 watt
CPP-11103	C9	Condenser paper tub .01 mfd-150V	RCP-34703	R11	Resistor carbon 470,000 ohm 1/2 watt
CHP-15500	C10	Condenser mica 50 mmf-500V	ALP-10013	L1	Loop antenna
CPP-12203	C11	Condenser paper .02 mfd-200V	TRCP-10000-D	L2	Oscillator coil
RCP-31500	R1, R12	Resistor carbon 150 ohm 1/2 watt	TSP-10002	T1	I.F. Transformer
RCP-31002	R2	Resistor carbon 10,000 ohm 1/2 watt	TOP-10000	T2	Output transformer
RCP-32204	R3	Resistor carbon 2.2 megohm 1/2 watt	SRP-10005	SPKR	Speaker P.M. 3" round for Model 5A7
RCP-36801	R4	Resistor carbon 6800 ohm 1/2 watt			
RCP-31003	R5	Resistor carbon 100,000 ohm 1/2 watt			

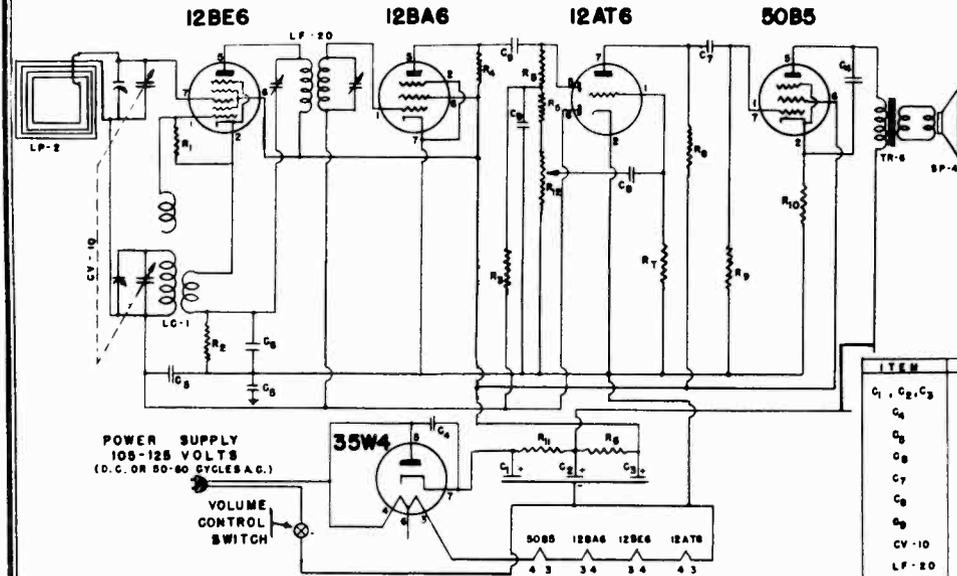






W. T. GRANT COMPANY

CHASSIS Series H, R



I. F. - 455 K.C.

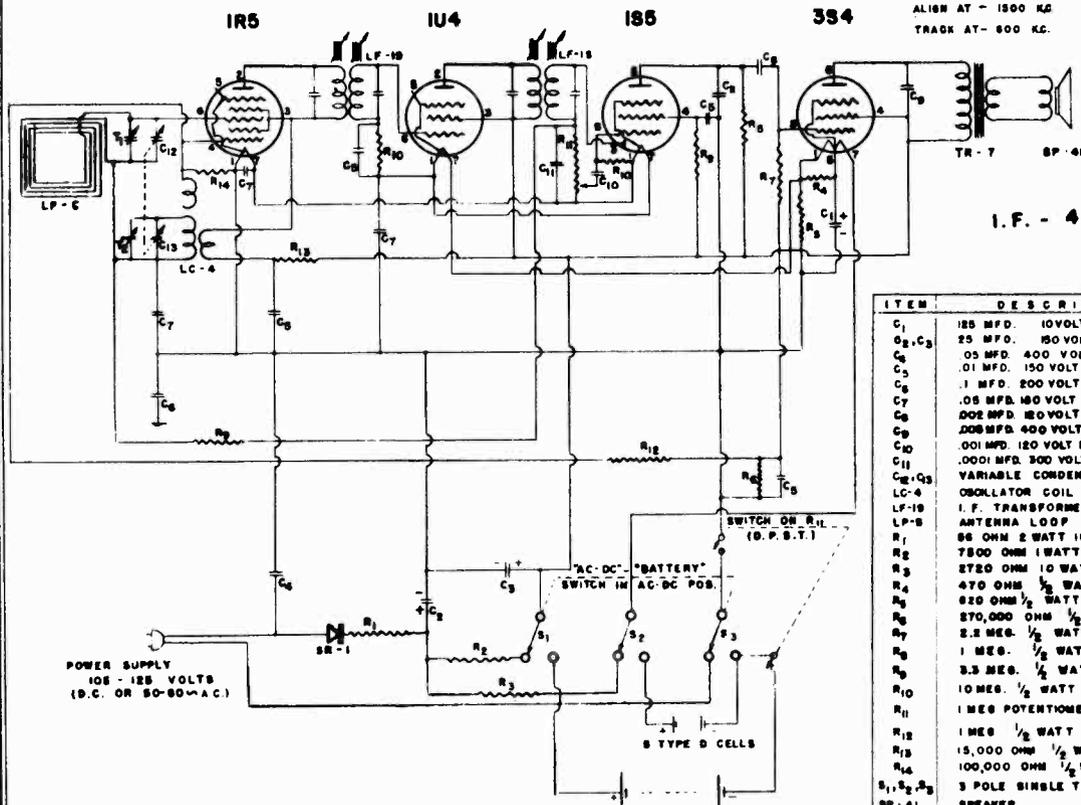
CHASSIS SERIES "H"

ITEM	DESCRIPTION	PART NO.
C <sub>1</sub> , C <sub>2</sub> , C <sub>3</sub>	3X 20 MFD - 150 VOLT ELECTROLYTIC	CE - 11
C <sub>4</sub>	.02 MFD - 400 VOLT PAPER CONDENSER	CP-503-1
C <sub>5</sub>	.05 MFD - 200 VOLT PAPER CONDENSER	CP-503-4
C <sub>6</sub>	.01 MFD - 400 VOLT PAPER CONDENSER	CP-103-1
C <sub>7</sub>	.01 MFD - 150 VOLT PAPER CONDENSER	CP-103-2
C <sub>8</sub>	.002 MFD - 400 VOLT PAPER CONDENSER	CP-202-2
C <sub>9</sub>	.0005 MFD - 500 VOLT MICA CONDENSER	CM-50-1
CV-10	VARIABLE CONDENSER	CV-10
LF-20	I. F. TRANSFORMER	LF-20
LP-2	LOOP	LP-2
R <sub>1</sub>	22,000 OHMS 1/2 WATT RESISTOR	RC-223-1
R <sub>2</sub>	22 OHMS 1/2 WATT 10% RESISTOR	RC-220-2
R <sub>3</sub>	2.2 MEG. 1/2 WATT RESISTOR	RC-225-1
R <sub>4</sub>	8800 OHMS 1/2 WATT RESISTOR	RC-882-1
R <sub>5</sub>	100,000 OHMS 1/2 WATT RESISTOR	RC-104-1
R <sub>6</sub>	1800 OHMS 1 WATT RESISTOR	RC-182-4
R <sub>7</sub>	10 MEG. 1/2 WATT RESISTOR	RC-108-1
R <sub>8</sub>	220,000 OHMS 1/2 WATT RESISTOR	RC-224-1
R <sub>9</sub>	470,000 OHMS 1/2 WATT RESISTOR	RC-474-1
R <sub>10</sub>	180 OHMS 1/2 WATT RESISTOR	RC-181-1
R <sub>11</sub>	180 OHMS 1 WATT RESISTOR	RC-181-4
R <sub>2</sub>	VOLUME CONTROL 1 MEG. WITH S.P.S.T. SW.	VC-5
SP-40	SPEAKER	SP-40
LC-1	OSCILLATOR COIL	LC-1
TR-6	OUTPUT TRANSFORMER	TR-6

FREQ. RANGE - 530-1700 KC.

ALIGN AT - 1500 KC.

TRACK AT - 600 KC.



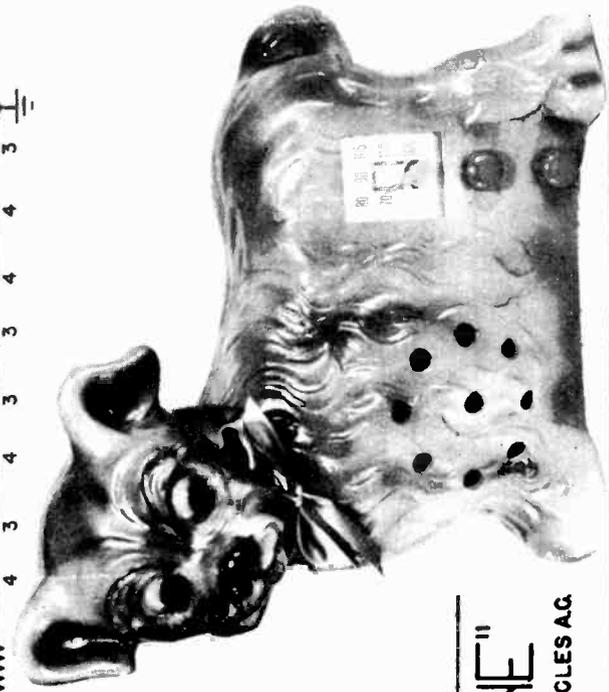
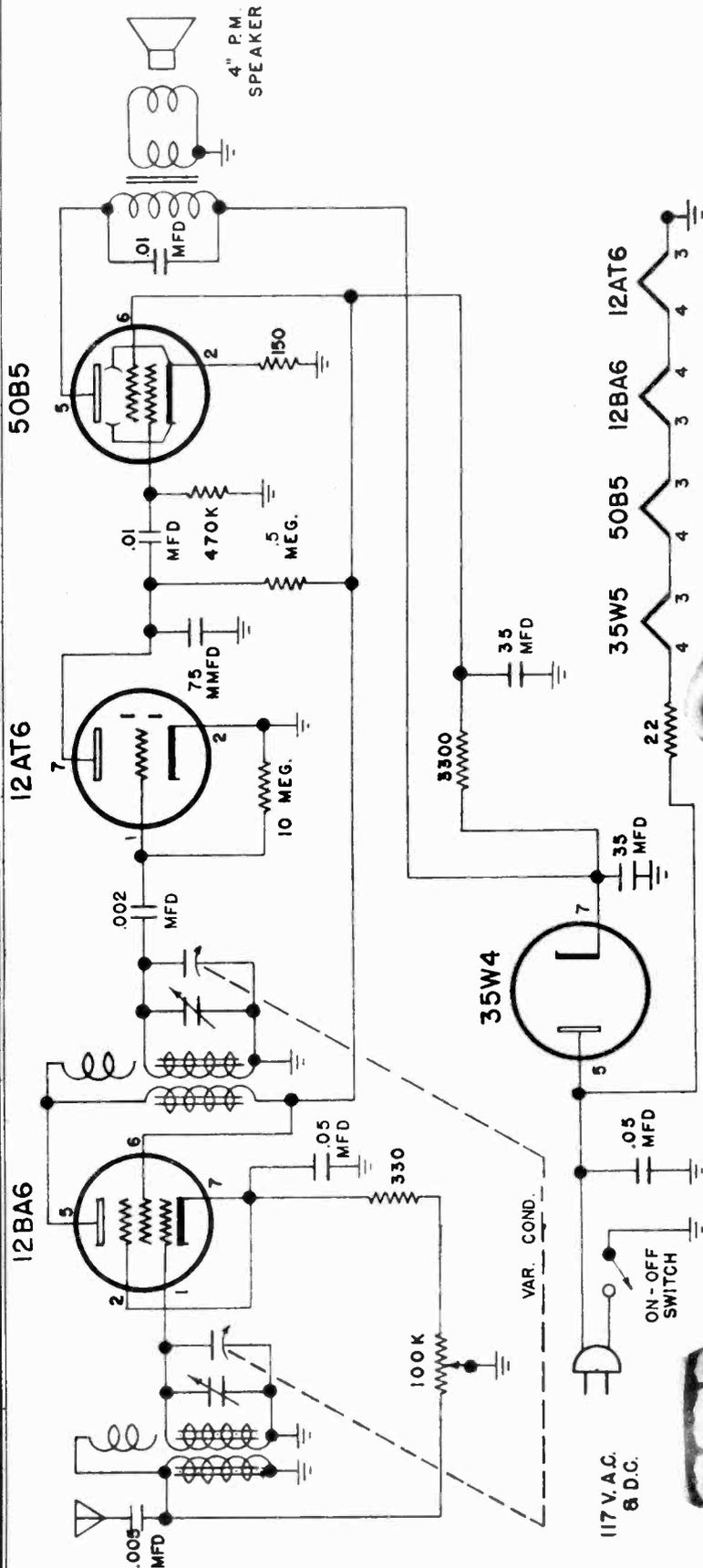
I. F. - 455 K.C.

CHASSIS SERIES "R"

EVEREADY NO 457 67 1/2 VOLT OR EQUIVALENT

ITEM	DESCRIPTION	PART NUMBER
C <sub>1</sub>	125 MFD 10 VOLT ELECTROLYTIC	CE-12
C <sub>2</sub> , C <sub>3</sub>	25 MFD 150 VOLT CONDENSER	CP 503-1
C <sub>4</sub>	.05 MFD 400 VOLT PAPER CONDENSER	CP 104-2
C <sub>5</sub>	.01 MFD 150 VOLT PAPER CONDENSER	CP 104-2
C <sub>6</sub>	.1 MFD 200 VOLT PAPER CONDENSER	CP 503-2
C <sub>7</sub>	.05 MFD 150 VOLT PAPER CONDENSER	CP 202-1
C <sub>8</sub>	.002 MFD 400 VOLT PAPER CONDENSER	CP 502-2
C <sub>9</sub>	.001 MFD 300 VOLT MICA CONDENSER	CP 102-1
C <sub>10</sub>	.001 MFD 300 VOLT MICA CONDENSER	CM 101-1
C <sub>11</sub>	VARIABLE CONDENSER	CV 10
C <sub>12</sub> , C <sub>13</sub>	VARIABLE CONDENSER	CV 10
LC-4	OSCILLATOR COIL	LC-4
LF-19	I. F. TRANSFORMER	LF-19
LP-5	ANTENNA LOOP	LP-5
R <sub>1</sub>	88 OHM 2 WATT 10% W.W. RESISTOR	RW 880-8
R <sub>2</sub>	7500 OHM 1 WATT 10% RESISTOR	RC 752-8
R <sub>3</sub>	2720 OHM 10 WATT 5% RESISTOR	RP - 1
R <sub>4</sub>	470 OHM 1/2 WATT RESISTOR	RC 471-1
R <sub>5</sub>	820 OHM 1/2 WATT 10% RESISTOR	RC 821-2
R <sub>6</sub>	270,000 OHM 1/2 WATT 10% RESISTOR	RC 274-2
R <sub>7</sub>	2.2 MEG. 1/2 WATT RESISTOR	RC 225-1
R <sub>8</sub>	1 MEG. 1/2 WATT RESISTOR	RC 105-1
R <sub>9</sub>	3.3 MEG. 1/2 WATT RESISTOR	RC 335-1
R <sub>10</sub>	10 MEG. 1/2 WATT RESISTOR	RC 106-1
R <sub>11</sub>	1 MEG POTENTIOMETER WITH SWITCH	VC - 6
R <sub>12</sub>	1 MEG 1/2 WATT 10% RESISTOR	RC 108-2
R <sub>13</sub>	15,000 OHM 1/2 WATT RESISTOR	RC 153-1
R <sub>14</sub>	100,000 OHM 1/2 WATT 10% RESISTOR	RC 104-2
S <sub>1</sub> , S <sub>2</sub> , S <sub>3</sub>	3 POLE SINGLE THROW SWITCH	SW - 3
SP-41	SPEAKER	SP-41
TR-7	OUTPUT TRANSFORMER	TR-7
SR-1	SELENIUM RECTIFIER	SR-1
T <sub>1</sub> , T <sub>2</sub>	TRIMMERS ON VARIABLE	



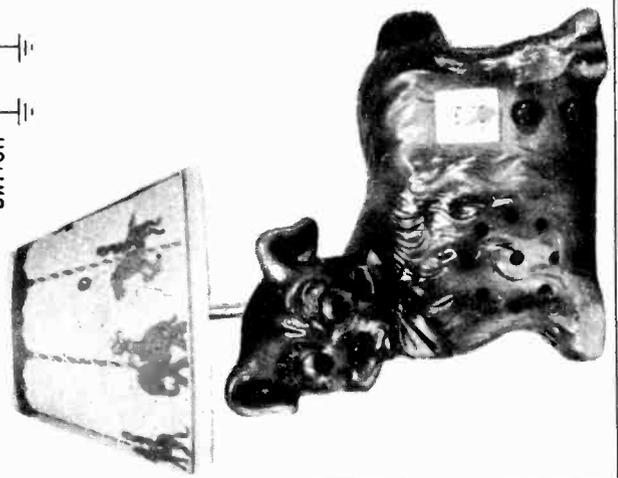


4 TUBE TRF RECEIVER  
SCHEMATIC DIAGRAM

RECEIVER ALIGNED WITH  
454A4F DUMMY ANTENNA

# "PUPPYTUNE"

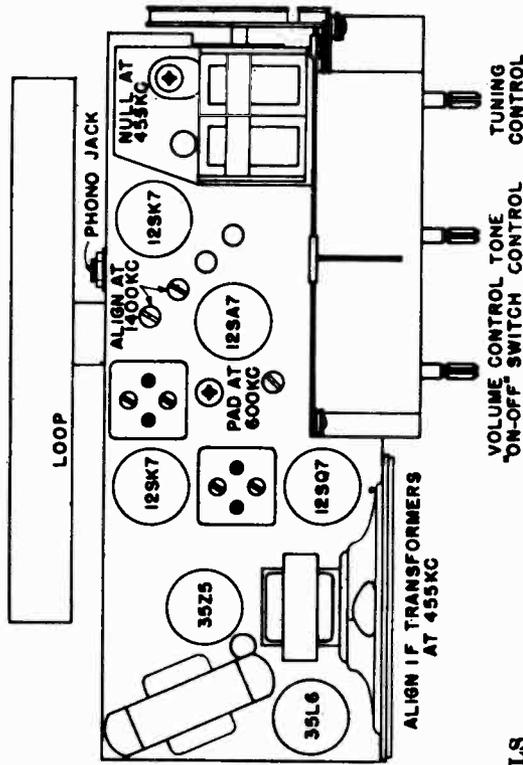
105-125 V. D.C. OR 50-60 CYCLES A.C.  
RANGE 540-1650 KC



MODEL 6K

MAGUIRE INDUSTRIES, INC.

TUBE LAYOUT



CONTROLS

**TOPE CONTROL: (Center knob).**

Turn knob counter-clockwise for maximum bass and clockwise for maximum treble response.

**VOLUME CONTROL: (Left-hand knob).**

Turning knob clockwise turns the receiver on and turning further increases the volume.

**TUNING CONTROL: (Right-hand knob).**

This knob is used to select stations. Tune station until it is at maximum clearness. Never attempt to reduce the volume by detuning the station—always use the volume control.

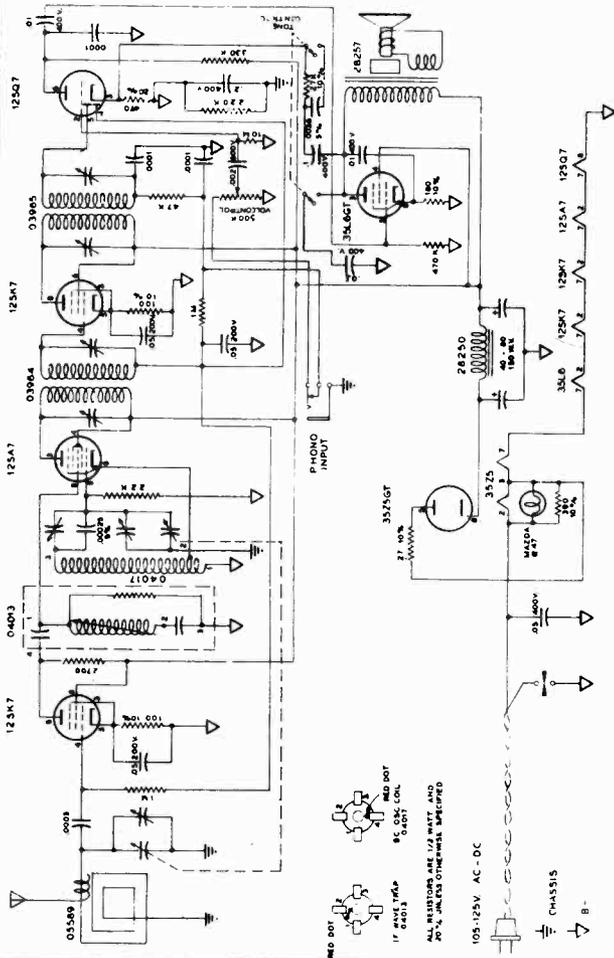
OPERATION

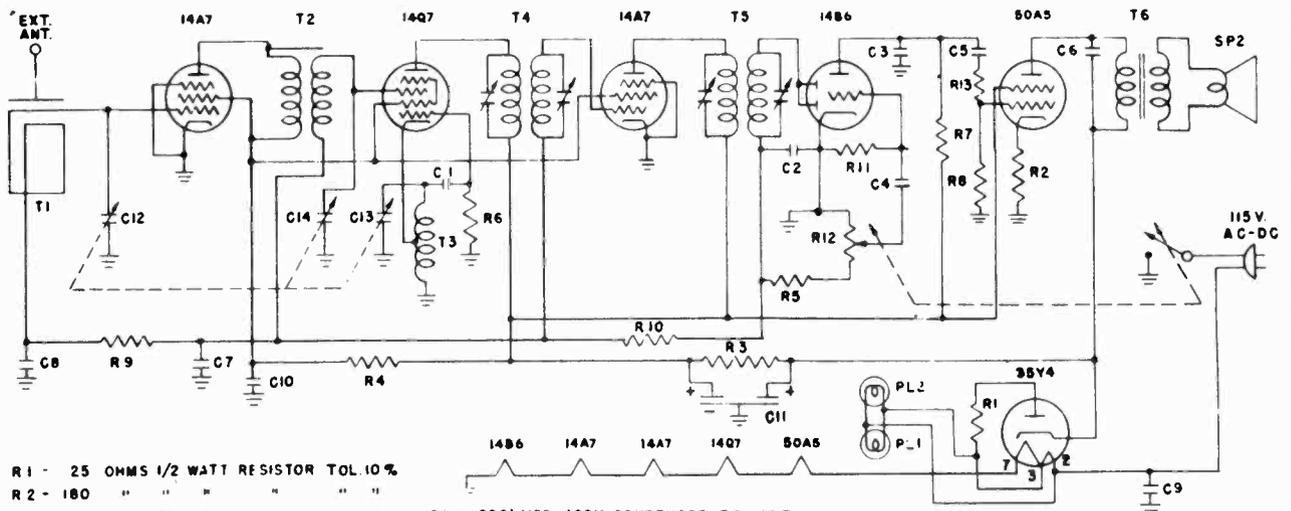
Turn the "On-Off" switch and volume control clockwise about half its range. This supplies power to the receiver. After allowing the tubes to warm up, tune in the desired station by rotating the tuning control. For best results, tune the desired station with the volume turned low. This enables you to get the exact point where the station comes in best. Then adjust the volume control.

To operate the receiver as a phonograph amplifier, insert phonograph plug in jack on rear of chassis. Turn "On-Off" switch and volume control clockwise about half its range and adjust tone control to desired position. For normal radio reception the phono plug must be withdrawn from the jack.

This is a 6-tube superheterodyne radio receiver, with provision for phonograph input, for operation on 105-125 volt AC or DC power supply. The tubes used are a 12SK7 as an R.F. amplifier, a 12SA7 as an oscillator-converter, a 12SK7 as an I.F. amplifier, a 12SQ7 as an AVC, detector, and 1st audio amplifier, a 35L6 as an output, and a 35Z5 as a power rectifier.

The broadcast band covers a frequency range from 535 to 1620 kilocycles. The dial is calibrated in kilocycles (KC) (less the final zero).





- R1 - 25 OHMS 1/2 WATT RESISTOR TOL.10%
- R2 - 180 " " " " " " " "
- R3 - 1200 " " " " " " " "
- R4 - 15M " " " " " " " "
- R5 - 50M " 1/3 " " " " " "
- R6 - 50M " " " " " " " "
- R7 - 500M " " " " " " " "
- R8 - 1MEG " " " " " " " "
- R9 - 1MEG " " " " " " " "
- R10 - 2MEG " " " " " " " "
- R11 - 5MEG " " " " " " " "
- R12 - 500M " POT WITH SWITCH
- R13 - 100M " 1/3 WATT RESISTOR TOL.10%

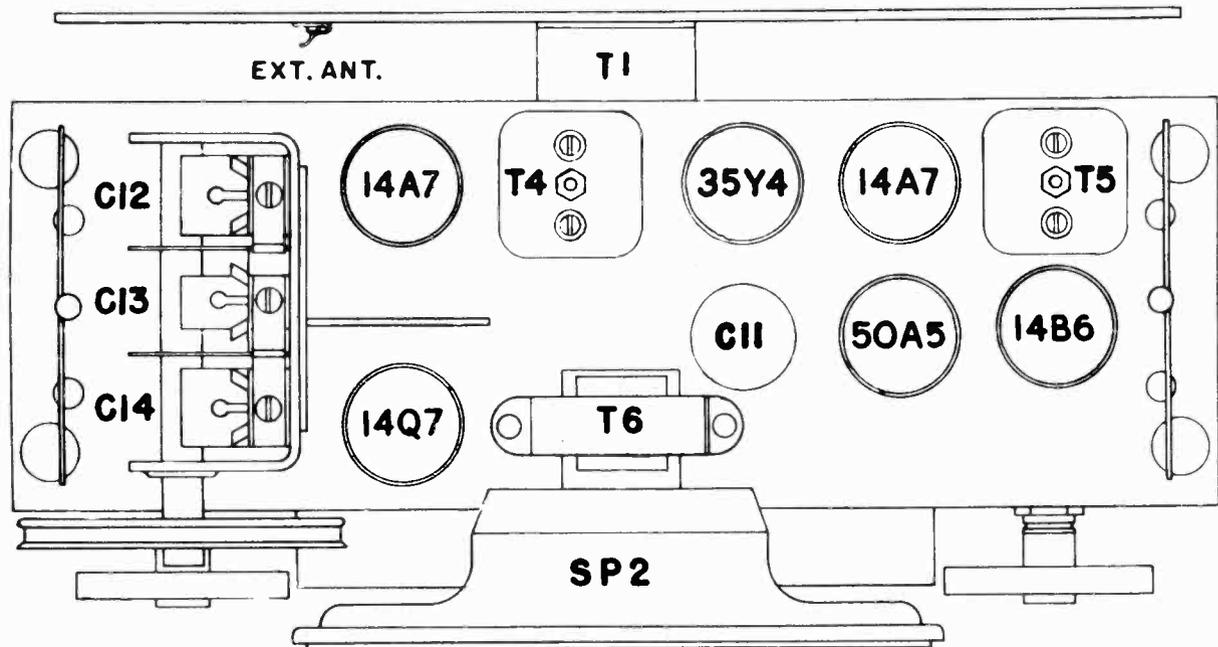
- C1 - .0001 MFD. 400V. CONDENSER TOL. 10%
- C2 - .0001 " " " " " "
- C3 - .0001 " " " " " "
- C4 - .0006 " " " " " "
- C5 - .01 " " " " " "
- C6 - .02 " " " " " "
- C7 - .05 " 200V " " " "
- C8 - .05 " " " " " "
- C9 - .05 " 400V " " " "
- C10 - .1 " 200V " " " "
- C11 - 50+50 " 150V " " " "

- C12 - ANT. SECTION OF GANG CONDENSER
- C13 - OSC. " " " "
- C14 - R.F. " " " "

- T1 - LOOP ANTENNA
- T2 - R F COIL
- T3 - OSC. COIL
- T4 - INPUT IF COIL 392 KC
- T5 - OUTPUT IF COIL 392 KC
- T6 - O P TRANSFORMER

IF Alignment--465 KC (connect to ant. connector on loop).  
 Loop Alignment--1500, 1000, and 550 KC.  
 Dial Pointer Alignment--538 with fully closed condenser.

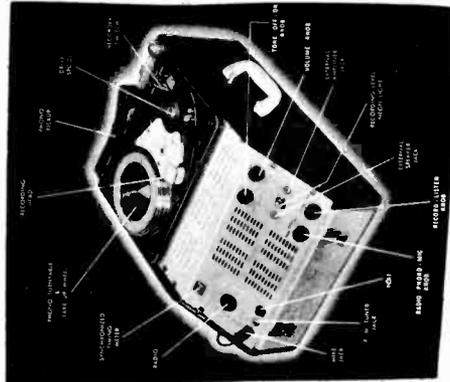
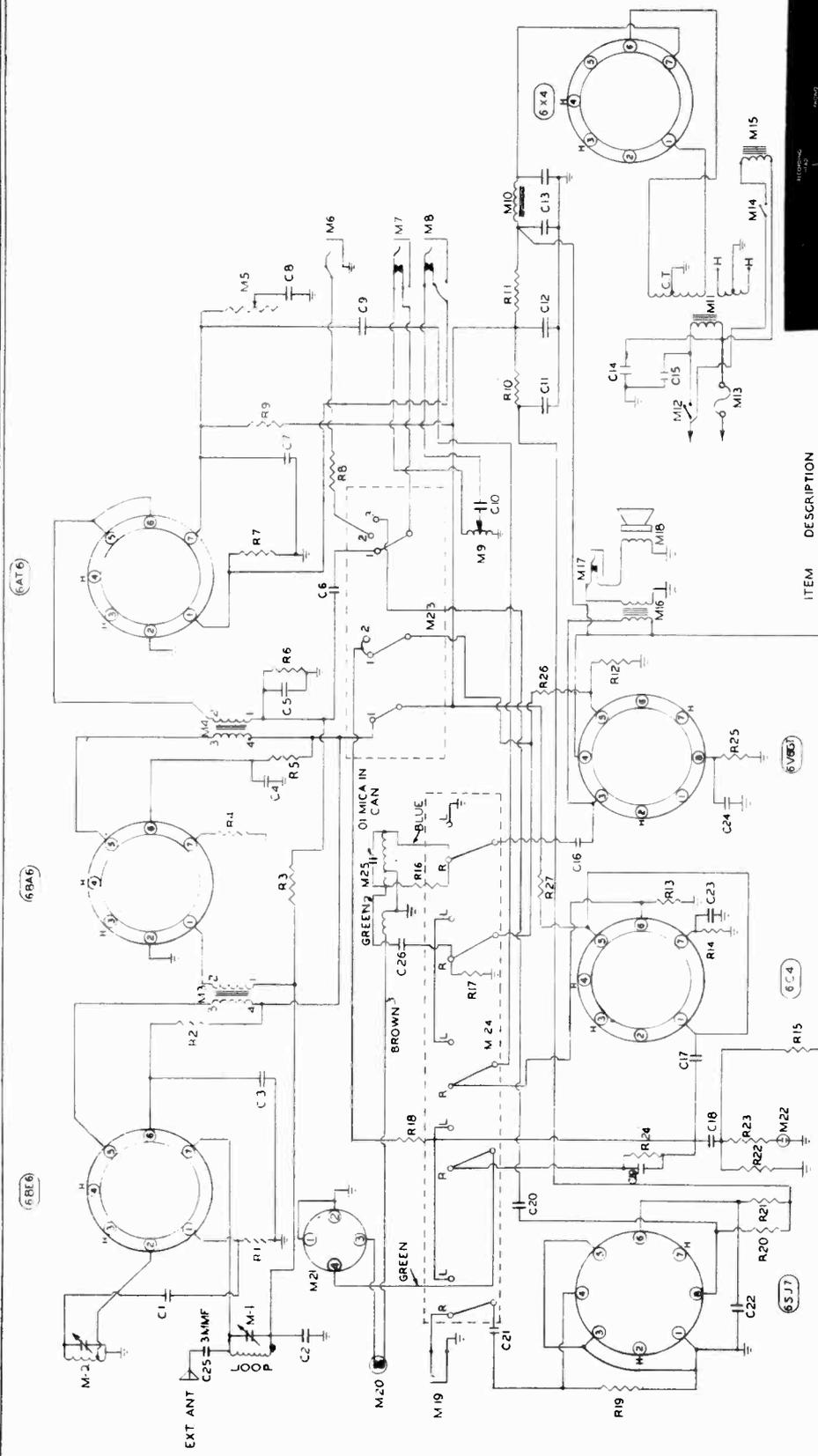
- PL1 - NO. 47 PILOT LAMP
- PL2 - " " " "
- SP2 - 6" P.M. DYNAMIC SPEAKER



Top view of chassis showing tubes and parts

MODEL 748,  
Astra-Sonic

PENTRON CORPORATION



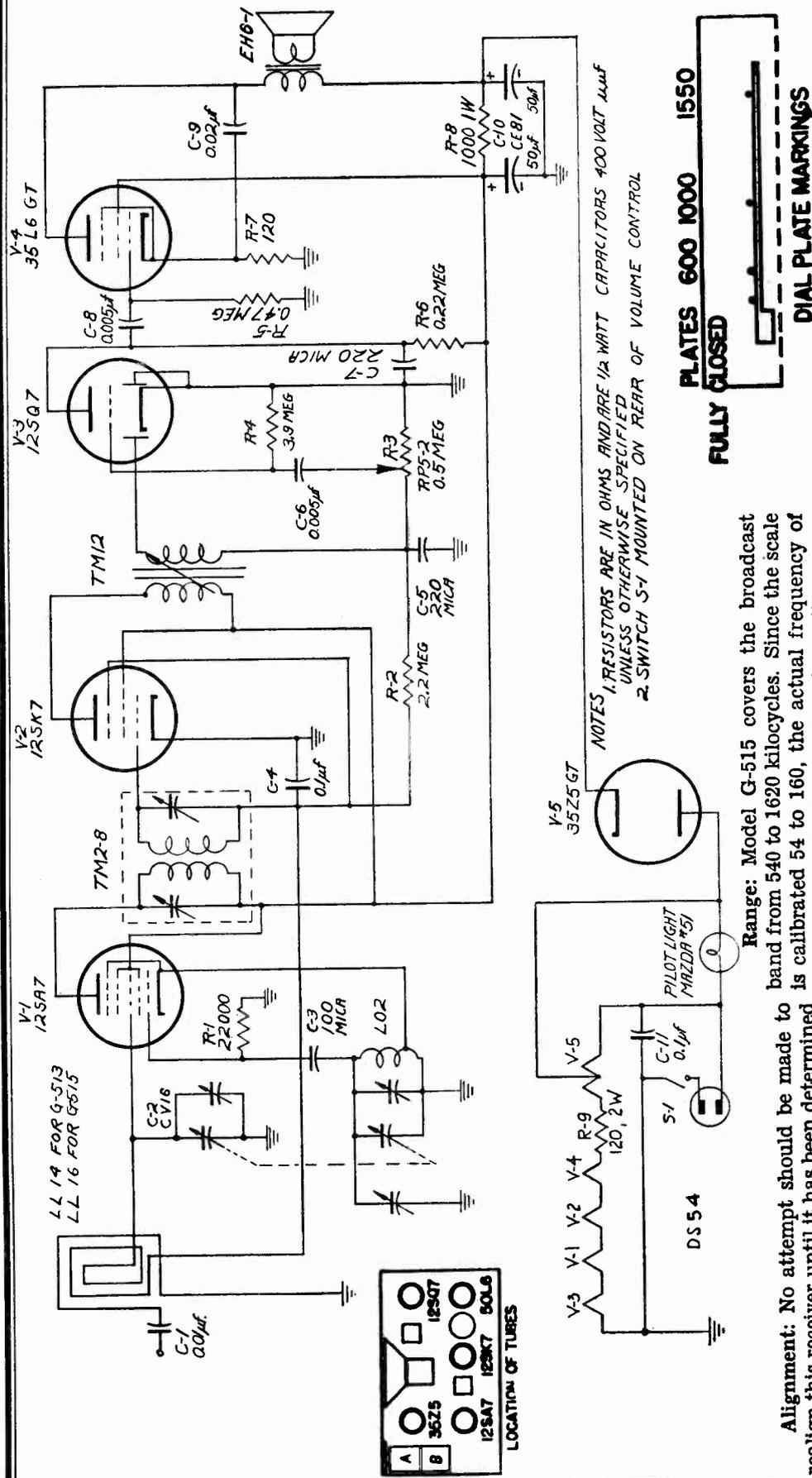
- | ITEM | DESCRIPTION                 |
|------|-----------------------------|
| M 3  | IF TRANSFORMER 455 KC       |
| M 4  | IF TRANSFORMER 455 KC       |
| M 5  | 50000 OHM TONE CONTROL      |
| M 6  | 50000 OHM TONE CONTROL      |
| M 7  | EXT. AMP JACK               |
| M 8  | EXT. AMP JACK               |
| M 9  | 500,000 OHM VOLUME CONTROL  |
| M 10 | 200 OHM 80 MA CHOKE         |
| M 11 | POWER TRANSFORMER           |
| M 12 | 500 OHM 1/2 WATT            |
| M 13 | 500 OHM 1/2 WATT            |
| M 14 | MOTOR SWITCH                |
| M 15 | RECORDING MOTOR             |
| M 16 | 5000 OHM OUTPUT TRANSFORMER |
| M 17 | EXT. SPEAKER JACK           |
| M 18 | SPEAKER (3.2 VOICE COIL)    |
| M 19 | RECORDING HEAD PLUG         |
| M 20 | RECORDING HEAD PLUG         |
| M 21 | RECORDING SWITCH            |
| M 22 | N.E. 51 NEON LIGHT          |
| M 23 | RADIO PHONO. MIC. SWITCH    |
| M 24 | RECORDOR-LISTEN SWITCH      |
| M 25 | 30-40 KC OSC. COIL          |

- | ITEM | DESCRIPTION                      |
|------|----------------------------------|
| C 12 | 10 MFD 350 VOLT CONDENSER        |
| C 13 | DUAL 30 MFD 350 VOLT CONDENSER   |
| C 14 | 1 MFD 400 VOLT CONDENSER         |
| C 15 | 1 MFD 400 VOLT CONDENSER         |
| C 16 | MICA CONDENSER .003 MFD 400 VOLT |
| C 17 | 1 MFD 400 VOLT CONDENSER         |
| C 18 | 10 MFD 400 VOLT CONDENSER        |
| C 19 | 10 MFD 400 VOLT CONDENSER        |
| C 20 | 10 MFD 400 VOLT CONDENSER        |
| C 21 | 0.1 MFD 400 VOLT CONDENSER       |
| C 22 | 1 MFD 25 VOLT CONDENSER          |
| C 23 | 20 MFD 25 VOLT CONDENSER         |
| C 24 | 20 MFD 25 VOLT CONDENSER         |
| C 25 | MICA CONDENSER .003 MFD          |
| C 26 | MICA CONDENSER .003 MFD          |

- | ITEM | DESCRIPTION                |
|------|----------------------------|
| R 21 | 22 MEG OHM 1/2 WATT        |
| R 22 | 220,000 OHM 1/2 WATT       |
| R 23 | 200,000 OHM 1/2 WATT       |
| R 24 | 100,000 OHM 1/2 WATT       |
| R 25 | 270 OHM 1 WATT             |
| R 26 | 4700 OHM 1/2 WATT          |
| R 27 | 47,000 OHM 1/2 WATT        |
| C 1  | 50 MMF 400 VOLT CONDENSER  |
| C 2  | 05 MFD 200 VOLT CONDENSER  |
| C 3  | 05 MFD 400 VOLT CONDENSER  |
| C 4  | 05 MFD 400 VOLT CONDENSER  |
| C 5  | 070 MMF 400 VOLT CONDENSER |
| C 6  | 1 MEG OHM 1/2 WATT         |
| C 7  | 500 MMF 400 VOLT CONDENSER |
| C 8  | 02 MFD 400 VOLT CONDENSER  |
| C 9  | 02 MFD 400 VOLT CONDENSER  |
| C 10 | 10 MEG OHM 1/2 WATT        |
| C 11 | 470,000 OHM 1/2 WATT       |

- | ITEM | DESCRIPTION          |
|------|----------------------|
| R 1  | 22,000 OHM 1/2 WATT  |
| R 2  | 220,000 OHM 1/2 WATT |
| R 3  | 100 OHM 1/2 WATT     |
| R 4  | 100 OHM 1/2 WATT     |
| R 5  | 100,000 OHM 1/2 WATT |
| R 6  | 100,000 OHM 1/2 WATT |
| R 7  | 100,000 OHM 1/2 WATT |
| R 8  | 220,000 OHM 1/2 WATT |
| R 9  | 100,000 OHM 1/2 WATT |
| R 10 | 4700 OHM 1/2 WATT    |
| R 11 | 47,000 OHM 1/2 WATT  |
| R 12 | 220,000 OHM 1/2 WATT |
| R 13 | 100,000 OHM 1/2 WATT |
| R 14 | 1 MEG OHM 1/2 WATT   |
| R 15 | 100,000 OHM 1/2 WATT |
| R 16 | 100,000 OHM 1/2 WATT |
| R 17 | 100,000 OHM 1/2 WATT |
| R 18 | 470,000 OHM 1/2 WATT |
| R 19 | 10 MEG OHM 1/2 WATT  |
| R 20 | 470,000 OHM 1/2 WATT |

© John F. Rider



NOTES  
 1. RESISTORS ARE IN OHMS AND ARE 1/2 WATT CAPACITORS 400 VOLT  $\mu$ mf  
 UNLESS OTHERWISE SPECIFIED  
 2. SWITCH S-1 MOUNTED ON REAR OF VOLUME CONTROL

Range: Model G-515 covers the broadcast band from 540 to 1620 kilocycles. Since the scale is calibrated 54 to 160, the actual frequency of the station received is obtained by adding a zero to the dial calibration.

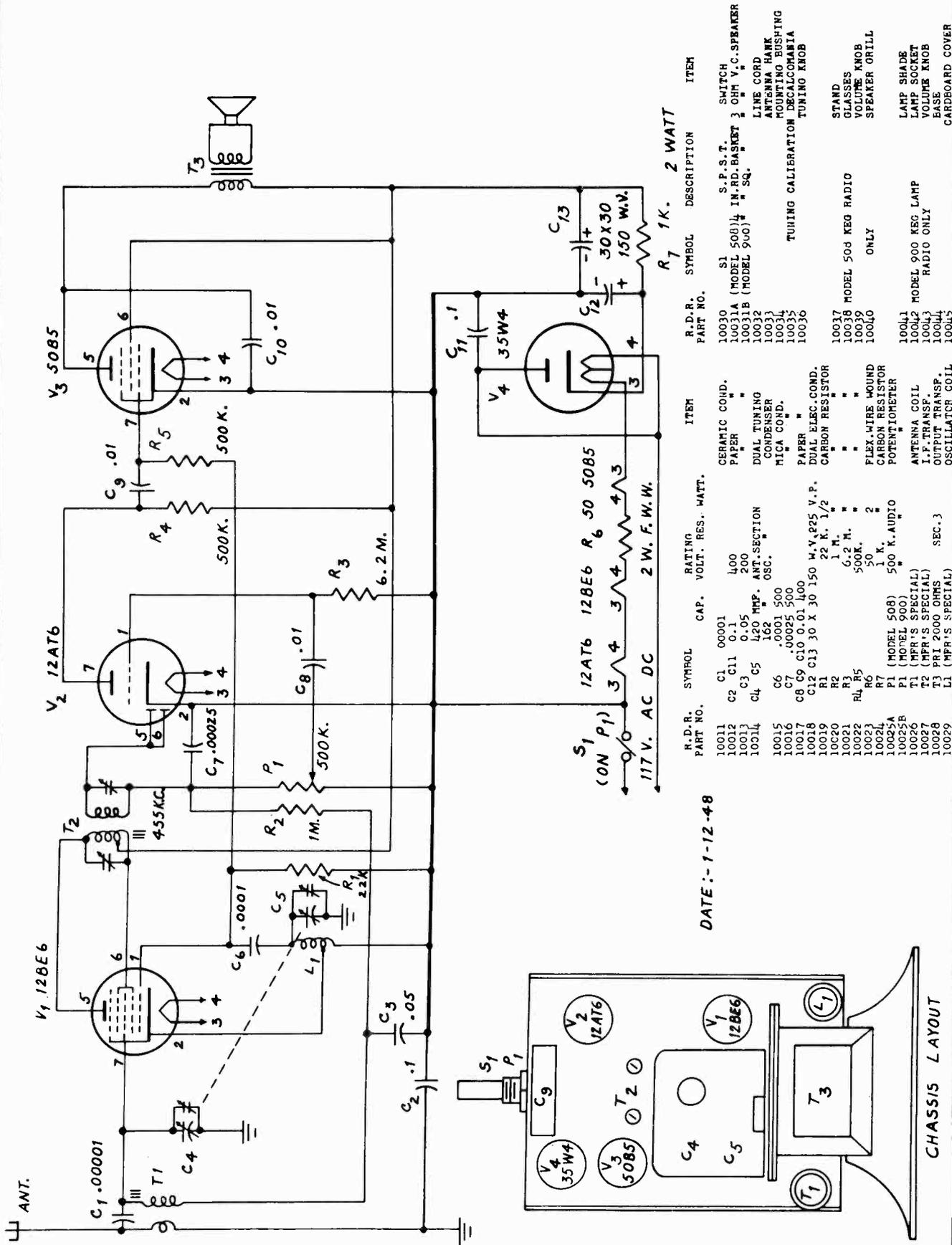
To align RF trimmers remove the 0.01 mf Signal Generator and connect the Signal Generator leads to 1550 capacitor and connect the Signal Generator leads to 1550 capacitor (B) (on rear section or two or three turns of heavy wire, forming a self-supporting loop of about 7 or 8 inches diameter, placed about a foot away from the receiver's loop antenna. Again, use the least possible input from the Signal Generator. With the tuning capacitor plates completely out of mesh, adjust pointer at extreme right end of travel, and the pointer to 1700 kc. Readjust both of tuning capacitor and tuning capacitor to 1550

Alignment: No attempt should be made to realign this receiver until it has been determined that a poor tube, or some local condition is not responsible for faulty reception. An output meter may be clipped directly across the voice coil lugs.

The Signal Generator may be connected through a 0.01 mf capacitor (used as dummy antenna) to the lug on RF section (B) of tuning capacitor. Connect ground clip of generator directly to chassis. Align the I. F. trimmers to 455 kc, using least possible input from Signal Generator to avoid developing A.V.C. voltage which would make the tuning adjustments very broad.

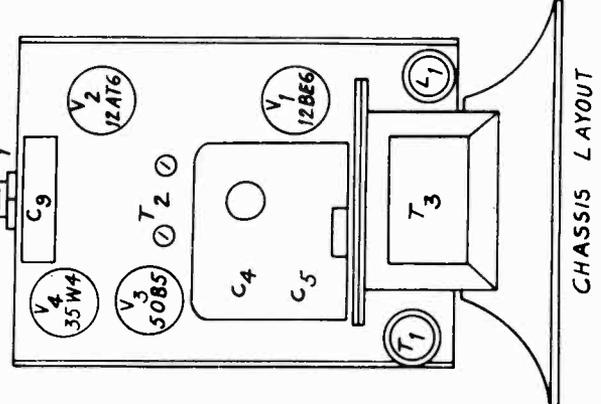
MODELS 508,  
900

RADIO DEVELOPMENT & RESEARCH CORP.

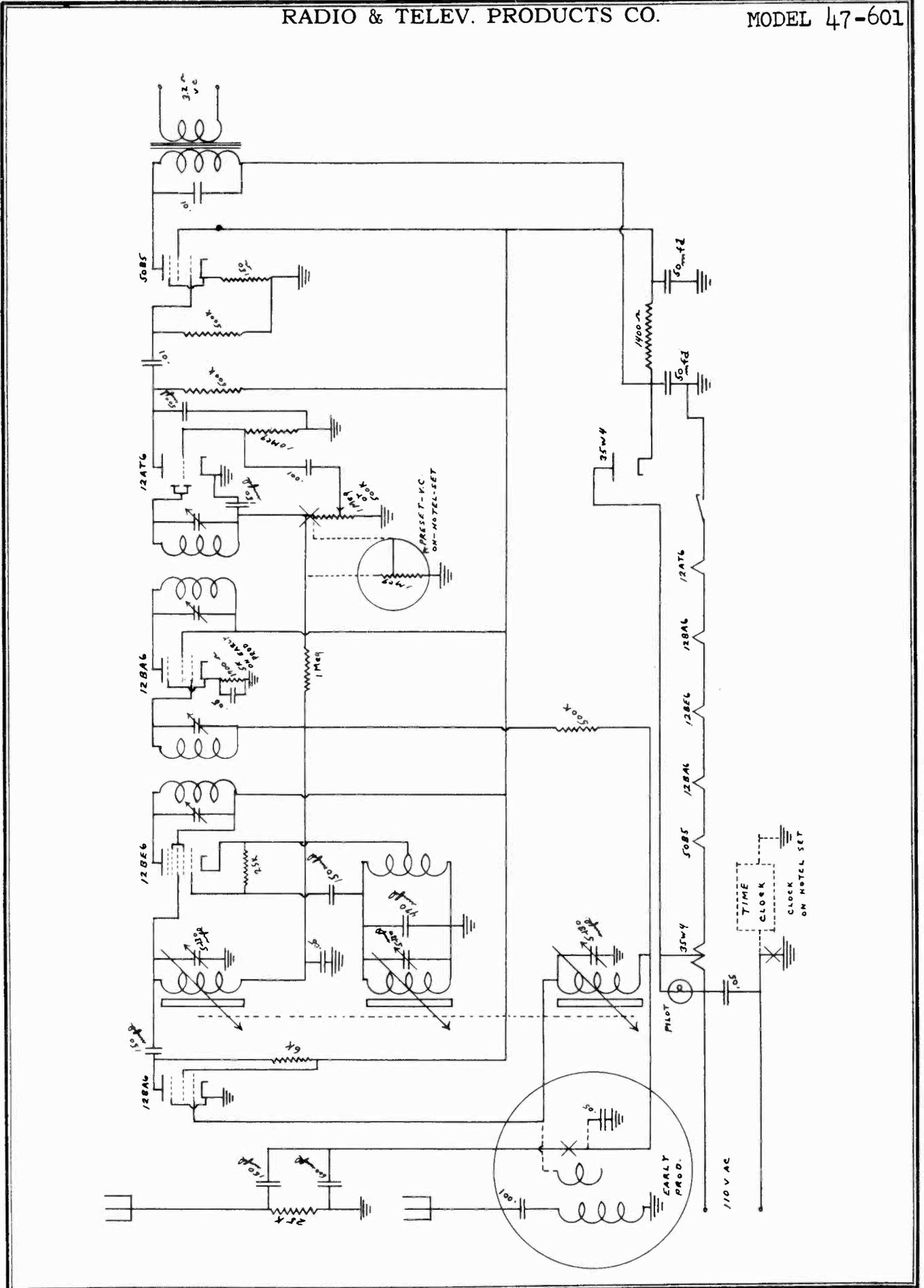


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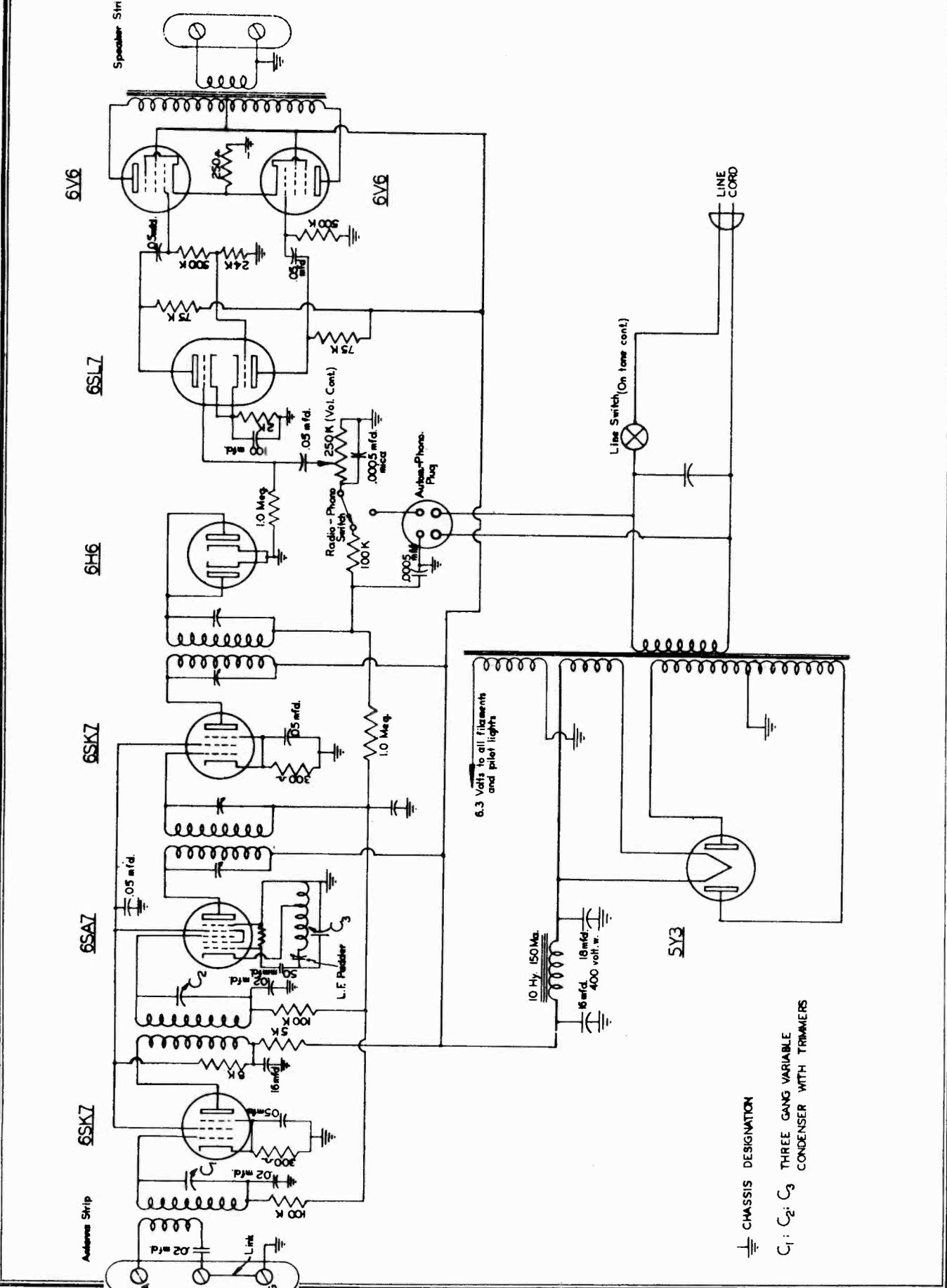
R.D.R. PART NO.	SYMBOL	CAP.	RATING	ITEM	R.D.R. PART NO.	SYMBOL	DESCRIPTION	ITEM
10011	C1	00001		CERAMIC COND.	10030	S1	SWITCH	
10012	C2	0.1	400	PAPER	10031A	1/4 IN. RD. BASKET	3 OHM V.C. SPEAKER	
10013	C3	0.05	200	PAPER	10031B	1/4 IN. RD. BASKET	3 OHM V.C. SPEAKER	
10014	C4	420 MHF.	ANT. SECTION	DUAL TUNING CONDENSER	10032		LINE CORD	
10015	C6	.0001	500	MICA COND.	10033		ANTENNA HARK	
10016	C7	.00025	500	PAPER	10034		MOUNTING BUSHING	
10017	C8	0.01	400	DUAL ELEC. COND.	10035		DECALCOMANIA	
10018	C9	500 K.	500	PAPER	10036		TUNING KNOB	
10019	C10	500 K.	500	PAPER	10037		STAND	
10020	C12	30 X 30	150 W.V.	CARBON RESISTOR	10038		GLASSES	
10021	R1	22 K.	1/2	"	10039		VOLUME KNOB	
10022	R2	1 M.	1	"	10040		SPEAKER GRILL	
10023	R3	6.2 M.	2	"	10041		LAMP SHADE	
10024	R4	500 K.	500	"	10042		LAMP SOCKET	
10025A	R5	500 K.	500	"	10043		VOLUME KNOB	
10025B	R6	500 K.	500	"	10044		VOLUME KNOB	
10026	R7	1 K.	2	"	10045		BASE	
10027	P1	500 K. AUDIO	POTENTIOMETER	FLEX. WIRE WOUND CARBON RESISTOR			CARDBOARD COVER	
10028	T1	(HFR'S SPECIAL)	I.F. TRANSF.	ANTENNA COIL				
10029	T2	(HFR'S SPECIAL)	I.F. TRANSF.	POTENTIOMETER				
10029	T3	PRI 2000 OHMS	SEC. 3	ANTENNA COIL				
10029	L1	(HFR'S SPECIAL)	OSCILLATOR COIL	I.F. TRANSF.				



CHASSIS LAYOUT



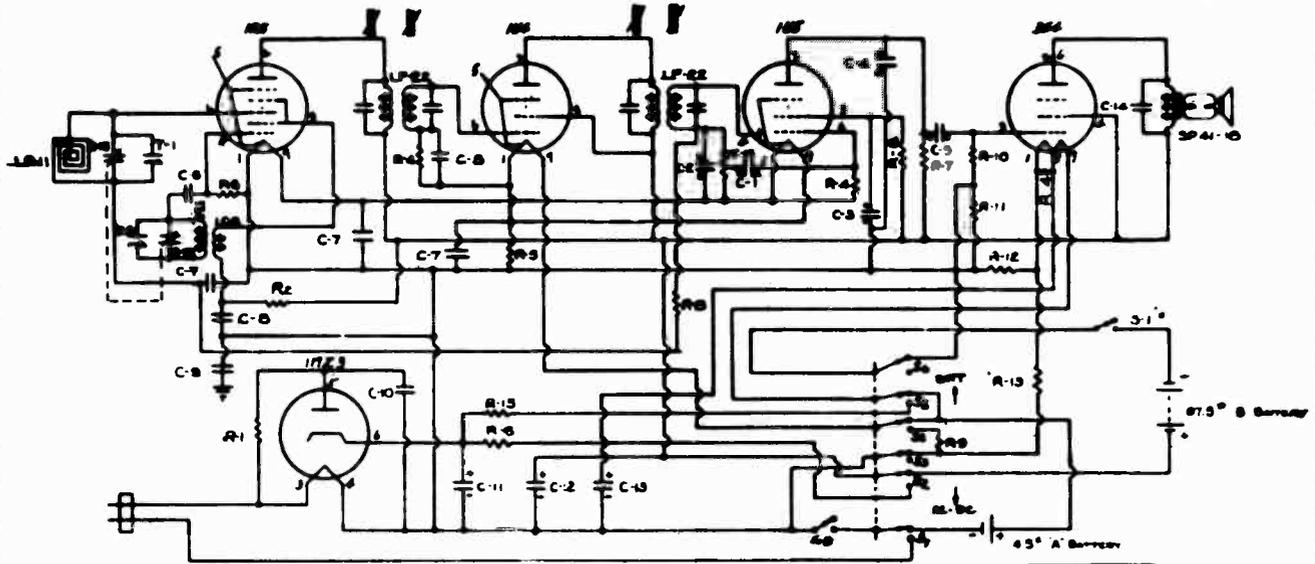
MODEL A-46 Series TAFFET RADIO & TELEV. CO.



CHASSIS DESIGNATION  
 C1: C2: C3 THREE GANG VARIABLE  
 CONDENSER WITH TRIMMERS

TELE-TONE RADIO CORP.

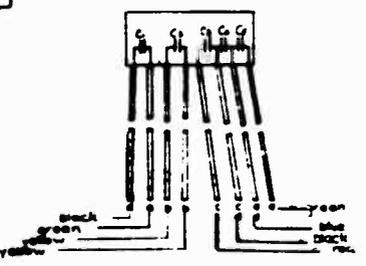
MODEL 185,  
CHASSIS AH



BS-1 DPST SW. IN RELAY CONTROL  
POWER SUPPLY  
105-125 VAC  
50-60 CYCLES AC

ALIGNMENT DATA  
IF 455 KC  
PEAK  $T_2$  1420 KC  
 $T_1$  1400 KC  
FREQ RANGE-1620-532.5 KC

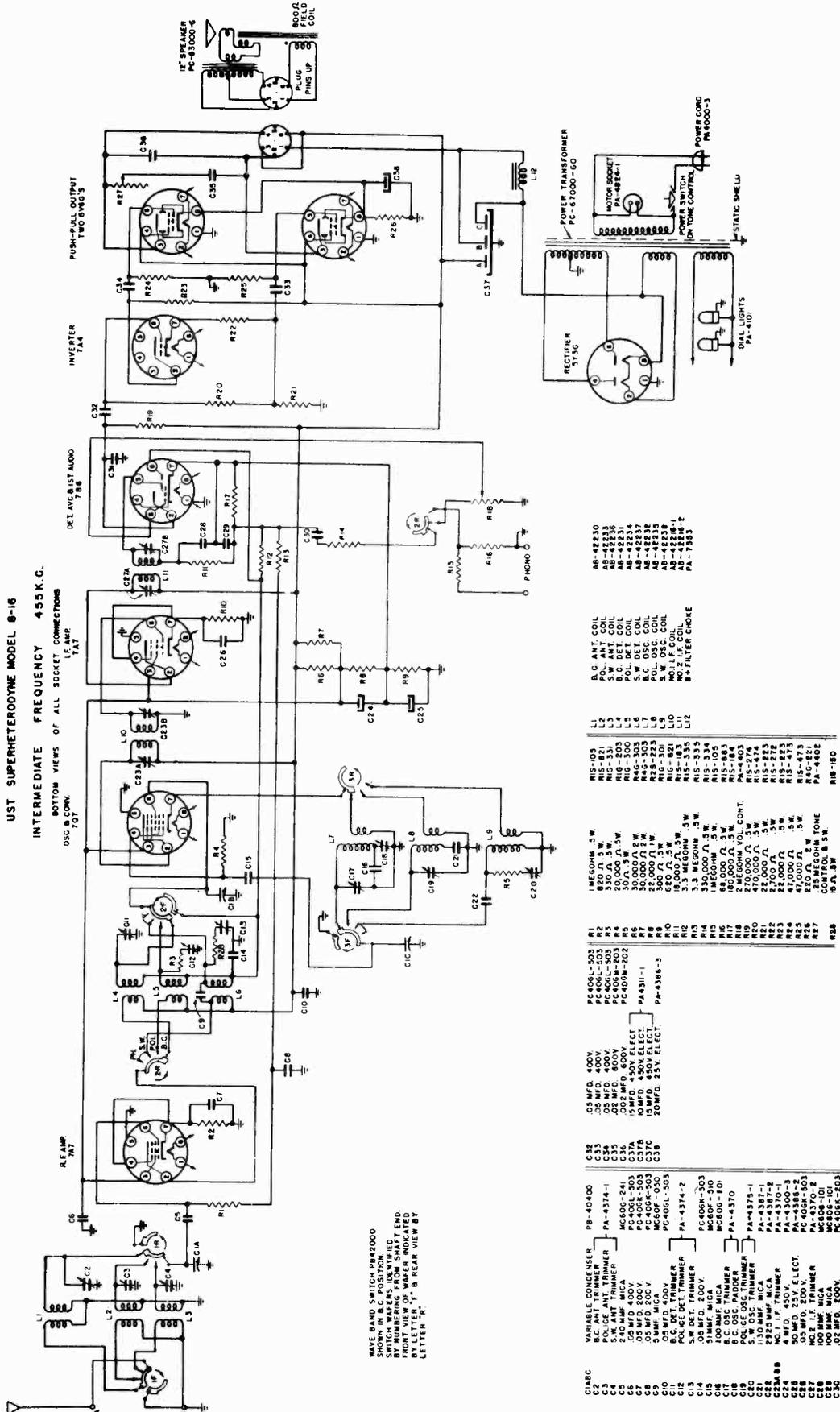
ITEM	DESCRIPTION
C	CONDENSER
R	RESISTOR
LF	IF TRANSFORMER
LP	ANTENNA LOOP
LC	OSC. COIL



CHASSIS SERIES 'AH'

ITEM	DESCRIPTION	PART NO.
C1,2,3,6,4,5	CERAMIC CONDENSER BLOCK	CC-5-1
C-6	.000047 MF MKA CONDENSER	CM-670-1
C-7	.25 MF 150V PAPER	CP-505-2
C-8	.01 MF 150V PAPER	CP-103-2
C-9	.1 MF 200V PAPER	CP-104-1
C-10	.05 MF 400V PAPER	CP-505-1
C-11	ELECT COND 40 MF 150V	CE-17V
C-12	40 MF 150V	
C-13	200 MF 150V	
C-14	.005 MF 400V PAPER	CP-502-2
C-15	VARIABLE CONDENSER	CV-15
T-1, T-2	TRIMMERS ON VARIABLE	
R-1	18 $\Omega$ 1/2 W $\pm$ 20% Carbon Res	RE-780-1
R-2	1500 $\Omega$ 1/2 W $\pm$ 20% "	RC-103-1
R-3	100000 $\Omega$ 1/2 W $\pm$ 20% "	RC-104-1
R-4	10 MEG 1/2 W $\pm$ 20% "	RC-100-1
R-5	2200 $\Omega$ 1/2 W $\pm$ 10% "	RC-222-2
R-6	6800 $\Omega$ 1 W $\pm$ 10% "	RC-682-3
R-7	1 MEG 1/2 W $\pm$ 20% "	RC-100-1
R-8	55 MEG 1/2 W $\pm$ 20% "	RC-550-1
R-9	39 $\Omega$ 1/2 W $\pm$ 10% "	RC-390-2
R-10	22 MEG 1/2 W $\pm$ 20% "	RC-223-1
R-11	680 $\Omega$ 1/2 W $\pm$ 10% "	RC-681-2
R-12	1500 $\Omega$ 1/2 W $\pm$ 10% "	RC-152-2
R-13	27 $\Omega$ 1/2 W $\pm$ 5% "	RC-270-3
R-14	390 $\Omega$ 1/2 W $\pm$ 10% "	RC-391-2
R-15	CANDOHM RES 2550 $\Omega$ 5%	RP-5
V-10	VOL CONTROL 1 MEG WITH DPST SWITCH	V-10
SP-41-10	6.3V 100 WATT 1/4 OT	SP-41-10
LF-22	IF TRANSFORMER	LF-22
LP-11	ANTENNA LOOP	LP-11
LC-8	OSC. COIL	LC-8
5,2,3,4,5,6,7	BATTERY SWITCH 6 POLE DT	SW-N

Late series have C removed from ceramic condenser block, paper condenser of same paper value used.



WAVE BAND SWITCH MK42000 SHOWN IN B.C. POSITION. SWITCH WAFERS IDENTIFIED FRONT VIEW OF WAFER INDICATED BY LETTER 'F' & REAR VIEW BY LETTER 'R'.

- |       |                       |             |      |                            |             |     |                            |
|-------|-----------------------|-------------|------|----------------------------|-------------|-----|----------------------------|
| C1A3C | VAR. CONDENSER        | FB-40400    | C33  | .05 MFD. 400V.             | PC405L-503  | R1  | 1 MEGOHM .5W               |
| C2    | B.C. ANT. TRIMMER     | PA-4374-1   | C34  | .05 MFD. 400V.             | PC406L-503  | R2  | 820 OHM .5W                |
| C3    | 5W OSC. TRIMMER       | MC60C-241   | C35  | .05 MFD. 400V.             | PC407L-503  | R3  | 330 OHM .5W                |
| C4    | 240 MMF. MICA         | PC 00L-503  | C36  | .002 MFD. 600V.            | PC408M-202  | R4  | 50 OHM .5W                 |
| C5    | PC 00L-503            | MC60F-050   | C37A | 15 MFD. 450V. ELECT.       | PA4311-1    | R5  | 30,000 OHM .5W             |
| C6    | .05 MFD. 200V.        | PC 00R-503  | C37B | 15 MFD. 450V. ELECT.       | PA4308-3    | R6  | 30,000 OHM .5W             |
| C7    | .05 MFD. 200V.        | MC60F-050   | C38  | 20 MFD. 25V. ELECT.        | PC-4374-2   | R7  | 500 OHM .5W                |
| C8    | .05 MFD. 200V.        | PC-4374-2   | C39  | 18,000 OHM .5W             | PC-4374-2   | R8  | 18,000 OHM .5W             |
| C9    | B.C. DET. TRIMMER     | PC-406K-303 | C40  | 3.3 MEGOHM .5W             | PC-406K-303 | R9  | 3.3 MEGOHM .5W             |
| C10   | 5W OSC. TRIMMER       | MC60F-101   | C41  | 1 MEGOHM .5W               | PC-4370     | R10 | 1 MEGOHM .5W               |
| C11   | 5W OSC. TRIMMER       | PC-4370     | C42  | 1 MEGOHM .5W               | PC-4370     | R11 | 1 MEGOHM .5W               |
| C12   | B.C. OSC. TRIMMER     | PC-4375-1   | C43  | 82,000 OHM .5W             | PC-4375-1   | R12 | 82,000 OHM .5W             |
| C13   | B.C. OSC. TRIMMER     | PC-4387-1   | C44  | 270,000 OHM .5W            | PC-4387-1   | R13 | 270,000 OHM .5W            |
| C14   | 150 MMF. MICA         | PC-4370-1   | C45  | 22,000 OHM .5W             | PC-4370-1   | R14 | 22,000 OHM .5W             |
| C15   | MO. I.F. TRIMMER      | PC-4300-3   | C46  | 21,000 OHM .5W             | PC-4300-3   | R15 | 21,000 OHM .5W             |
| C16   | 4 MFD. 450V.          | PC-4370-2   | C47  | 47,000 OHM .5W             | PC-4370-2   | R16 | 47,000 OHM .5W             |
| C17   | MO. E. I.F. TRIMMER   | PC-4058-503 | C48  | 47,000 OHM .5W             | PC-4058-503 | R17 | 47,000 OHM .5W             |
| C18   | .05 MFD. 200V. ELECT. | MC60S-101   | C49  | 25 MEGOHM TONE CONTROL .5W | MC60S-101   | R18 | 25 MEGOHM TONE CONTROL .5W |
| C19   | 100 MMF. MICA         | MC60S-101   | C50  | .02 MFD. 200V.             | MC60S-101   | R19 | .02 MFD. 200V.             |
| C20   | .02 MFD. 200V.        | MC60S-101   | C51  | .02 MFD. 200V.             | MC60S-101   | R20 | .02 MFD. 200V.             |
| C21   | MO. I.F. TRIMMER      | PC-4370-1   |      |                            |             |     |                            |
| C22   | B.C. ANT. COIL        | AB-42230    |      |                            |             |     |                            |
| C23   | 5W ANT. COIL          | AB-42231    |      |                            |             |     |                            |
| C24   | B.C. DET. COIL        | AB-42232    |      |                            |             |     |                            |
| C25   | 5W DET. COIL          | AB-42233    |      |                            |             |     |                            |
| C26   | B.C. OSC. COIL        | AB-42234    |      |                            |             |     |                            |
| C27   | 5W OSC. COIL          | AB-42235    |      |                            |             |     |                            |
| C28   | MO. I.F. COIL         | AB-42236    |      |                            |             |     |                            |
| C29   | B.C. DET. COIL        | AB-42237    |      |                            |             |     |                            |
| C30   | 5W DET. COIL          | AB-42238    |      |                            |             |     |                            |
| C31   | B.F. FILTER CHOKES    | PA-7353-2   |      |                            |             |     |                            |

**Bendix Par 80**

This model appears on pages 18-1 through 18-5 of *Rider's Volume XVIII*. On late production model PAR 80 receivers, a rubber grommet has been added over the battery switch lead at the metal shield to prevent eventual wear and shorting of the lead. If servicing of this receiver indicates excessive wear of the battery switch lead, a small standard grommet of suitable size may be added at point where the lead enters the switch shield.

**Bendix 110, 110W, 111, 111W, 112, 114, and 115**

These models appear on pages 18-6 through 18-8 of *Rider's Volume XVIII*. On recent models of this series a circuit change has been made which adds a coupling plate, stock number AC0C00, between the first audio tube, 12SQ7, and the output tube, 50L6, in lieu of the following components used on earlier receivers:

Plate-load resistor, R5, stock no. RC1H54; grid resistor, R7, stock no. RC1H58; Plate r-f bypass capacitor, C8 stock CP4T20.

These parts are eliminated when coupling plate, stock no. AC0C00 is used, although installation is otherwise interchangeable. To use the coupling plate may cause a slight increase in the plate voltage of the 12SQ7 tube, but no adverse effect is made on the receiver. The resistance measured from the grid of the 50L6 tube to common B- is approximately 450K. while the resistance measured from the plate of the 12SQ7 tube to common B- will give a reading which increases approximately 10 megohms in magnitude, caused by the charging of the filter capacitors since the receivers have no d-c return to ground.

**Bendix 626**

This model appears on pages 16-1 through 16-3 of *Rider's Volume XVI*. Either of two coils may be found in this model. In some, an r-f coil making use of a small capacitor (3.3  $\mu$ f) between the start of the secondary winding and the finish of the primary winding is used, while in others an r-f coil with an added tertiary winding is used in lieu of the capacitor. These coils, when properly used, are interchangeable, and in the future only r-f coils with the tertiary winding will be provided as replacements.

If, in the receiver to be repaired, the coil requiring the 3.3- $\mu$ f capacitor is replaced with the other type, eliminate the 3.3- $\mu$ f capacitor from the circuit.

**Bendix 646A**

This model appears on pages 15-5 and 15-6 of *Rider's Volume XV*. The change involves a revision in the replacement parts list as follows:

In the cabinet components section of the parts list on page 15-6, substitute the stock number HZ0S04 for the existing stock number HZ0L01 which is incorrect. The nomenclature and identification of the component part is correct as listed.

**Crosley 9-101**

This model appears on pages 18-1 through 18-3 of *Rider's Volume XVIII*. Recently it was discovered that in some areas, the oscillator coil (Part No. 142975) developed trouble due to corrosive tape. To avoid possible complaints in the field, it is recommended that the coil be replaced with a new coil (Part No. 145105).

**Bendix 847B**

This model appears on pages 17-7 through 17-14 of *Rider's Volume XVII*. The replacement parts list on page 17-15 should be revised as follows:

The r-f oscillator chassis assembly bearing the stock number AR0B00 is no longer stocked as a complete replacement assembly. This chassis can be repaired satisfactorily in the field and the necessary component parts may be obtained as separate stock items, when desired.

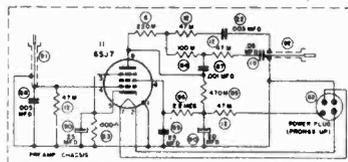
**Crosley 9-201, 9-202M, 9-203B**

These models appear on pages 18-14 through 18-19 of *Rider's Volume XVIII*. The part number of item 83 (volume control) was shown on page 18-19 as 39368-14. This number should be 39368-18. To use the No. 39368-18 control on these models, it will be necessary also to use a No. 39-370-2 plug-in type knurled shaft.

**Farnsworth GK-111, GK-112, GK-114, GK-115**

These models are the same as model GK-100, appearing on pages 17-3 through 17-10 of *Rider's Volume XVII*, except that they employ the P56MP record changer instead of the P56.

The P56MP record changer is a reluctance type pickup and, therefore, additional amplification in the phono circuit is necessary. A 6SJ7 tube has been added to the phono circuit, as shown in the accompanying diagram.



The circuit of the 6SJ7 tube that was added so that a reluctance pickup could be used in Farnsworth Models GK-111, 112, 114, 115.

The following parts should be added to the parts list:

Part No.	Description
78057	Volume control, 3 megohms
94204	Power transformer
94239	Output transformer
13772	Speaker
38696	Loop antenna for GK-111, GK-112
38859	Loop antenna for GK-114
26032	Loop antenna trimmer, GK-114
22169	Pickup cable
22170	Output cable
22171	Power adapter cable
25431	Capacitor, electrolytic, 20 $\mu$ f, 450 v, 25 $\mu$ f, 25 v
25432	Capacitor, 0.001 $\mu$ f, 200 v
25433	Capacitor, 0.25 $\mu$ f, 600 v
H-273	Cabinet for GK-114
H-291	Cabinet for GK-111 Mah.
H-292-1	Cabinet for GK-112 C
H-292-2	Cabinet for GK-112 B1.

**Federal 1027, 1035**

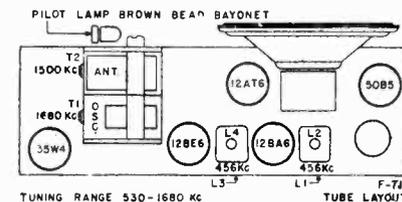
Basically, these models are the same both in chassis and cabinet as model 1025 which appears on pages 16-1 through 16-4 of *Rider's Volume XVI*. However, differences exist in the exterior cabinet finish and color of these models.

**Federal 1034**

This model is essentially the same as model 1024 which appears on pages 16-1 through 16-4 of *Rider's Volume XVI*. The only modification has been in the cabinet

**Fada 711, 740**

These models appear on pages 17-15, 17-20, and 17-24 of *Rider's Volume XVII*. The socket layout on page 17-15 applies only to model 740. The socket layout for model 711 is shown herewith. The schematic and parts list refer to both models.



Socket layout for the Fada model 711.

**Firestone R3157A**

This model is the same as Model S7427-2 appearing on pages 12-19, 20, 12-21, 12-6, and C.S. 12-4 and C.S. 12-5 of *Rider's Volume XII*.

**General Electric P4**

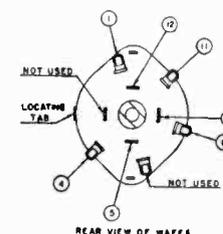
This model appears on RCD. CH. Pages 17-5 through 17-9 of *Rider's Volume XVII*. The sound of a metallic click and audible thump through the receiver speaker is usually traced to the operation of the velocity trip mechanism. This is caused by too much tension of the Clutch Tension Spring (reference 29 in Fig. 3 on RCD. CH. Page 17-7) binding the velocity trip lever. Adjustment may be made, reducing spring tension to prevent binding and still maintain normal operation.

In earlier production, a limited quantity of record changers employed a flat spring type clip fitted over the pickup arm pivot shaft. The clip was brought to bear upon the clutch tension spring, compressing the spring to the proper friction upon the velocity trip lever as was necessary for proper changer operation. To provide a more positive adjustment, later productions use a Clutch Spring Tension Collar, in lieu of the original clip, which makes a more convenient, accurate, and more permanent adjustment.

If extreme difficulty is experienced in proper adjustment of the earlier production changers, the spring clip may be replaced with the collar, Cat. No. RMX-080. A detailed view of the later version of record adjustment is shown in Fig. 6 on RCD. CH. 17-8.

**GE 250**

This model appears on pages 15-32 through 15-36 of *Rider's Volume XV*. The switch that is supplied under the number RSW-009 is of a different construction than the original flat-wafer switch. The accompanying figure shows the numbers which correspond to those in the schematic diagram.



Construction of the wafer switch replacement for the General Electric 250.

**GE 41, 42, 43**

These models appear on pages 17-1<sup>2</sup> through 17-16 of *Rider's Volume XVII*. The following changes should be made. Add Cat. No. REF-003, line fuse F201, 3AG, 5 amp., 250 volts, to the parts list and add this to the schematic diagram of the Special Power Unit on page 17-3. The fuse should be placed in series with the power transformer primary and the power cord. Besides the addition of a fuse, the safety will be further increased by placing a sheet of asbestos underneath the power unit to cover the ventilation slots. Thus, even in the case of overload, the hot tar of the over-heated transformer is prevented from dropping on the floor.

Add Cat. No. RSV-001, Switch—power ON-OFF switch to the parts list. Replacement is readily made by merely bending the mounting taps.

To adjust for minimum hum level, turn the volume control until the audio output is zero and vary resistor R201 (which is parallel to the filaments and center-tapped to the chassis, forming an effective hum balancing circuit).

**General Electric 41, 42, 43, 44, 45**

These models appear on pages 17-1<sup>2</sup> through 17-16 of *Rider's Volume XVII*. A sliding type switch has been added in series with R67 (8200 ohms) connecting the resistor to the phonograph pickup input jack, J3. This switch is on the receiver chassis back apron with its respective label indicating High Fidelity and Normal, the open and closed positions, respectively.

In the replacement parts list under Cat. No. RSS-003, add the item: High Fidelity-Normal switch.

**General Electric 50**

This model will be found on pages 15-1 through 15-4 of *Rider's Volume XV*. This change covers a correction to the original parts list in the model 50 where Cat. No. RHS-001 was changed to RMX-006 for a tuning assembly and spacer.

A further correction is necessary in the item description since only the tuning shaft and drive pulley (assembled) is supplied under RMX-006. The spacer is the tuning shaft bearing, and is catalogued as a separate item under RHJ-001. The original parts listing of the drive pulley under this number has been deleted.

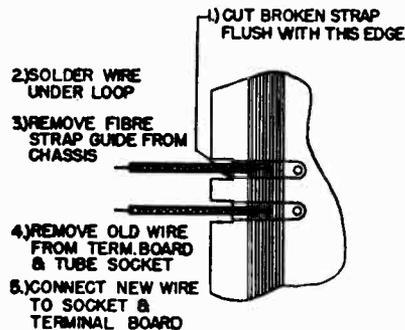
**GE 140**

This model appears on pages 17-21 through 17-23 of *Rider's Volume XVII*. The following changes should be made in the parts list: From Cat. No. RAD-027 remove the statement "(with loop connecting strips only)." Change Cat. No. RCC-075 to read RCC-080. Delete Cat. Nos. RDK-098, RHC-008, and RMX-103. Add the following parts.

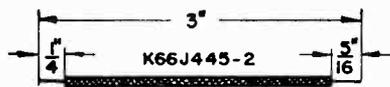
RDK-106	Knob—door catch knob
RCE-002	Strap—loop contact strap
RHE-002	Eyelets—spacer eyelets for escutcheon screws RHS-016
RHE-003	Eyelet—used for loop contact strap
RHR-002	Rivets—door hinge rivets (power cord access)
RHS-015	Screw—self tapping (used for cabinet door cover)
RHS-016	Screw—Phillips, flat-head, mounts bottom of escutcheon

The following procedure is recommended for repairing broken antenna loop connecting straps.

The broken straps should be cut back flush with the inside edge of the notch on the loop. The flexible wire is then used to make connections from the loop to the inside of the receiver. Consult the accompanying diagrams for loop connecting details and wire specifications. Carefully lift the section of the loop to allow connecting the specified pieces of wire and solder



WIRE DETAILS

**2 REQUIRED PER SET**

Above, the loop connecting details of the General Electric Model 140. The wire details for the antenna loop connections are shown in the lower figure.

wires to remainder of loose straps. Remove the fibre strap guide which originally insulated the loop straps within the cabinet. Remove original wire leads and pieces of loop strap connected inside the cabinet to the chassis terminal strip and pin 6 of the 1R5 oscillator-converter tube socket. Solder the new leads from the antenna loop directly to the terminal board and tube socket. Make certain that the inside of the loop is connected to pin 6 of the 1R5 tube socket.

The following procedure is recommended to replace a speaker in this model.

- 1—Unsolder leads on speaker, using small tip iron.
- 2—Unsolder 90- $\mu$ f capacitor (C14) at terminal strip.
- 3—Without unsoldering, remove dual 40- $\mu$ f capacitor (C20) from mounting clip.
- 4—Using long screwdriver (8 inches or longer) loosen screws holding speaker to chassis.
- 5—Remove nuts holding speaker to front panel.
- 6—Lift up left end of resistor mounting plate and then lift out speaker.

If the antenna straps which interconnect the antenna in the receiver cover with the radio chassis circuit break, the following replacement procedure is recommended:

- 1—Bend up insulating material covering set end of antenna strips by inserting the tip of a long-nose pliers and twisting gently so as not to tear material.
- 2—Unsolder wires from loop strips in receiver.
- 3—Remove screws holding door cover.
- 4—Lift loop at point midway between hinges to expose strip rivets and unsolder loop from loop strips.

5—Remove rivet or rivets as needed, taking care not to damage loop or loop back.

6—Replace broken straps by new members, Cat. No. RCE-002, and rivet it in place with eyelets, Cat. No. RHE-003.

In order to replace the rectifier disc assembly, SR, proceed as follows:

- 1—Remove two mounting screws from the power switch, S1 (door switch).
- 2—Dress power switch away from mounting plate, providing more access to underside of top chassis deck.
- 3—Unsolder leads to rectifier disc assembly.
- 4—Push aside components underneath rectifier assembly mounting screw until screw can be loosened.

**General Electric 210, 211, 212**

These models appear on pages 18-21 through 18-25 of *Rider's Volume XVIII*. Change the third column (Signal Input Point) of the alignment charts on page 18-23 to read: 12BE6 grid (pin 7 of V2) See note 7.

The parts list on page 18-25 should be changed as follows: Change catalogue number UOP-557 to UOP-558 for Speaker 5/4-inch PM. Add the reference symbol R32 to Cat. No. URD-141—Resistor—6.8 meg., 1/2w., carbon.

The following changes have been made in the schematic diagram on page 18-21.

Where capacitor C38 is shown terminating at ground on this schematic, later model receivers have this ground connection removed and the capacitor is terminated at the junction of the antenna input and capacitor C14. Capacitor C36 should be added and connected from the junction point of R29, pilot lamp I1, and pin 4 of V7 to ground. Resistor R32, which has been added to replacement parts list above, is connected from the junction of R8 and C4 (AVC filter) to the cathode, pin 2, of output tube V6.

This resistor, R32, has been added to increase the converter stage gain when operating in the A-M position because of a change in performance characteristics relative to grid cut-off of the 12BE6 tube.

**General Electric 230 Kaiser-Frazer**

This model appears on pages 18-26 through 18-28 of *Rider's Volume XVIII*. The change involves a substitution of catalog numbers in the replacement parts list as follows:

Cat. No. URE-035 and URF-055 are catalogued for carbon-type resistors. These numbers are to be replaced for numbers specifying wirewound resistors, RRW-037 becoming the Cat. No. for R13 and RRW-036 the number for R18.

**General Electric 502**

This model appears on pages 17-4 through 17-8 and pages 17-39,40 through 17-47 of *Rider's Volume XVII*. The changes involve a schematic correction and a correction in the value of a component in the replacement parts list.

The schematic diagram which shows an open circuit in the screen grids of the 6V6 tubes, V10 and V11, should be corrected to show the screen grids connected to the 260-volt B-plus line.

In the listing of Cat. No. RCW-1028, the capacitor value was mistakenly given as 22- $\mu$ f. The capacitors listed are actually 100- $\mu$ f and RCW-1028 should be changed to read 100- $\mu$ f.

**Hollicrafters SX-42**

This model appears on pages 17-6 through 17-13 of *Rider's Volume XVII*. The following service hints apply to the S-Meter operation.

**SYMPTOM NO. 1:**

Meter fails to zero on AM.

**ANALYSIS:**

Assuming that all connections and other circuits, including AVC, are normal...

- 1) The line voltage is low, or
- 2) The first RF tube is weak

**SYMPTOM NO. 2:**

Zero adjustment appears too critical. Does not hold.

**ANALYSIS:**

The leads to the outside terminals of the "Zero Set" potentiometer should be disconnected, reversed, and reconnected.

**SYMPTOM NO. 3:**

Meter fails to zero on FM

**ANALYSIS:**

- 1) Adjust meter indicator mechanically with zero set on the meter.
- 2) Replace 7A4 tube
- 3) Replace R-68 with lower resistance if indicator remains on right side of FM zero
- 4) Replace R-68 with higher resistance if indicator remains on left side of FM zero

**REMARKS:**

The internal resistance of the meters is not specified, and depends on the supplier. The resistance ranges from 12 to 50 ohms.

The meter has a range of 5 ma. on a linear scale. The FM zero is arbitrarily calibrated at 1.4 ma.

An arbitrary figure of 60 m.v. to the antenna terminal was used for S-9 on the 20 meter band. Each S-unit represents 6 db variation.

60 m.v. to the antenna terminal of the receiver represents roughly a field strength of 15 m.v. per meter.

**Hoffman C504, C514**

These models are the same as model B504 appearing on pages 17-1 and pages 17-3,4 through 17-7 of *Rider's Volume XVII*, except for the following. Push-pull parallel 6K6 tubes are used in the output instead of push-pull 6V6 tubes. See Fig. 1.

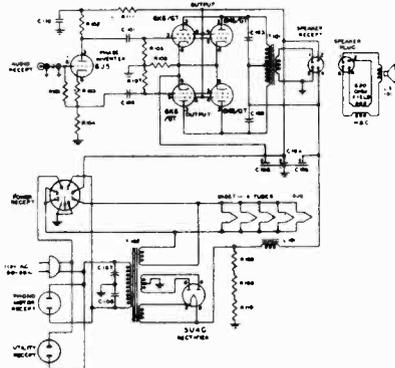


Fig. 1. Changes in the output stages of the Hoffman Models C504 and C514.

A resistance-capacitance filter (R111 and C110) has been inserted in the B-plus line feeding the phase inverter stage in order to reduce the inherent hum level of the receiver to a satisfactory level. See Fig. 1.

An "entertainment panel" has been wired into the tuner chassis to provide microphone input, a speaker on-off switch, a pillow speaker plug, and an auxiliary phono input to be used either for television sound or wire recorder input. See Fig. 2.

On the recorder amplifier, the screen-dropping resistor (R11) has been changed from 0.1 megohm to 2.2 megohms and the cathode resistor (R2) changed from 2200

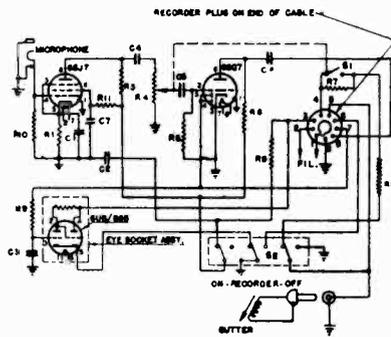


Fig. 2. Changes made to accommodate the "entertainment panel" of the Hoffman C604.

ohms to 4700 ohms. This change allows the screen current of the 6SJ7 to be self-regulating to eliminate variations in gain between various 6SJ7 tubes.

Several changes were made in the late production. A 270,000-ohm resistor was added across the phono input jack of the radio chassis. This resistor was on the record changer (960260-2) in the early production (Serial Nos. B-1001 to B-6000 and B-28,500 to B-30,000).

The location of the resistor may be checked by measuring the shunt resistance across the phono input jack of the radio chassis and across the phono output cable of the changer mechanism.

**Hoffman C502 and C512, Chassis 113**

These models are the same as Model B502, Chassis 113, appearing on pages 17-1 to 17-6 of *Rider's Volume XVII*, except for the following changes. Four 6K6-GT tubes are used in push-pull parallel in the output stage instead of the 6V6 tubes in push-pull.

An "entertainment panel" has been wired into the tuner chassis to provide microphone input, a speaker off-on switch, a pillow speaker plug, and an auxiliary phono input to be used either for television sound or wire recorder input. See Fig. 1.

A resistance-capacity filter R111 and C110, has been inserted in the B-plus line of the phase inverter stage in order to reduce the inherent hum level of the receiver, as shown in Fig. 2.

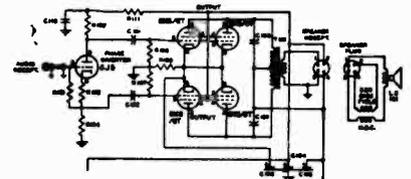


Fig. 2. The resistance-capacity filter in the Hoffman models C502 and C512.

The following changes should be made in the parts list:

Symbol	Description	Hoff. No.
C60	0.005 $\mu$ f, 600 V, tubular, paper	4102
R16, R20, R50	100,000 ohms $\pm$ 20%, 1/2 watt	4511
R21, R48	47,000 ohms, $\pm$ 20%, 1/2 watt	4504
R49	10 megohms, $\pm$ 20%, 1/2 watt	4506
R27, R46	0.22 megohm, $\pm$ 20%, 1/2 watt	4500
R47, R51	0.47 megohm, $\pm$ 20%, 1/2 watt	4506
C110	10 $\mu$ f, 450 V, electrolytic	4203
R111	10,000 ohms, $\pm$ 20%, 1/2 watt	4515

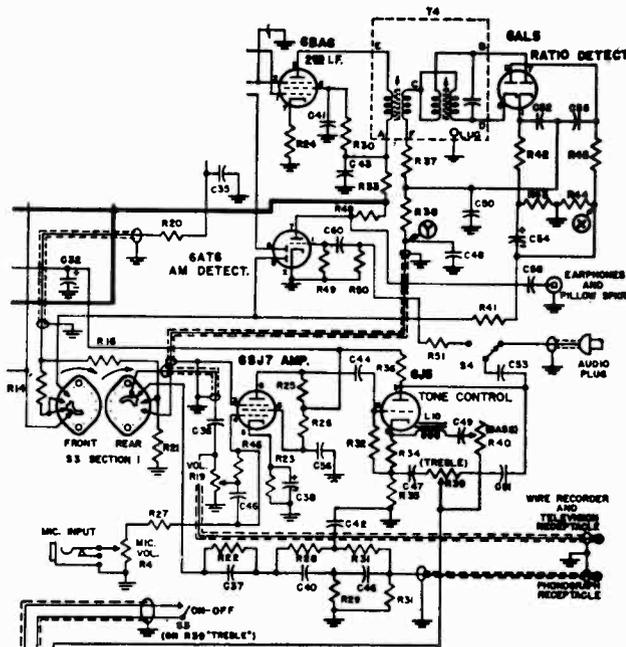


Fig. 1. The entertainment panel that is wired into the Hoffman models C502 and C512.

**Majestic 5AK781**

This model is the same as model 5AK731 found on pages 17-3 and 17-4 of Rider's Volume XVII, except for the following changes in the parts list.

Part No.	Description
S-1441	Dial cord assembly
S-1448	Output transformer
21-29	Aero record changer
115-49-1	Cabinet, (Aero cut out) Blonde, walnut, or mahogany
122-47	Escutcheon plate, metal
128-62	Knobs, tuning and volume
128-80	Knob, phono - radio
101-485	Screw, mounting chassis
106-124	Washer, mounting chassis

**Majestic 7BK758**

This model is the same as Model 7JK777R appearing on pages 17-5 and 17-6 of Rider's Volume XVII, except for the dial scale. The dial scale used is part no. 117-78.

**Majestic 12FM782, Chassis 12C20E**

This model is the same as Model 12FM778, Chassis 12B26E, appearing on pages 17-27, 28 to 17-33 of Rider's Volume XVII, except that it does not have push-buttons and indicator lights for "Records" and "F.M."

The following additions should be made to the parts list.

Part #	Description
115-45-2	Cabinet—console combination
21-32	Changer, oak
22-43	Speaker, 12" including output transformer
20-27	A-m loop antenna (less cover)
122-20	Escutcheon glass (large)
122-44	Dial grill
128-37	Knob (vol-tuning-tone)
128-85	Knob (band switch)
128-46	Spring insert for above knob

**Midwest 98**

This model is the same as model RM-8, appearing on pages 18-1 through 18-3 of Rider's Volume XVIII, except that two pilot lamps have been added. Each #46 pilot lamp is in series with a 10-ohm resistor, and each series combination is in parallel with the other. One end of the parallel combination is connected to the 6.3-volt filament line and the other end is grounded.

**Noblitt-Sparks 182TFM, Chassis RE-237**

This model appears in Rider's Volume XVII, pages 17-9,10 through 17-15. At the start of production, the glass oscillator trimmer "14" was mounted to the bracket on the variable capacitor with a brass nut and had a locking nut to hold tension on the adjusting screw. When this locking nut was tightened down enough to prevent it from working loose while adjusting the trimmer, the tension on the screw was too great for production alignment. To correct this trouble, the locking nut was tightened down to give the proper tension and then soldered to the bracket to prevent it from working loose. This was a difficult solder operation, and the trimmer screw would still work loose after being run in and out a few times, due to a cutting action between the lock nut and the threads on the screw. To correct this trouble, the locking nut was removed and the bracket revised to use a piece of No. 14 music wire to apply tension to the adjusting screw. (See Fig. 1.) The trimmer is much more stable with the new arrangement

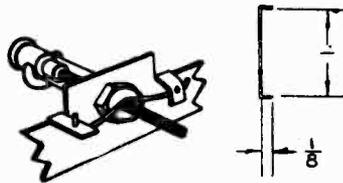


Fig. 1, left, shows the music wire spring applied to the adjusting screw.  
Fig. 2, right, shows the music wire spring.

On some trimmers, the threads for the mounting nut did not go down far enough to allow the nut to tighten down against the bracket. A No. 12 lockwasher has been added under the mounting nut to assure a good tight contact between the trimmer and the bracket. If a set is found where the capacity of the oscillator trimmer changes or the trimmer is noisy, the following procedure is recommended:

See that the trimmer mounting to the bracket is tight. Since the trimmer glass is almost sure to break if an attempt is made to tighten the mounting nut after the opposite end of the trimmer has been soldered in place, it is suggested that the trimmer be soldered to the back side of the bracket before attempting to tighten the nut (use care in soldering, apply heat from soldering iron to the bracket to prevent breaking trimmer glass).

Remove the locking nut and replace it with the music wire spring, part number A21902, Fig. 3, by soldering the two metal lugs, part number A21889. Fig. 2 on the present bracket, as shown in Fig. 1.

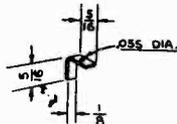


Fig. 3. Two lugs of this type are used as shown in Fig. 1 above.

**AM-IF Alignment**

Two peaks may be obtained with the 455 i-f slugs; one with the slug tuned almost all the way in and another with the slug tuned almost all the way out. When such is the case, the peak with the slug tuned out should be used.

**Noisy F-M Reception**

If the set is noisy on F.m., check the six ground leads from the variable capacitor to the chassis to make sure none of them are broken. One broken ground lead will not only make the set noisy, but can also effect the alignment of the set.

**Ceramic Capacitors**

Care must be taken in placement of ceramic capacitors to prevent shorts which would occur if any part of the capacitor touched other metal parts.

**FADING . . .** If fading occurs, check the shielded audio leads. One lead should be connected from the center lug of the volume control to the audio coupling capacitor on the stand-off insulator. The other lead should be connected from the right-hand terminal of the control to the band-change switch. If these two leads are reversed, the AVC will be ineffective.

**ANTENNA . . .** On some of the first sets produced, the primary and secondary windings of the antenna-coupling transformers T1, were shorted together, causing

the antenna terminals on the back of the set to be grounded to the chassis. This should be carefully checked before connecting an external antenna to the set, because one position of the a-c plug in the outlet will place 110 volts between the antenna and any grounded object. This would be a shock hazard, and if the antenna became grounded the r-f choke in the a-c leads in the set would burn out.

**OSCILLATION . . .** If oscillation is encountered, try dressing the yellow filament leads, in the i-f section of the receiver, down against the chassis and away from the tube sockets. Also, see that all grounded leads on the variable capacitor are soldered and not broken.

Some cases of regeneration in the FM i-f circuit have been encountered. This can be detected by a high discriminator voltage, and also a high avc voltage with no signal input. Replacing the 0.005- $\mu$ f 2nd i-f cathode-bypass capacitor, C32, with a 0.002- $\mu$ f 350-volt ceramic capacitor will correct this in most cases.

**22-OHM RESISTOR BURNS . . .** Some receivers have a 1/4-watt 22-ohm fusing resistor in the B-plus circuit. If this resistor burns, replace it with a 1-watt resistor. **CAUTION . . .** First check the B-plus current to see that it does not exceed approximately 100 milliamperes. If the current is greater than this value, some other trouble exists in the receiver and this must be corrected in order to prevent damage to other parts in the receiver.

**FLOATING R-F UNIT . . .** On some sets the complete r-f assembly is mounted on rubber to prevent microphonics. When servicing these sets, be sure that the ground leads between the r-f assembly and the chassis are securely soldered.

**INSULATING CONTROL SHAFTS . . .** Some sets have been found with the flat metal washer under the insulating fibre washer on the tone control, volume control and band switch. This would be a shock hazard if a knob was left off the shaft and should be corrected by removing the metal washer and placing it on top of the fibre washer.

The following changes should be made on the schematic diagram:

1. A B- connection was added between R10 and L15.
2. A 220-ohm resistor, R15, has been added across the antenna terminals.
3. Antenna coil L4 has been relocated. In the original schematic it was in series with C1, and the series combination was shunted by C1A. The modification consists of placing C1 and C1A in shunt with each other, and placing L4 in series with this shunt combination and the top connection of L1, the point which is connected to the AM terminal of the selector switch.

The following changes should be made in the parts list:

1. R5 should be C20060-221 resistor, 220 ohms, 1/4 watt
2. P.S. — A21709 parasitic suppressor should be added
3. C10 should be C20204-500 capacitor, 0.00005- $\mu$ f., 500 V, ceramic
4. R8, 22-ohm fusing resistor should be 1 watt, C20103-220
5. A19328-4 grommet, rubber, Mtg., RF Assy.
6. A19138-3 eyelet spacer, Mtg., RF Assy.

**Montgomery Ward 64WG-1050B, 1050D, 74WG-1050D**

These models are the same as Model 64WG-1050A on pages 15-75 to 15-77 of *Rider's Volume XV*, except for the following changes. The 0.1- $\mu$ f capacitor C-11, is connected between pin 1 of the 1R5 oscillator-detector tube and the common negative circuit instead of the chassis ground.

In the D models, a 1000-ohm resistor, R-13, is connected between pin 7 of the 3S4 output tube and the common negative circuit. The following should be added to the parts list.

Ref. No.	Part No.	Description
R-13	B84102	100 ohms, 0.05 watt, carbon

**Montgomery Ward 64WG-1050C**

This model is the same as Model 64WG-1050A on pages 15-75 to 15-77 of *Rider's Volume XV*, except for the following changes. The 1500-ohm resistor R-3 is now connected from the center tap of the filament of the 3S4 output tube to the common negative circuit, lug 4 on the changeover switch, instead of to the positive filament lead (pin 7) of the 1S5 oscillator-detector tube, lug 9 of the changeover switch.

A 100-ohm resistor R-12 has been connected between R-11 and the selenium rectifier.

Ref. No.	Part No.	Description
R-12	D84101	100 ohms, 2.0 watt, carbon

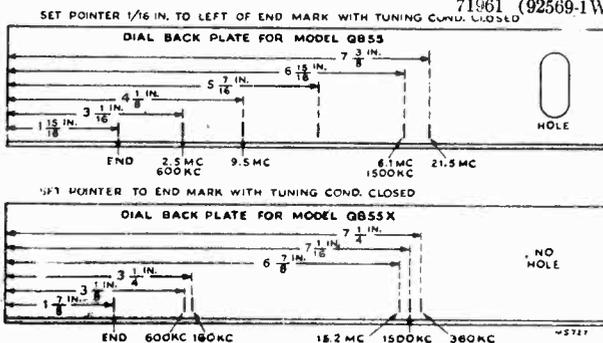
**RCA QB55X Chassis RC-563-K**

This model appears on pages 17-9 through 17-11 of *Rider's Volume XVII*. In some chassis two 2000- $\mu$ f capacitors in parallel are used in place of the specified 3900- $\mu$ f capacitor C7.

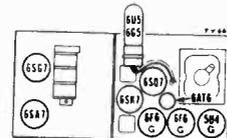
**RCA QB55, QB55X**

Model QB55, chassis RC-563A, appears on pages 15-27 through 15-29 of *Rider's Volume XV*. Model QB55X, chassis RC-563K, appears on pages 17-9 through 17-11 of *Rider's Volume XVII*. A viscoloid damper has been added to the stator plates of the oscillator section of the tuning capacitor to reduce microphonics on short wave reception.

Some of these sets have dial back plates without the score marks which may be used as a reference during alignment. The glass dial scale may be removed from the cabinet and used as a reference during alignment, or the check points indicated in the accompanying diagram may be used.



Check points to be used when aligning the RCA models QB55 and QB55X



The correct tube locations for the RCA Model QU-62.

**RCA Q109 (RC-602), Q109x (RC-602A)**

The following voltage-current table should be added to the service data appearing in *Rider's Manual Volume 18*, pages RCA 18-3 through 18-10.

Socket Voltages — Cathode Currents  
Local-Phono-Distant Switch in Distant Position.

Tube	Plate Volts	Screen Volts	Cathode Volts	Cathode Current
1 6SG7	137	112	0	13.1 ma
2 6SA7	260	103	0	12.2
3 6SK7	235	103	1.3	13.3
4 6SQ7	86*	.....	0	0.4
5 6F6G	257	260	19.2	23.5
6 6F6G	257	260	19.2	23.5
7 6AT6	90*	.....	0	0.7
8 6U5	260	21*	0	2.1
9 5Y3G	.....	.....	355	90.0

\*Measured with Chanalyt or Voltomyst

In LOCAL position the cathode circuit of the 6SG7, the RF amplifier, is opened ("A" Band only) and the voltages are correspondingly higher due to the absence of cathode current in this tube.

The stock number of the speaker cone should be changed to read:  
No. 70972 Cone — Cone and voice coil assembly

**RCA Q10, Q10A, Q10A2, Q10-2, Q10-3, Q110**

This material appears in *Rider's Manual Volume 15*, pages 15-5 through 15-7. In the event that regeneration develops in the receiver, it may be due to a resonant condition due to electrolytic capacitor C21 being parallel with capacitor C11 (0.1- $\mu$ f). Three methods have been used at the factory to correct this condition. These are:

- (1) C11 may be 0.05- $\mu$ f instead of 0.1- $\mu$ f
- (2) An additional 0.1- $\mu$ f capacitor may be added in parallel with C11
- (3) The RED and GREEN leads of the electrolytic capacitor (C21 and C22) may be interchanged

In some chassis, R1 may be 2.0 megohms instead of 2.2 megohms.

**RCA 8V7, 67V1, 67AV1, 710V2**

Model 8V7 appears on pages 18-15 through 18-16 of *Rider's Volume XVIII*. Models 67V1, 67AV1 appear on pages 16-35 through 16-39 of *Rider's Volume XVI*. Model 710V2 appears on pages 18-55 through 18-60 of *Rider's Volume XVIII*. An alternate Speaker (stamped 92569-1K) has been used as a substitute for the listed speaker (or speakers) in these models.

Add the following to the parts list: Under "Speaker Assemblies" add the following: 92569-1K.

- 70574 Cone—Cone and voice coil assembly.
- 31539 Plug—5 prong male plug for speaker.
- 37899 Transformer—Output transformer.
- Replace complete speaker with Stock No. 71961 (92569-1W).

**RCA 66X11, 66X12, 66X13**

These models appear on pages 17-29 through 17-30 of *Rider's Volume XVII*. Some oscillator coils which were specified for the first production (RC-1046A, RC-1046, RC-1046B) of these models have been used on the second production (RC-1046C, RC-1046D, RC-1046E).

Some oscillator coils and associated coupling capacitors (C19) which were specified for the second production have been used on the first production.

If replacement is necessary — use the specified parts — the range of inductance adjustment may be insufficient if used otherwise.

**RCA QU-62**

This model appears on pages 17-13,14 through 17-20 of *Rider's Volume XVII*. In some instruments the speakers listed following have been used as alternates for the speakers listed in the parts list.

- Speaker Assemblies 92520-1K
- 70574 Cone—cone and voice coil assembly
- 5118 Plug—3 prong male plug for speaker
- 70686 Speaker—12" PM speaker complete with cone and voice coil less plug
- (Used as alternate for PM speaker stamped 92469-4W)

- Speaker Assemblies 92516-2K
- 70574 Cone—cone and voice coil assembly
- 5119 Plug—3 contact female plug for speaker
- 31539 Plug—5 prong male plug for speaker
- 70573 Speaker—12" EM speaker complete with cone and voice coil less output transformer and plugs
- 70688 Transformer—output transformer (T4)
- (Used as alternate for EM speaker stamped 92566-3W)

The alternate speakers will not fit on the mounting bolts used with the original speakers. If a replacement which differs from the original equipment speaker becomes necessary, it is suggested that the mounting bolts be cut off and the replacement speaker mounted using rubber grommets, spacers, and wood screws.

The top view of this model is shown on page 17-18 of *Rider's Volume XVII*. The tuning capacitor has six sections—C1 and C2 Ant, C14 and C15 R.F., and C11 and C31 Osc. The tube and trimmer location view shows only C1, C14 and C31, which are used on the "A" and "B" bands only.

The following change should be made in the parts list on page 17-20. Replace Stock No. 31970 spring with Stock No. 31418 spring—Drive or indicator cord spring.

The instrument label used on some instruments is incorrect in showing tube locations. The r-f shelf assembly should be turned 90° clockwise. The correct tube locations are illustrated in the accompanying diagram.

**RCA QU-61**

This was published in *Rider's Manual Volume 16, page 15-55*. The following pertains to the power-supply ratings for this receiver.

Only one power-supply rating (Symbol Rating D) is applicable to QU-61. As manufactured it may be operated on 100 to 260 volts, 50-60 cycles. A universal type of transformer having five voltage ranges is used. The desired range may be selected by the proper positioning of a link beneath a cover on the top of the power transformer as follows:

110 position	100 to 115 volts
125 position	115 to 135 volts
150 position	135 to 165 volts
210 position	165 to 230 volts
240 position	230 to 260 volts

The receiver is shipped with this link in the 240-volt position.

**CAUTION** . . . Remove the power cord from the line receptacle before changing the position of the link.

The record changer is made for operation on a 60-cycle power supply but may be converted to 50-cycle operation by the addition of a conversion spring to the motor shaft.

**Change in Replacement Parts:**

Stock No. 34183 Transformer

Delete "For Specification Ratings A and C"

Add "For Specification Rating "D"

Stock No. 39786 Transformer

(No phonograph motors are available to permit operation of this instrument on 25-cycle current. However, this transformer may be used for operation on 105 to 125 volts, 50-60 cycles.)

**RCA 8X521, 8X522**

These models appear on pages 18-43 through 18-44 of *Rider's Volume XVIII*. On late production sets, slotted holes are provided in the tuning capacitor mounting bracket, and washers (maximum of five required) are used on the tuning capacitor shaft (between dial knob and capacitor) to permit adjustment of the dial. If the cabinet or tuning capacitor should be replaced, it may be necessary to adjust the mounting of the tuning capacitor or change the number of washers to prevent rubbing of the dial on the cabinet.

The following changes should be made in the parts list:

Delete: 70601 Capacitor — tubular, 0.002  $\mu$ f (C9)

Add: 74063 Capacitor — ceramic 200  $\mu$ f (C9)

74183 Washer — vellutex washer for dial knob clearance

**RCA 54B5**

This model appears on pages 16-28 through 16-30 of *Rider's Volume XVI*.

The following addition should be made to the parts list.

70708 Lead—battery lead assembly

**RCA Radiola 61-10 (RC-1023A and RC-1023C)**

This material appears in *Rider's Manual Volume 16, pages 15-53, 15-51, and 15-52*. In some of the 1023A chassis, two 10- $\mu$ f capacitors are used in parallel in place of the specified 22- $\mu$ f capacitor, C-15.

In the case of the 1023C chassis, service data given for the 1023A chassis will apply in toto.

**RCA 711V2**

This model appears on pages 17-44 to 17-55 of *Rider's Volume XVII*. Interference has been noted on the broadcast band in certain localities. This interference appears in the background of certain stations or between stations, and generally takes the form of code or amateur voice. An abnormal quantity of whistles when tuning across the band is also present. Connecting an external antenna to the set merely makes the condition worse.

A production change has been made to overcome this condition. Receivers having this change may be identified by the letter L following the serial number on the radio chassis. The antenna coil L3 has been removed and a different loop antenna installed. These changes may be made as follows.

1. Remove radio chassis.
2. Refer to illustration and remove the red lead connected from the loop loading coil L3 to terminal 8 of S4.
3. Unsolder the blue lead from loop loading coil L3 and connect this lead to terminal 8 of S4. L3 may be left in the chassis without leads connected to it.
4. Remove the loop cable from loop and from the terminal board on the rear of the cabinet.
5. Remove the lug from the end of the yellow loop lead and solder this lead to terminal 5 on the antenna terminal board on the radio chassis.
6. Re-install the radio chassis.
7. Clip off pin 5 on chassis end of the five-conductor flexible antenna cable and file the remainder of the pin smooth with surface of plug.
8. Plug the five-conductor cable into the antenna terminal board on chassis (see sketch). Note that with one pin removed, the plug can be moved one pin to the right and plugged in, making incorrect contact.
9. Carefully pull the yellow lead downward along the five-conductor cable far enough to permit taping it to the plug portion of this cable to prevent

the yellow lead from breaking at the soldered joint at terminal 5 when flexed by opening of the radio door.

10. Connect the red and black loop leads to the rear terminals 4 and 5 respectively from which they were originally removed. Close link from 4 to 5 if an external antenna is not used. If an external antenna is used, it may be connected as described on page 17-54 of *Rider's Volume XVII*.
11. Remove the screw from terminal 6 in the antenna board on rear of cabinet to avoid improper connection in the future.
12. Remove the old loop and install the new loop in its place.
13. Plug the loop cable into the new loop.
14. Peak the loop trimmer on a weak station around 1400 kc.
15. If a test oscillator is available, the low-frequency oscillator core (L12) adjustment should be made while rocking the gang through 600 kc, to obtain maximum output. Repeak loop trimmer again at 1400 kc.
16. Grounding one of the the f-m antenna terminals (connect terminal 1 to 5) on the board on the rear of the cabinet may prove advantageous to reduce excess signals if an external f-m antenna is used.

**NOTE:** The new loop referred to above may be identified by a green paint dot on one metal mounting bracket. Also, the large coil has 20 turns of wire with only a few turns, or no turns, visible through the holes near the edge of the loop frame. The original loop contains 13 turns, all of which are visible through the holes near the edge.

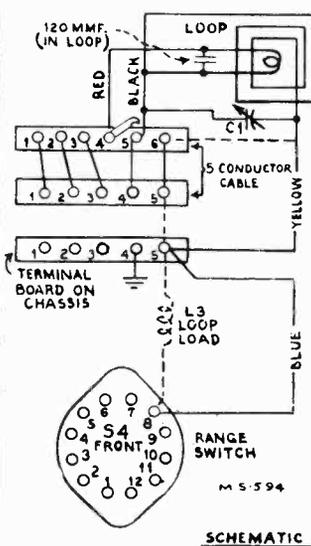
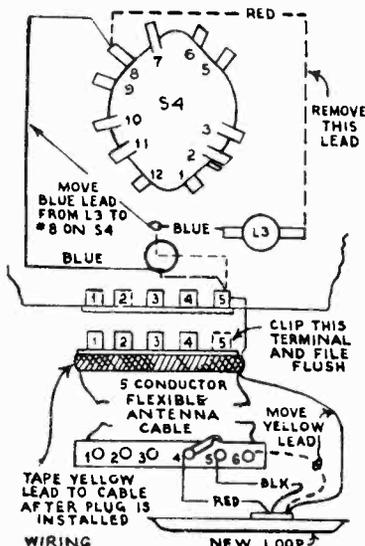
The leads which are not shown in the accompanying diagrams need no change.

Delete 71863 cable from the parts list and add the following.

73250 Cable—five-conductor molded antenna lead in cable

71614 Capacitor—120  $\mu$ f, ceramic—in shunt with the loop primary

73480 Loop—antenna loop complete. For receivers without loop loading coil.



**711 SERIES LOOP AND LOADING COIL WIRING CHANGE**  
(BROKEN LINES INDICATE ORIGINAL WIRING REMOVED)

Necessary connections for the new loop for the RCA model 711V2

**RCA 66BX, Chassis RC-1040B**

This model is the same as model 66BX, Chassis RC-1040 appearing on pages 15-37 and 15-38 of *Rider's Volume XV*, except for the following changes:

Chassis RC-1040B uses a 3V4 output tube and a selenium rectifier. Resistor R3 and capacitor C8 in the converter stage are omitted.

Resistor R17 in the power supply has been changed in value to 2650 ohms. Resistor R20 (2700 ohms) replaces resistor R18 in the power-supply circuit. A 33-ohm resistor (R31) has been added between the selenium rectifier and the "hot" side of capacitor C33. Capacitor C33 is now grounded. See Fig. 1.

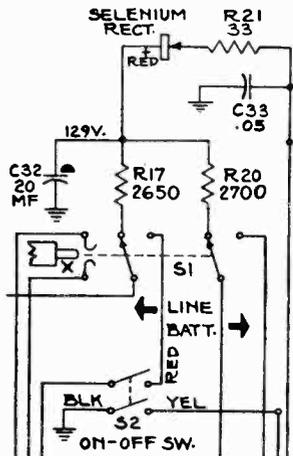
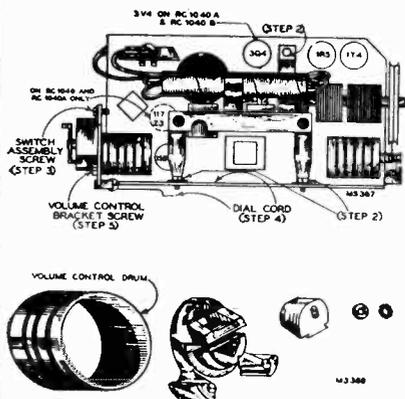


Fig. 1. Power supply of the RCA Chassis RC-1040B.

If the volume control needs replacement, the following steps should be followed. See Figs. 2 and 3.

1. Remove the 3V4 power output tube.
2. Remove the three screws holding the power cord bracket assembly. (Do not damage insulating washers.)
3. Remove the screw holding the switch assembly and remove the switch.
4. Remove the dial cord from the pulley.
5. Remove the screw holding the volume control bracket assembly.
6. Loosen the screw which maintains pressure on the expansion assembly.
7. Remove the drum.
8. Remove the expansion assembly from the volume control shaft.
9. Remove the nut holding the volume control to the bracket.

The following changes should be made in the parts list. Delete the following:



Stock No.	Description
38875	Resistor—1800 ohms, 1 watt (R18)
71038	Resistor — ballast resistor, 2300 ohms, 6 watt (R17)
30649	Resistor — 2.2 megohms, ¼ watt (R3)
70392	Cord — power cord
31709	Capacitor — ceramic 6.8- $\mu$ f (C7)
Add the following parts to the parts list.	
Stock No.	Description
39043	Capacitor—Ceramic, 6.8- $\mu$ f (C7)
70022	Cord — power cord
72283	Grommet — rubber grommet to mount tuning capacitor (4 required)
72543	Rectifier — selenium rectifier
71290	Resistor—33 ohms, 1 watt (R21)
30930	Resistor — 1800 ohms, ¼ watt (R6, R15)
72760	Resistor — ballast resistor, 2650 ohms, 7 watt (R17)
14421	Resistor—2700 ohms, 1 watt (R20)
72541	Socket — tube socket - miniature - 7 prong bottom mounted with shield
72980	Side — case side — l.h. with decorative ribs at top, bottom, and both sides.
72979	Side — case side — r.h. (loop side) less capacitor assembly with decorative ribs at top, bottom, and both sides.

**RCA Radiola 62-1 (RC-1017A)**

This appeared in *Rider's Manual Volume 16*, pages RCA 16-33 and 16-34. A 270,000-ohm resistor, R12, is connected across the phono input between the center contact of the phono jack. One lead of the resistor joins the contact which goes to switch S1 and the other lead joins the jack at the point where C4 is connected to it.

**RCA 65U-1**

*Rider's Volume 15*, pages RCA 15-85 and 15-86 list models 65U and 65AU. These are the same as model 65U-1. The difference is found in the cabinets. The U and AU models have a rounded top at the front and the U-1 has a beveled top in front.

**RCA 67V1, Chassis RC-606C**

This model appears on pages 16-35 through 16-39 of *Rider's Volume XVI*. Resistor R18 which was originally 470,000 ohms, appears in some chassis as 330,000 ohms and in some chassis as 220,000 ohms.

**RCA 67V1, 67AV1**

These models appear on pages 16-35 to 16-39 of *Rider's Volume XVI*. In late production models, resistor R18 connected from the phono jack to ground has been changed from 120,000 ohms to 330,000 ohms.

**RCA 75X11, 75X12 (RC-1050)**

The following changes have been made in the wiring. The circuit appears in *Rider's Manual Volume 18* pages RCA 18-49 and 18-50.

Capacitor C18 is now connected between pin #3 and pin #8 of the 35Z5GT rectifier. The service data indicates that it is connected between pin #3 of the above rectifier tube and the junction of R17 and C19.

Add to the parts list the following; under the heading of Chassis Assemblies:  
39632 Capacitor-Mica 150- $\mu$ f (C13)

Fig. 2, above. Parts layout of RCA chassis RC-1040B. Fig. 3, left. Volume control disassembly.

**RCA 75X11, 75X12 (RC-1050A)**

These models are the same as models 75X11 and 75X12, chassis RC-1050, appearing in *Rider's Volume 18* on pages RCA 18-49 and 18-50 except for differences in the i-f transformers. Here are the listing of the i-f transformer part numbers for the two different chassis.

Chassis RC-1050 uses:

- 1st IF trans. stamped 922246-7, Stock No. 71558
- 2nd IF trans. stamped 940351-2, Stock No. 71631

Chassis RC-1050A uses:

- 1st IF trans. stamped 922246-11, Stock No. 70128
- 2nd IF trans. stamped 922246-12, Stock No. 70129

Connections to the i-f transformers are identical for both chassis. Capacitors C8 and C9 of the 2nd i-f transformer stamped 922246-12 (RC-1050A) are 122- $\mu$ f each; the windings of this transformer have a d-c resistance of 13 ohms each.

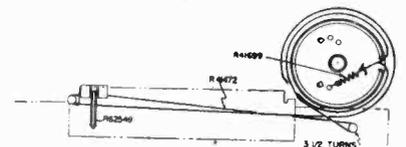
**RCA 76ZX12**

This receiver is in *Rider's Manual Volume 18*, pages RCA 18-51, 18-52. The following corrections are made in the parts lists. Under the miscellaneous heading

- Delete No. 36886 Knob and Add No. 70414 Knob—control knob ivory for 76ZX12

**Sears 6686, Chassis 101.851**

This model appears on page 17-1 of *Rider's Volume XVII*. It has been found that the dial cord slips on some of these models. To help correct this condition, it will be necessary to replace the present dial cord with a longer dial cord to change the pointer hookup. The new cord should be cut about 40 inches long and should measure 16¼ inches folded after assembly to the dial string tension spring. See the accompanying diagram for correct hookup.



Dial cord hookup for Sears chassis 101.851

Dial slippage may be due to a tight ganged tuning capacitor. If light lubrication does not correct the condition, the thrust adjusting screw on the rear of the tuning gang may be backed off very slightly and securely locked in the new adjustment. Use great care to avoid excessive loosening as the rotor and stator plates may short. The set may require realignment after this adjustment.

If frequency shift occurs, the following change is recommended to correct the condition:

1. Remove the screw and mica and bend up the leaf of the capacitor shunted across the a-m oscillator trimmer capacitor, C23.
2. Replace this part with a 15- $\mu$ f  $\pm$  10% ceramic capacitor.
3. Realign the a-m band of the radio receiver.

This change is being incorporated in production and will be effective on all sets shipped after September 30, 1948.

**Sears 6230A, Ch. 101.802-1**

This model is the same as model 6230, ch. 101.802, which appears on pages 15-16 through 15-18 of *Rider's Volume XV*, except for the following change.

A phono jack has been added to the circuit. This phono jack is connected to the control grid (pin 6) of the 1LB4 output tube. Physically, the jack is located on the top of the chassis in the rear left corner near transformer T3.

**Sears Roebuck 6362, 6363, 6364. Chassis 101.581**

These models appear on pages 11-64, 11-80, and 11-82 of *Rider's Volume XI*. If frequency shift in the a-m band occurs, the following should be done. Remove the screw and mica and bend up the leaf of the capacitor shunted across the a-m oscillator trimmer capacitor C23. Replace this part with a 15- $\mu$ f, 10% ceramic capacitor. Then realign the a-m band as outlined on page 11-82 of *Rider's Volume XI*. This change is being incorporated in the present production of these models.

**Sears Roebuck 7054, 8052, 8053**

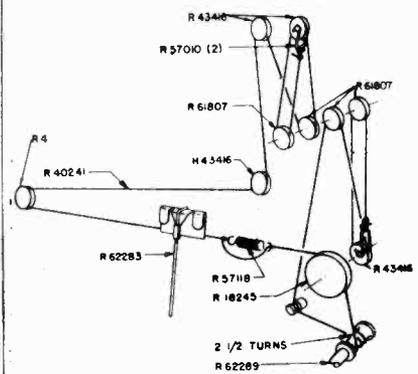
Models 8052 and 8053 are similar to Model 7054, but include the change shown on page 3 of the September issue of *Successful Servicing*. Model 7054 appears on pages 16-1 through 16-3 of *Rider's Volume XVI*. It has been found that some of the failures of the 35Y4 rectifier tube in these models can be prevented by adding a shunt resistor of 270 ohms across pins number 1 and 4 of the 35Y4 tube. This change was not made in production, so it is suggested that it be made in service when this type of failure is encountered.

**Sears 7230, Ch. 101.802A**

Basically, this model is the same as model 6230, ch. 101.802, which appears on pages 15-15 through 15-18 of *Rider's Volume XV*. However, it differs in the following respects.

A phono jack has been mounted on the top of the chassis in the left rear corner near transformer T3. This jack is connected to the grid (pin 6) of the 1LB4 output tube.

Also, the dial cord and pointer arrangement has been changed to the hookup shown in the accompanying diagram.



Dial cord arrangement for the Sears Model 7230

The battery supply used with this model is Cat. No. 6306 Battery Pack.

**Sparks Withington 1005.6.7.8**

These models appear in *Rider's Manual Volume XVIII*, pages 18-3 through 18-10. The signal generator frequency in operation 9 in the alignment chart on page 18-5 should be changed to read 10.7 megacycles.

**Sears 7100, Ch. 101.811-1**

Model 7100, Ch. 101.811, appears on pages 16-1, 16-4, 16-5, and 16-8 of *Rider's Volume XVI*. A change has been made in the circuit as follows:

A tone-control network consisting of resistor R16 and capacitor C24 has been connected from the plate (pin 2) to the cathode (pin 7) of the 7C6 tube. In order to accommodate this added circuit, some rearrangement has been made in the position of parts on the bottom of the chassis.

**Stromberg-Carlson 1204**

This 1949 model is similar to the previously manufactured Model 1204, appearing on pages 18-4 through 18-6 of *Rider's Volume XVIII*. The following changes provide complete servicing information:

Remove C-4 and R-5 and ground the cathode of the i-f amplifier (Pin 7).

Remove C-29 and R-20 and ground the cathode of the 1st i-f amplifier (Pin 7).

Remove C-37 and R-22 and ground the cathode of the 2nd i-f amplifier (Pin 7).

Short out L-18 and R-7 in the screen of the i-f amplifier (Pin 6).

Change R-9 from 680 ohms to 2200 ohms with an r-f choke wound on the resistor and connected in parallel with it.

Remove C-30 and short out R-34 in the screen of the 1st i-f amplifier (Pin 6).

Remove C-38 and short out R-24 in the screen of the 2nd i-f amplifier (Pin 6).

Add a 0.1- $\mu$ f capacitor from Pin 8 to ground and from pin 3 to ground on the 12H6 f-m detector.

Add a 10-megohm, 1/2-watt resistor from the grid (Pin 7) of the converter to the a-vc string.

Add a 220,000-ohm, 1/2-watt resistor from terminal 5 to terminal 7 of 1st i-f transformer.

Disconnect Pin 5 of 2nd i-f transformer from ground and insert a 0.01- $\mu$ f capacitor from Pin 5 to ground. Connect Pin 5 to the a-vc string through a 100,000-ohm, 1/2-watt resistor.

Change the converter, 1st i-f amplifier, and 2nd i-f amplifier B-plus line to feed from the low side of the filter choke.

**Stromberg-Carlson 1210, 1408**

The information for Model 1210 appears on pages 17-1 through 17-7 of *Rider's Volume XVII*. The 1408 is the same except that it is being manufactured in two cabinet styles, the blonde 1408 M6A (108119) and the mahogany 1408 PLM (10811), both equipped with the VM-800 record changer and the 1210 radio chassis.

Now that the low-frequency f-m band is practically non-existent, these two models can be modified to give greater sensitivity on the high-frequency f-m band at the sacrifice of the low-frequency f-m sensitivity. This is done by changing the built-in f-m dipole on the back of the cabinet. Use the following procedure:

Remove the original dipole attached to the rear of the cabinet.

Cut a piece of 300-ohm transmission line to 57 inches in length. This will be the new dipole.

Short the two parallel leads together at each end of this transmission line and solder.

At the center of one of the wires in the 300-ohm line, break the lead and connect another piece of 300-ohm line long enough to reach from the top of the cabinet to the dipole antenna terminals on the 1210 chassis. Solder the connection.

Attach the 57-inch length of line to the cabinet, dressing it so that it is kept away from the a-m loop and so that the center of the dipole is at the center of the cabinet at the top.

Connect the other end of the lead-in to the f-m antenna terminals of the 1210 chassis.

**Stromberg-Carlson 1400, 1400 Special**

These models are the same as Model 1200, appearing on pages 18-1 through 18-3 of *Rider's Volume XVIII*, except for the following changes. Omit R-9 (220 ohms) and connect the screen grid of the converter (12BA6, Pin 6) to the screen grid i-f amplifier (12BE6, Pin 6).

Omit C-2 (.05  $\mu$ f). Omit the dial lamp. Omit R-14 (120 ohms 2 watt) and jumper the former terminals of the resistor to make the heater string continuous.

The difference between these models is that Model 1400 has a dial with the numbers on the curved lens while Model 1400 Special has a dial with numbers on the flat glass plate behind the curved lens.

**Teletone 149, 157**

These models are the same as model 135 which appears on page Misc. 16-11 of *Rider's Volume XVI*.

**United Motors R-705**

Add to the material on this model appearing in *Rider's Volume XVII*, pages 17-1 through 17-6 (the Electro-Tuner in *Volume XVIII*, pages 18-6 and 18-7), the Service Part #7256226, Fuse Block.

Ignition interference on an R-705 recently installed in a new convertible Studebaker Commander has been suppressed through the following procedure.

To eliminate chassis pickup:

Sand edges of the case and cover the chassis unit and install additional cinch clips to insure a tight cover to case fit. Bond motor to firewall with part #6022 Braid. Bond heater control wire sheath to firewall at entrance point of firewall. Use one-inch braid. Soldering the braid to control wire sheath is not recommended. A mechanical connection is more desirable since there is less danger of soldering the control wire and sheath together.

To eliminate antenna pickup:

Bond antenna base to instrument panel using as short a length of braid as possible. Install a choke coil in antenna circuit. This may be accomplished by wiring choke part #1214382 into the chassis at the antenna connector or using part #555382 adapter. This latter part is available only through the Oldsmobile Lansing Parts Department Stores "A", Lansing, Michigan.

**Westinghouse H-124**

This model is the same as Model H-125 which appears on pages 15-8 through 15-10 of *Rider's Volume XV*, except that the side panels of the H-124 cabinet are a darker shade of green. The following items have been added to the parts list:

Part No.	Description
V-3461-3	Cover, left hand
V-3459-3	Cover, right hand

**Westinghouse H-186, H-187**

This model appears on pages 18-26 through 18-30 of *Rider's Volume XVIII*. The 0.1- $\mu$ f resonant-type capacitor (C33) is not used on late production chassis. This capacitor is shown connected between the B-plus line and ground in the schematic diagram on page 18-26.

**Westinghouse H-164, H-166, H-166A, H-167**

These models appear on pages 18-12 through 18-19 of *Rider's Volume XVIII*. The changes are as follows:

The notes under Figs. 1 and 4 should be revised to read: "All V-2119 chassis have 1st and 2nd i-f transformer adjustments as shown by the dotted line." The dotted-line adjusting points apply to current production chassis as well as to early models. The adjusting points shown in Fig. 3 apply to the V-2119-1 chassis which was also used in the above models.

Early models of the V-2119 chassis used a V-3295 power transformer which required a voltage-dropping resistor (R50) between the rectifier tube and the filter input to provide the correct voltage at the input to the filter. The V-2119-1 chassis and late models of the V-2119 chassis use a different power transformer (stock numbered V-4761) and the voltage-dropping resistor, R50, is no longer required.

Capacitor C76, which is shown connected between the B-plus line and ground in the schematic diagram on page 18-13, is not being used on late production chassis.

The items listed below are incorrectly listed in the replacement parts list. They should be changed to read as follows:

RC30AE332K Resistor, 3,300 ohms, 1 w. (R31)

V-4886-1 Choke, filament (L2, L3)

**Westinghouse H-165**

This model appears on pages 17-12 through 17-14 of *Rider's Volume XVII*. The switch for this model was listed as a complete assembly including a wafer section (SW1) and an a-c switch section (SW2). In cases where the a-c switch is defective, but the remainder of the switch is not damaged, repairs can most easily be made by replacing the a-c section only. For this reason, the a-c section of the switch assembly is listed below as an addition to the parts list.

Part No.	Description
V-4803-1	Switch, a-c (SW2) and mounting plate

**Westinghouse H-185 and H-195**

These models appear on pages 18-23 through 18-25 of *Rider's Volume XVIII*. The changes are as follows:

The value of R3 on the schematic diagram should read 220 ohms instead of 220K ohms as shown.

The 220K resistor, R7, which was previously connected between the common negative line and the chassis, is not being used in late production chassis. Also in later production chassis, the value of R9 was changed from 3,300 ohms to 1,800 ohms.

In later production receivers, an adjustment hole was provided in the right side of the model H-185 cabinet. It is recommended that the r-f trimmer (C6) be adjusted with the chassis in the cabinet and the rear cover closed. The plug that fits this hole is listed below.

The following items should be added to the parts lists:

RC20AE182K	Resistor, 1,800 ohms, 1/2 w. (R9)
V-1157-4	Cabinet, plastic (H-185 grey)
V-4836-6	Plug, button (H-185 grey cabinet)
V-4836-5	Plug, button (H-185 maroon cabinet)

**Westinghouse H-153, H-155, H-156, H-171, H-171A, H-171C, H-184**

These models are electrically the same as Model H-122, appearing on pages 15-5 through 15-7 of *Rider's Volume XV*. The cabinets differ from that of Model H-122.

The parts list should be changed to include the following:

Item	Part No.	Description
	V-3360	Loop, antenna (H-171 Mah., H-171A, H-171C, H-184)
	V-4364	Loop, antenna (H-153, H-171 Blonde and Limed Oak)
	V-4373	Loop, antenna (H-156)
	V-4079	Receptacle (H-153, H-171)
	V-5405	Socket, molded power (H-171, H-171C)
	V-3393-1	Socket, receiver, a-c power (H-153)
	V-3412	Background, dial (H-153, H-171, H-171A, H-171C, H-184)
	V-4376	Background, dial (H-156)
	V-4891	Baffle and grill cloth assembly (H-155)
	V-3677	Baffle, cardboard (H-156)
	V-3532	Bar, flat, record changer mounting (H-153, H-171, H-171C)
	V-3489S-1	Bumper (cabinet foot for H-153, H-155, H-156)
	V-6021-1	Bumper, 3/8" dia., self-adhering (H-184)
	V-6021-2	Bumper, 1/2" x 2", self-adhering (H-184)
	V-5725	Bumper, bottom cover mounting (H-184)
	V-1125-1	Cabinet (radio section - H-153, H-171 Blonde and Limed Oak)
	V-1126	Cabinet (H-155)
	V-1128	Cabinet (H-156)
	V-1158-1	Cabinet, less radio section (H-184)
	V-5056	Catch, bullet (H-171 Blonde and Limed Oak)
	V-5286	Catch, bullet (H-171 Mah., H-171A, H-171C)
	V-3219S-1	Cord, dial drive (spool)
	V-5047	Cover, back (H-171 Blonde and Limed Oak)
	V-5287	Cover, back (H-171 Mahogany)
	V-5734	Cover, bottom (H-184)
	V-3663	Decal, radio-phonograph (H-155, H-156)
	V-3662	Decal, stations (H-155, H-156)
	V-3660	Decal, tone (H-155, H-156)
	V-3661	Decal, volume (H-155, H-156)
	V-3665	Decal, Westinghouse (H-155, H-156)
	V-3647	Dial (H-155)
	V-4344	Dial (H-156)
	V-7009-1	Door, front (H-171 Limed Oak)
	V-7009-2	Door, front (H-171 Blonde)
	V-7011	Door, front (H-171 Mah., H-171A, H-171C)
	V-3829	Felt Strip, 1/4" x 1/16" x 8 3/8" (H-153, H-171, H-171A, H-171C, H-184)
	V-4902	Glide, furniture (H-171, H-171A, H-171C)
	V-4228	Grille Cloth (H-156)
	V-3345-5	Grommet, variable capacitor mounting.
	V-4973	Hinge, door (H-171 Blonde and Limed Oak)
	V-5355-1	Hinge, door (H-171 Mah., H-171A, H-171C)
	V-3510	Hinge, lid (H-171 Mah., H-171A, H-171C)
	V-4321	Hinge, lid (H-153, H-171 Blonde and Limed Oak)
	V-5836	Knob, door (H-171A, H-171C)
	V-4362-2	Knob, radio-phonograph (H-153, H-171 Blonde and Limed Oak)
	V-4371-2	Knob, radio-phonograph (H-156)
	V-4361	Knob, tuning and tone (H-153, H-171 Blonde and Limed Oak)
	V-4697-3	Knob, tuning and tone (H-156)
	V-4362-1	Knob, volume (H-153, H-171 Blonde and Limed Oak)
	V-4371-1	Knob, volume (H-156)
	V-3333S-2	Medallion (H-153, H-155, H-171 Blonde and Limed Oak)
	V-3894	Nameplate, Westinghouse (H-153, H-171, H-171A, H-171C)
	V-6024-1	Plate, hinge (H-184)
	V-4365	Pointer, (H-153, H-171 Blonde and Limed Oak)
	V-4384	Pointer (H-156)
	V-3836-1	Pointer assembly, including pointer, mount and slide (H-171 Mah., H-171A, H-171C, H-184)
	V-3836-2	Pointer assembly, including pointer, mount and slide (H-155)

V-3370	Pointer slide assembly, including pointer mount and pointer slide (H-153, H-171 Blonde and Limed Oak)
V-3166S	Pulley, 7/16" dia.
V-4379	Rail assembly, pointer (H-156)
RC20AE334M	Resistor, 330K 1/2 w. (part of record changer)
V-3322	Shaft, tuning
V-3530	Spacer, felt, 1/16" x 3/8" x 1" (H-171A, H-171C)
V-4323	Spacer, felt, 1/16" x 3/8" x 1" (H-153, H-171 Blonde and Limed Oak)
V-5057	Strike, bullet catch (H-171 Blonde and Limed Oak)
V-5290	Strike, bullet catch (H-171 Mah., H-171A, H-171C)
V-4324	Support, lid (H-153, H-171 Blonde and Limed Oak)
V-5291	Support, lid (H-171 Mah., H-171A, H-171C)
V-3752S	Washer, felt, for small knobs (H-171 Mah., H-171A, H-171C, H-184)
V-4366	Washer, felt, for small knobs (H-153, H-171 Blonde and Limed Oak)
V-3668S	Washer, felt, for knobs (H-155)
V-5277-1	Washer, felt, for knobs (H-156)
V-5762	Washer, fibre, phono mounting (H-171A, H-184)
V-3267S-4	Washer, flat, chassis mounting
V-3215S	Washer, spring
V-3356	Window, dial (H-153, H-171, H-171A, H-171C, H-184)

**Wilcox-Gay 8J10**

This model appears on pages 18-1 and 18-2 of *Rider's Volume XVIII*. Several changes have been made in late production receivers. For receivers with serial numbers 14,940 and up, the grid of the 6B36 tube is grounded when the function switch is set in the "RECORD MIKE" position. This helps eliminate high-frequency noise disturbances when recording from the microphone. On receivers with serial numbers 14,939 and below, the yellow wire connected to pin #2 on the 6B36 socket should be moved to pin #7.

The output transformer (81-2106) on all receivers with serial numbers 25,001 and up, has been replaced by a tapped primary transformer (81-2109-1) with a neon limiter lamp (45-2023) connected across the yellow and red primary leads, as shown in Fig. 1.

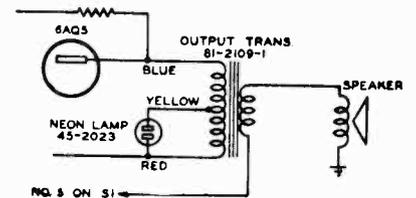


Fig. 1. New output transformer and limiter circuit of the Wilcox-Gay 8J10.

This supersedes the previous limiting circuit using two neon lamps across the secondary leads of the output transformer.

The single neon lamp limits the amount of voltage to the crystal so that the crystal will not be damaged by the application of excessively strong signals.

Several cases have been reported where the coupling capacitor C13 has shorted due to excessive peak voltages. The shorting of this capacitor places the d-c plate voltage directly across the crystal record-playback head, resulting in "burned-out" or cracked crystals.

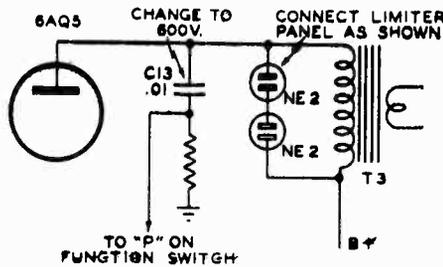


Fig. 2. To eliminate crystal failure, these changes should be made.

To eliminate crystal failure from this source, on all chassis having the double neon bulb limiter panel and the 400-volt coupling capacitor, the capacitor should be changed to one having a 600-volt rating and the dual limiter panel should be connected directly across the primary of the output transformer. See Fig. 2. Every set with the dual limiter that is returned for service should have this change made. Failure of C13 is eliminated on late models by using the tapped-primary transformer described previously.

**Wilcox-Gay 6B10, 6B20, 6B30, 6B40, and 6B42**

These models are the same as Model 6B10, Late, on page 15-4 of Rider's Volume XV, except for the following changes. a 0.00005- $\mu$ f capacitor (C34) has been connected across R38.

A 6E5 tube has been substituted for the 6U5; the socket connections are the same. A 6SJ7GT tube has been substituted for the 6J7GT formerly used. The socket connections for the 6SJ7GT are:

- 1 No connection
- 2 Heater
- 3 Suppressor Grid
- 4 Grid
- 5 Cathode
- 6 Screen Grid
- 7 Heater
- 8 Plate

Tie points are utilized for voltage measurements, see the accompanying voltage chart.

**Zenith S 13200**

This model is the same as Model S-11468 on RCD. CH. Pages 15-1 through 15-8 of Rider's Volume XV, except that the Model S 13200 has a Cobra tone arm and a muting switch.

**Zenith 6R886, Chassis 6E02**

This model appears on pages 17-16 and 17-17 of Rider's Volume XVII. In some cases when microphonics are encountered, replacing the 6C4 tube mounted at the top of the chassis alleviates this condition. The 6C4 tube is easily accessible after the screen in the record changer compartment is removed.

**Zenith 7R887, Chassis 7E22**

This model appears on pages 18-33,34 through 18-36 of Rider's Volume XVIII. When replacing defective or burned out tubes in this receiver, care must be taken that the 6SK7 i-f amplifier tube be replaced only with another 6SK7. Use of a 6SK7GT or G tube will result in extreme oscillation which can be controlled only by the use of the 6SK7 metal tube.

**TYPICAL VOLTAGE CHART**

TUBE	VOLTAGE TO GROUND PIN NO.							
	1	2	3	4	5	6	7	8
6A8	0	13	240	80	-10	156	13	2.6
6SK7	0	13	3.3		3.3	80	13	240
6SN7	0	232	6.5	0	55	1.6	13	13
6SQ7	0	0	1.5	0	0	68	13	13
6V6	0	13	225	240	0	240	13	13
6SJ7	0	13	0	0	0	3.3	13	80
5Y3	0	280		275AC		275AC		280
6E5	13	6	0	240	1	13		

MEASURED WITH 1000 OHMS PER VOLT METER.  
SCALES USED -3-30-150-300

ALL PLUNGERS IN RELEASED POSITION.

Typical voltage chart for the Wilcox-Gay 6B10, 6B20, 6B30, 6B40, and 6B42.

## SETTING UP CHANGER FOR OPERATION

### Section 2

#### UNPACKING

Before operating the record changer, the following procedure should be followed:

Remove all packing material and pieces of tape from changer compartment.

Remove locking screw from back side of changer compartment.

Remove the cardboard spacers between turntable and cabinet shelf.

Remove shipping bolts from floating panel.

See that changer and mounting panel float upon the spring mountings.

See that gears and cam tracks are lubricated (can be checked by observation while in cabinet).

See that levers have not been displaced during transit.

Check needle and pickup for damage.

Run changer by hand through cycle to discover any binding.

See that the changer is level.

#### CHECKING THE CHANGER

Check the needle landing with full stack of records, intermixed. This is done by loading the spindle shelf with 10 records, both 10" and 12" and press-

ing the control button to reject a record and put the changer into operation. The stabilizer arms must be moved into the recess in the spindle to prevent interference in loading the records. Allow the first record to play through and trip, observing the needle landing on several 10" and 12" records, then trip records up to and including nine. Allow the ninth record to play through and feed number ten automatically, observe needle landing, automatic trip and automatic shut-off.

Check electrical operation by turning radio program switch to phono position and playing a record. The noise eliminator should be checked in each position by listening to reproduction. As a rule, old worn records should be played while the switch is in the No. 1 position. Position 2 is for normal records, while No. 3 gives wide-range reproduction from the new high-fidelity recordings.

#### DEFECTIVE RECORDS

This record changer is adjusted to operate with standard records. Records that are undersized, too thick, or with deformed center holes, cannot be expected to operate properly on this or any other changer. Trip grooves that are not standard may result in erratic tripping. Records should be examined for faults before making adjustments to the changer.

## DESCRIPTION AND OPERATION OF THE CHANGER

### Section 3

#### RECORD LOADING

The record spindle shelf is to be loaded to a maximum of 12 ten inch, 10 twelve inch, or to the red line on the spindle with both sizes, intermixed. The stabilizer arms must be moved into the recess of the spindle to prevent interference in loading the records.

The tone arm set-down is always in 10" position unless a 12" record has just been dropped from the spindle shelf. In dropping to the turntable, the 12" record strikes the interceptor lever #58698, contacting the tone arm swing lever #58698, imparting movement to the tone arm lift lever #58694 and causing the tone arm to be set down to 12" position.

#### RECORD CHANGING

After the changer is loaded with records, the control button is pressed to start the record change cycle. Rotation of the main cam will actuate the compression lever causing the compression rod to depress the inner-spindle assembly. The four-prong

spring support (spindle shelf) has receded into the outer spindle and the rubber sleeve on the spindle, being compressed, has expanded, and therefore holds all but the bottom record which descends to the turntable. Then the tone arm return lever moves the tone arm into position to be lowered to the record by following the cam track. The tone arm moves across the record until the selection is finished and the trip mechanism functions. Finally, the tone arm is lifted and carried over the record until clear of the record stack and the next record is released, completing one change cycle. In this manner all the records in the stack are played.

#### AUTOMATIC STOP

The weight of the records on the spindle allows the record lift lever to follow the contour of the main cam. When the last selection is played, a spring lifts the record lift lever into position to move the automatic stop pawl inward. The main cam carries the stop pawl into engagement with the switch lever, thus stopping the changer.

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### SPRING MOUNTING

The changer is solidly mounted on a panel which is floated upon spring mountings. These spring mountings eliminate rumble or feedback and insulate the changer from any cabinet vibration occasioned by the sound waves emanating from the speaker. This vibration, if transmitted through the tone arm to the pickup, would be amplified in the audio system of the radio and passed into the speaker again. The spring mountings also cushion the changer from sudden jars or shocks.

To remove the changer from the cabinet, remove four acorn nuts located on the corners of the mounting panel and lift panel out of cabinet. In some cases it is necessary to remove the cabinet drawer before removing the mounting panel.

On the underside of changer loosen screw next to spindle (paragraph B, section 7), and turn lock so that turntable may be removed from changer. Remove three screws and lift changer out of mounting panel.

## CYCLE OF OPERATION

### Section 4

#### STUDYING THE CYCLE

The record change cycle consists of the sequence of motions required to move the pickup into position on a record, play the record, remove the pickup and place a record into position. Since movements of various parts are being performed simultaneously, it is impossible to follow all of the actions at one time. A suggested method is to select one certain cycle of operation. For example the raising of the tone arm, moving it over the record and the replacement on the record may be studied while running the changer slowly by hand. After the motions associated with the tone arm are understood, another portion of the changer may be observed.

#### TRIP ASSEMBLY

Motion of the tone arm is transmitted through the tone arm crank to the tone arm lever and pin assembly #15194 which is secured to the tone arm support tube with lever #58695. When the needle enters the trip grooves of a record, the increased velocity of movement impels the tone arm lever against the starting reset lever #58853. The starting reset lever then engages the starting pawl on the turntable hub.

#### THE CHANGE CYCLE

The turntable is driven through an idler pulley by the electric motor, the turntable being free on the spindle. A gear on the turntable hub meshes with the main cam gear. Several teeth are left off the main cam to stop it in playing position. After a selection has been played, the trip mechanism moves the starting reset lever, which is part of the main cam assembly #13672, forward at the right speed and correct distance to permit it to mesh properly with the starting pawl on the turntable hub. As the main cam rotates, the tone arm lift lever #58694 lifts the tone arm upward and the tone arm return lever moves the tone arm over the record. The compression lever #57240 will actuate the compression rod #55424, which will in turn depress the inner-spindle assembly #11379. During this cycle

the rubber sleeve #62152 has expanded and is holding all but the bottom record. At the same time the spindle shelf recedes into the outer spindle #55334, dropping the bottom record to the turntable. By following the cam track the tone arm return lever moves the tone arm into position to lower the pickup needle to the starting groove in the record. The main cam is now in playing position, disengaged from the turntable hub gear. One change cycle has been completed.

#### PICTORIAL REPRESENTATION

The following series of photographs, with a corresponding brief explanation of each phase, are inserted to illustrate the movements of pertinent parts of the changer during a change of record cycle.

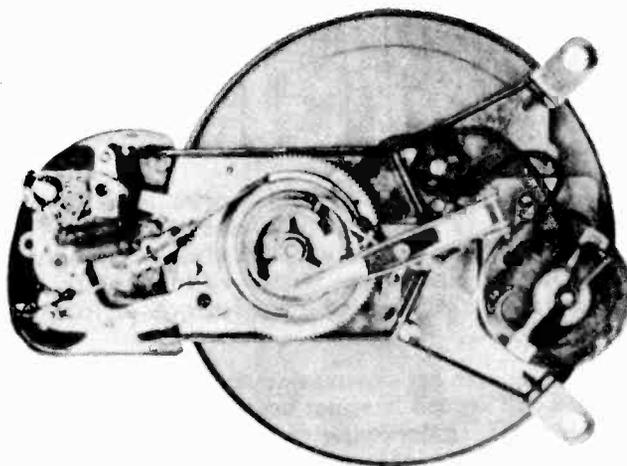


FIGURE A

The main cam is driven through the gear on the turntable hub. When a change cycle is completed, the main cam disengages from the turntable gear because several teeth are left off the main cam gear. The tone arm is in position on the record and free to follow the playing groove. This phase of cycle is called the playing position.

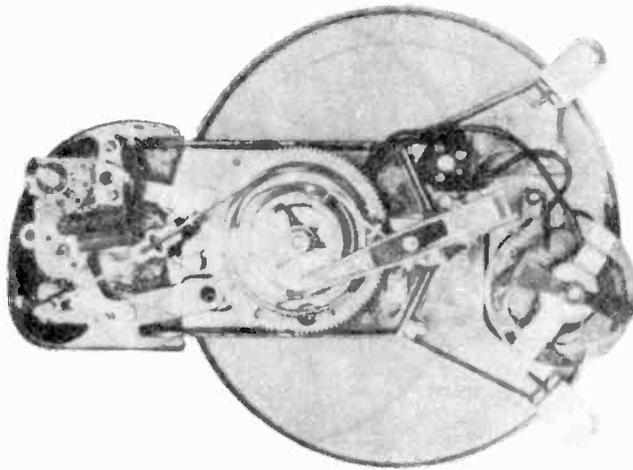


FIGURE B

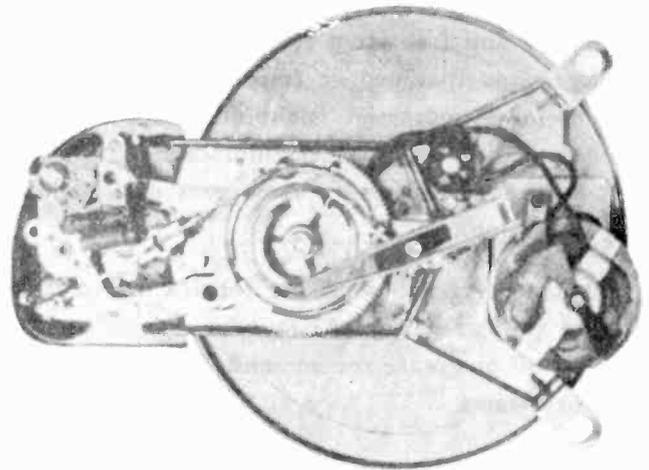


FIGURE C

The change cycle has just begun. The tone arm lift lever has raised the tone arm from the record and the tone arm return lever has started to move the tone arm away from the turntable. The compression lever assembly has started to pull the compression rod, thus beginning to recede the spindle shelf into the outer spindle and expanding the rubber sleeve on the spindle.

The tone arm has moved outward, clear of the turntable, and the spindle shelf has fully retracted into the outer spindle, dropping the bottom record to the turntable. The rest of the record stack is held by the expanded rubber sleeve. The spindle shelf has started to return to its former position.

## CHANGER LUBRICATION

### Section 5

The record changer should be lubricated and cleaned periodically or when a major part or assembly is replaced. Dirt, old oil, or grease may be removed with carbon tetrachloride or other similar cleaning fluid.

Use only a good grade of electric motor oil.

Care should be exercised to prevent an excess of oil being used on any part and that no oil gets on the velocity trip assembly, motor pulley, idler pulley or turntable rim. There is a self-lubricating type bearing in the turntable with an oil reservoir which may be filled through the four holes in the turntable hub.

Once a year a thin coat of light grease of the vaseline type may be applied to all surfaces of the main cam that contact lift levers and record lift lever roller. Also grease all working parts on the main cam and oil other moving parts (see figures D & E) except those that rely upon friction, i.e., contact surfaces being dry.

### PRECAUTIONS

With mechanical devices, much information pertinent to lubrication can be obtained by observation. Obviously, it will be seen that certain parts of rotating or sliding machinery must be lubricated,

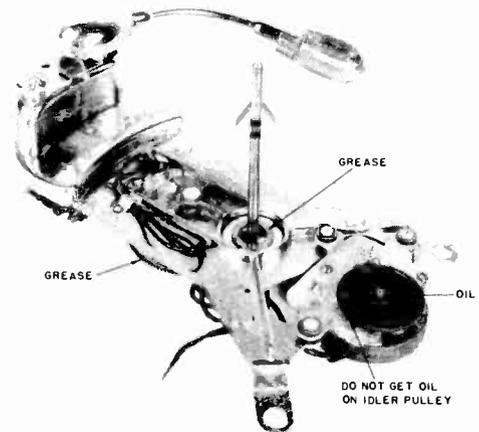


FIGURE D

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but that other parts depend upon contact surfaces being dry and free from foreign substances, such as grease, so that proper friction exists. Where lubrication is indicated, it should be applied judiciously, avoiding any excess lubricant that may be transferred or thrown to some part designed for dry operation.

Inspect parts not requiring lubrication to make certain they are clean. Always be sure to use the type of oil or grease recommended for lubricating specified items.

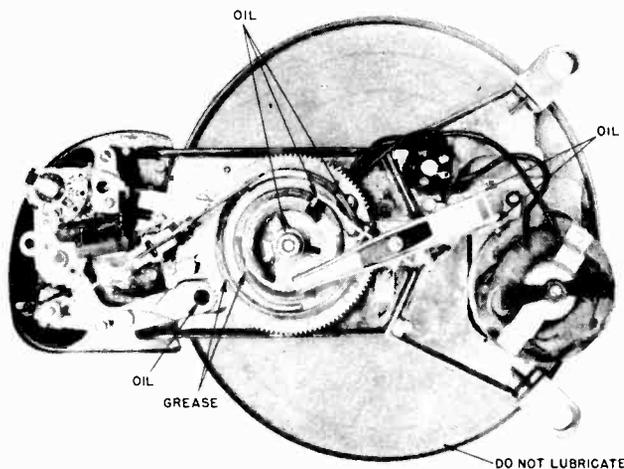


FIGURE E

## PARTS IDENTIFICATION

### Section 6

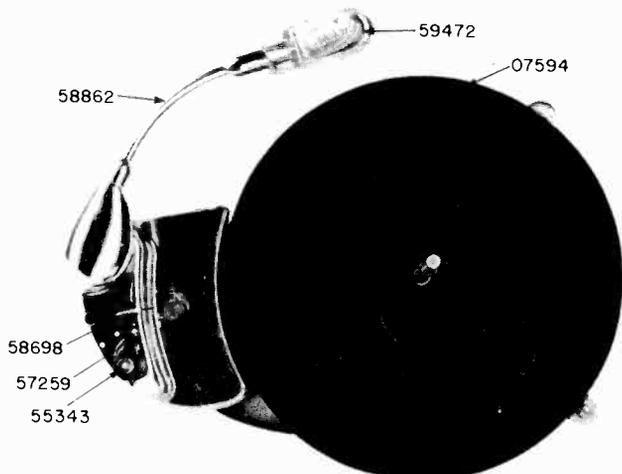


FIGURE 1—Top View

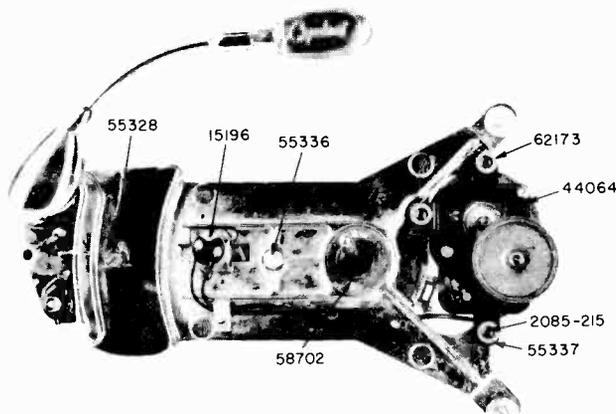


FIGURE 2—Top View with Turntable Removed

FIGURE 1

FIGURE 2

*Part No. Description*

- 55343 — Reject Plunger.
- 57259 — Noise Eliminator Knob.
- 58698 — Tone Arm Interceptor Lever.
- 58862 — Tone Arm Tube only.
- 59472 — Plastic Pickup Housing only.

*Part No. Description*

- 15196 — Automatic Stop Switch Assy.
- 44064 — Phono Motor.
- 55328 — Tone Arm Adjusting Stud.
- 55336 — Mounting Bolt For Main Cam.
- 55337 — Motor Mounting Spacer.
- 58702 — Bearing Support Washer.
- 62173 — Rubber Motor Mounting Grommets.
- 2085-215 — Motor Mounting Bolt (#6-32 x 3/8")

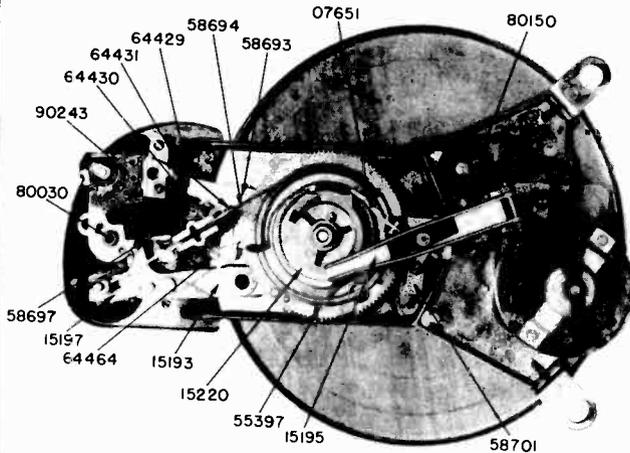


FIGURE 3—Bottom View

FIGURE 3

Part No.	Description
07651	Record Lift Lever Assy.
15193	Tone Arm Swing Lever Assy.
15195	Compression Lever Assy.
15197	Tone Arm Crank and Pin Assy.
15220	Main Cam.
55397	Trip Adjustment Screw.
58693	Switch and Reject Lever.
58694	Tone Arm Lift Lever.
58697	Tone Arm Adjusting Lever.
58701	Turntable Hold-Down.
64429	Reset Spring.
64430	Reject Spring.
64431	Lift Lever Spring.
64464	Switch Release-Spring.
80030	Phono Output Jack.
80150	4 Prong Motor Plug (Male).
90243	Tone Switch.

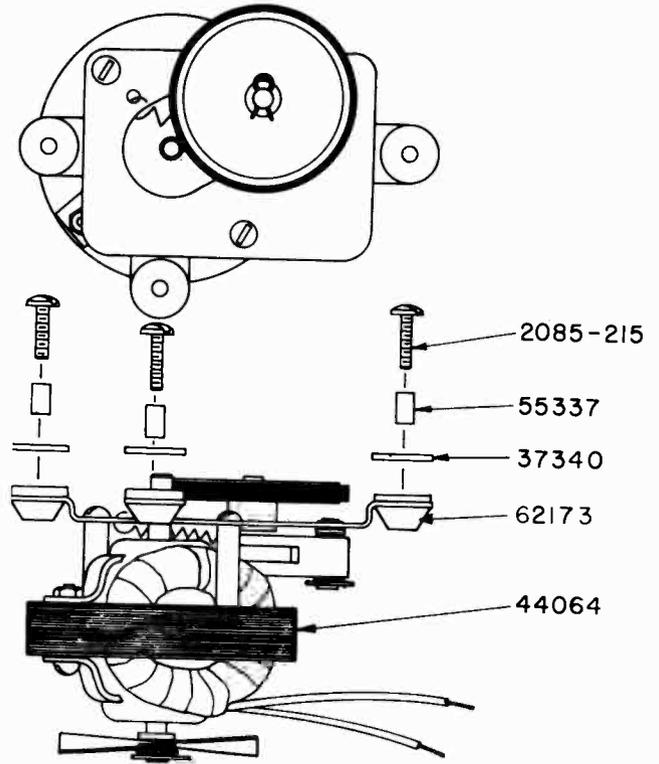


FIGURE 5—Phono Motor Assembly

FIGURE 5

Part No.	Description
37340	Brass Washer.
44064	Phono Motor.
55337	Motor Mtg. Spacer.
62173	Rubber Motor Mtg. Grommet.
2085-215	Motor Mtg. Bolt (#6-32 x 5/8").
11437	Phono Motor Assy. Complete.
13819	Idler Pulley.
15237	Idler Brkt. and stud assy.
37421	"E" washer (to mount idler pulley, idler pulley brkt., and ventilator fan).
54308	Fibre thrust washer (to mount idler pulley and idler pulley brkt.)
54309	Fibre thrust washer (to mount ventilator fan).
64471	Spring for idler pulley.
80150	4 prong motor A. C. plug (male).
92335	Felt washer (for ventilator fan).
62190	Alternate rubber motor mounting.

FIGURE 4

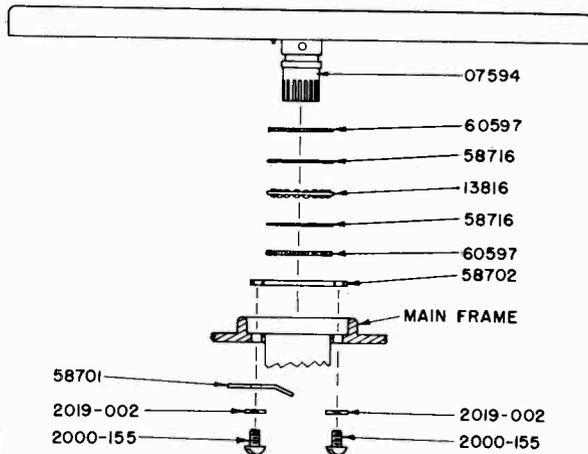


FIGURE 4—Turntable and Bearing Assembly

Part No.	Description
07594	Turntable Assy.
13816	Ball Bearing and Retainer.
58701	Turntable Hold Down.
58702	Bearing Support Washer.
58716	Bearing Race Washer.
60597	Cork Washer for Turntable Bearing.

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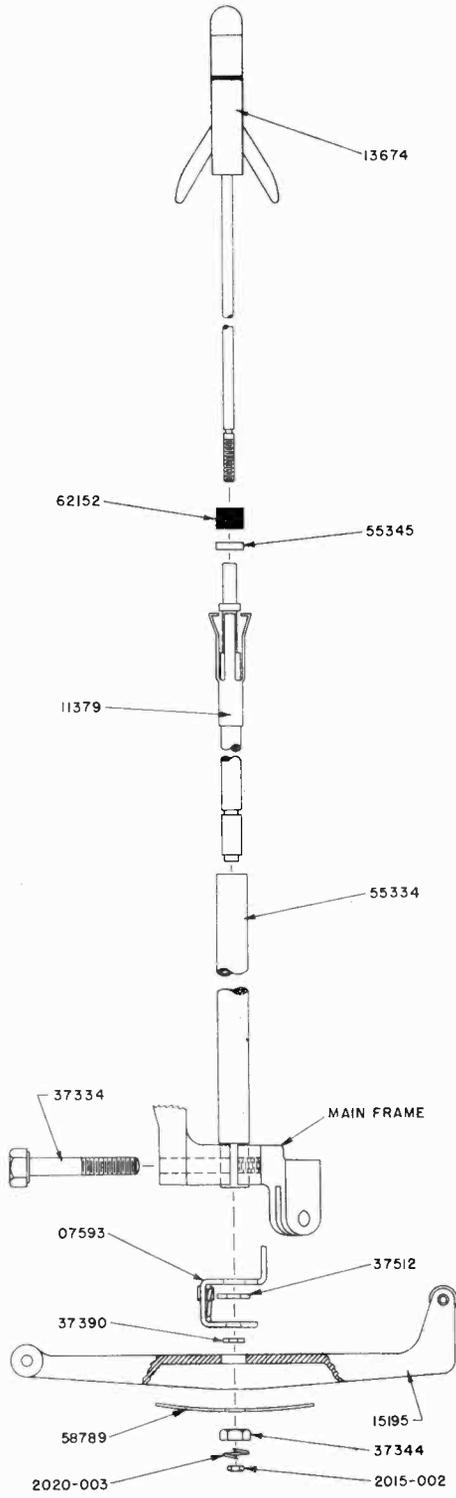


FIGURE 6—Spindle Assembly  
FIGURE 6

- | Part No. | Description                     |
|----------|---------------------------------|
| 07593    | Record Lift Lever Bracket Assy. |
| 11379    | Inner Spindle Assy.             |
| 13674    | Upper Spindle Assy.             |
| 15195    | Compression Lever Assy.         |
| 37334    | H. H. Bolt (#10-32 x 7/8").     |

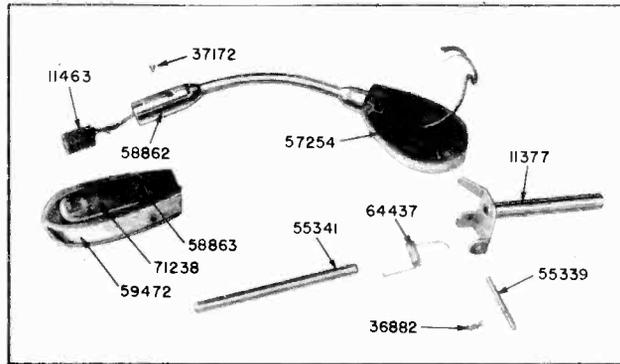


FIGURE 7—Tone Arm Assembly  
FIGURE 7

- | Part No. | Description                      |
|----------|----------------------------------|
| 11377    | Tone Arm Tube & Bracket Assy.    |
| 11463    | Pickup Lead Assy.                |
| 36882    | H.P. Cotter.                     |
| 37172    | #4-36 x 1/8" Special Flat H.M.S. |
| 55339    | Hinge Pin.                       |
| 55341    | Tone Arm Lift Rod.               |
| 57254    | Tone Arm End.                    |
| 58862    | Tone Arm Tube Assy.              |
| 58863    | Spring Clip.                     |
| 59472    | Pickup Housing.                  |
| 64437    | Tone Arm Spring.                 |
| 71238    | Variable Reluctance Pickup.      |

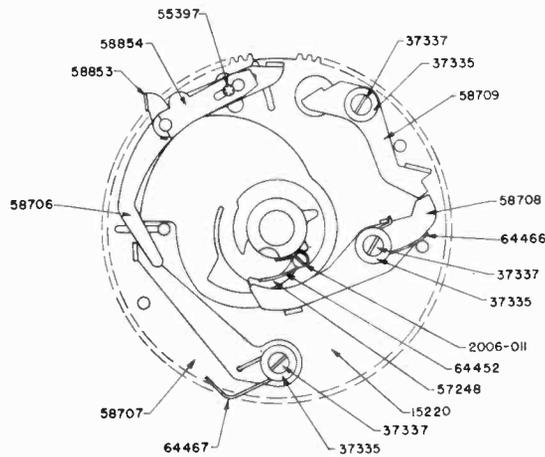


FIGURE 8—Main Cam Assembly

- |          |  |
|----------|--|
| 37344    | Special Hex Nut (#3-48).               |
| 37390    | "E" Washer (small) for Record Spindle. |
| 37512    | "E" Washer (large) for Record Spindle. |
| 55334    | Outer Spindle.                         |
| 55345    | Sleeve Support Washer.                 |
| 58789    | Compression Spring.                    |
| 62152    | Rubber Sleeve for Record Spindle       |
| 2015-002 | Hex Nut (#3-48).                       |
| 2020-003 | Split Lockwasher (#3)                  |

FIGURE 8

Part No.	Description
15220	— Main Cam and Pin Assy.
37335	— Washer (#4 x 3/8" o.d).
37337	— Mtg. Screw for Levers (H.M.S #4-36 x 1/4").
55397	— Trip Adjustment Screw.
57248	— Main Cam Switch.
58706	— Starting Lever.
58707	— Reject Lever.
58708	— Tone Arm Hold Out Lever.
58709	— Hold Out Locking Lever.
58853	— Starting Reset Lever.
58854	— Starting Lever Spring.
64452	— Cam Switch Spring.
64466	— Spring for Hold Out Lever.
64467	— Trip Spring.
2006-011	— #2-56 x 7/16" Fil. M.M.S.

FIGURE 10

Part No.	Description
36857	— 1/4-28 Hex. Nut (To Mount Main Cam)
37338	— Shim Washer.
37339	— Flat Washer (1/4" i.d. x 5/8" o.d. x 1/16" thick).
55335	— Cam Spacer (Inside Main Cam Hub).
55336	— Mtg. Bolt for Main Cam.
2019-007	— 1/4" S.P. Int. Lockwasher.

Inspect parts not requiring lubrication to make certain they are clean. Always be sure to use the type of oil or grease recommended for lubricating specified items.

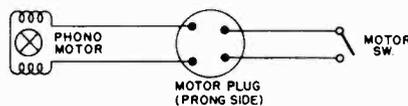
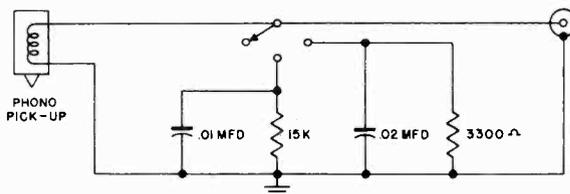


FIGURE 9—Circuit Diagrams

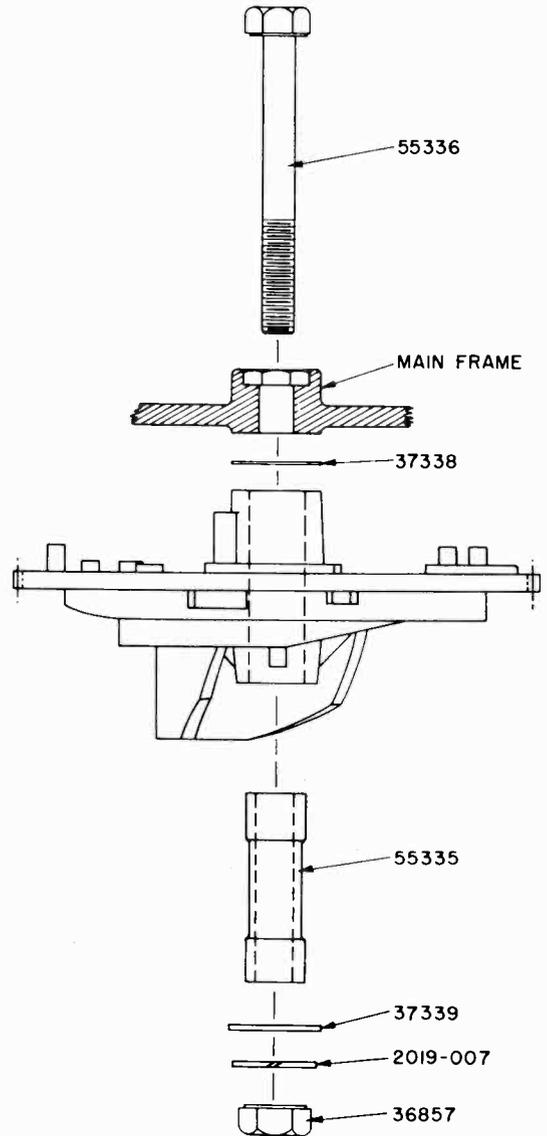


FIGURE 10—Cam Mounting Assembly

## PARTS REPLACEMENT

### Section 7

#### A. REASSEMBLING PARTS

When repairs are being made, a careful check should be made of all moving parts in order to make sure that no binding occurs. Check all moving parts for binding before springs are connected.

All levers which operate on shoulder studs should be assembled with the burred side of the retaining washer away from the lever to prevent the washer from binding on the lever.

#### B. TO REMOVE AND REPLACE TURNTABLE

Remove the changer from the cabinet, and from the bottom side of the main frame (near the spindle) loosen the screw which holds the turntable down, so that it is clear of the pinion gear. The turntable may then be raised from the top side of the changer. Care must be taken not to damage the cork washers next to the bearing.

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When replacing the turntable, see that the cork washer 60597, then the bearing race 58716, bearing retainer 13816, and another bearing race and cork washer are installed in this sequence (see Figure 1). Align these parts with the center spindle. When pushing the turntable over the spring assembly, push firmly but cautiously, avoiding too much pressure which may damage the springs. When the turntable is in place, move hold-down into groove in turntable hub and tighten screw.

#### C. TO REMOVE IDLER PULLEY

After the turntable has been removed, the idler pulley can be removed by slipping off the small hairpin cotter on the end of the idler pulley shaft.

When replacing the pulley a single drop of oil should be used on the pulley shaft.

#### CAUTION:

Do not allow oil to get on either the idler pulley or the turntable rim.

#### D. TO REMOVE AND REPLACE SPINDLE ASSEMBLY

Remove nuts from bottom of compression rod. Lift compression lever 57240 out of position. Remove E washers and record lift bracket 58700. Pull spindle assembly out from top side. Do not attempt to repair assemblies but replace with new parts. To reassemble, push assembly inside of outer spindle from the top. Put record lift bracket in place and install E washers. Swing compression lever into position and install flat spring 58789, nuts 37344 and 2015-002 and No. 3 lockwasher. Tighten nuts on compression lever until rubber sleeve on spindle reaches .330" to .337" diameter when fully compressed. Use Glyptal to secure lock nuts.

#### E. TO REMOVE AND INSTALL MAIN CAM ASSEMBLY (Fig. 1)

Remove turntable (paragraph B). Remove nuts from bottom of spindle and turn compression lever back to clear cam. Disconnect spring from tone arm lift lever 58694. Remove nut 36857 from under side of cam and withdraw bolt 55336 from top side of changer. Slide cam out carefully so as not to bend any levers on baseplate side. Adjust screw 55397 so that tension on starting reset lever 58853 is 6 to 8 grams. Use Glyptal on bottom side of screw. To reinstall the cam replace cam shim 37338, slide bolt through from top side of changer and slide cam into place being sure that spacing shim

37338 is not lost. Cam should have insert spacer 55335. Use flat washer 37339, lockwasher 2019-007 and hex nut 36857. Reinstall tone arm lift lever 58694 and attach spring 64431. Swing compression lever into place and install flat spring, two nuts and lockwasher. Secure these nuts with Glyptal after spindle assembly has been adjusted. Reassemble turntable (paragraph B.)

#### F. TO REMOVE AND INSTALL TONE SWITCH & BRACKET ASS'Y 13825

Disconnect pickup lead wires from socket 80030. Remove two screws which hold bracket to baseplate. Lift bracket from assembly.

To reinstall, insert tone switch coupling 64464 between rejects plunger 55420 and switch 90243. Replace screws 2000-157 and lock washers 2019-004. Resolder pickup wires to socket; the black wire should be connected to the center terminal.

#### G. TO REMOVE AND REPLACE TONE KNOB & PLUNGER ASSEMBLY 09353

Remove Tone Switch and bracket assembly 13825 (paragraph F). Lift plunger assembly out from top side. Unscrew reject knob 59486 while holding shaft 55420 rigid. Remove spring 64474 and knob 57262 by lifting over top of shaft. To reassemble, place knob 57262 on shaft. Drop spring into knob and screw reject knob onto shaft. Push assembly in from top side of changer so that pointer is on markings on baseplate. Reinstall tone switch and bracket assembly (paragraph F).

#### H. SHIPPING CHANGER

The changer is solidly mounted on a mounting board. The mounting board is mounted upon free-floating springs.

When shipping the changer, a hold-down bolt should always be used on each side of the changer mounting board to hold the changer securely in the cabinet. A cardboard spacer  $\frac{1}{8}$ " thick should be placed adjacent to the shipping bolts between the mounting board and the cabinet. The tone arm may be held securely to the outer edge of the turntable by arranging a cardboard strip to fit over the spindle and hold the tone arm down.

#### I. INSERTING PHONO PLUG

The phono input plug must be inserted into the phono socket as far as possible to avoid "grid hum". If hum persists, check ground connection of socket.

## OPERATIONAL ADJUSTMENTS

### Section 8

#### J. TONE ARM HEIGHT ADJUSTMENT

Load a 10" record on the spindle and turn the turntable by hand through cycle until the tone arm is at its highest point. From bottom side of changer, loosen hex nut 2015-007 and adjust screw 37511

to tone arm height desired. Tighten locknut on lift lever.

To remove lift lever 58694, release spring 54431 and withdraw lever from slot. To reinstall, insert pin 55325 in lift lever. Insert lift lever in slot and connect spring.

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**K. NEEDLE LANDING ADJUSTMENT**

Place a 10" record on spindle and press reject button. Changer should continue in cycle until coming into playing position. Observe whether or not the needle lands in starting groove (about 3/32" from outside edge of record). If needle lands too close to outer edge of record, turn top tone arm adjusting screw 55328 with coin in direction indicated on baseplate. If needle landing was too far from outer edge of record, turn adjusting screw in opposite direction. Hold top of spindle down and press reject button to check needle landing.

12" needle landing will usually not require adjustment. If required, it should be made only after 10" adjustment has been corrected. For erratic needle landing, check the wire leads to see that they do not bind or interfere with the tone arm.

**L. VELOCITY TRIP ADJUSTMENT**

Break the seal on the adjustment screw 55397 which is located in hole in bottom of cam near spindle. Turn to the left to tighten until the tone arm will trip on the record. To check adjustment lever 58706 on cam should contact both lugs on turntable hub when tone arm is in last playing grooves of record before tripping. Seal screw thread with Glyptal to prevent screw from coming out of adjustment.

**M. RECORD FEED**

**1. DOES NOT DROP RECORDS**

- a. See that stabilizer arms are not down under the record stack.
- b. Check vertical clearance in spindle. Should be approx. 1/64".
- c. Check the records to see that the label is not extended into the center hole.

**2. DROPS MORE THAN ONE RECORD**

- a. Check center hole of record for being chipped or oversized. (This changer will not chip or break records).
- b. If 12" record hangs on interceptor lever 58698, check slot in changer head for burrs. This lever should move freely with a slight drag on the side of the slot.

**3. CHANGER DOES NOT START**

- a. If changer does not start immediately, press reject button a second time.

**N. REPRODUCTION**

- 1. No response.
  - a. Audio system. Check with radio reception.
  - b. Pickup leads shorted.
  - c. Pickup cartridge dead. Try new cartridge.
- 2. Distorted tone.
  - a. Worn needle.
  - b. "WOWS" or variance in speed.
    - (1) Oil on idler pulley and turntable rim.
  - c. Warped records.
  - d. Defective pickup cartridge.
    - 1. Use of badly chipped records or records with breaks.
    - 2. Dropping tone arm on record.
- 3. Thumping noise.
  - a. Groove in idler pulley worn by motor drive pulley. Result of idler pulley being held stationary with motor running.
    - 1. Sand idler pulley smooth or replace pulley.
- 4. "Grid Hum".
  - a. Insert phono input plug into phono socket as far as possible.
  - b. Check electrical ground connection of phono socket.
- 5. Mechanical Hum.
  - a. Check alignment of turntable motor armature.
  - b. Check if phono plug and line cord are in their respective sockets.
  - c. If further trouble, turn turntable several revolutions to be sure that changer was not shut off during cycle. Press reject button to start.

**4. CHANGER SHUT-OFF**

Changer should shut off after last record is played. Spindle should have approx. 3/32" vertical motion when no records are on spindle. One 10" record should be sufficient weight to depress spindle so that changer will not shut off. If changer does not shut off or if it shuts off before last record is played, see that spindle is not sticking. It should have a free vertical motion. Also check stop pawl for binding.

**PARTS**

Part No.	Description	Part No.	Description
57262	Noise Eliminator Selector knob .....	13816	Ball Bearing & Retainer (for turntable)
07593	Record Lift Lever Bracket Assy. ....	13819	Idler Pulley .....
07594	Turntable Assembly .....	13825	Tone Switch & Brkt. Assy. Complete...
07651	Record Lift Lever Assy. ....	15193	Tone Arm Swing Lever Assy. ....
09271	Mtg. Spring Assy. for 21P-4, 24P-4, 26P-4, 29P-4 and 30P-4 .....	15194	Tone Arm Lever & Pin Assy. ....
09362	Mtg. Spring Assy. (used on late 31P-4 and all other not previously listed).....	15195	Compression Lever Assy. ....
09365	Mtg. Spring Assy. (used on early 31P-4 .....	15196	Automatic Stop Switch Assy. ....
11377	Tone Arm Support Tube & Brkt. Assy....	15197	Tone Arm Crank & Pin Assy. ....
11378	Magnetic Pickup and Housing Assy. Complete .....	15220	Main Cam (casting only) .....
11379	Inner Spindle Assy. ....	15237	Idler Brkt. and Stud Assy. (on phono motor) .....
11437	Phono Motor Assy. ....	25112	.01 mfd. 200 volt Condenser .....
11463	Pickup Lead Assy. ....	25276	.02 mfd. 200 volt Condenser .....
13674	Upper Spindle Assy. ....	36857	1/4"-28 Hex Nut (to mount main cam).....
		36882	H. P. Cotter .....
		37066	Acorn Nut .....

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Part No.	Description	Part No.	Description
37155	Spade Lug (for tone arm lift lever spring)	58698	Tone Arm Interceptor lever
37332	#6 Special Flat Washer (to mount reject lever Assy.)	58701	Turntable Hold Down Brkt.
37333	"E" Washer (for tone arm adjusting stud)	58702	Bearing Support Washer (Under Turntable Bearing)
37334	#10-32 x 7/8" H. H. Bolt (to mount outer spindle)	58706	Starting Lever
37335	#4 x 3/8" o.d. washer (for mounting levers on main cam)	58707	Reject lever (on main cam)
37337	#4-36 x 1 1/4" bdg. H.M.S. (mtg. screws for levers on main cam—reject, tone arm hold out)	58708	Tone Arm Hold Out Lever
37338	Shim Washer (to mount Main Cam)	58709	Hold Out Locking Lever
37339	Flat Washer 1/4" i.d. x 5/8" o.d. x 1/16 thick To Mount Main Cam	58716	Bearing Race Washer (for turntable)
37340	Brass Washer (to Mount Motor)	58789	Compression Spring
37341	#8-32 x 7/8" Hex Head Bolt (for tone arm crank assy.)	58851	Tone Switch Bracket
37343	#3 x 5/16" o.d. flat washer (on bottom of record spindle)	58852	Manual Reject Link
37344	#3-48 Special Hex Nut (Spindle Height Adj. nut)	58853	Starting Reset Lever
37390	"E" Washer (small) for record spindle	58854	Starting Lever Spring
37421	"E" Washer (to mount idler pulley, idler pulley Brkt. and Ventilator Fan)	58862	Tone Arm Tube Only (Chrome)
37511	#10-32 x 5/8" H.H.M.S. (on tone arm lift lever)	58971	Ventilator Fan for phono motor
37512	"E" Washer (large) for record spindle	59486	Reject Button for P-71
37646	Mounting Bolt (for mtg. changer to mtg. board) (two required)	60597	Cork Washer for Turntable Bearing (for turntable)
54308	Thrust Washer for Idler Pulley and Idler pulley Brkt.	62152	Rubber Sleeve for Record Spindle
54309	Thrust Washer for Motor Ventilator Fan	62173	Rubber Motor Mtg. Grommets
55325	Lift Lever Pin	64429	Reset Spring
55328	Tone Arm Set Down Adjustment Stud	64430	Reject Spring
55329	Pin For Tone Arm Interceptor Lever	64431	Lift Lever Spring
55332	Pin For Compression Lever	64433	Spring For Tone Arm Adjustmet
55333	Pin For Record Lift Lever	64434	Spring For Tone Arm Interceptor Lever
55334	Outer Spindle	64437	Tone Arm Counterbalance Spring
55335	Cam Spacer (inside Main Cam Hub)	64452	Cam switch spring
55336	Mounting Bolt for Main Cam	64464	Switch Release Spring
55337	Motor Mtg. Spacer	64465	Tone Switch Coupling Link
55339	Tone Arm Hinge Pin	64466	Spring For Tone Arm Hold Out Lever
55341	Tone Arm Lift Rod	64467	Trip Spring
55345	Sleeve Support Washer For Record Spindle	64471	Spring For Idler Pulley
55395	Hinge Pin for Reject Link	64474	Spring For Reject Button
55396	Mounting Pin For Starting Lever	64476	Lead-in Spring
55397	Trip Adjustment Screw	71238	Magnetic Pickup (Less Housing)
55416	Mounting Bolt (One required to mount changer to mounting board)	72240	3300 ohm 1/2 watt resistor
55420	Manual Reject Plunger Rod	77426	15K ohm 1/2 watt resistor
57248	Main Cam Switch	80030	Phono Output Jack
57254	Tone arm end housing	80150	4 Prong Motor Plug (male)
58863	Retainer Spring for Pickup	80327	2 Prong Molded Pickup Socket
58692	Interceptor Reset Lever	90243	Tone Selector Switch
58693	Switch & Reject Lever	92256	Felt Washer For Turntable Bearing
58694	Tone Arm Lift Lever	92335	Felt Washer For Motor Ventilator Fan
58697	Tone arm adjustment lever	2003-155	#6-32 x 1/4" F.H.M.S. (to mount tone arm adjusting lever)
		2006-011	#2-56 x 7/16 Fil. H.M.S. (to mount cam switch)
		2015-001	#2-56 Std. Hex nut (to mount cam switch)
		2015-002	#3-48 Std. Hex nut (lock nut for spindle height adj.)
		2015-007	#10-32 Std. Hex Nut
		2017-004	#8 i.d. x 3/8" o.d. flat washer (for tone arm crank assy.)
		2019-007	1/4" S.P. Int. Lockwasher (to mount main cam)
		2085-205	#6-32 x 1/4" Truss H.M.S. (for mtg. reject lever)
		2085-215	Motor Mtg. Bolt #6-32 x 5/8"

**SPECIFICATIONS**

Power Consumption at 117 volts .....18 watts Type of Pickup.....Variable Reluctance  
Voltage Rating .....105 to 125 volts at 60 cycles Type of Needle .....Permanent Osmium Point

**MOUNTING HARDWARE FOR P-71 RECORD CHANGER**

- 09271 Mtg. spring assy. for 21P-4, 24P-4, 26P-4, 29P-4 and 30P-4
- 09362 Mtg. spring assy. (used on late 31P-4 and all other not previously listed)
- 09365 Mtg. spring assy. (used on early 31P-4)
- 37066 Acorn palnut (four required)
- 37646 Mounting bolt (for mtg. changer to mtg. board) two required
- 55416 Mounting bolt (for mtg. changer to mtg. board) one required

## ELECTRICAL CIRCUIT

Most service men working on Capehart instruments have had considerable experience with radio and phono radio combinations and can handle both. However, some service men have asked for an explanation of the electrical-mechanical trip system of the 16-E, so a schematic diagram of the changer circuit as used on the 400M is given on page 5.

In the 400M series when the Phono Button on the tuner is pushed, the "Off-On" Relay is actuated as is the "Selector Motor" Relay. These relays are located in the tuner. The "Off-On" Relay holds itself closed until the "Off" button is pushed, this operates the "locking" Relay which opens the "Off-On" Relay Coil Circuit. In the 100 series, the "Off-On" Switch is mechanically operated and is ganged with the volume control shaft.

In the 400M the "Off-On" Relay is used to turn on the power for the entire instrument; except for the 18V transformer in the tuner chassis, which is always connected to the 117 Volt line, so the relays can be operated at will. One set of the "Off-On" relay contacts is used to keep its coil energized until the "Off" button is pressed, at which time the holding circuit is opened and the relay restored to normal. Another set of contacts is used for the 6.3 Volts for the heaters and pilot lights in the tuner. Another set of contacts completes the 117 volt supply for the Amplifiers, Phono Motor (if phono is selected) and the "Reject" Relay (located in the Junction Box). In the 100 series instruments, the AC phono switch is ganged with the program switch. When the program switch is turned to phono position, 117 VAC is supplied to the phono motor and reject relay (located in cabinet junction box). Due to the fact that the contacts of this Relay are closed until the coil is energized, the 117 volts are applied to the clutch Solenoid in the Record Changer. This causes the Record Changer to go through its cycle, unless the Automatic Switch is in "Off" position, before playing a record, thus the tubes are given time to reach operating temperature.

In the 400M models, the "Selector Motor" relay controls the Phono-Radio indicator lights as well as the Dial Scale lights, the "Phono" Relay (in the Junction Box), the Selector Motor and "Mutes" the signal when the program service is changed by a push button.

In the Record Changer the Clutch Solenoid is energized by the Phono Button (the program switch phono position on all 100 K. & M. series), the Reject Button, or the Automatic Trip Switch.

When the Reject Button is pressed, the Clutch Solenoid is energized by the "Remote Reject" Relay (in the Junction Box).

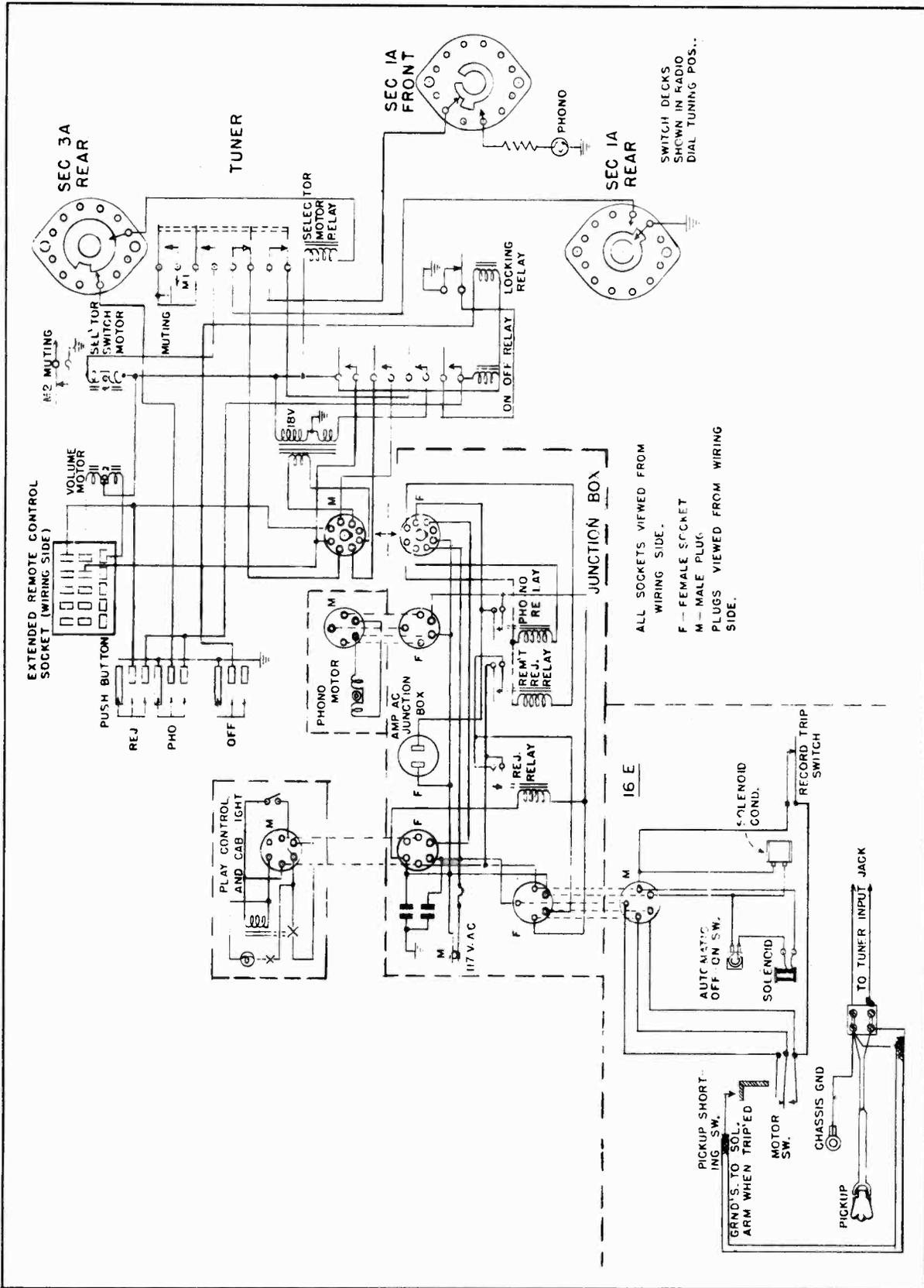
When the needle enters the trip or change groove in the record, the motion of the Tone Arm actuates the Automatic Trip Switch which energizes the Clutch Solenoid.

Whenever the Clutch Solenoid is energized, the changer goes into cycle. As soon as the cycle is started, the solenoid circuit is opened by breaking the top and center contacts of the motor solenoid switch. If the instrument is turned off during the cycle the changer continues to complete the cycle due to the center and bottom contacts of the Motor Solenoid switch by passing the motor switch contacts of the Phono Relay and Off-On Relay.

The Automatic Trip Switch, located under the Turntable, is actuated by the movement of the Stop Trip Lever being transferred by the Tone Arm. On the underside of the turntable there is a fibre pin which moves the Stop Trip Lever back. During each revolution of the turntable, the fibre pin hits the lever, thus resetting the stop trip lever until the needle enters the change groove; this causes the Clutch Solenoid to be energized by closing the Automatic Trip Switch. The automatic "Off-On" switch is used to open the Clutch Solenoid circuit, in the event it is desirable to use the instrument manually.

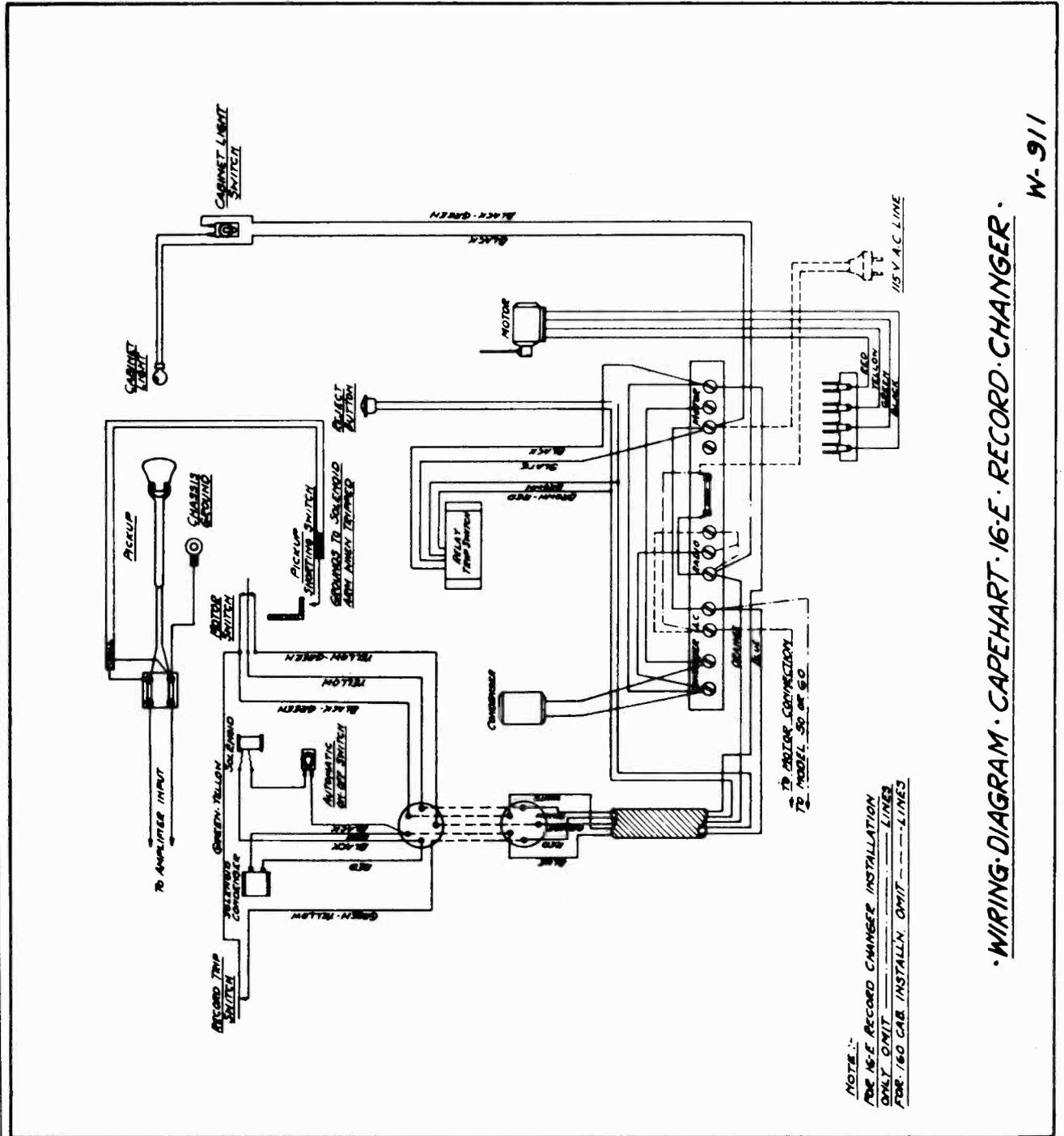
MODEL 16-E,  
Capehart

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ALL SOCKETS VIEWED FROM  
WIRING SIDE.  
F — FEMALE SOCKET  
M — MALE PLUG  
PLUGS VIEWED FROM WIRING  
SIDE.

FIGURE B. COMPLETE RECORD REPRODUCING CONTROL CIRCUIT DIAGRAM FOR 400M



WIRING DIAGRAM · CAPEHART · 16-E · RECORD · CHANGER ·

W-911

MODEL 16-E,  
Capehart

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## MECHANICAL OPERATION

The best approach to a knowledge of the 16-E changer is to accept it on the basis that it is really "Four Changers in One". A study of each of the four fundamentals will enable a quick analysis of trouble.

The first operation, (Manual), is accomplished by placing the Automatic Switch in the "Off" position, thus opening the Clutch Solenoid circuit so the changer mechanism is not connected to the Drive Shaft at the end of a record.

The second operation, (Repeat), is accomplished by throwing the Automatic Switch to "On" position and the Selector Lever to the "Repeat" Position. Then, at the completion of a record, the Automatic Trip Switch actuates the Clutch Solenoid, thus connecting the changer mechanism to the motor. The steps that follow are:

1. Pickup Arm is elevated.
2. Pickup Arm is swung clear of the Record Tray.
3. The Record Magazine tilts but does not discharge a record.
4. The Record Magazine starts to return, as does the Pickup Arm.
5. While the Record Magazine is completing its return the Pickup Arm engages the Stop Arm, the needle is lowered to the record, and the cycle is complete.
6. No record is released from the record magazine during the repeat cycle since the record release lever has been pulled away from the Main Cam by the Selector Lever.

During the change cycle the Pickup is short-circuited by a muting switch.

The third operation, (Play one side).

1. Pickup Arm is elevated.
2. Pickup Arm swings clear of Record Tray.
3. Record Tray lifts to deliver record to Magazine.
4. As record in Record Tray strikes Record Support Pins, another record is discharged from the Magazine.
5. After record is expelled from the Magazine, the Record Tray returns part way and pauses.
6. Magazine tilts, and waits to deliver record to Record Tray, which starts down again.
7. Record Tray again pauses to allow record to settle over Spindle.
8. Magazine returns to normal position as does Record Tray.
9. Pickup Arm swings in and engages Stop Arm. This positions pickup over record and then needle is lowered to record.

The fourth operation, (Play both sides).

1. Pickup Arm is elevated and swings clear of the Record Tray.
2. The Record Reverse Arm and Guide swing

around in front of the magazine.

3. The Record Tray places the record against the Reversing Arm and starts back to normal position, pausing midway.

4. The Magazine tilts to slide the reversed record onto the Record Tray, pauses in its return until the record touches the front of the Tray, and then returns to normal position.

5. The record settles over the spindle.

6. The Tray returns to normal position.

7. Pickup Arm swings against Stop Arm.

8. Needle is lowered on record.

### STEP BY STEP DESCRIPTION

**REPEAT CYCLE.** At the completion of the record the needle enters the change groove, swinging the Pickup Arm, thus closing the Automatic Trip Switch, and energizing the Clutch Solenoid. Energizing of the Clutch Solenoid engages the two clutch sections, starting the change cycle. At the time the Clutch sections are engaged, the Clutch Solenoid Circuit is opened by breaking top and center contacts of the motor solenoid switch. Cycle is completed even though main switch is turned off since the center and bottom contacts of the Motor Solenoid Switch by-passes the motor contacts of the phono-motor relay and main on-off Relay causing the motor to run until cycle is completed.

The Pickup elevation is accomplished by the Pickup Lift Cam raising the Pickup Lift Shaft. As soon as the Pickup is fully elevated, the Pickup Arm is swung clear of the record by the Pickup Swing Cam rotating the Pickup Arm Swing Lever. Due to the fact that the mechanism is in cycle, the Magazine is tilted by the Main Cam operating the Magazine Slide Arm. Just after the Magazine starts to return to the normal position, the Pickup Arm starts to lower and swing into playing position. When moving in, the Pickup Arm Lever Hook engages with the Pickup Arm Stop Lever. With 12" records the Rubber Roller at the end of the Stop Lever touches the edge of the record and stops the inward motion of the Pickup Arm. On 10 inch records this is done by an adjustable machine screw striking a stop which is a part of the baseplate casting. The Pickup Arm is swung against the Stop Lever by the Pickup Arm Friction Cam. The Pickup Arm Stop Lever swings back out of the way after the needle has touched the record, but before the full weight of the pickup is on the needle.

### ONE SIDE CYCLE

To play one side of the record, the Selector Lever is moved to the One Side position (middle). This engages the Clutch to allow the Record Tray to be lifted by the Main Cam through the Record Tray Cam Follower. When this Clutch en-

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MODEL 16-E,  
Capohart

gages, the Record Separator Hook Arm and Roller Assembly swings over the periphery of the Main Cam.

After playing the record, the needle enters the change groove, thereby closing the Automatic Trip Switch and energizes the Clutch Solenoid. This action engages the Driving Clutch, and the change cycle starts with the Pickup Arm being elevated and swung clear of the Record Tray, which lifts the record off the Turntable and delivers it to the Magazine. Just before the tray with the record reaches the point where the record touches the sloping face of the Record Support Pins, a record is ejected from the Magazine by the Record Separator. When the changer is in cycle, the Main Cam revolves; on its periphery is a raised portion that lifts the Record Separator Hook Arm and Roller Assembly, drawing the Record Separator Hook down, thereby raising the Record Separator and three records. One record is lifted to the shoulder of the Lower Record Support Assembly and the Hook which is part of the Record Separator, and located on the center line of the Lower Record Support Assembly, engages the two bottom records of the stack and lifts them slightly. This assists in the discharge of the record from the Magazine by forcing the second and third record back against the first record, thereby helping to push it off the separator knife into the record well. The record drops to the Rubber Bumpers in the well while the Record Tray is delivering a record to the Magazine. The tray starts downward and its curved tailpiece lifts the record as the Magazine starts to tilt. The Record Tray pauses midway on its downward trip until the Magazine moves to the highest horizontal point, thus allowing the record to slide out; the Magazine then remains stationary until the record slides against the front of the Record Tray which has resumed its downward movement, only pausing to allow the Magazine to lower the center hole of the record over the Spindle. The Record Tray returns to normal position as does the Magazine, the Pickup Arm swings in and is lowered, as in the repeat cycle, and the Clutch is disengaged by the Clutch Throwout Cam striking the Clutch Throwout Lever.

## BOTH SIDES CYCLE

To play Both Sides, the Record Reverse Cam Shaft Lever moves the Record Reverse Cam so that it engages with the Record Reverse Cam Pin in the Reverse Cam Shaft. In the other positions, the Reverse Cam floats on the Cam Shaft and does not rotate with the Shaft. The Record Reverse Arm and Roller rides over the face of the reverse cam and operates the reverse arm assembly thru an adjustable drive rod.

After the Pickup is elevated, the Record Reverse Arm and Guide Assembly swings around in front of the Magazine. When it gets to the reversing position and the Tone Arm is clear of the Record Tray, the Tray raises. As the Tray raises, the record slides back against the Rear Rubber Bumpers, and the Tray compresses the spring arms of the Record Reversing Guide. The record hits the slanting face of the Support Pins while the Tray continues up, and the record slides up these faces to the top surface of the Support Pins. When the Record Tray starts to return, the spring tension of the Record Guide pushes the bottom edge of the record off the support pins and as the record Tray pauses midway to the normal or playing position, the Magazine tilts, causing the record to slide down the Record Guide. The Magazine reaches its furthest excursion and returns part way, where it pauses, and the Record Tray continues downward to nearly the normal position. About the time the record hits the front of the Tray, the Magazine returns to the normal position after the record has dropped over the Spindle. The Record Tray then returns to normal, and the Pickup Arm is returned as in the repeat and one side conditions.

If one carefully watches the Magazine in the Both Sides Position, it will be noted the travel of the Magazine is shorter in the "Reversing" cycle than in the change cycle. On the side of the Main Cam, away from the rear of the instrument, there are two cam tracks. On the Magazine Slide Arm there are two rollers on a rocker arm, and when the Repeat, Play One Side and the change cycle of play Both Sides are in use, the outer cam track is engaged. On one side of the Record Reverse Cam is a pin which shifts the arm and moves the rocker so the inner cam track is used to change the Magazine travel. On the arm is another pin, which is struck by the Magazine Slide Arm Cam, changing the roller in use, also the cam track. Due to the fact that the Reverse Cam Shaft runs half as fast as the Main Shaft, the above action occurs every two cycles. The Record Reverse Cam, making only one-half turn per cycle, raises the Reverse Arm and Roller every other cycle, and in raising it, the Reversing Arm and Guide are swung around in front of the Magazine. When the Reversing Arm and Guide swing in front of the Magazine, the Record Separator Hook Arm and Roller are swung away from the Main Cam to prevent discharge of a record from the Magazine in the "Reversing" cycle.

Due to the impossibility of covering the action of each part in the changer in the brief description above, it is essential that every service man spend considerable time observing the action of each part of the changer under each of the four conditions outlined above.

MODEL 16-E,  
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## MOTOR DRIVE GEAR REDUCTION - DRIVE SHAFT ALIGNMENT

A silent and smooth operating drive motor and gear reduction unit, properly coupled to the record changer, is of utmost importance for perfect reproduction of records. Unless these parts are all functioning properly, there is a possibility that waver or wows may be noticed in the sound reproduction from records. It is also possible that an objectionable hum or rumble may be discernible during low passages in records or the change cycle. If such conditions are apparent, we suggest a careful check and adjustment in accordance with the procedures which follow.

After freeing the record changer by removing the four hold down bolts used in shipment, make certain that the record changer is floating freely on its rubber mounting supports, and that it does not touch the record changer mounting shelf at any point. There should be a feeling of entirely free floating motion when the changer is shaken slightly. If such is the case, it is a good indication of full free floating action. By making sure that the record changer is "free floating" the possibility of acoustic feed-back, hum, or rumble is eliminated.

Because of the importance for positioning the record changer into a free floating position, it is always advisable to check the alignment of the record changer drive shaft with respect to the gear reduction unit and between this unit and the drive motor. Unless the correct relationship is maintained, excessive hum or rumble may be present as well as the possibility of uneven turntable speed causing waver or wows in the record reproduction.

If the above conditions are apparent with record changer in free floating position, shift the gear reduction unit and motor assembly slightly until a position is found where the difficulty is eliminated or negligible. It may be necessary to enlarge mounting holes in the motor and gear unit assembly mounting board.

**NOTE:** Drive motors and gear reduction units are "run-in" and aligned on the mounting board at the factory, and will seldom, if ever, require adjustment in the field unless they have been tampered with, or in the event the motor has shifted due to rough handling in transit. If hum or rumble persists after trying previous suggestions, loosen the motor and shift slightly locking it in place when minimum hum position is located.

### SAFETY CLUTCH—PURPOSE AND ADJUSTMENT

The purpose of this feature is to uncouple the record changer from the gear reduction unit in the event a faulty record or improper operation of the machine causes the record changer to jam during some portion of the change cycle.

Essentially, this device consists of two metal discs with a leather washer between. The driving power is transmitted from the lower to the upper disc through the leather washer because of the pressure developed by the nut, part 368-2, controlling the pressure of the spring, part 3938. Pressure of the spring determines the amount of back pressure, and by its adjustment, it may be set so as to cause the clutch to slip if more than normal drive tension or load develops somewhere in the record changer during its change cycle, thereby acting as a "safety" feature.

The proper method of checking the adjustment of the safety clutch follows. With the record changer in cycle and the record magazine fully loaded, apply a slight downward pressure on the bottom of the record magazine, while the magazine is tilting backward. When such pressure is applied, it should cause the safety clutch to slip and the turntable should stop revolving. In the event the action of the safety clutch is not as described, loosen nut, part 368-2, thereby releasing pressure on spring, 3938, this will permit safety clutch to unload sooner. After this adjustment is made, the changer should be put through a number of cycles to make certain that the clutch does not slip at any point in the normal change cycle as this would cause the changer to stall.

The action of this safety clutch should always be checked when the instrument is permanently set up in the customer's home since it acts as a safety device to prevent record breakage or damage to changer in the event of a jam because of reasons previously mentioned. **CAUTION:** The leather clutch facing should be kept free from oil or grease.

**NOTE:** The Safety Clutch is locked together by use of a "C" washer in the end of the shaft. If unable to make proper adjustment after clutch has been slipping, remove clutch assembly and examine to determine if washer is out of position. If the washer is lost and none is at hand, the end of the shaft may be drilled and a small cotter key used to hold assembly together.

### GEAR REDUCTION UNIT

At least once a year the gear reduction unit should be checked to make certain it contains the proper amount of oil. It should contain one-half ounce, No. 10 S.A.E. oil. Stock No. 1315-1.

### LUBRICATION

At least every six months a few drops of oil should be applied to the drive motor oil cups. See illustration. For this purpose, use the special electrical motor oil which is carried by most all oil companies for electric fans, sewing machine motor, etc.

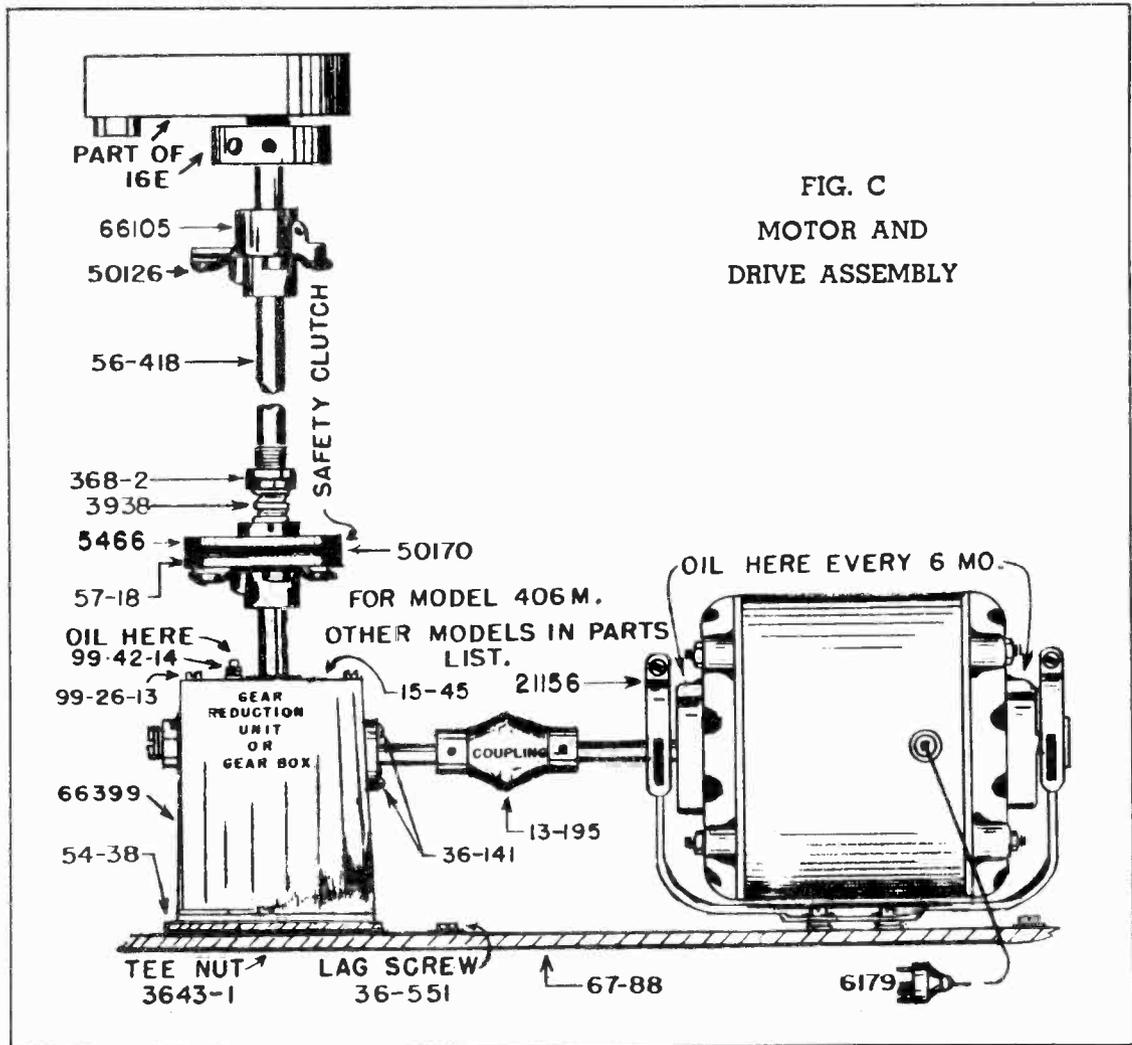


FIG. C  
MOTOR AND  
DRIVE ASSEMBLY

MOTOR DRIVE PARTS LIST

Part No.	Description	13-151	410M Friction Drive Assembly
21156	Motor, 60 cycle	13-195	Motor Coupling & Set Screw
21157	Motor, 50 cycle	15-45	Gear Box, Cover, Pinion & Bearing Assembly
35107	Gear Box Worm Gear	36-136	No. 10 Plain Washer
3938	Spring, Safety Clutch	36-141	6/32 x 1/4" R. H. M. S.
4067	Bearing	36-258	Spacers
50126	Leather Disc	36-501	"C" Washers for Friction Drive
50170	406M Drive Facing (Leather)	36-550	No. 10/32 x 3/4" Slotted H. H. M. S.
50225	Gear Box Cover Gasket	36-551	Lag Screw
5466	406M Upper Friction Drive Disc	41-89	"C" Washer Pkg. 12
6019	1/4" Allen Wrench	54-38	Reduction Unit Shim
6179	5 Prong Motor Plug	56-419	410M Shaft for Friction Drive
66105	Flexible Coupling	56-415	411M Shaft for Friction Drive
66399	Gear Box 60 cycle	56-417	412M Shaft for Friction Drive
66435	Gear Box 50 cycle	56-418	406M Shaft
99-26-13	10/24 x 3/8" H. H. M. S.	57-18	Lower Friction Drive Disc (all models)
99-28-13	1/4 x 20 x 1/4" Allen Set Screw	60-144	Fibre Washer
99-34-7	406M Cotter Pin	62-46	Motor Grommet
99-42-13	1/4" Steel Ball	67-88	Mtg. Board
99-42-14	1/8" Pipe Plug	368-2	4CcM 3/8 x 32" Hex Nut
13-148	411M Friction Drive Assembly	1315-1	Reduct. Unit Oil S.A.E. 10, 1/2 oz.
13-150	412M Friction Drive Assembly	3611-4	No. 10 S. P. Lock Washer
13-141	406M Friction Drive Assembly	3643-1	No. 10/32 Tee Nut
99-28-13	Flexible Coupling Set Screw		

# ELECTRIC PLAY CONTROL ADJUSTMENTS AND MAINTENANCE M Series

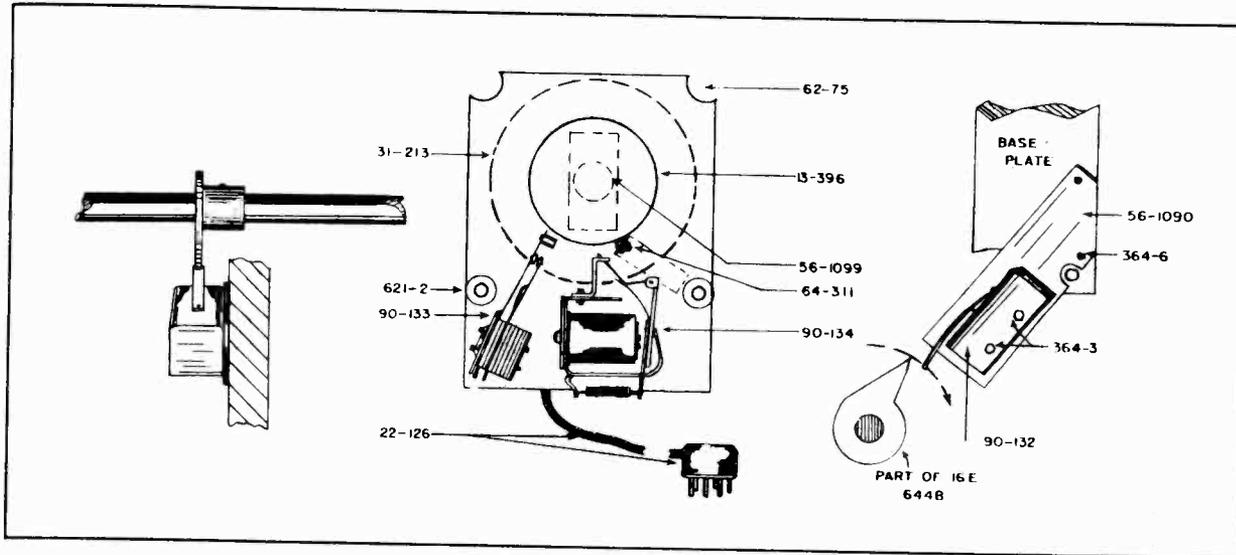


FIGURE D. M SERIES PLAY CONTROL

### PARTS LIST

Stock No.	Description
13-368	Play Control & Cabinet Light Assembly, Complete
13-396	Ratchet Assembly
22-126	Cable and Plug Assembly
31-213	Dial Scale
56-1099	Shaft
56-1100	Steel Ball Bearing
59-142	Housing
59-143	Housing
62-75	Rubber Grommet
64-311	Dog Spring
90-125	Light Switch
90-132	Acro Switch
90-133	Relay (Complete)
90-134	Master Switch
92-140	Back Cushion
621-2	Rubber Grommet
61163	Light Bulb

**ELECTRIC PLAY CONTROL—M SERIES—Cont.**

1. The following parts comprise a complete play control installation. Play control with cables, plug and switch, compartment light, mounting bracket, two bracket mounting screws, two switch mounting bolts, and four wood screws. Check packing material so no parts are overlooked.

2. The mounting bracket should be installed on the record changer first, see illustration.

3. The bracket is mounted on the boss which supports the clutch fork shaft and the reverse cam shaft, on the side of the boss away from the main cam, so the clutch fork shaft sets in the cutout. Pass the two screws that fit the tapped holes in the switch bracket through the old play control bracket holes when mounting the bracket.

4. Remove the plug button from the partition between radio and changer, put the six prong plug, the switch and the cables through the holes in the partition. Fasten the play control on the partition by means of the wood screws being careful not to crack the plastic case by drawing

the screws too tight or driving the screws in crooked. Also be sure the record tray clears the play control housing before driving any screws.

5. Fasten the switch to the bracket by means of the two bolts. See illustration. This puts the switch in such a position that the throwout cam can actuate the switch. Of course, the switch goes on the bracket with the leads at the bottom and pointing toward the left (when looking in the back of the cabinet), this brings the spring finger in line with the throwout cam.

6. Remove play control shorting plug (six prong) from junction box and plug in cable from play control. Set play control at any number except zero (off) and run changer through several cycles. If the switch is too close to the throwout cam, the relay in the play control will buzz; if not close enough, the action will be erratic. Be sure the bolts holding the switch and the screws holding the bracket are properly tightened.

## MECHANICAL PLAY CONTROL MODELS PRIOR TO M SERIES

### TO ADJUST THE PLAY CONTROL

When setting a play control, the counter should reset at Zero just as the needle touches the record. That is, the play control cam, on the record changer main shaft, should be from  $\frac{1}{4}$ " to  $\frac{1}{2}$ " beyond the plunger after the main clutch has disengaged. The control cable is put in the hole in the plunger and the set screw tightened, then the cable housing should be held in place by the set screw—do not set the screw tight. Turn the bar knob pointer back and forth over the play control dial, if the pointer catches or binds, slip the cable housing away from the bracket slightly, until the pointer runs free, then run the changer through a cycle to see that the play control resets properly, then tighten the screw.

When adjusting the play control, which is in the record compartment, after removing the wood screws which mount the control to the shelf, remove the clips holding the 110-volt leads to the switch. Then remove the pointer and the two round head machine screws from the back. The stop spring of the stop spring and ball assembly, No. 66324, should be tangent to the gear and the ball should be in the space between the last and the next to the last tooth, before the blank space in the gear tooth. With the ball in this position, the set screw in the collar at the rear of the unit should be firmly against the stop pin. To make this adjustment, loosen the set screw, while holding the gear, move the collar, then tighten

the set screw. In this position, the switch pin, No. 48202, should hold the switch open and permit the switch to close when the gear is advanced one tooth. The stop bracket, No. 4450, for the resetting dog, should allow the dog to advance only one tooth at a time, if it picks up more than one tooth, move the stop toward the dog until it advances only one tooth at a time.

The resetting dog, No. 3839, should not ride on the gear tooth, as this will prevent turning the pointer toward one hundred. Shift the stud, No. 4354, until the dog clears the tooth, then check the alignment of the plunger tube and the cable housing stud, for if the cable is bent here, the play control may fail to function.

When replacing the pointer, No. 6062, turn the shaft to the position, where the switch is open, then turn the shaft ONE notch or stop toward the one hundred, at this point, set the indicator on ZERO and set up the set screw, checking to see that the pointer does not ride on the dial at any point.

If trouble is experienced examine the cable for kinks or rust spots, in any case do not substitute music wire as it does not have the proper hardness and probably will not be the correct diameter, if it is too large, it will bind; if too small, it will kink.

Powdered graphite blown in cable or mixed with light oil and run in cable will improve operation.

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## MECHANICAL PLAY CONTROL

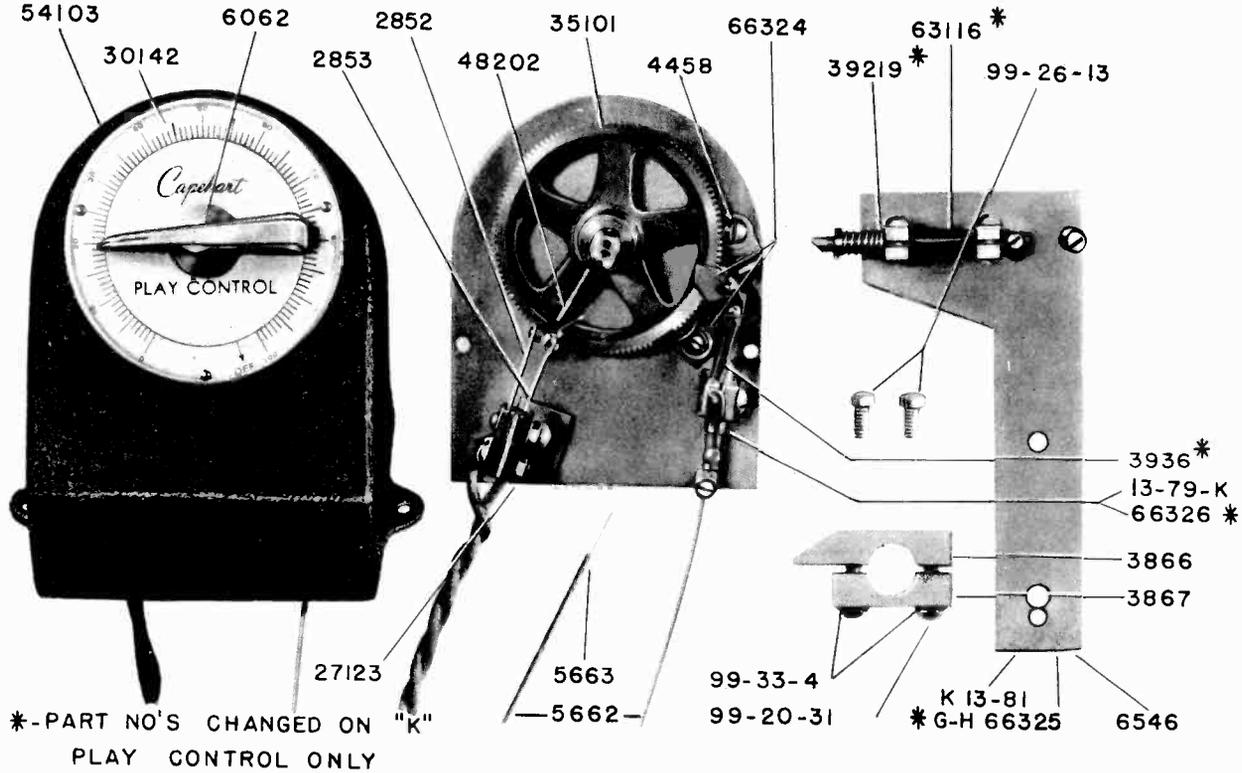


FIGURE E. 16-E MECHANICAL PLAY CONTROL

### PARTS LIST

Part No.	Description	Part No.	Description
27123	Switch Assembly	5663	Control Cable
2852	Switch Arm "Straight"	6062	Bar Knob—Pointer
30142	Play Control Dial	63116	Plunger Tube Assembly
35101	Gear	5654	Plunger Tube Assembly, "K" only
3866	Play Control Split Cam, Long	6546	Complete Play Control Bracket for Field Assembly
3867	Play Control Split Cam, Short	66324	Stop Spring and Ball Assembly
3936	Spring, Dog	66325	Bracket Assembly for 16E Chassis, "K" only
64-32	Spring, Dog, "K" only	66326	Dog Plunger Assembly
39219	Plunger Return Spring	13-79	Dog Plunger Assembly, "K" only
64-31	Plunger Return Spring, "K" only	99-20-31	10-32 x 3/8" R. H. M. Screw
4458	Dog, Stop Bracket	99-26-13	10-24 x 3/8" Hex Head
48202	Switch Pin	99-33-4	No. 10 Special Shakeproof Washer
54103	Play Control Housing		
5662	Cable Housing		

## QUESTIONS AND ANSWERS

To assist the service men, who have not had the advantage of factory training nor experience servicing the Capehart 16E Record Changer, we have prepared this section, which covers the more common complaints reported by users, dealer's service departments, our salesmen and field engineers.

Of course, there are many factors responsible for the troubles encountered. Below we are listing some of them.

1. Customers—Failure to properly load or operate the instrument. Friends who drop in and think they know all about everything. Owner not having been properly instructed or their general inability nor desire to learn.

2. Records—Variations from standards, rough edges, thickness, warped, etc.

3. Adjustments—Not proper due to:

- A. Improper operation of instrument.
- B. Misuse and neglect.
- C. Wear, due to lack of oil and grease.
- D. Improper inter-relation of parts due to adjustments of one section without complete follow through on other related parts.

Below are listed some of the more common complaints, along with some of the possible causes, and reference to the service notes where adjustments may be found. These are not complete as it is impossible to cover every case but we believe they will help the service man over the rough spots.

1. **Waver and Wow, poor tone.** May be caused by any one or all of the following: Refer motor drive—Gear Reduction Unit—Drive Shaft Alignment section.

- A. Loose set screws in motor to turntable shaft and couplings.
- B. Loose rivets in flexible couplings.
- C. Leather coupling oil soaked and/or soft.
- D. Improper alignment of gear reduction shaft with turntable shaft. Must be within  $\frac{1}{4}$  inch. Remove top universal and use shaft for aligning.
- E. Lack and grade of oil in gear reduction unit.
- F. Defective crystal pickup.

2. **Needle drops off edge of record or fails to feed in at times.**

- A. Instrument not level. Check and level at base plate near tone arm—not cabinet.
- B. Pickup brush gone, worn or improperly adjusted. Must extend  $\frac{1}{32}$  inch below standard length needle and no other length needle should be used.
- C. Pickup arm stop lever and/or stop lever hook improperly adjusted. Refer Fig. 9A and 13A.
- D. Improper adjustment of Tone Arm feed in cam. Refer Fig. 8.  
Clearance between cam and tone arm lift level should be about  $\frac{1}{32}$  inch when changer is in play position.
- E. Tension too great on pickup stop lever spring. Refer Part No. 3984.
- F. Pickup stop lever rubber roller worn or out of round. See Part No. 5044.
- G. Rough edges on 12" records causing pickup and tone arm to jerk and jump as rubber roller on stop lever comes in contact with record.

3. **Failure to trip properly.** (Too soon or too late).

- A. Not sufficient tension or too much tension on trip lever friction joint.
- B. Movable trip switch arm bearing stuck. This occurs near salt water and in humid climates.
- C. Check for dirt and corrosion between trip lever arm and base plate at friction contact mounting. Clean and apply drop of light oil.
- D. Check complete adjustment.

4. **Excessive amount of tick at end of record.**

- A. Tension too great on trip arm lever friction. Back off adjusting screw, clean and oil between base plate and lever at point of mounting.
- B. Place piece of rubber tubing or tape on end of trip lever where contact is made with tone arm trip bracket.

5. **Excessive record wear.**

- A. Worn needles.
- B. Friction on trip switch lever too great causing wear near end of record.
- C. Improper adjustment and alignment of True Tangent Tone Arm. Pickup should be in straight alignment with tone arm

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**QUESTIONS AND ANSWERS—Cont.**

when needle is  $1\frac{1}{2}$  inches from center spindle of turntable shaft.

- D. Tone arm binding in mounting or resting on tone arm feed in cam due to improper adjustment of cam. Refer Fig. 8.

**6. Clutch disengages before completion of cycle.**

- A. Insufficient tension on Solenoid wedge spring. Refer Fig. 12B.
- B. Solenoid Torsion spring in wrong hole for action desired.
- C. Improper adjustment motor solenoid switch—Excessive upward tension on clutch lever. Refer Fig. 10.
- D. Clearance between drive and driven sections of clutch. Refer Fig. 7.
- E. Excessive upward tension from muting switch on clutch lever.
- F. Improper adjustment of Clutch Throwout lever. Clutch only partly engaging. Refer Fig. 10.
- G. Any binding of clutch action causing clutch to not completely engage or disengage.

**7. Changer continues to cycle without playing record.**

- A. Improper adjustment of clutch throwout lever. Spring part No. 3990, holding clutch throwout lever too high—misses clutch throwout cam.
- B. Solenoid Torsion spring in top hole instead of center or bottom. Refer Fig. 10.
- C. If buzzing sound is heard at end of cycle look for reject button stuck, trip switch contacts stuck or reject relay contacts closed (should be open during phonograph operation).

**8. Record breakage.**

- A. Clean with oil soaked cloth all polished surfaces on magazine and record tray with which records come in contact.
- B. Check adjustment of magazine, especially back stop. Refer "B" Fig. 3.
- C. Improper adjustment of vertical bumper guide. Refer Fig. 2.
- D. Note—If record break is half moon shape record has stuck on slide rails and came out late. If crack from edge toward center hole, magazine is adjusted too far forward. If chipped on edges, including V shape breaks, damage is caused in turn over position and requires complete cleaning of record tray near lower rubber bumpers and cleaning of reverse arm upright polished surfaces. Also polish and check adjustment record support pins. Refer Fig. 2.

**9. Noise when 12" records drop.**

- A. Record caught between record reverse arm and record tray prohibiting return of reverse arm.
- B. Record reverse arm jammed or out of position with reverse arm crank. Refer Fig. G.
- C. Excessive records in magazine—not more than 18.
- D. Bent reverse arm and roller. Refer Fig. 4.

**10. Records fail to unload from magazine occasionally.**

- A. Insufficient records. Should be 6 or more. Six to fifteen records for best operation.
- B. Warped records and/or chips on edges.
- C. Improper adjustment of record separator—adjusted too low. Refer Fig. 2.

## MECHANICAL ADJUSTMENTS

### 16-E RECORD CHANGER

Due to the fact that certain critical shortages have developed in the metals used in the 16-E Record Changer, we are listing in the parts lists the standard parts, which have been used in the past, as well as those parts consisting of the newer metals. Beginning with the Serial Number 20,000, a new base of cast iron was incorporated. A new magazine is now being used, as well as a zinc record tray. With the new tray, because of its extra weight, a counterbalance spring and the necessary fittings are required, these fittings are shown on page 35. A list of these parts is included in the parts price list and these parts are marked with an \*.

In making all adjustments of the assemblies on the top of the record changer the turntable is the datum point.

Before attempting any adjustments the service man should learn to disengage clutch while changer is in cycle by placing thumb of left hand on top of clutch fork and forefinger under fork. Lift with finger to disengage clutch and press with thumb to engage clutch. This makes it possible to stop changer in any desired position while motor is running.

#### ADJUSTMENTS

##### 1. TO LOCATE AND ADJUST THE RECORD TRAY (6687) (Fig. F).

If it becomes necessary to replace a record tray, the first tooth of the driver quadrant (6257) (Fig. F) should mesh with the second tooth of the driven quadrant of the record tray (3515) (Fig. F). This is to permit proper adjustment of the tray height, which adjustment is covered below.

An easy way to locate tray and match with gears is to place selector lever in repeat position. This releases quadrant gear (6257) (Fig. F). Then place selector lever in one side position and lift quadrant until it snaps in male and female clutch position. The tray may then simply be placed around turntable and pins inserted. Place selector lever again in repeat position and lift tray for

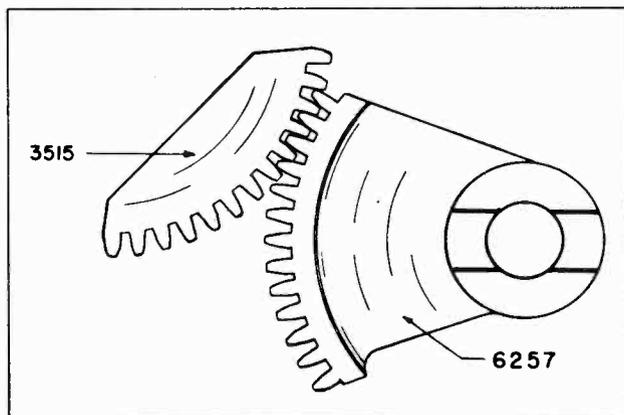


FIGURE F. RECORD TRAY GEARS

examination. Teeth should then be properly meshed. Changer should be in play position when this adjustment is made.

After the gears are properly meshed, the record tray should be adjusted sidewise until the turntable is uniformly spaced within the tray at the time when the record tray is raised until the front end of the 10" felts are level with the turntable felt. After the tray has been properly positioned sidewise, tighten the two Allen set screws holding the record tray pivot pins, then check to see that no side play exists.

##### TO ADJUST THE RECORD TRAY ELEVATION:

With the record control lever (6231) (Fig. 9B) in the "One Side" position, run the record changer thru a cycle until the large hole in the main cam is exactly half way past the upper edge of the record tray cam follower as shown at "A" in Fig. 5. In this position the front points of the 10 inch felts in the record tray should be level with the turntable felt (a straight edge should be used). If the level is not the same, loosen the nut on the back of the eccentric screw (3237) (Fig. 5). Adjust this screw until the felts are the same heights, then while holding the screw to prevent its turning, tighten the nut.

Unless this adjustment is carefully made, the record center hole will miss the spindle, for if the tray is too low the records will slide over the 10" stop in the tray, while if the tray is too high they will land with the spindle hole behind the spindle.

##### 2. TO LOCATE AND ADJUST THE RECORD MAGAZINE (6686) (Fig. 1).

Before attempting any adjustment of the record magazine, make certain that the center of the right hand magazine pivot pin (34132) (Fig. 2) is exactly  $8\frac{3}{8}$ " above the base plate. This is shown in Fig. 2. This height is very critical and may be the cause of records not being properly delivered to the record tray. If this height is found to be incorrect, it can be adjusted by striking the buckhorn with a rubber hammer. Strike the underside if the height is less than  $8\frac{3}{8}$ ". If more, strike the upper side of the buckhorn.

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**MECHANICAL ADJUSTMENTS—Cont.****TO POSITION RECORD MAGAZINE:**

The record magazine may be moved sideways by loosening the two set screws located underneath the magazine pivot pins in the magazine support assembly (Buckhorn) (6684) (Fig. 1). The correct position of the record magazine is determined by the position of the pin in the Record Reverse Crank with respect to the slot in the Record Reverse Fork. The illustration Fig. G, below, shows this clearly. After this position has been reached, the magazine should be securely fastened by the Allen set screws which are located in the Magazine Support Assembly.

Swing the Record Reverse Arm around in front of the magazine to determine if the Record Guide strikes either of the Record Support Pins (34138) (Fig. 12A). If the guide strikes either of the support pins, it will be necessary to bend the interfering pin so that clearance is secured.

Next move the Record Selector Arm to the Repeat Position. This disengages the Record Repeat Sliding Clutch and permits lifting the Record Tray. After placing a 10" record on the turntable and slowly raising the tray by hand, the record should hit the pins simultaneously about halfway between top and bottom of the angle surface of the pins. If it does not, it will be necessary to bend the pins until the record does. This adjustment is predicated upon the fact that the rear record bumpers are in good shape (not unequally worn). If an adjustment of the pins is made, see that clearance is maintained between the Support Pins and the Record Reversing Arm and Guide, as well as the holes in the Record Tray.

If the magazine has been replaced or moved, the Magazine Stop Screw, "B" Fig. 5, may need readjustment. The correct adjustment is made when the changer is in the playing position. The

record separator must be engaged by hook—and should just touch the vertical portion of it. In this position the record reverse arm should rest against the stop tubing, and the record reverse crank should be in the fork of the record reverse arm as shown in the accompanying illustration. This view is shown with reverse arm in Reverse Position and looking down.

If it is necessary to shift the magazine, the final check should be to determine that the Record Separator Hook (4323) (Fig. 2) does not bind in the slot at the end of the Record Separator Arm, (6445) (Fig. 1). The adjustment of this separator arm is covered in part 5 of this section.

**3. MAGAZINE LINK ADJUSTING SCREWS ("A") (Fig. 2).**

The Record Magazine should always return snugly against the Magazine Stop Screw ("B") (Fig. 5). If it does not, it is necessary to place selector lever in repeat position and loosen the two adjusting screws on the magazine actuating link to a sliding tension, and run the changer thru its cycle until the magazine attains the position shown in Fig. 2. Stop the cycle either by disengaging the turntable clutch, or by disconnecting the A. C. line cord. Press downward on the lower part of the magazine thus lengthening the Magazine Link Assembly. Now resume the cycle, and when the magazine touches the Magazine Stop Screw, the Magazine Link will adjust itself, after which the adjusting screws on the link assembly should be tightened securely.

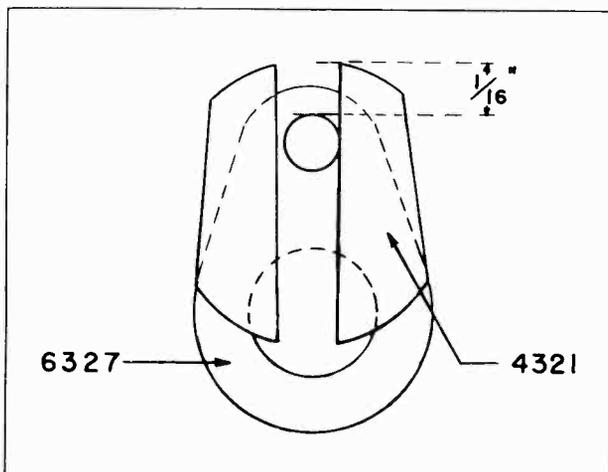
**4. TO ADJUST AND POSITION THE RECORD REVERSE GUIDE (6444) (Fig. 1).**

When a 12" record is placed in the Magazine, the Record Reverse Guide should be parallel to this record at the time when the guide is swung from its normal resting position to a position in front of the magazine, snugly against the rubber bumper as shown in Fig. 2. This is known as the Reversing Position.

If the guide is parallel with the 12" record, it should return and rest against the rubber bumper on the Magazine Support Assembly, in such a position as is shown in Fig. 1. If the Eccentric Cam (3825) (Fig. 11) is properly adjusted, the guide will rest against the rubber bumper; however, if the Record Reverse Guide does not properly return, loosen the screw holding the Eccentric Cam and rotate the Cam slightly until the correct position is secured.

If the Reverse Guide does not return to the rubber bumper, check the position of the Crank Pin in the Record Reverse Fork (under Magazine Adjustments and Fig. "B").

If the Eccentric Cam is turned too far, the Reverse Guide will not swing around far enough to rest easily on the rubber bumper (5043) (Fig. 1) while in the playing position.



**FIGURE G. REVERSE PINION CRANK AND PIN ASSEMBLY**

**MECHANICAL ADJUSTMENTS—Cont.**

With the Record Selector Lever in the Both Sides position, run the changer thru a cycle until the point is reached where the Record Reverse Guide swings in front of the magazine. In this position the Crank Pin should touch the side of the Record Reverse Fork, that is, toward the magazine without binding. To adjust the position of the Crank Pin, while the Record Reverse Guide is in the reversing position, loosen the lock nut marked "D" Fig. 11. Next, remove the shoulder screw that holds the Reverse Assembly Link Rod to the gear quadrant, (3550) (Fig. 11) and adjust the length of the Link Rod by turning the end which has just been disconnected. After correctly positioning the Crank Pin tighten the lock nut.

#### 5. TO ADJUST RECORD SEPARATOR (Figs. 1 & 2).

With a 10" record in the magazine, the upper edge of the Record Separator (6445) (Fig. 1) should be flush with the top of the Lower Support. To adjust the position of the Record Separator, move the Record Separator Stop to the position desired by loosening the two screws holding this stop. This stop (4520) is shown clearly in Fig. 2 and is located at the bottom of the right hand side of the magazine. The Record Separator Hook should then be adjusted.

#### 6. TO ADJUST THE RECORD SEPARATOR HOOK (4323) (Fig. 2).

As the Record Separator Hook should enter the slot in the end of the Record Separator without binding, it will be necessary to readjust the Record Separator Hook in the event it has been necessary to adjust the Separator Stop. To adjust the Hook, loosen Nut (99-12-3) (Fig. 2) and turn the Hook, which is threaded, until it enters the slot in the Record Separator freely.

**NOTE: IF IT IS EVER NECESSARY TO RE-ADJUST THE HOOK, BE SURE TO CHECK THE HEIGHT OF MAGAZINE PIVOT PIN (SEC. 2).**

Be sure the screw marked "E" in Fig. 11 is screwed all the way in and locked with the nut. This prevents the Separator Hook from ejecting a record from the magazine during the Reverse Cycle, allowing the record to be caught under the returning magazine, due to its inability to reach the turntable while another record is being reversed.

#### 7. TO ADJUST TONE ARM HEIGHT

When an unwarped 12" record is placed on the turntable, the outer edges of this record should coincide with the center of the rubber roller at the end of the Stop Lever (64197) (Fig. 9A). Run

the changer through a cycle until the Tone Arm Lever Hook just touches the Stop Lever. The correct tone arm height is secured when the center of the Tone Arm Hook is the same height as the top of the Stop Lever. To effect this adjustment, lift the tone arm by hand, thus making accessible two Allen set screws, normally covered by the Tone Arm Base. After adjustment, and before finally tightening these set screws, check the clearance between the Pickup Head and the Record Tray. This should be  $\frac{5}{8}$ " while the tray is in the process of raising or lowering with the Pickup Arm swung back by the swing cam, i. e., during either the One Side or Both Sides cycle. The tone arm lever hook should clear through the slot in the stop lever when changer is in play position.

#### 8. TO ADJUST THE PICKUP ELEVATION

After the Pickup Arm Lever Hook has moved the Stop Lever in to the needle landing position, the Hook moves down the Stop Lever. In its downward journey, it pauses momentarily before the Hook, and then enters the Slot in the Stop Lever, thus permitting the Stop Lever to swing to its normal position. If the record changer is stopped at this point in its cycle, it will be found that the ball at the end of the pickup arm lift shaft is at the point marked "F" on the Lift Cam (6449) (Fig. 8).

With the needle, which is to be used in the Pickup, and the Lift Shaft at "F", lift the Pickup and allow the needle to drop off the edge of the Record. The needle point should extend below the playing surface a distance equal to half the thickness of the record.

To make this adjustment, turn screw 99-22-29 (Fig. 13A) until the correct position of the needle is reached. Be sure to retighten the lock nut.

**THIS ADJUSTMENT IS IMPORTANT, DUE TO THE VARIOUS LENGTHS OF DIFFERENT BRANDS OF NEEDLES. UNLESS THIS ADJUSTMENT IS CHECKED, IT MAY CAUSE THE NEEDLE TO FALL OFF THE RECORD BEFORE ENTERING THE PLAYING GROOVES.**

#### 9. TO ADJUST PICKUP FEED-IN

An examination of the Pickup Friction Cam will disclose the fact that there is a flat leather portion that applies friction to hold the Pickup Arm Lever Hook against the Stop Lever until the weight of the pickup is transferred to the needle. This friction should be applied long enough to prevent the needle falling off the record, but if maintained too long, the needle may skip across the first few playing grooves, and thus miss playing the first portion of the record.

Before adjusting tone arm feed-in cam, be

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### MECHANICAL ADJUSTMENTS—Cont.

sure no end play exists in main shaft, otherwise position will vary as main shaft shifts position.

In the earlier model changers this Friction Cam is held on the shaft by a taper pin as well as two Allen set screws. However, later models employed the Allen screws only. If it is necessary to advance or retard this Friction Cam, do not tighten BOTH screws until the proper position is secured, as the set screws have cup points, and after being set up tightly, leave an imprint in the shaft and thus have a tendency to "pull back" into the old position. On instruments where the set screws have been tightened, it might be well to remove the main shaft, and smooth out the old screw marks before attempting to reset this cam. Rotating the cam in the direction of its normal rotation relieves the pressure on the pick-up arm earlier.

#### 10. TO ADJUST THE MAGNETIC PICKUP

Remove the Pickup Cover and check the location of the Stylus with respect to the Pole Pieces (569) (Fig. 6). This stylus should be centrally located in respect to these poles. To adjust the stylus the spool assembly may be shifted, after the set screws (99-28-3) have been loosened. When tightening the set screws, exercise care not to crack the bakelite bobbin. When checking the pickup, carefully examine the rubbers as they harden and split. Due to age, the majority of complaints are traceable to this fact. It should not be necessary to caution against steel chips getting into the assembly.

#### 11. TO ADJUST NEEDLE LANDING

The 12" landing should be adjusted first. In Figs. 5 and 13A the Stop Lever Hook (5658) is shown. In the normal or playing position its flat face is parallel with the bottom of the slot in the Stop Lever, and when engaged with the Stop Lever, the adjacent faces of the Stop Lever and the Lever Hook are parallel. The Lever Hook is adjusted by loosening the Bristol Set Screw No. 99-28-31 (Fig. 6 & 13A) located in the bottom of the Center Bolt, which is the pivot for the Pickup Head Bracket. The Lever Hook should be adjusted to allow the needle to land  $3/32$ " from the edge of a 12" record. Be sure the Bristol set screw is retightened. Next, place a 10" record on the turntable and adjust screw 99-18-20, which is located in the Stop Lever (Fig. 9A) until the needle lands  $3/32$ " from the edge of the 10" record.

**CAUTION**—The Lever Hook should not bind when going through the slot in the stop lever.

#### 12. TO ADJUST CLUTCH THROWOUT LEVER & CAM (6460) (Fig. 10).

The Clutch Throwout Lever & Cam is ad-

justed by loosening the shoulder screw holding the cam to the lever, and adjusting the cam until it just clears the point of the Clutch Throwout Cam which is located on the main shaft. This adjustment must be made with the changer in the playing position, i. e., when the Pickup Arm Lift Shaft is in its lowest position, as shown in Fig. 8. Unless sufficient clearance is secured, the changer may jam; excess clearance will cause the changer to cycle without playing records.

The wire spring (3990) (Fig. 10) must lift the cam far enough to clear the Clutch Throwout Cam, otherwise the changer will jam; if it holds the cam too high the changer will continue to cycle.

#### 13. TO ADJUST SOLENOID WEDGE SPRING (39132) (Fig. 12B).

The Wedge Spring is located on one of the three spacers used to mount the solenoid plate and is directly over the solenoid coil. Its purpose is to prevent clutch bounce or chatter when the clutch engages. It may be bent to proper tension by means of a long screwdriver. If the clutch disengages before a change cycle is completed, it is advisable to increase the tension of this spring.

#### 14. TO ADJUST REVERSE CAM SHIFT LEVER (5326) (Fig. 3).

When the Record Selector Lever (Fig. 9B) is moved to the "Both Sides" position, the Record Control Rod Pin (34145) (Fig. 9B) moves the Record Control Shaft, which in turn moves the Reverse Cam Shift Lever. This causes the Reverse Cam (6325) (Fig. 4) to engage with the Reverse Cam Pin (34144) (Fig. 4). The Shift Lever should be positioned on the Control Shaft so that the Reverse Cam is free of the Reverse Cam Pin in the "Repeat" and "One Side" cycles, but is firmly engaged in the "Both Sides" cycles. Under no circumstances should the Shift Lever be positioned so as to bind the Reverse Cam.

#### 15. TO ADJUST RECORD REPEAT LOCK LEVER (5334) (Fig. 3).

This lever is to prevent accidental shifting of the Record Selector Lever during the change cycle. In the playing position, the tip of this lever should clear the Clutch to Solenoid Lever by  $3/16$ " while moving under it. In the "Repeat" cycle, this lever is on the side of the Clutch Solenoid Lever away from the Main Cam. In the other two cycles it encloses the Clutch Solenoid Lever.

#### 16. TO ADJUST REVERSE CAM LOCK LEVER (5339) (Fig. 3).

This lever serves the same purpose as the Record Repeat Lock Lever and should clear the Clutch Solenoid Lever by  $1/16$ " while moving

**MECHANICAL ADJUSTMENTS—Cont.**

under it in the playing position. During the "Both Sides" cycle, it is on the side of the Clutch Solenoid Lever, towards the Main Cam, and in the other two cycles it encloses the Clutch Solenoid Lever.

**17. TO ADJUST RECORD REPEAT CLUTCH LEVER (5332) (Fig. 3).**

The Sliding Clutch permits disengagement of the Record Tray Driving Quadrant during the "Repeat" Cycle, when the same record is used. The Clutch Lever should allow the clutch to engage firmly in the "One Side" and "Both Sides" cycles, but be entirely disengaged in the Repeat Cycle. The Clutch Lever is secured to its shaft by means of an Allen Set Screw.

**18. TO LOCATE MAIN CAM SHAFT**

Both end bushings of the Main Cam Shaft are movable, and are used to position the Main Cam Shaft. To position this shaft, loosen the H. H. Cap Screws (99-26-9) (Fig. 11) holding the bushings, then move the shaft until the ball in the end of the Tone Arm Lift Rod is exactly centered on the Lift Cam as shown in Fig. 8. When tightening the Cap Screws, be careful not to crush the Durex Bushings or crack the split bearings located near the turntable shaft.

**19. TO ADJUST AUTOMATIC TRIP SWITCH (2792) (Fig. 9B)**

This switch is located underneath the turntable and is actuated by the motion of the Tone Arm being transmitted to the Trip Arms thru their associated Friction Joint.

To adjust this switch, remove the long trip arm from the Switch Cover and the two F. H. M. S. holding this cover. There should be  $1/32$ " clearance between the switch points. Replace the turntable on its spindle, and move the tone arm toward the turntable spindle so that the trip quadrant moves the trip arm about  $1/4$ ", then turn the turntable one complete revolution. This rotation is for the purpose of having the Fibre Trip Pin, at the bottom of the turntable, reset the Trip Arm. Remove the turntable, and check the position of the trip arm in respect to the movable contact arm which should be equidistant from both bakelite insulators. In order to position the trip arm, loosen both screws holding the switch and adjust it until there is approximately  $1/32$ " clearance between each bakelite insulator and the trip arm. Recheck this position before replacing the cover. When replacing the trip arm through the slot in the cover, be sure that it is between the bakelite insulators, otherwise it may make contact with one side of the A. C. line and cause a fuse to blow.

A single strand of wire is soldered from one side of the A. C. line to the movable arm of the switch for the purpose of preventing chattering, which may occur if the current flows only through the bearings to the arm.

**20. TO ADJUST SOLENOID MOTOR SWITCH (Fig. 10).**

The Solenoid Motor Switch is located underneath the cast cover (5226) (Fig. 3) and is used to disconnect the Solenoid Coil during the change cycle and to shunt the phono relay contacts in order to keep the motor running until the change cycle is completed, even though the instrument is turned off. This switch is actuated by the Clutch to Solenoid Lever.

The cover (5226) is secured by a bolt at one end, and a screw at the other. When the clutch is disengaged, the upper contacts should make good electrical contact, and there should be approximately  $3/32$ " clearance between the bottom contacts. When the clutch engages, the upper contacts should remain closed until the bottom contacts close, after which they should open. When the clutch is fully engaged, the bottom contacts should be closed, and there should be approximately  $3/32$ " clearance between the upper contacts. To adjust the switch, loosen the screw (or screws) holding the bakelite insulator to the solenoid plate.

**21. TO ADJUST AUTOMATIC TRIP SWITCH FRICTION JOINT**

This friction joint is located underneath the record tray, and is used to transmit the motion of the tone arm to the Automatic Trip Switch by means of the two Trip Arms.

Place the Selector Lever (9B) in the Repeat position and raise the record tray. A flat spring, which can be adjusted by a screw, holds the two trip arms together against a cork washer. The tension of the flat spring determines the friction between the two trip arms. If the tension is too great, the changer will cycle before completing a record, and if not great enough, the changer may not trip at the completion of a record.

On some instruments a "Thump" may be heard through the speakers during each revolution at the time when the Turntable Fibre Pin strikes the Trip Arm. This motion is transmitted to the needle point, and may be reduced or eliminated by proper adjustment of the Friction Joint. In some stubborn cases it may be necessary to place a small piece of surgical rubber tubing over, or to wrap several layers of cellophane tape around the Trip Quadrant where it touches the Trip Arm, which will effectively kill the thump.

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*MECHANICAL ADJUSTMENTS—Cont.*

**22. TO ADJUST VERTICAL BUMPER GUIDE**  
(6693) (Fig. 1).

This Guide, located behind the Lower Support Assembly, is used to guide the record when it drops to the rubber bumpers and also when the record is being raised by the rear of the record tray (elevating hook). The guide should be just far enough back from the lower record support to allow a 12" record to drop freely upon the rubber bumpers, and the lower points of this guide should be far enough forward to tilt a 12" record sufficiently to go freely behind the two points of the upper record support. If the lower points of the guide do not extend forward enough, there is danger of the record bouncing against the points of the upper record support and being chipped. When adjusting the Vertical Bumper Guide, make certain that the elevating hook (rear portion of the record tray) has clearance, otherwise the record tray will not return to its correct position.

**23. TO ADJUST CLUTCH CLEARANCE.**

In order to insure proper disengagement of the Driven Clutch (6326) (Fig. 7) and the Driving Clutch 3630, the clearance should be .020" when the changer is in the playing position. This clearance is obtained by loosening screw marked "G" Fig. 10 and moving the Clutch Fork. Be sure screw "G" is tightened after correct clearance is obtained.

**24. OILING INSTRUCTIONS.**

Due to careful design and precision workmanship the Capehart 16-E Record Changer requires a minimum of oiling or mechanical adjustment.

Some 16-E Record Changers produced in the past have had all cams, gears and sliding surfaces coated with graphite grease. These coated surfaces should be greased with white vaseline, which will replace the oil that has been used up during operation.

An occasional LIGHT coat of vaseline should be applied to all faces of the magazine at the points where the records come in sliding contact during the cycle, apply vaseline then wipe off with the fingers.

A good grade of light machine oil should be used on the sliding clutches (except motor slip clutch) reverse cam shaft, and eccentric shoulder screws.

**DO NOT OIL DUREX BUSHINGS. DO NOT USE AN EXCESS OF LUBRICANT.**

Later production changers used Lubriplate instead of Graphite.

On these, all surfaces of the main cam, the reverse cam, and the tone arm lift cam that come

into contact with rollers should be coated with a film of Lubriplate. Lubriplate can be purchased at almost any electrical supply or hardware store.

The drive motor should have its oil cup filled every six months.

The Gear Reduction unit used with the Emerson motor should be checked to make certain it contains the proper amount of No. 10 S.A.E. oil. (Amount required—1/2 oz.).

In the Gear Box of the Bodine Motor, the grease should be replaced each year. This grease may be 75% Vaseline and 25% S.A.E. 40 Motor Oil.

**25. TO REPLACE RECORD REVERSE CAM.**

There are two methods used in removing a broken Record Reverse Cam, the first being to remove the Turntable Drive Shaft, the second, to drop the Main Cam Shaft.

To remove the Turntable Drive Shaft see Fig. 7.

1. Mark the Drive and Driven Gears in order that they can be again meshed in the same position. (This should be done regardless of which ever method is used).

2. Remove turntable shaft.

3. Knock out the taper pin from the Driven Gear (on Reverse Cam Shaft) also the Reverse Cam Pin.

4. Move the Reverse Cam Shaft away from the Main Cam until the Reverse Cam drops off the shaft.

5. When replacing the Reverse Cam, make certain that the Reverse Cam Shift Lever is properly engaged in the slot in the Reverse Cam, before pinning the Driven Gear to the Shaft. Remember this is a taper pin and only goes in one way. Consequently, the shaft has to be properly aligned or the pin will not enter. Next replace the Reverse Cam Pin. Replace the Turntable Drive Shaft and check. If the Reverse Cam Shaft is only partly withdrawn, the gears will remain properly meshed.

6. Check in order to determine that the Reverse Arm and Roller Assembly does not ride on the Reverse Cam; about 1/16" clearance should be maintained. The shaft of the Reverse Arm may be shifted by loosening the set screw that holds the end of the shaft nearest the Main Cam.

**TO REMOVE THE MAIN SHAFT**

Put the instrument in playing position. Remove the Eccentric Shoulder Screw holding the Magazine Slide Arm, and the screw holding the recoil slide arm. Loosen the single H. H. Cap Screw

**MECHANICAL ADJUSTMENTS—Cont.**

holding the front Durex Bushing; remove this Bushing, and the bearing cap that holds the rear Durex bushing. Work the shaft backwards out of the front bearing hole.

Knock the taper pin out of the Driven Gear, and remove the collar from the front end of the Reverse Cam Shaft. Move this shaft toward the rear until the Reverse Cam drops off the Shaft. Replace with a new cam, put gear on shaft, push shaft through Durex bushing and replace collar. Replace taper pin in gear.

Replace the Main Shaft and put Durex bushing on front end, after which mesh the driver and driven gears in accordance with the guide marks previously made. If the gears are properly meshed, the Reverse Cam will slide under the Reverse Arm and Roller Assembly without binding at the time the selector arm is moved into the "Both Sides" position. Rotate the Reverse Cam 180° with the fingers, and again move the Selector Arm to the "Both Sides" position. It should go in without binding. Replace the rear bushing and bearing cap. Replace the Magazine and Record Tray Slide Arms, and adjust the Record Tray height.

**26. TO REMOVE RECORD CHANGER FROM CABINET**

As the new series (beginning at 20,000) are equipped with cast iron bases, heavier magazines, and record trays, exceptional care must be exercised when removing a changer to prevent marring the cabinet.

After disconnecting the pickup and shorting leads, the play control cable and the drive shaft, remove the middle screw of the three holding the upper record support, and the shoulder screw 3239 (Fig. 1). Removal of the shoulder screw permits the magazine to be swung parallel with the base. Next, swing the Record Reverse Arm around in front of the magazine by raising the Record Reverse Arm Lock until the Reverse Arm is in front of the magazine. Then, release the Lock which will hold the Record Reverse Arm in place.

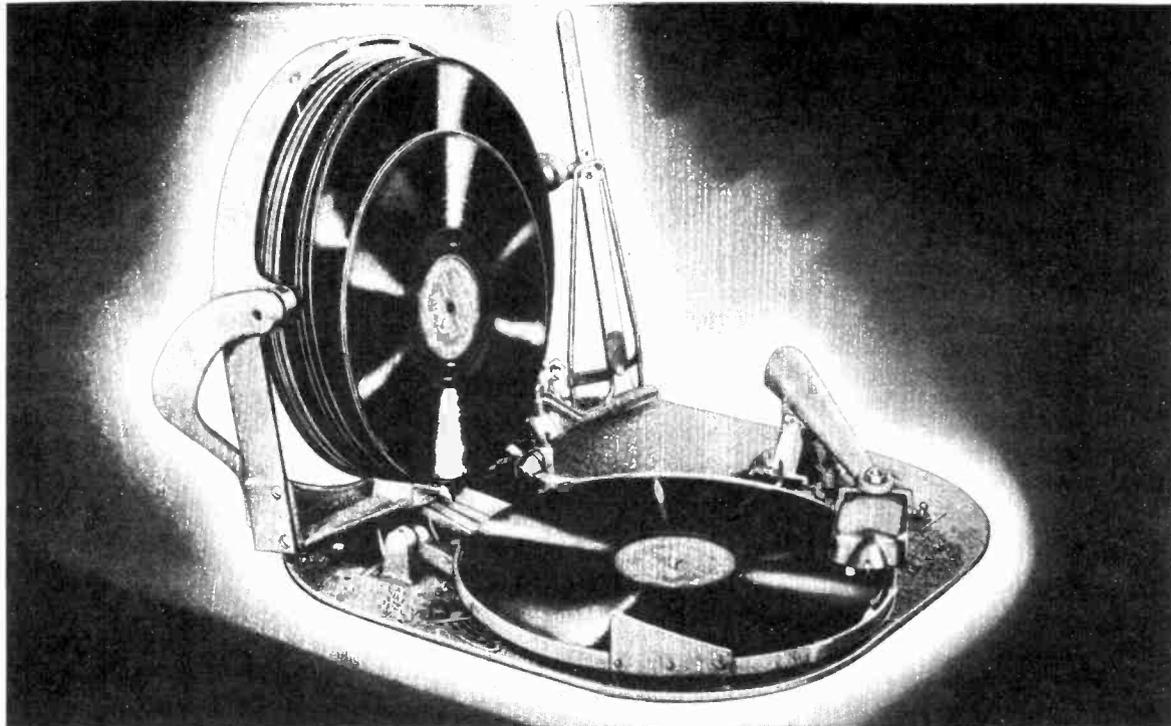
Lift the changer up and tilt it to clear the shelf, then remove it through the back of the cabinet.

As it is possible to mar the cabinet; the shelf, the top, and side of the cabinet, should be protected in some manner while removing and installing the changer.

**27. ALIGNMENT OF TRUE TANGENT PICKUP**

When properly aligned, the pickup head and the tone arm for a straight line when the needle is 1 1/2" from the center of the turntable drive shaft. To adjust, loosen the nut (43160) (Fig. 14A) and turn the steering rod (43148) until the correct adjustment is secured. After adjusting, determine that there is still 5/8" clearance between the Record Tray and the Pickup Head.

**NEVER USE STEERING ARM TO ADJUST NEEDLE LANDING.**





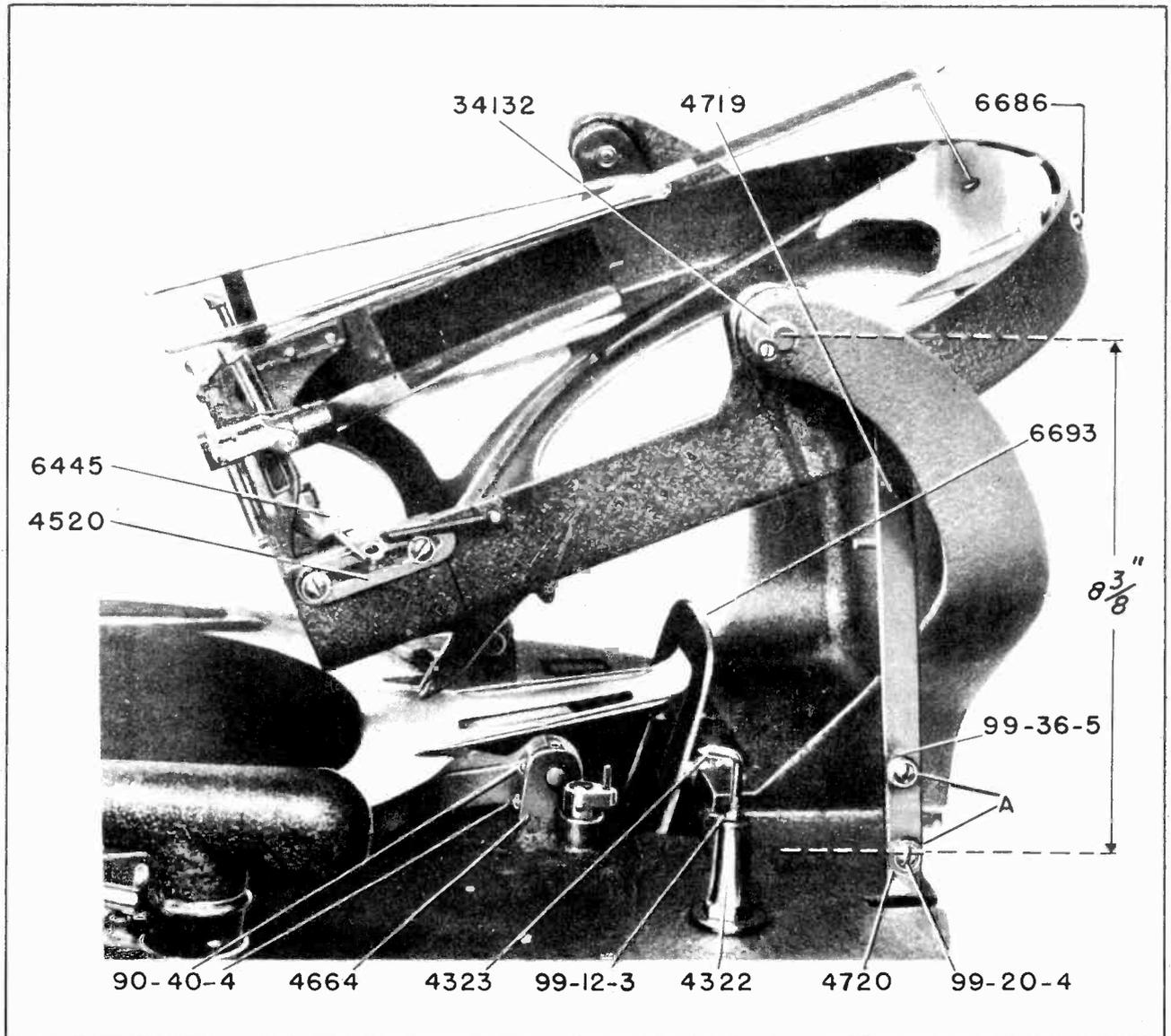


FIGURE 2

PARTS LIST

Part No.	Description	Part No.	Description
3983	Record Separator Hook Spring	3239	Magazine Link -Shoulder Screw. See Fig. 1.
4322	Record Separator Hook Post	4520	Record Separator Stop
4323	Record Separator Hook	6230	Reverse Pinion & Crank Assembly
99-12-3	8-32 Hex Nut for 4323	3552	Reverse Pinion
4664	Record Reversing Arm Lock Stop	6327	Reverse Pinion Crank & Pin Assembly
99-40-4	No. 4 x 1/4" Drive Screw for 4664	99-35-5	00 x 1/2" Taper Pin
4719	Magazine Link, Upper	6686	Complete Magazine Assembly— See Fig. 1.
4720	Magazine Link, Lower	6693	Record Bumper Guide Assembly— See Fig. 1.
99-20-4	10-24 x 3/8" R. H. M. S.	62-26	Rubber Record Bumper—Left
99-36-5	Flat Washer	62-27	Rubber Record Bumper—Right

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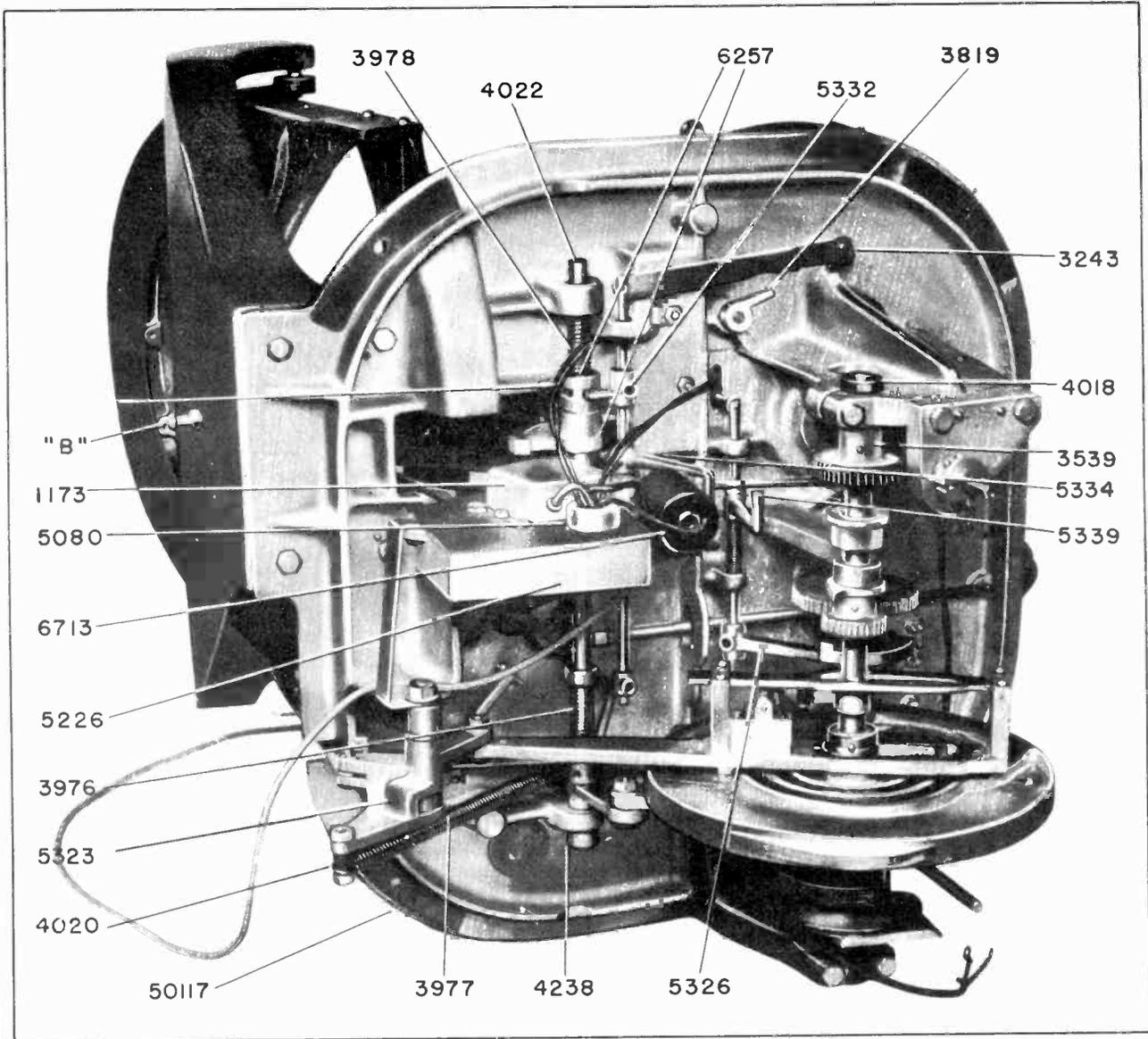


FIGURE 3

PARTS LIST

Part No.	Description	Part No.	Description
1173	Condenser 1 Mfd.—400 Volt	5080	Porcelain Bushing and Nut
3243	Repeat Lever Shoulder Screw	50117	Frame Pad, Rubber
3539	Worm Gear	5226	Solenoid Plate Cover
3819	Record Repeat Throwout Cam	5323	Magazine Slide Arm Lever
3976	Record Separator Hook Lever Spring	5326	Record Reverse Cam Shift Lever
3977	Magazine Slide Arm Spring	5332	Record Repeat Clutch Lever
3978	Record Repeat Clutch Spring	5334	Record Repeat Lock Lever
4018	Main Shaft Bushing Durex	5339	Reverse Cam Lock Lever
4020	Record Magazine Bushing Durex	6257	Record Tray Gear & Sliding Clutch
4022	Record Tray Shaft Bushing	6713	Solenoid Assembly
4238	7/16" Collar for Taper Pin		

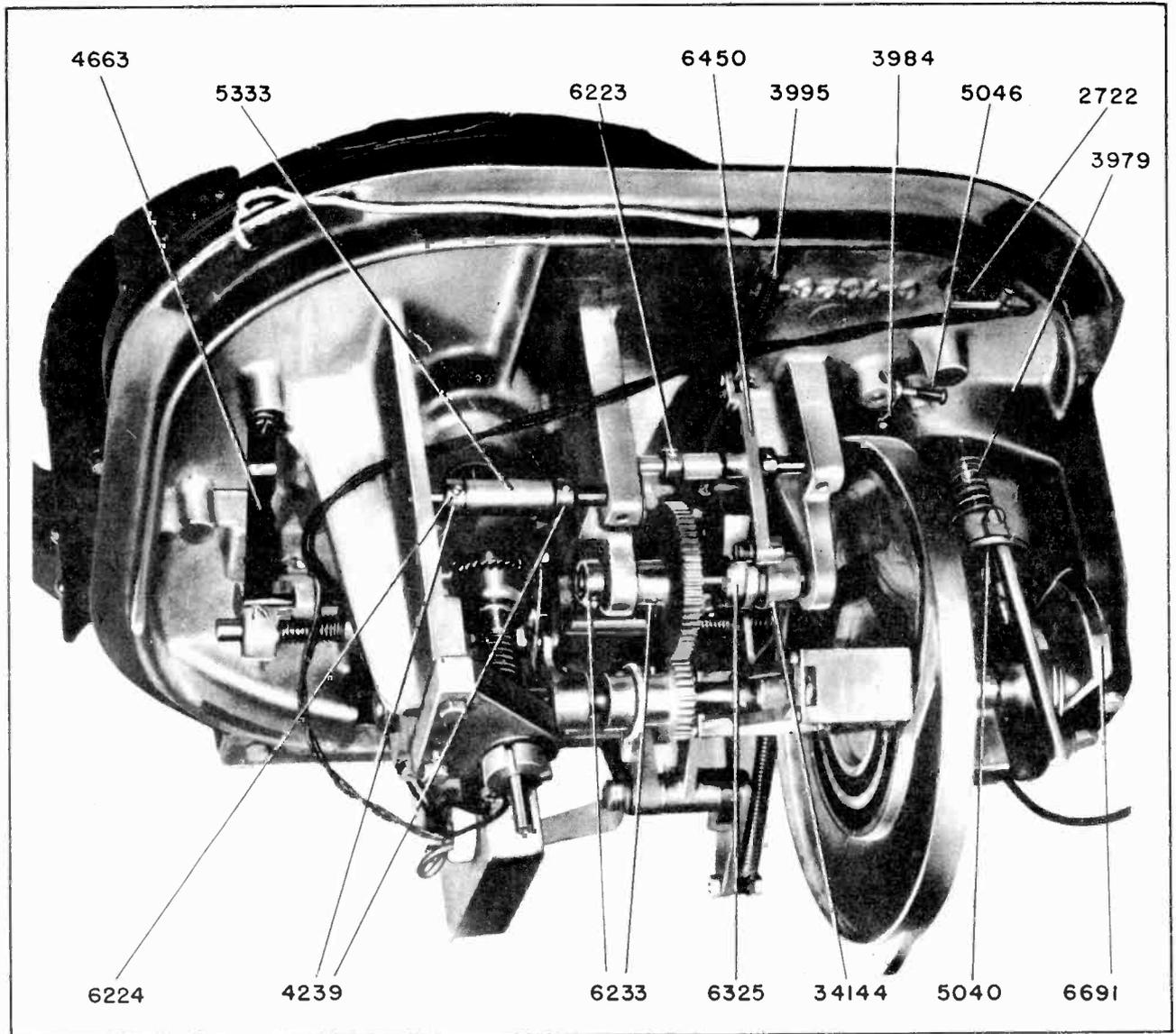


FIGURE 4

PARTS LIST

Part No.	Description	Part No.	Description
2722	Toggle Switch	6224	Solenoid Lever Shaft & Collar Assy.
3979	Pickup Arm Brake Spring	3239	5/16" Collar for Taper Pin
3984	Tone Arm Stop Lever Spring	6233	Record Reverse Cam Shaft Gear & Collar Assembly
3995	Reverse Arm Spring	6325	Record Reverse Cam & Pin
4663	Record Repeat Throwout Lever	34144	Record Reverse Cam Pin
5040	Pickup Arm Brake Facing, Cork	6450	Reverse Cam Arm & Roller Assembly
5046	Tone Arm Stop Lever Sleeve, Rubber	6691	Pickup Arm Friction Cam Assembly
5333	Main Clutch Fork Lever	5041	Pickup Arm Friction Cam Facing, Leather
6223	Record Reverse Arm Shaft & Collar Assembly		

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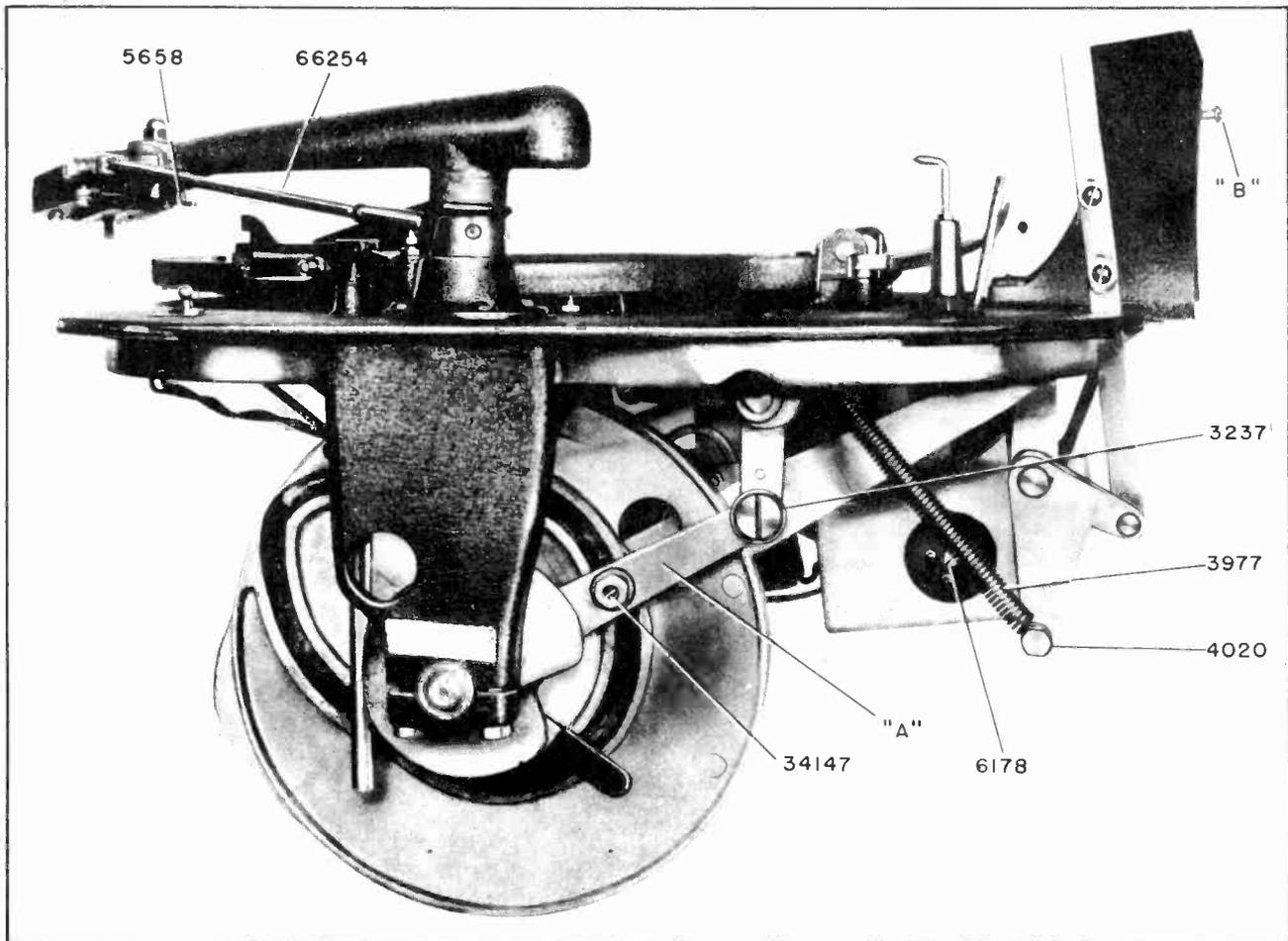


FIGURE 5

PARTS LIST

Part No.	Description
3237	Shoulder Screw, Record Tray Adjusting
34147	Record Tray Slide Pin
3977	Magazine Slide Arm Spring
4020	Record Magazine Bushing
6178	Chassis Plug—5 Prong Male
66254	Steering Arm Assembly—See Fig. 13A

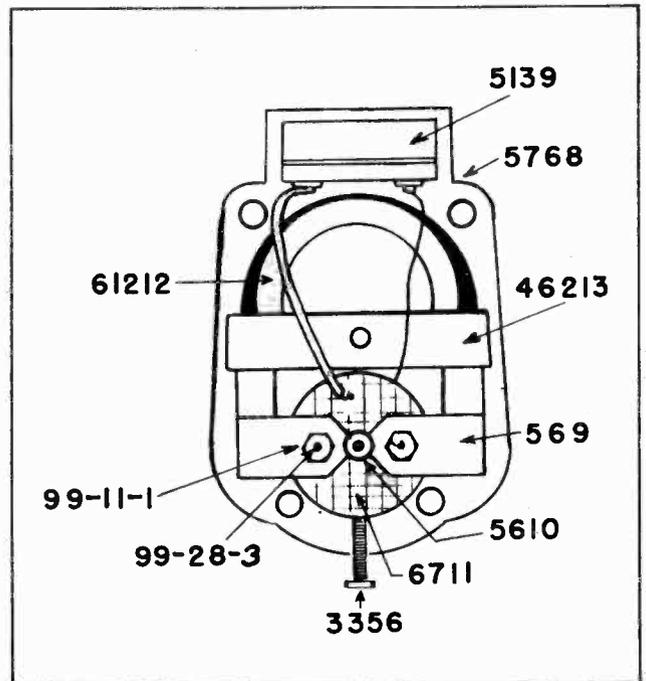
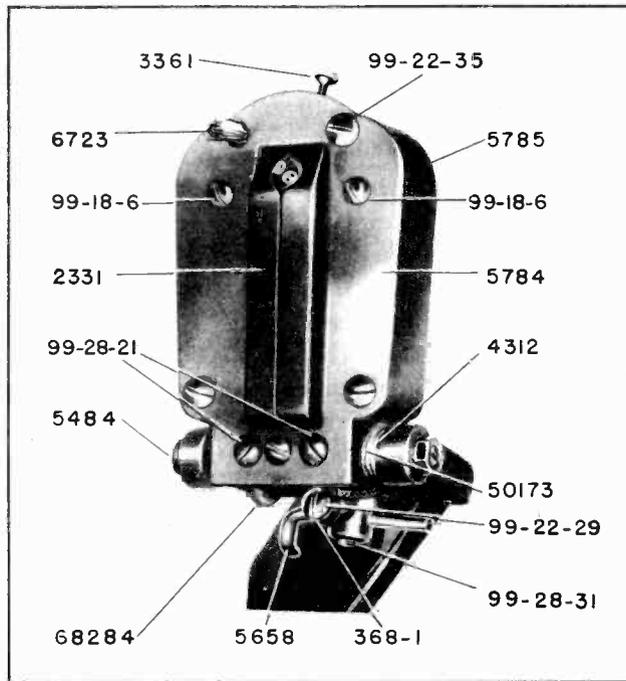


FIGURE 6 PICKUP, CRYSTAL AND MAGNETIC

PARTS FOR CRYSTAL PICKUP

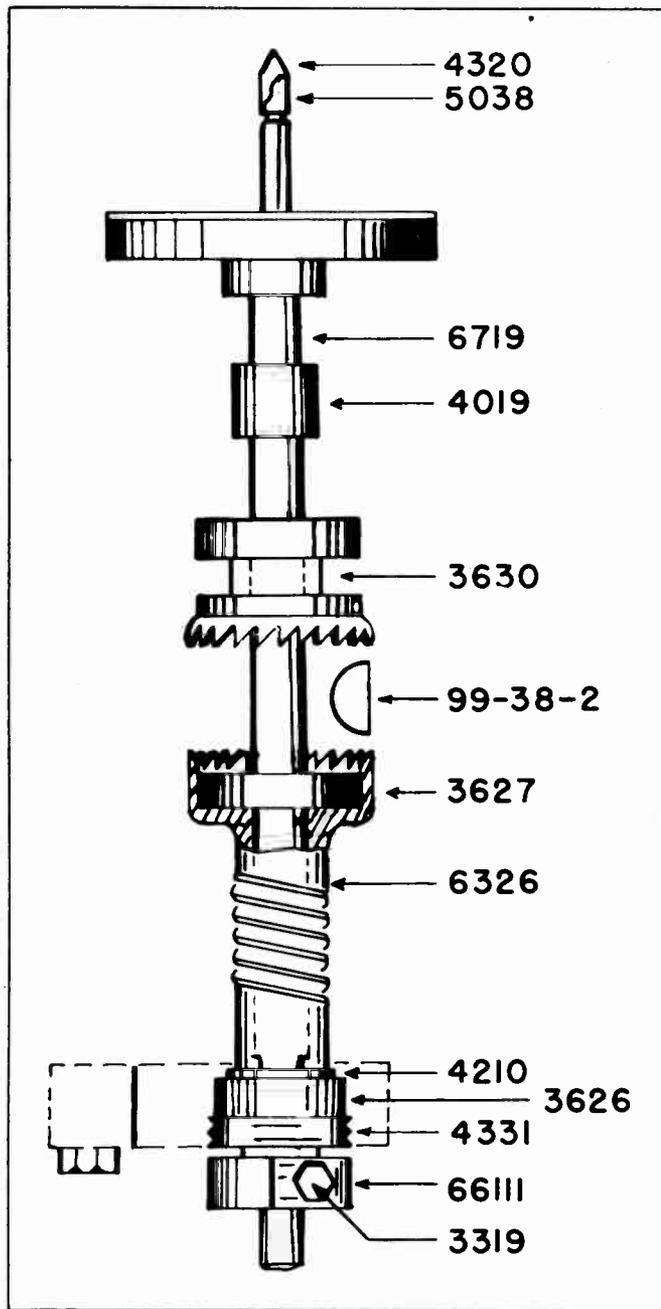
Part No.	Description
2331	Crystal Cartridge
3361	Needle Screw
4312	Bushing
50173	Tone Arm Bushing
5484	Pickup Arm Bracket
5658	Pickup Lever Hook
5784	Pickup Back Crystal
5785	Cover Crystal
6723	Brush Assembly
68285	Pickup Lead
99-18-6	6-32 x 1/4" R. H. M. S.
99-22-29	6-32 x 3/8" B. H. M. S.
99-22-35	6-32 x 1/4" Mch. Screw Oval Hd. Nickel
99-28-21	6-32 x 1/8" Headless Set Screw
99-28-31	6-32 x 3/16" Bristol Set Screw
368-1	Adjusting Screw Nut

PARTS FOR MAGNETIC PICKUP

Part No.	Description
3323	Screw, Pickup Hole Piece
3356	Screw, Pickup Pole
46213	Magnet Holder
5033	Rubber Insulating Bushing
5058	Rubber Bumper
5059	Rubber Bearing (2)
5060	Dust Rubber
5139	Terminal Block
569	Pole Piece
5610	Stylus
5765	Pickup Cover
5768	Pickup Back
61212	Pickup Magnet
6711	Spool Assembly
6723	Brush Assembly
68285	Pickup Cord
99-11-1	6-32 Hex Nut
99-18-21	6-32 x 3/8" R. H. M. S.
99-28-3	6-32 x 1/4" Headless Set Screw
99-28-21	6-32 x 1/8" Headless Set Screw

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PARTS LIST FIGURE 7

Part No.	Description
3626	Ball Bearing
3627	Ball Bearing
3630	Turntable Shaft Clutch
4019	Turntable Shaft Bushing, Durex
4210	Thrust Washer
4320	Turntable Drive Shaft Cap
4331	Bearing Retainer Plug
5038	Turntable Drive Shaft Cap Tubing
6326	Worm & Bushing Assembly
66111	Turntable Shaft Collar & Screw
4244	Turntable Shaft Collar
3319	Turntable Shaft Collar Screw
6719	Turntable Shaft Assembly
99-38-2	No. 2 Woodruff Key

TURNTABLE DRIVE SHAFT

When it becomes necessary to remove the turntable drive shaft, it is necessary to remove the upper flexible coupling and the Turntable Collar No. 66111. After the collar is removed, the shaft may be raised until the Woodruff Key (99-38-2) is exposed. Grasp the upper end of the key in a pair of pliers and roll the key out of the driven clutch. After the key is removed, the shaft may be lifted out of the changer. If the Clutch is disassembled, be sure the thrust washer (4210) is not lost.

FIGURE 7—TURNTABLE DRIVE SHAFT

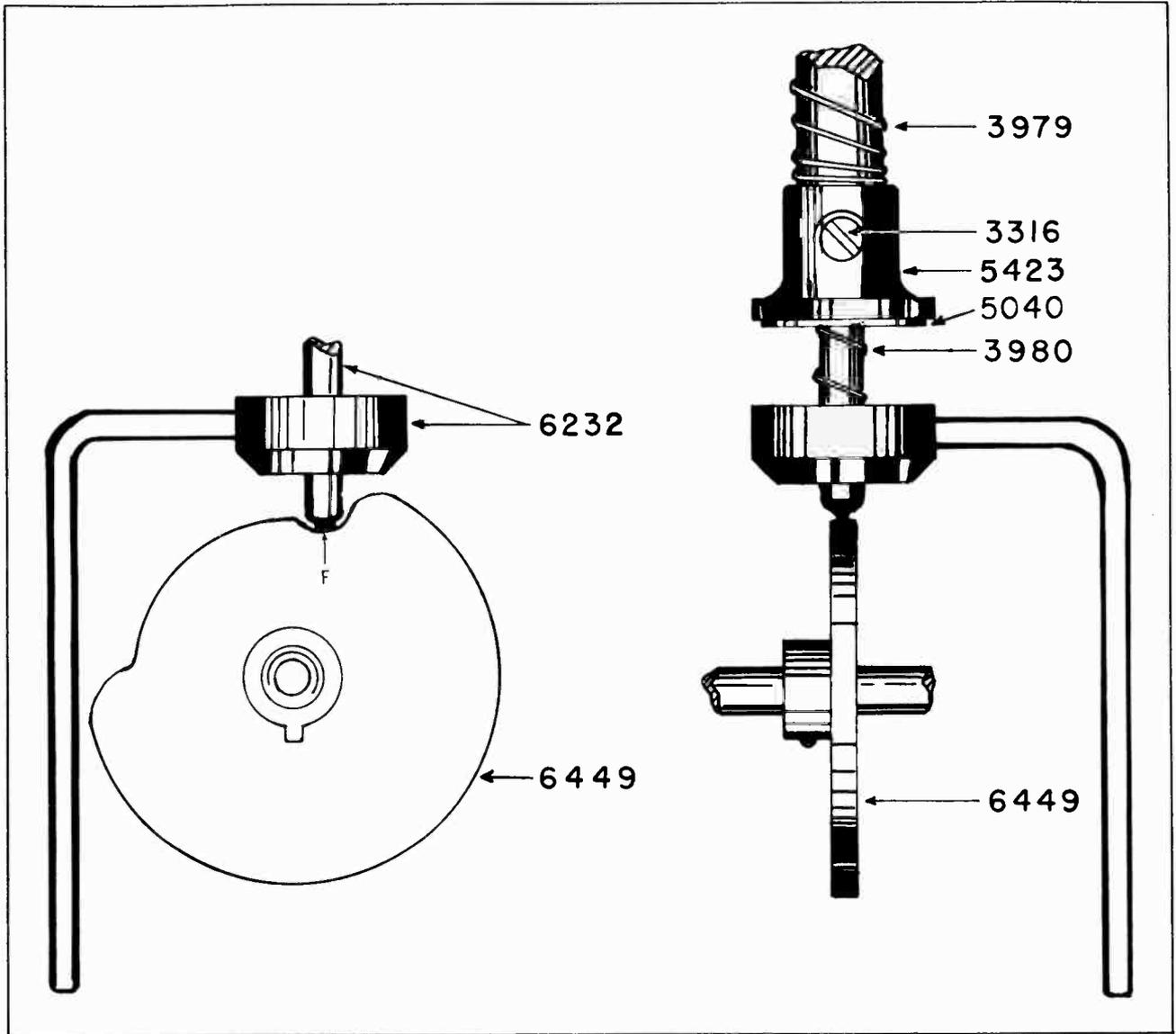


FIGURE 8. TONE ARM LIFT CAM AND LIFT ROD

PARTS LIST

Part No.	Description
3316	10-24 Screw
3979	Pickup Arm Brake Spring
3980	Pickup Arm Lift Spring
5040	Pickup Arm Brake Facing
5423	Pickup Arm Brake
6232	Pickup Swing Lever & Collar Assy.
6449	Pickup Arm Lift Cam & Hub Assy.

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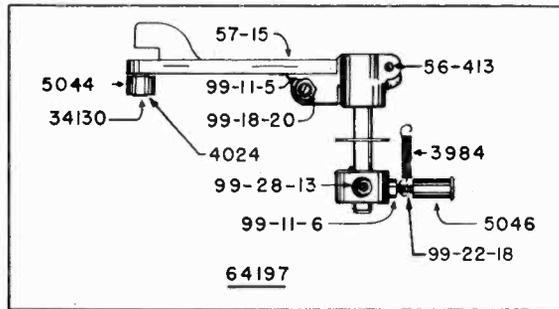


FIGURE 9A—TONE ARM STOP LEVER

PARTS LIST

Part No.	Description	Part No.	Description
64197	Pickup Arm Stop Lever Assembly	99-18-20	6-32 x 5/8" R. H. M. S.
5044	Stop Lever Roller Tubing	66107	Stop Lever Collar Assembly
34130	Pin Stop Lever Roller Tubing	3984	Tone Arm Stop Lever Spring
4024	Stop Lever Roller Bushing	5046	Bumper—Rubber
64201	Stop Lever & Bracket Assy.	99-28-13	1/4-20 x 1/4" Allen Set Screw
56-413	Stop Lever Pin	99-11-6	6-32 Hex Nut
99-11-5	6-32 Hex Nut	99-22-18	6-32 x 1 1/4" R. H. M. S.

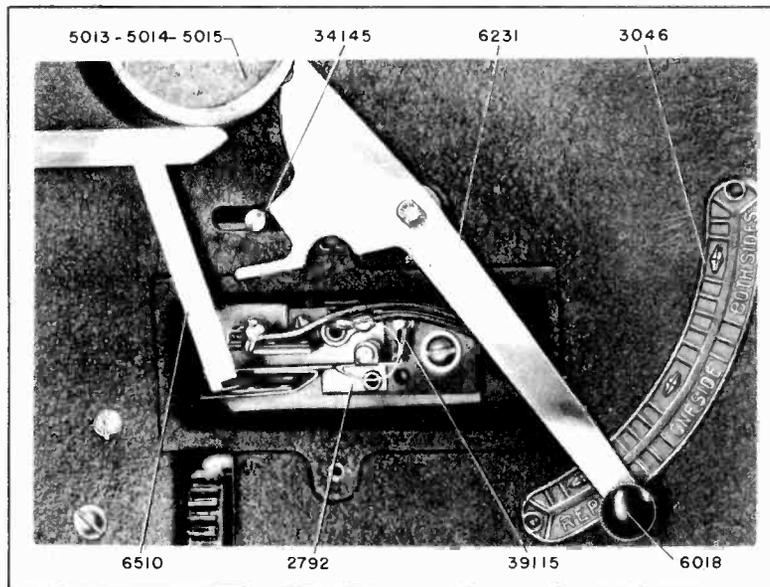


FIGURE 9B. AUTOMATIC TRIP SWITCH

PARTS LIST

Part No.	Description	Part No.	Description
2792	Record Trip Switch Assembly	5013	Heavy, Turntable Drive Facing, Cork
3046	Selector Lever Escutcheon	5014	Medium, Turntable Drive Facing, Cork
99-40-1	Escutcheon Pin	5015	Light, Turntable Drive Facing, Cork
39115	Trip Switch Spring	5051	Automatic Trip Lever Washer
2831	Stationary Switch Finger	6231	Record Control Lever & Stud Assembly
2846	Movable Switch Finger	6018	Record Control Lever Knob
6510	Automatic Trip Lever Long Assy.	34145	Record Control Rod Pin
4533	Automatic Trip Lever Short		
3988	Automatic Trip Lever Spring		

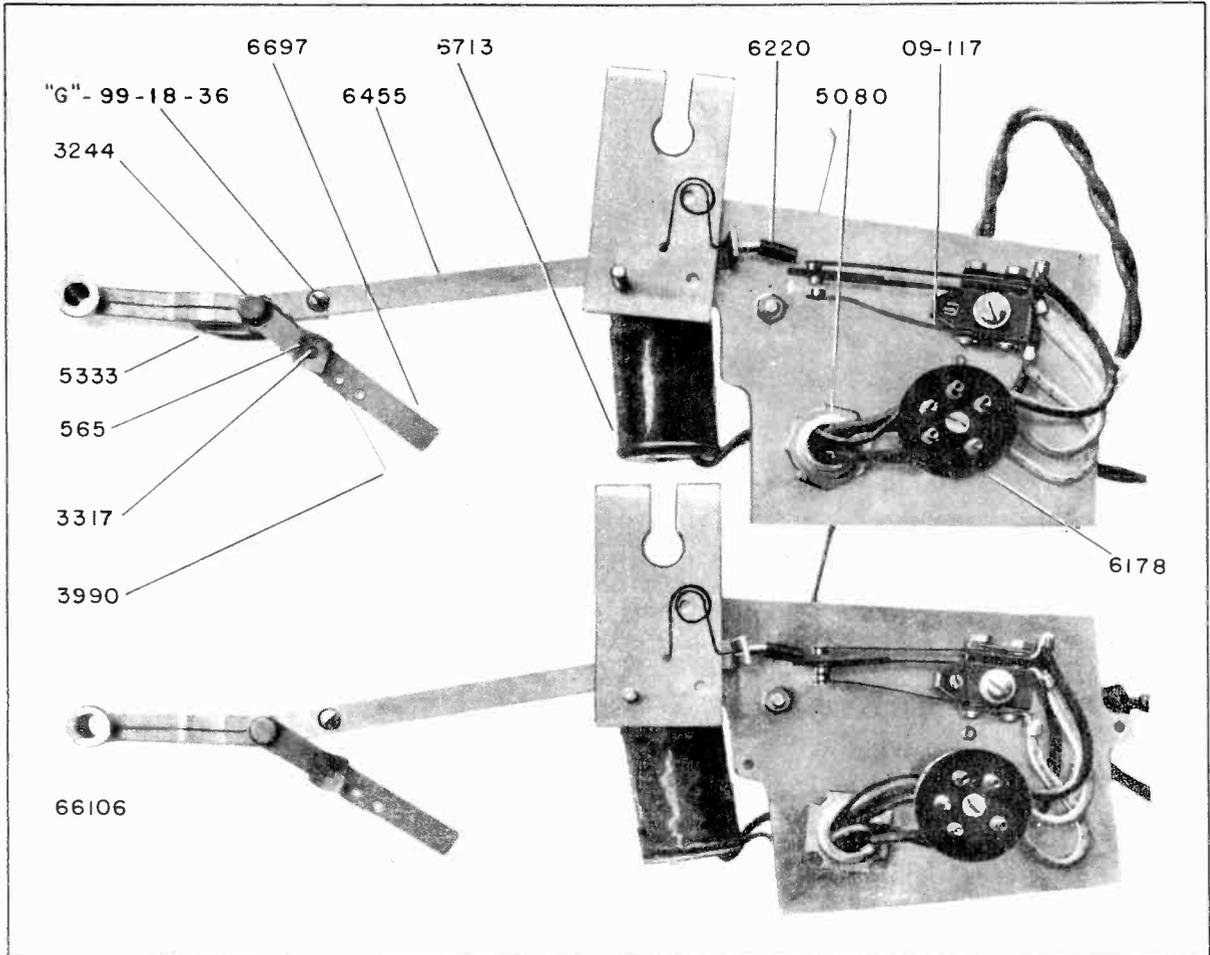


FIGURE 10 SOLENOID CLUTCH LEVER AND MOTOR SOLENOID SWITCH

PARTS LIST

Part No.	Description
6178	Chassis Plug
09-117	Solenoid-Motor Switch
6713	Solenoid Assembly
3986	Solenoid Lever Torsion Spring
66106	Main Clutch Fork & Lever Assembly
3244	Clutch Throwout Lever Throwout Screw
5333	Main Clutch Fork Lever
6455	Solenoid to Clutch Lever
62-20	Lever Bumper—Rubber
6697	Clutch Throwout Lever & Cam Assembly
3317	Clutch Throwout Cam Screw
3990	Clutch Throwout Spring
565	Clutch Throwout Cam

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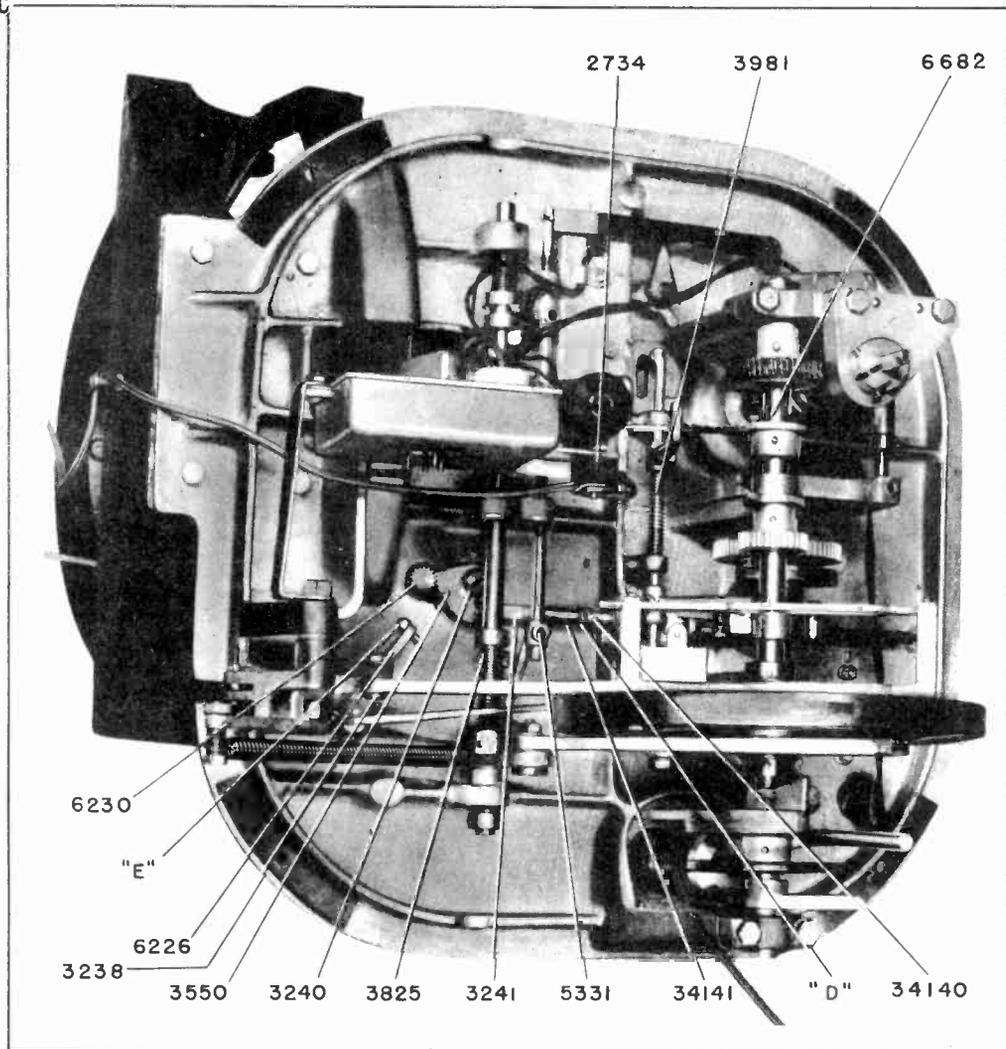


FIGURE 11 BOTTOM VIEW 16-E CHANGER

PARTS LIST

Part No.	Description
2734	Pickup Shorting Switch
3238	Magazine Slide Arm Shoulder Screw
3240	Shoulder Screw, Reverse Segment
3241	Reverse Segment Link Shoulder Screw
34140	Reverse Segment Pin, Long
34141	Reverse Segment Pin, Short
3550	Record Reverse Pinion Segment
3825	Reverse Segment Stop Cam
3981	Record Reverse Cam Control Spring
5331	Record Repeat Throwout Hook Lever
6230	Reverse Pinion & Crank Assembly
6226	Separator Hook & Arm Assembly
6682	Main Shaft Assembly
99-26-9	1/4-20 x 1 1/8" H. H. Cap Screw

Record Support Pins set 19° angle so as to match angle of record.

1. Record being released.
2. Next Record in line.
3. Second and Third Records being forced against first record, pushing first off record knife.

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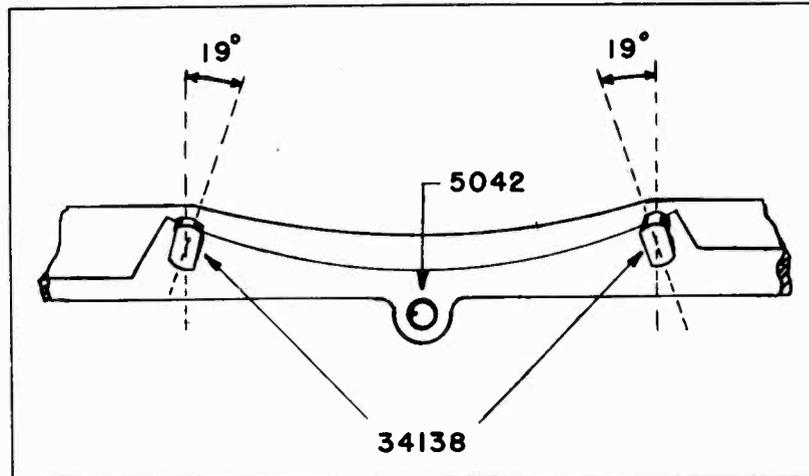


FIGURE 12A LOCATION RECORD SUPPORT PINS

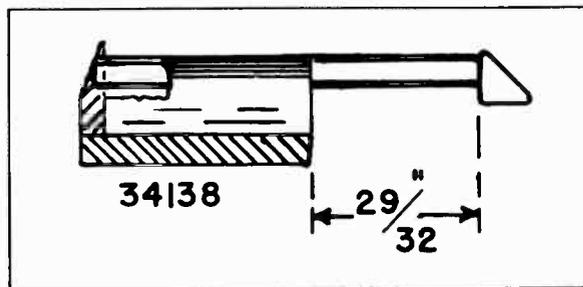


FIGURE 12AA LOCATION RECORD SUPPORT PINS

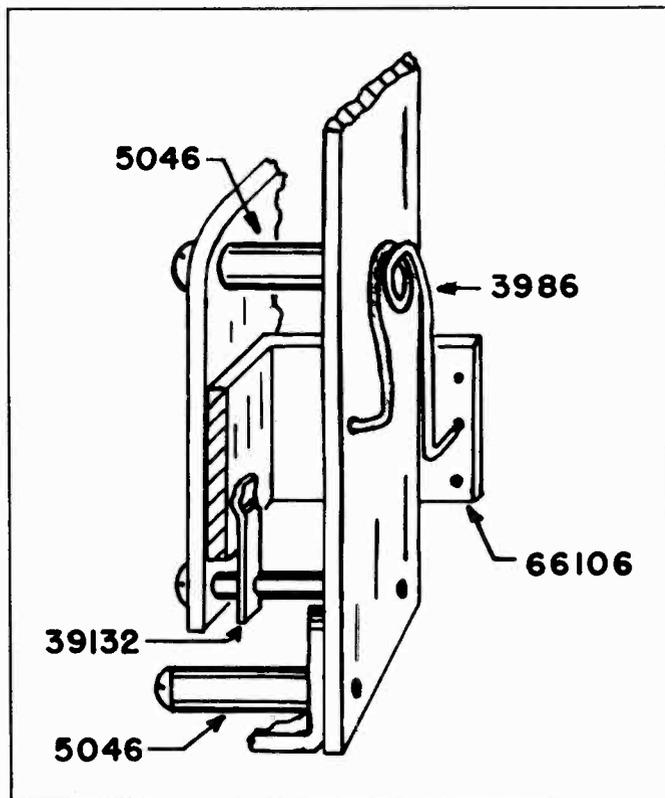


FIGURE 12B SOLENOID TORSION AND WEDGE SPRINGS

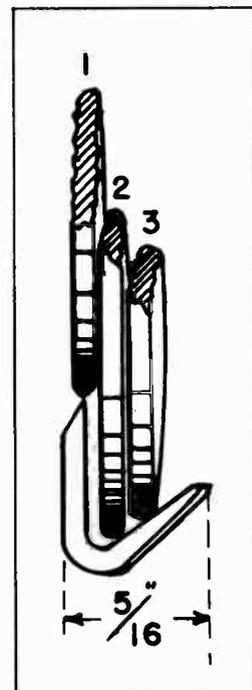
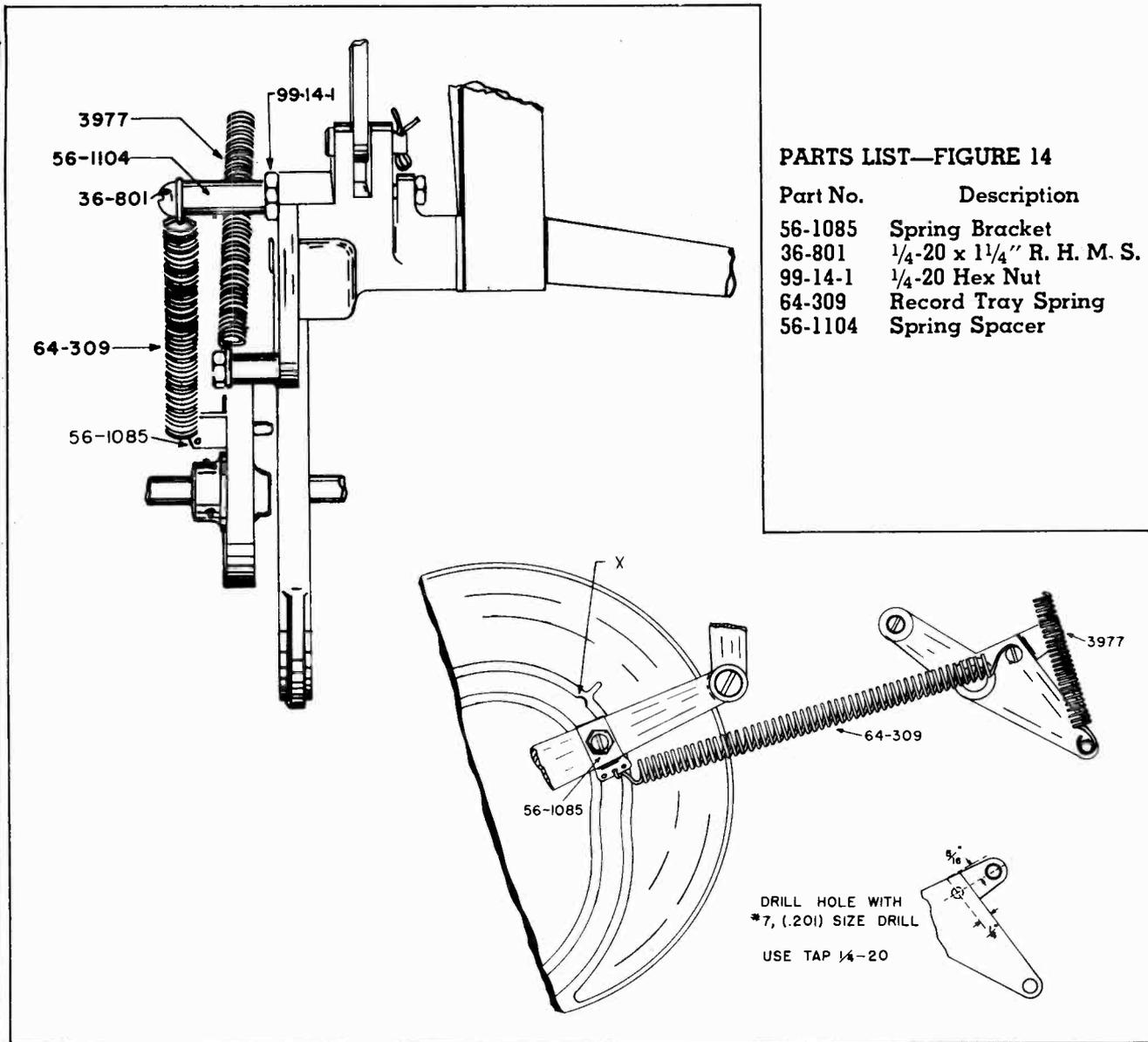


FIGURE 12C RECORD  
SEPARATOR AND RECORDS  
EDGE VIEW

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**PARTS LIST—FIGURE 14**

Part No.	Description
56-1085	Spring Bracket
36-801	1/4-20 x 1 1/4" R. H. M. S.
99-14-1	1/4-20 Hex Nut
64-309	Record Tray Spring
56-1104	Spring Spacer

**FIGURE 14—ADDITIONAL PARTS REQUIRED FOR ZINC TRAY**

If it is necessary to replace the aluminum tray used on changers having a serial number below 20,000, it is necessary to add the above parts, which are necessary due to the additional weight of the zinc tray which is now available.

The bell crank which is used to swing the magazine must have a 1/4-20 hole tapped in the location shown; 1/4" from one edge and 5/16" from the other edge. A No. 7 drill is used for the hole, and a plug tap should be used for threading the hole.

When assembling the screw (36-801), nut (99-14-1) and spacer (56-1104), 1/16" space should be left between the spacer and screw head to allow free motion of the tray spring (64-309).

Assemble spring bracket (56-1085) under the nut holding the tray slide arm roller, as shown in the illustration above. The spring should be used in the middle hole of the bracket.

At the point marked "X" in the illustration there is a guide mark and a semi-circular spot has been milled in the cam track. It is necessary that this track be bent so the semi-circular spot is flush with the remainder of the cam wall. This can be done best by means of an iron block and heavy hammer. Hit the block with the hammer until the track is straight. This is necessary to prevent the spring holding the tray lift shaft so the sliding clutch cannot be properly engaged when changing from Repeat to One or Both Sides.

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## GENERAL PARTS LIST

Part No.	Description	Part No.	Description
565	Clutch Throwout Cam	99-18-6	No. 6-32 x 1/4" R. H. M. S.
569	Pole Piece	99-18-21	No. 6-32 x 3/8" R. H. M. S.
5610	Stylus	99-20-4	No. 10 24 x 3/8" R. H. M. S.
5615	Record Reverse Guide Fork Only	99-20-31	No. 10 32 x 3/8" R. H. M. S.
5658	Pickup Lever Hook	99-22-29	Screw—Pickup Stop
5662	Cable Housing	99-22-35	No. 6-35 x 1/4" M. S. O. H. Nickel
5663	Control Cable	99-26-9	No. 3/4-20 x 1 1/8" H. H. Cap Screw
5745	Complete Turntable Assembly	99-26-13	No. 10/24 x 3/8" H. H. M. S.
5765	Pickup Cover	99-28-3	No. 6-32 x 1/4" Headless Set Screw
5768	Pickup Back	99-28-13	1/4 x 20 1/4" Allen Set Screw
5769	Tone Arm Assembly Less Pickup	99-28-21	No. 6-32 x 1/8" Headless Set Screw
5784	Pickup Back-Crystal	99-28-31	No. 6-32 x 3/16" Bristol Set Screw
5785	Cover-Crystal	99-33-4	No. 10 Special Shakeproof Washer
6018	Record Control Lever Knob	99-34-7	Cotter Pin
6019	1/4" Allen Wrench	99-35-5	00 x 1 1/2" Taper Pin
6062	Bar Knob-Painter	99-38-2	No. 2 Woodruff Key
6178	Chassis Plug—5 prong male	99-41-11	1/8" x 1/4" Eyelet
6179	5 prong Motor Plug	99-42-13	1/4" Steel Ball
61163	Light Bulb	99-42-14	1/8" Pipe Plug
61212	Pickup Magnet	13-79	Dog Plunger Assembly—"K" only
6223	Record Reverse Arm Shaft & Collar Assembly	13-81	Bracket Assembly for 16E Chassis—"K" only
6224	Solenoid Lever Shaft & Collar Assembly	13-141	406M Friction Drive Assembly
6226	Separator Hook & Arm Assembly	13-148	411M Friction Drive Assembly
6228	Record Reversing Arm & Fork	13-150	412M Friction Drive Assembly
6230	Reverse Pinion & Crank Assembly	13-151	410M Friction Drive Assembly
6231	Record Control Lever & Stud Assembly	13-195	Flexible Coupling & Set Screw
6232	Pickup Swing Lever & Collar Assembly	13-368	Play Control Cabinet & Cabinet Assy. Complete
6233	Record Reverse Cam Shaft Gear & Collar Assembly	13-396	Ratchet Assembly
6257	Record Tray Gear & Sliding Clutch	15-45	Gear Box, Cover, Pinion & Bearing Assembly
6325	Record Reverse Cam & Pin	22-126	Cable and Plug Assembly
6326	Worm & Bushing Assembly	31-213	Dial Scale
63116	Plunger Tube Assembly	36-136	No. 10 Plain Washer
6444	Record Reverse Guide Assembly	36-141	6/32 x 1/4" R. H. M. S.
6445	Record Separator & Hub Assembly	36-258	Spacers
6449	Pickup Arm Lift Cam & Hub Assembly	36-501	"C" Washer for Friction Drive
6450	Reverse Cam Arm & Roller Assembly	36-550	No. 10/32 x 3/4" Slotted H. H. M. S.
6455	Solenoid to Clutch Lever	36-801	*1/4-20 x 1 1/4" R. H. M. S.
6460	Clutch Throwout Lever & Spring Assembly	41-89	"C" Washer—Package 12
64197	Pickup Arm Stop Lever Assembly	54-38	Reduction Unit Shim
6510	Automatic Trip Lever—Long	56-415	411M Shaft for Friction Drive
6682	Main Shaft Assembly	56-416	Shaft for Friction Drive 111 & 112
6684	Record Magazine Support Assembly	56-417	412M Shaft for Friction Drive
6685	Lower Record Support Assembly	56-418	406M Shaft
6686	Complete Record Magazine Assembly	56 1085	*Spring Bracket
6687	Complete Record Tray & Gear Assembly	56-1099	Shaft
6691	Pickup Arm Friction Cam Assembly	56-1100	Steel Ball Bearing
6693	Record Bumper Guide Assembly	56-1104	*Spring Spacer
6697	Clutch Throwout Lever & Cam Assembly	57-18	Lower Friction Drive Disc
66105	Flexible Coupling—Set Screw No. 99-28-13	59-142	Knob, M Play Control
66106	Main Clutch Fork & Lever Assembly	59-143	Housing, M Play Control
66107	Stop Lever Collar Assembly	60-144	Fibre Washer
66111	Turntable Shaft Collar and Screw	62-26	Rubber Record Bumper—Left
66254	Ball Crank & Steering Rod Assembly	62-27	Rubber Record Bumper, Right
66324	Stop Spring and Ball Assembly	62-46	Motor Grommet
66325	Bracket Assembly for 16-E Chassis	62-75	Rubber Grommet
66326	Dog Plunger Assembly	64-31	Plunger Return Spring, "K" only
66389	Motor Coupling and Set Screw (New No. 13-195)	64-32	Spring, Dog—"K" only
66399	Gear Box, 60 cycle	64-309	*Record Tray Spring
66435	Gear Box, 50 cycle	64-311	Dog Spring
6711	Spool Assembly	67-88	Mounting Board
6713	Solenoid Assembly	90-125	Light Switch
6719	Turntable Shaft Assembly	90-132	Acro Switch
6723	Brush Assembly	90-133	Relay (Complete)
68285	Pickup Lead Assembly	90-134	Master Switch
99-11-1	No. 6-32 Hex Nut	92-140	Back Cushion
99-11-6	No. 6-32 Hex Nut	368-1	Adjusting Screw Nut
99-12-3	No. 8-32 Hex Nut for 4323	368-2	406M 3/8 x 32" Hex Nut
99-14-1	*No. 1/4-20 Hex Nut	621-2	Rubber Grommet
		1315-1	Reduction Unit Oil S.A.E. .10, 1/2 oz.
		3611-4	No. 10 S. P. Lockwasher
		3643-1	No. 10/32 Tee Nut

MODEL 16-E,  
Capehart

FARNSWORTH TELEV. &amp; RADIO CORP.

## GENERAL PARTS LIST

Part No.	Description	Part No.	Description
1173	Condenser, 1 mfd.—400 volt	4020	Magazine Bushings, Durex
21156	Motor, 60 cycle	4021	Record Tray Bushing, Durex
21157	Motor, 50 cycle	4024	Stop Lever Roller Bushing (Metal)
2331	Crystal Cartridge	4067	Bearing, Gear Box
2333	Complete Crystal Pickup Assembly	4210	Thrust Washer, Worm Shaft
2722	Toggle Switch	4238	7/16" Collar for Taper Pin
2734	Pickup Shorting Switch	42129	Spacer, Pickup
2792	Record Trip Switch Assembly	4312	Bushing, Tone Arm Pivot
27123	Switch Assembly	4320	Turntable Drive Shaft Cap
2852	Switch Arm—Straight	4321	Record Reverse Fork
2853	Switch Arm—Bent	4322	Record Separator Hook Post
3046	Selector Lever Escutcheon	4323	Record Separator Hook
3059	Automatic Switch Escutcheon	4331	Bearing Retainer Plug
30142	Play Control Dial	43147	Pickup Center Bolts
3237	Shoulder Screw, Record Tray Adjusting	43159	1/4-28 Cap Nut
3238	Magazine Slide Arm Shoulder Arm	4431	Auto Stop Trip Quadrant Bracket
3239	Magazine Link	4458	Dog, Stop Bracket
3240	Shoulder Screw, Reverse Segment	4520	Record Separator Stop
3241	Reverse Segment, Link Shoulder Screw	4533	Automatic Trip Lever Short
3242	Shoulder Screw	4659	Record Reversing Arm Lock
3243	Repeat Lever Shoulder Screw	4663	Record Repeat Throwout Lever
3244	Clutch Throwout Lever (Throwout Screw)	4664	Record Reversing Arm Lock Stop
3316	No. 10-24 Screw	46213	Magnet Holder
3317	Clutch Throwout Cam Screw	4719	Magazine Link, Upper
3318	Pivot Set Screw Pole	4720	Magazine Link, Lower
3323	Screw Pickup Hole Piece	48202	Switch Pin, Play Control
3356	Screw, Pickup Needle	4911	Turntable Felt
3361	Needle Screw	4912	Record Tray Felt 12" Record
34130	Stop Lever Roller Pin	4913	Record Tray Felt, 10" Record
34132	Magazine Pivot Pin	4915	Magazine Felt—Face
34133	Record Tray Pivot Pin	4916	Felt, Lower Record Support
34134	Reverse Guide Stop Pin	4917	Bumper Guide Felt
34138	Record Support Pin	4923	Magazine Felt—Side
34140	Reverse Segment Pin, Long	4925	Felt, Outer Record Way
34141	Reverse Segment Pin, Short	5013	Turntable Drive Facing, Heavy
34145	Record Control Rod Pin	5014	Turntable Drive Facing, Medium
34147	Record Tray Slide Pin	5015	Turntable Drive Facing, Light
34157	Pin for 3982 Spring	5033	Rubber Insulating Bushing, Tone Arm
34176	Turntable Trip Pin, Fibre	5036	Record Tray Bumper, Rubber, Front
3539	Worm Gear	5037	Record Tray Bumper, Rubber, Rear
3550	Record Reverse Pinion Segment	5038	Turntable Drive Shaft Cap Tubing
35101	Gear	5040	Pickup Arm Brake Facing, Cork
35107	Gear Box Worm Gear	5041	Pickup Arm Friction Cam Facing, Leather
3626	Ball Bearing	5042	Reverse Arm Bumper, Rubber
3627	Ball Bearing	5043	Reverse Guide Pin Tubing
3630	Turntable Shift Clutch	5044	Stop Lever, Roller Tubing, Rubber
3653	Ball Bearing	5046	Tone Arm Stop Lever Sleeve, Rubber
3819	Record Repeat Throwout Cam	5051	Automatic Trip Lever Washer
3825	Reverse Segment Stop Cam	5058	Rubber Bumper
3866	Play Control Split Cam, Long	5059	Rubber Bearing (2)
3867	Play Control, Split Cam Short	5060	Dust Rubber
3936	Spring, Dog	5080	Porcelain Bushing and Nut
3938	Spring, Safety Clutch	50117	Frame Pad, Rubber
3976	Record Separator Hook Lever Spring	50126	Leather Disc
3977	Magazine Slide Arm Spring	50170	Clutch Drive Facing (Leather)
3978	Record Repeat Clutch Spring	50173	Tone Arm Bushing
3979	Pickup Arm Brake Spring	50225	Gear Box Cover Gasket
3980	Pickup Arm Lift Spring	5139	Terminal Block
3981	Record Reverse Cam Control Spring	5226	Solenoid Plate Cover
3982	Record Separator Spring	5323	Magazine Slide Arm Lever
3983	Record Separator Hook Spring	5326	Record Reverse Cam Shift Lever
3984	Tone Arm Stop Lever Torsion Spring	5330	Record Reverse Arm
3986	Solenoid Lever Torsion Spring	5331	Record Repeat Throwout Hook Lever
3988	Automatic Trip Lever Spring	5332	Record Repeat Clutch Lever
3990	Clutch Throwout Spring	5333	Main Clutch Fork Lever
3995	Reverse Arm Spring	5334	Record Repeat Lock Lever
39115	Trip Switch Spring	5339	Reverse Cam Lock Lever
39130	Record Reverse Guide Spring	5423	Pickup Arm Brake
39210	Spring for Ball Crank	5466	Upper Friction Drive Disc
39219	Plunger Return Spring	5484	Pickup Arm Bracket
4018	Main Shaft Bushing, Durex	54103	Play Control Housing
4019	Turntable Shaft Bushing, Durex	5517	Upper Record Support

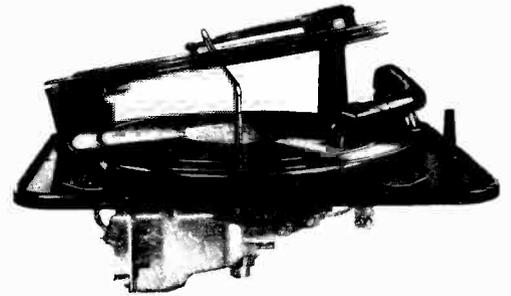
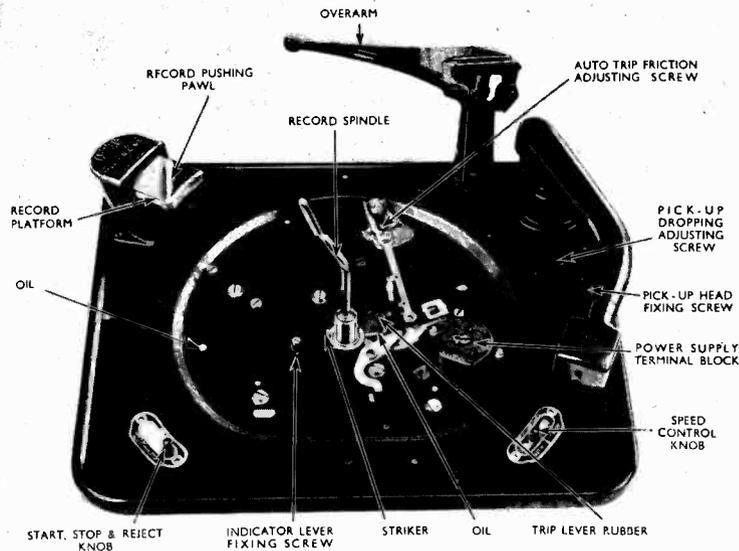


Diagram 1

## OPERATING INSTRUCTIONS

The "GARRARD" Record Changer will play any number of records up to eight 10" and 12" mixed in any order.

To operate, proceed in the following order:—

1. If a permanent needle is not used insert a needle—the type that will play 10 or more records—in the pick-up; lift the Pick-up Arm to do this.
2. Place the record spindle in position, the sloping part leaning towards the record platform, raise overarm, and place any number up to eight records on the record spindle, their lower edge resting on the record platform, then lower overarm.
3. Move the left-hand knob to "Start." The motor will start and the Changer operate.  
When the last record has been played, the Changer will automatically stop.  
To remove records, raise overarm and withdraw the record spindle.  
To reject a record, move the left-hand knob to the reject position.  
The Changer can be stopped by moving the left-hand knob to the "Stop" position.

If the Changer is switched off while a record is playing, that record will be automatically rejected, and the next record commence when switching on again.

If desired a 10" record may be repeated any number of times by placing the record on the turntable, raising the overarm and switching on with no records on the record spindle. When it is desired to stop the record, lower the overarm, and the Changer will automatically switch off at the end of the record.

This cannot be done with 12" records as the pick-up arm will automatically come to the 10" position when there are no records on the platform.

Should the Record Changer be stopped with the pick-up arm not on its rest, the pick-up should not be handled, but the left-hand knob moved to "Start," the pick-up will then return to its rest.

When the Changer is fitted with a High Fidelity Pick-up of any type, extra care should be taken to avoid accidental damage to the pick-up, and attention should be given to the following points:—

The Changer should not be switched off either by the switch on the Changer, the switch on the set, or the house switch during its changing cycle, as this may lead to the pick-up being lowered on to the turntable covering when the Changer is next used.

If it is suspected that the Changer has been switched off in the wrong position, place a 12" record on the Turntable before switching on.

Do not use badly warped records, they may not drop and the pick-up will lower on the Turntable covering, also badly warped records will give trouble by slipping during playing. Care should be taken in storing records to prevent contact with dirt and dust which sets up abrasive action and causes rapid wear.

### NEEDLES.

It is emphasized that if for any reason the needle, whether of the permanent or semi-permanent type, is taken out of the pick-up head after it has played even only a part of a record, it should be discarded and not used again, as a small flat is worn on the side of the needle tip which rests on the record and as the needle cannot be put back into the pick-up without turning it slightly the flat will not rest on the record in its original position, and will form a cutting edge to tear up the record groove.

**INSTALLATION**

**DIMENSIONS.**

The cabinet space required for fitting is 15 1/4 in. long by 13 1/4 in. with 5 1/4 in. clearance above and 4 1/4 in. clearance below unit plate.

**FITTING TO CABINET.**

(i) The "GARRARD" Automatic Record Changer is supplied with Spring Suspension to prevent acoustic feedback occurring between the loud speaker and the pick-up. Ample clearance should be left between the edges of the unit plate and the cabinet to allow the Record Changer to float freely. Diagram 2 illustrates the assembly of the spring suspension.

In cases where there is no possibility of acoustic feed-back occurring such as where the loud speaker is in a separate cabinet, the spring suspension is not necessary and the Changer can be screwed down to the motor board with four of the wood screws supplied for the spring suspension.

Two additional holes will be found in the unit plate, these are for transit fixing screws which should be used to fix the Changer rigid to the cabinet during transit, and removed on final installation. These are only necessary when using the spring suspension.

(ii) If desired, a template for cutting the motor board when fitting the Record Changer into the cabinet may be obtained on application to The Garrard Eng. & Mfg. Co. Ltd. After installation see that the Changer is level by placing a spirit level on a

record on the turntable. If not level, adjust by means of the spring suspension fixing nuts. Finally, the nuts and threads of the spring suspension fixing screws should be coated with a locking paint such as shellac varnish to prevent the nuts working loose due to vibration.

**SPEED SETTING.**

Due to the wide voltage range of the motors it may be necessary on some power supplies when installing the unit to make a slight re-adjustment of the speed Indicator Lever so that the speed of the Turntable corresponds with that shown on the Indicator scale.

To set the speed on alternating current power supply of 50 or 60 cycles use the "GARRARD" Stroboscopic Speed Indicator enclosed with each Record Changer. To set speed on direct current power supply or supplies having frequencies other than those covered by the stroboscope, the turntable should be checked with a watch. Set speed so that turntable revolves at 78 r.p.m., remove the turntable and carefully loosen the screw holding the indicator lever to the vertical brake shaft, move the indicator lever to the centre position on the indicator plate and tighten up the screw (diagram 3). On some models the screw is not accessible from the top of the unit. In this case lift the changer from the cabinet and adjust the screw from underneath the unit plate. The speed should now be correct.

One side of the stroboscopic speed indicator is designed for use in adjusting speed on a 50 cycle, and the other side a 60 cycle power supply.

**VOLTAGE.**

The "GARRARD" Model R.C.65 Record Changer is made in two types:—

R.C.65/D.16 Dual Voltage Range 100/130 and 200/250 volts 40/60 cycles.

R.C.65/U.16 Universal Voltage Range 100/130 and 200/250 volts D.C. and A.C. 25/60 cycles.

On installation, the links in the terminal block should be set to the correct position to correspond with the voltage of the power supply, as shown in diagrams 4 to 7.

A red terminal block cover is fitted to the Universal type (R.C. 65/U.16).

A brown terminal block cover is fitted to the A.C. type (R.C. 65/D.16).

The motor should be earthed by connecting a lead from the earthing tag, located under one of the motor end cover screws and a good earth connection.

When adapting an A.C./D.C. (Universal) Radio Receiver, Amplifier or one using a D.C. Power Pack for the reproduction of gramophone records, a pick-up transformer or condensers in series with the pick-up leads should be fitted, otherwise the pick-up circuit becomes alive. Also, the leads from the radio set or amplifier to the pick-up should be as short as possible to prevent picking up mains hum.

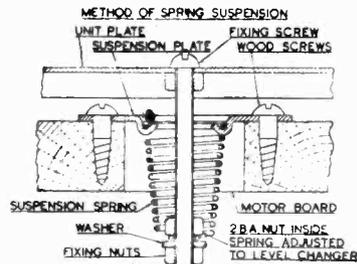


Diagram 2.

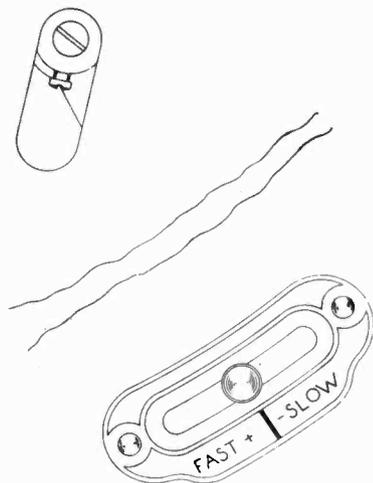


Diagram 3.

CONNECT BOTH BARS THUS FOR 200/250 VOLTS.

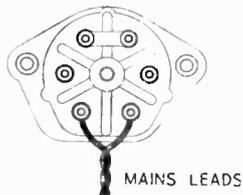


Diagram 4.

Link Connections, RC 65 D 16

CONNECT BARS THUS FOR 100/130 VOLTS.

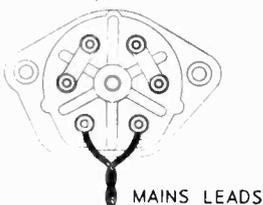


Diagram 5.

CONNECT BOTH BARS THUS FOR 200/250 VOLTS.

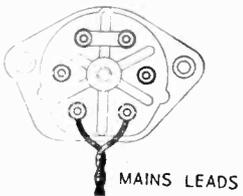


Diagram 6.

Link Connections, RC 65 U 16

CONNECT BOTH BARS THUS FOR 100/130 VOLTS.

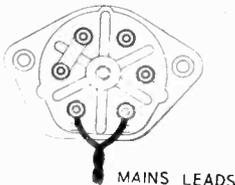


Diagram 7.

## SERVICE ADJUSTMENTS

### MOTORS.

The R.C. 65/D.16 is fitted with a governor controlled Induction Motor for use on A.C. only. The stator coils are connected in series on the high voltage range and in parallel on the low voltage range.

The R.C. 65/U.16 is fitted with a governor controlled series wound universal motor for use on A.C. or D.C., and in this case the windings are connected in series with a voltage dropping resistance, a portion of which is shorted out when the motor is used on the low voltage range. A condenser is connected across a section of the resistance to keep the motor torque constant over the frequency range when on A.C.

### OILING.

Due to the oil retaining bearings, the motor only requires oiling at intervals depending upon the length of time the Record Changer is used. Lift off the Turntable and the oil holes (diagram 1) are accessible. A few drops of "GARRARD" or thin lubricating oil are sufficient.

Wavy or watery reproduction of the record is often due to dry governor pads. These should be lubricated by saturating the felt pads with a thin oil. Occasionally the governor will rattle badly and the reproduction will be distorted. This is caused by the surface of the governor spindle, on which the governor sleeve slides as the balls fly outwards, becoming dry, and it should be lubricated with a thick oil.

Thick oil should on no account be used for the motor bearings.

### STARTING FAILURES.

If the motor fails to start when the control knob is turned to the Start position, first check the power supply and ascertain that the current is reaching the motor terminals. Give the turntable a turn by hand to help it round, in case, when the Record Changer was last used, the motor was switched off during the changing cycle, in which case it is possible for the motor to be unable to start under the full load of the Record Changing Mechanism.

Disconnect the mains supply and examine the terminal block to see that the leads and nuts are tight, also examine the switch contacts, clean and adjust if necessary. If a thick oil has been used to lubricate the motor bearings, the motor will appear weak, and pos-

sibly not start. It will be necessary to dismantle the motor, and clean away all traces of the thick oil, it is, therefore, essential to lubricate the motor bearings with a good quality thin machine oil.

In the case of the U.16 Motor periodical examination of the carbon brushes should be made. If they are allowed to become dirty or worn, brush noises will occur, and occasionally the motor may run unsteadily or stop. The brushes can be cleaned by lightly scraping the contact surface with a penknife. The brushes should be a perfectly free sliding fit in the brush tubes. It is essential the brushes should be replaced in the same holder and in the same way round as originally found.

New brushes are  $\frac{9}{16}$ " long under the Springs. When worn down to  $\frac{3}{8}$ ", they should be replaced. To remove the brushes unscrew the brush caps and the brushes can be withdrawn. If the copper Commutator upon which the brushes rest has become corroded, dirty or greasy, it should be cleaned with a rag damped with petrol or lighter fuel. When finally replacing the brushes always ensure that the brush caps are screwed up tight. Should the motor get too hot first see that the voltage changeover links are set correctly to correspond with the voltage of the power supply. To check the motor windings insert a milliammeter in either motor lead. The maximum current should not exceed:—

R.C. 65/D.16	High Range	0.11 amp.
	Low Range 50 cycles	0.22 amp.
	Low Range 60 cycles	0.24 amp.
R.C. 65/U.16	High Range A.C.	0.15 amp.
	Low Range A.C.	0.14 amp.
	High Range D.C.	0.16 amp.
	Low Range D.C.	0.19 amp.

If readings in excess of the above figures are obtained, the motor units or coils should be returned to our Service Department for examination.

If the motor has to be removed from the Record Changer, disconnect the switch leads from the switch and remove the clips holding the leads, then remove the motor fixing screws and the motor can be withdrawn. When withdrawing the motor note carefully how the divided speed control lever parts in two, so that it may be correctly re-assembled when the motor is replaced.

Now refit this screw in an adjacent hole according to the adjustment required. Moving the screw to a hole nearer the platform lengthens the link and increases the inward movement of the platform. By moving the screw in the opposite direction the link is shortened and the outward movement of the platform increased. The permissible adjustment is one hole in either side of existing position of the screw.

### RECORDS FAILING TO DROP.

If the records fail to drop correctly, the angle of the record spindle should be checked from the template printed at the end of this manual and corrected if necessary, using great care in doing this as the thin neck of the spindle is very easily broken if unduly bent. If the spindle is correct slide off the name plate on the record platform cover and examine the record pushing pawl (diagram 8). It will be noted that the lower rear tail of this pawl engages a stop at the back of the platform as the platform moves back when a 10" record is to be played. When a 12" record holds the pawl down the lower tip passes over the stop. When the platform is in the playing position, that is, when the changing cycle has finished and the needle is playing the record there should be a gap of approximately  $\frac{1}{8}$ " between the rear of the pushing pawl and the front of the stop. If this gap is incorrect, the stop can be

adjusted by releasing its two fixing screws and moving it backwards or forwards as necessary, finally re-tightening the screws.

### OVERARM.

Note that when a batch of records is on the record spindle and the overarm is lowered thereon, only the pad nearest to the platform should rest on the records. There should be a gap of approximately  $\frac{1}{4}$ " between the other pad and the surface of the top record. This side of the overarm only comes into action when the last record is a 10". It then prevents the record tipping as the platform moves back leaving the record balanced on the record spindle.

### RECORD SPINDLE.

Should an intermittent squeak develop it is probably due to the anti-slip sleeve on the spindle having become dry and may be cured by putting a spot of thin oil between the sleeve and the spindle.

### TEMPLATE FOR R.C.65 RECORD SPINDLE.

Should the record spindle be accidentally bent out of position through being dropped or other reasons, the record dropping will be affected. If trouble is experienced with erratic record dropping, lay the record spindle on template and check that it conforms to the shape thereof.

**PICK-UP DROPPING POSITION.**

The pick-up arm has been finely adjusted so that the needle comes on to 10in. records in a  $9\frac{3}{8}$ in. diameter circle and 12in. records in a  $11\frac{1}{8}$ in. diameter circle. These positions were arrived at after checking a very wide selection of records of various makes.

There may be a few records where the record track starts further away from the centre, (i.e., nearer the edge), and in these exceptional cases the needle may alight on the record a few grooves from the start. If the pick-up dropping position were set for these exceptional discs it would not be suitable for average records.

Should the dropping position of the pick-up require adjustment the pick-up adjusting screw—accessible through a hole in the unit plate (diagram 1)—should be turned with the Changer in its start position; that is, with the pick-up arm on its rest.

The pick-up adjusting screw should be turned either to the right or left, according to requirements. A quarter of a turn in either direction will give you the maximum adjustment. After adjustment, switch on, check the dropping position and re-adjust if necessary.

**PICK-UP HEIGHT.**

The Pick-up should lift sufficiently high for a long needle to just clear the surface of the eighth record on the turntable when the pick-up returns to its rest. If it is necessary to adjust the amount of lift look for the "Adjustment for pick-up lift" shown on diagram 3.

When viewing from back of the Record Changer, this adjustment is immediately underneath the pick-up arm pivot spindle and appears as two similar screw heads. The left-hand head is the locking screw and the right-hand head is the eccentric adjustment screw. To adjust this, first operate the changer and stop when the pick-up arm is moving back across the record to its rest. Loosen the two nuts on the back of the screws, then turn the eccentric adjustment screw as necessary to give the correct height. One half a turn of this screw will give the maximum amount of adjustment. After making the necessary correction, re-tighten the nuts on the back of the screws.

**AUTO-TRIP MECHANISM.**

The satisfactory operation of the Record Changer depends upon the operation of the auto trip. Occasional adjustment of the auto trip friction spring may, therefore be necessary.

If, at the end of a record, the auto trip does not operate—that is, the pick-up remains at the end of a record—first see that the record has a run-off groove in its centre (as only records with run-off grooves can be played automatically on Record Changers). If the record is in order in this respect see that the trip lever is clear of the unit plate, since any added friction here will prevent it moving in towards the striker. If it is quite free, increase the tension of the friction spring by turning the auto trip friction adjustment screw (see diagram 1) in a counter-clockwise direction; about half a turn is all that should be necessary. This screw is accessible on removing the turntable. Should the changer operate before the end of a record, or a bumping or tapping noise be audible, first examine the trip lever rubber and if it is worn, give it half a turn to present a new surface to the striker. If badly worn, renew. If trip lever rubber is in good condition, reduce the tension of the friction spring by giving the auto trip friction adjusting screw (see diagram 1) half a turn in a clockwise direction.

**RECORD PLATFORM ADJUSTMENT.**

When despatched from our Works the record platform is set to accommodate records of average dimensions. Occasionally, however, records may be found outside the normal limits; if necessary, therefore, the platform may be adjusted to take them.

To control the platform movement are two adjustable links, each fitted with two screws. One link, with its pivot at the bottom of the platform lever, controls the platform tilt, whilst the other controls the distance the platform pushes inward (see diagram 8).

It is this latter link which may be adjusted to accept records differing from the normal in diameter. To do this, loosen the screw further away from the platform and remove the other screw.

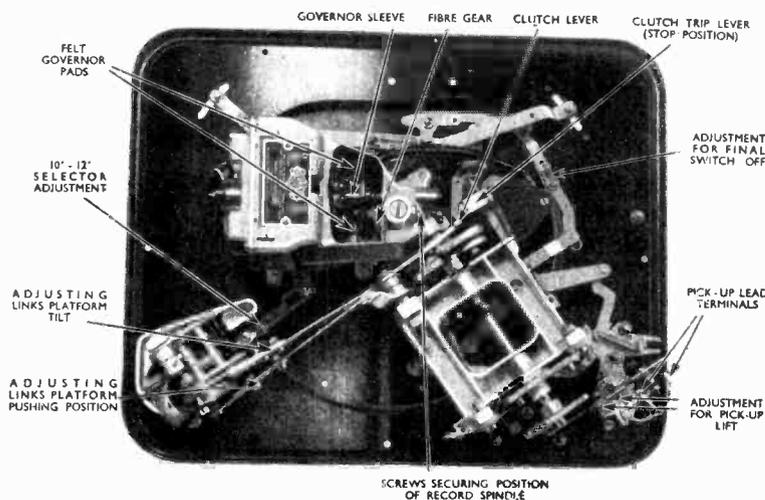


Diagram 8.

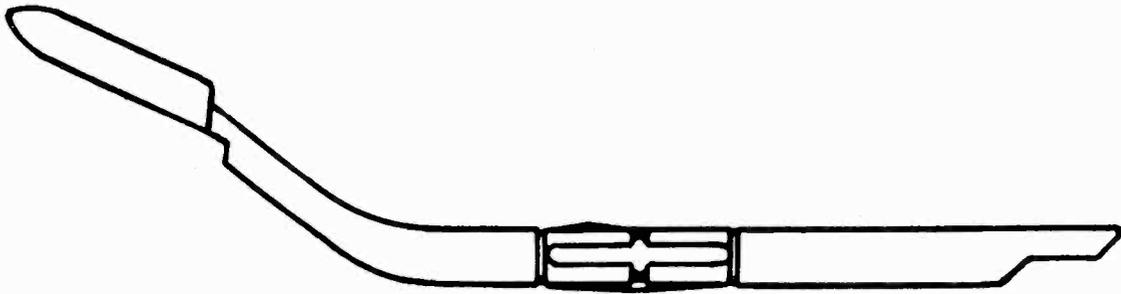


Diagram 9.

### ADJUSTMENT TO PICK-UP

"GARRARD" Magnetic types of pick-up are interchangeable with the Crystal type or vice-versa without alteration to the pick-up arm on these Record Changers, provided the pick-up is fitted in a "GARRARD" Head.

All "GARRARD" pick-up heads are of the plug-in type, connections being made by two plugs and sockets at the back of pick-up head.

To remove the pick-up head, unscrew the pick-up fixing screw, withdraw the pick-up, easing the pick-up lead under the arm, and remove the two plug connections from back of pick-up.

If reproduction ceases, or becomes distorted when fitted with a "GARRARD" standard magnetic pick-up, first make sure that the amplifier is in order. Should this be found satisfactory, a slight adjustment to the pick-up may be necessary or the damping rubber may need renewing.

To examine the pick-up proceed as follows: Unscrew the two screws to be found underneath the head, (do not touch the two screws located on each side of the needle), and remove the pick-up unit from the head, then, viewing the front of the pick-up examine the armature to see that it is in the centre of the gap between the pole pieces.

If it is touching one of the pole pieces it must be re-centred. To do this, loosen the two screws holding the adjusting plate, sliding the latter until the armature is in the centre, then retighten the screws.

If the armature will not retain its centre position, it will be necessary to renew the damping rubber. This can be done by removing the adjusting plate, replacing the rubber and re-assembling the plate.

Adjust the plate until the armature is centred before tightening the screws.

The top damping rubber tends to perish in time. It should, therefore, be replaced whenever it appears that the needle stiffness has increased, otherwise excessive record wear may occur.

Distortion may be caused by dirt or foreign matter in the gap between the pole pieces. To remedy, remove the adjusting plate and damping rubber and clean gap.

The pick-up coil winding can be checked for continuity with an ohmmeter.

If a Crystal or High Fidelity Pick-up is suspect, the pick-up head should be returned for examination. A continuity test cannot be carried out on Crystal pick-ups with an ohmmeter.

Crystal Cartridges or High Fidelity Pick-ups must not be opened or the manufacturers will disclaim all responsibility.

### SPARE PARTS LIST FOR R.C.65

NAME OF PART	NUMBER	NAME OF PART	NUMBER
Record Spindle	A.45380A	Motor Field Coils U.16	A.47775
Turntable	A.45390	Change Over Block Cover D.16 Brown	B.45473
Turntable Cover	A.45395	Change Over Block Cover U.16 Red	A.46806
Main Spindle with Fibre Gear	A.45348	Motor Resistance complete U.16	A.47778
Pick-up Arm	B.47654	Spring Trip Lever	A.41602
Overarm Bracket	B.47597	Auto Trip Friction Spring	A.41513
Pick-up Connector Assembly	A.47592	Auto Trip Lever Rubber Bush	A.47247
Pick-up Lead D.16	A.47786	Switch Contact Spring	A.41597
Pick-up Lead U.16	A.47787	Pick-up Top Damping Rubber	A.45303
Platform Bracket	B.47438	Rotor Spindle with Rotor	A.45337
Platform	A.45150	Screw securing Pick-up Head	A.40241
Governor Spring D.16	A.41520	Carbon Brush and Spring U.16	A.46319
Governor Spring U.16	A.41572	Brush Cap U.16	A.46409
Motor Stator Coils D.16	A.47750		

MODEL 70

GARRARD ENG. &amp; MFG. CO. LTD.

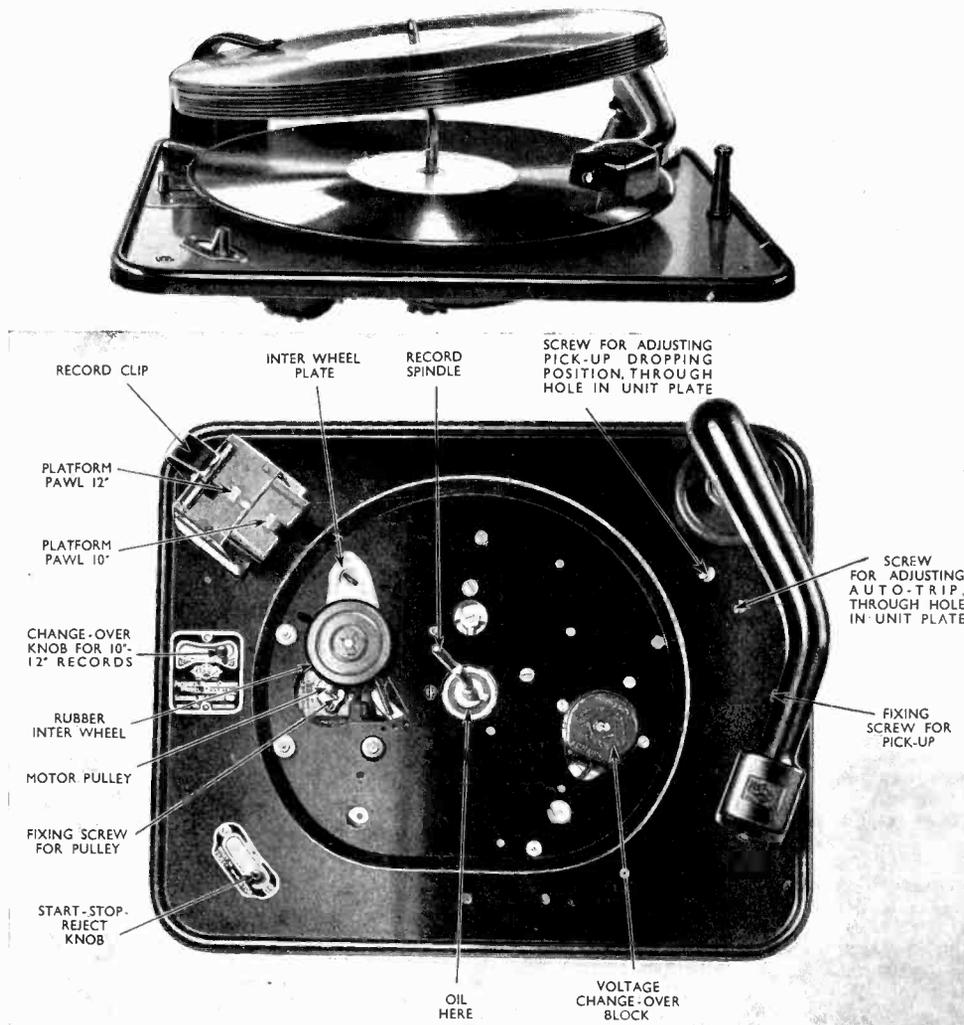


Diagram 1.

## OPERATING INSTRUCTIONS

The "GARRARD" Model R.C.70 Automatic Record Changer will play any number of records up to ten 10" records or ten 12", not mixed.

To operate the Record Changer proceed in the following order:—

1. If a permanent needle is not used, lift the pick-up head and insert a needle of the type that will play ten or more records. On some models the pick-up head will turn to facilitate needle changing.
2. Place the record spindle in position, the sloping part leaning toward the record platform. Set the record selector knob to 10" or 12" according to the size of the records it is desired to play, raise the record clip and place any number up to ten records on the record spindle, their lower edge resting on the record platform, then lower the record clip.
3. Move the front left-hand knob to "Start." The motor will commence to run and the changer operate. When the last record has played, the changer will automatically switch off. To remove the records, raise the record clip and withdraw the record spindle.

To reject a record, move the left-hand knob to the "Reject" position.

The changer can be switched off by moving the left-hand knob to the "Stop" position. If this is done while a record is playing, that record will be automatically rejected and the next record commenced when switching on again.

If desired, one record may be repeated any number of times by placing the record on the turntable, setting the Selector Knob to the size of the record, and switching on with no records on the record spindle and the record clip raised.

When it is desired to stop the record, lower the Record Clip and the changer will automatically switch off at the end of the record.

### NOTE.

Should the record changer be stopped with the Pick-up Arm not on its rest, the pick-up should not be handled but the left-hand knob moved to "Start." The Pick-up Arm will then return to its rest.

When the Changer is fitted with a High Fidelity Pick-up of any type, extra care should be taken to avoid accidental damage to the Pick-up and attention should be given to the following points:—

The Changer should not be switched off, either by the switch on the changer, the switch on the set, or the house switch during its changing cycle as this may lead to the pick-up being lowered on the turntable felt when the changer is next used. If it is suspected that the changer has been switched off in the wrong position, place a 12" record on the turntable before switching on.

Do not use badly warped records, they may not drop and the pick-up would lower on the turntable felt, also badly warped records will give trouble by slipping during playing.

Care should be taken in storing records to prevent contact with dirt and dust which sets up abrasive action and causes rapid wear.

### MAINTENANCE.

The motor and intermediate wheel bearings being the oil retaining type will rarely need lubricating. When the need for oil is apparent a few drops of fine machine oil is all that is necessary.

The rubber rim on the intermediate wheel **must** be kept free of oil.

### INSTALLATION

#### DIMENSIONS.

The Cabinet space required for fitting is 15½ ins. long by 13 ins. wide with 5½ ins clearance above and 2½ ins. clearance below the plate.

Loudspeaker and pick-up. Ample clearance should be left between the edges of the unit plate and the cabinet to allow the Record Changer to float freely. Diagram 2 illustrates the assembly of the spring suspension.

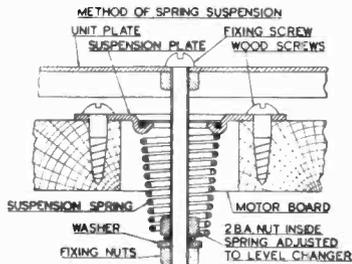


Diagram 2.

In cases where there is no possibility of acoustic feed back occurring, such as where the loud speaker is in a separate cabinet, the spring suspension is not necessary and the changer can be screwed down to the motor board with four of the wood screws supplied for the spring suspension.

Two additional holes will be found in the unit plate; these are for transit fixing screws which should be used to fix the changer rigid to the cabinet during transit and removed on final installation. These are only necessary when using the spring suspension.

If desired, a template for cutting the motor board when fitting the record changer into a cabinet may be obtained on application to The Garrard Engineering & Manufacturing Co. Ltd.

After installation see that the Changer is level by placing a spirit level on a record on the turntable. If not level, adjust by means of the spring suspension fixing nuts. Finally, the nuts and threads of the spring suspension fixing screws should be coated with a locking paint such as shellac varnish to prevent the nuts working loose due to vibration.

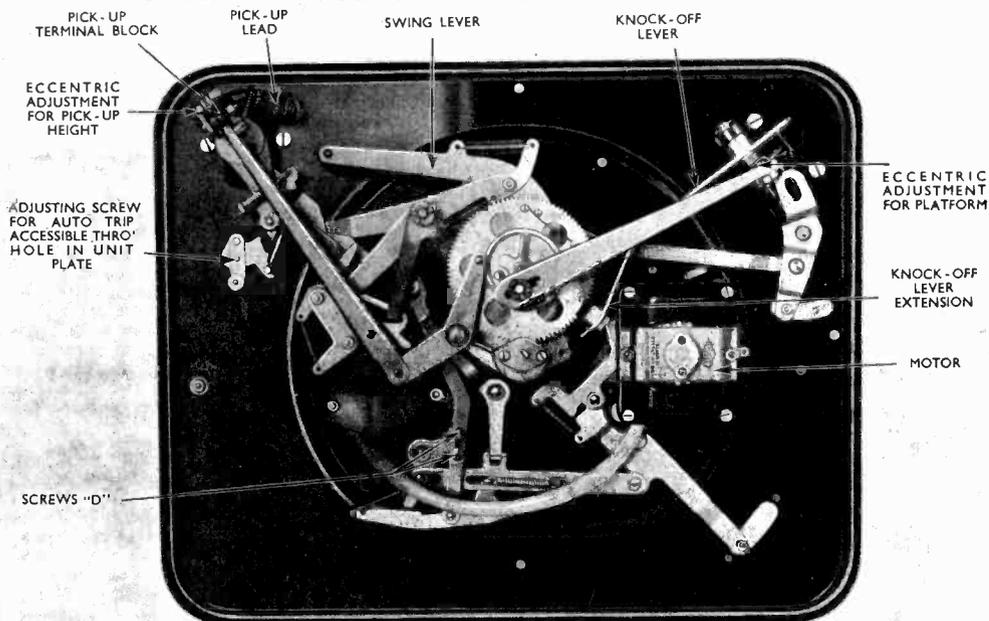


Diagram 5.

#### FITTING TO CABINET.

The "GARRARD" Model R.C.70 Automatic Record Changer is supplied with spring suspensions to prevent acoustic feed back occurring between the

#### VOLTAGE.

The "GARRARD" Model R.C.70 Record Changer is suitable for use on 100/130 and 200/250 volts 50 cycles.

A motor driving pulley can be supplied for 40 or 60 cycle mains if desired.

On installation, the links on the terminal block should be set to the correct position to correspond to the voltage of the power supply as shown in diagrams 3 and 4.

The links are set for operating on the 200/250 volts range when the changer leaves the factory, and need only be altered if it is required for use on the 100/130 volt range.

CONNECT BOTH BARS THUS FOR 200/250 VOLTS.

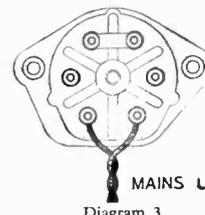


Diagram 3.

CONNECT BARS THUS FOR 100/130 VOLTS.

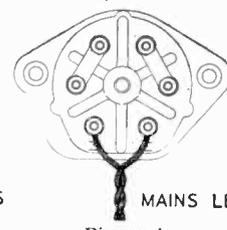


Diagram 4.

The motor should be earthed by connecting a lead from the earthing tag, located under one of the motor end cover screws and a good earth connection.

When adapting an A.C./D.C. (Universal) Radio Receiver, Amplifier or one using a A.C./D.C. Power Pack for the reproduction of gramophone records, a pick-up transformer or condensers in series with the pick-up leads should be fitted, otherwise the pick-up circuit becomes alive. Also the leads from the radio set or amplifier to the pick-up should be as short as possible.

## SERVICE ADJUSTMENTS

### SPEED.

No adjustment for speed is provided on this model, there being no governor, and the motor being of the constant speed induction type, maintains the turntable at 78 r.p.m.

It is essential that the driving surface of the small brass pulley on the motor spindle, the rubber tyred pulley and the drum of the turntable, be kept absolutely free from all oil or grease. If the speed should become slow or varying, this is the first point that should be checked, and the pulley drum and intermediate wheel should be cleaned with a rag and a few spots of petrol or lighter fuel.

### MOTORS.

If the motor fails to start when the control knob is turned to "start," first check the power supply and ascertain if current is reaching the motor terminals.

Next disconnect the mains supply and examine the terminal block and see that the leads and screws are tight, also examine the switch contacts accessible underneath, clean and adjust if necessary.

If a thick oil has been used to lubricate the motor bearings the motor will appear weak or will not start. It will be necessary to dismantle the motor and clean away all traces of the thick oil. It is, therefore, essential to lubricate the motor bearings with a good quality thin oil.

Should the motor get too hot, see that the voltage change over links are set correctly to correspond with the voltage of the power supply. If correct, check the motor windings by inserting an A.C. milli-ammeter in either motor lead. The maximum current consumption should not exceed 100/130 volts, 50 cycles, 0.26 amp., 200/250 volts, 50 cycles, 0.13 amp.

If readings in excess of the above figures are obtained, the motor unit should be returned for examination.

To remove the motor, first make sure the electricity supply is disconnected, then remove the insulated plate on the underside of the terminal block, underneath the plate will be disclosed the nuts on the screws securing the terminal block to the unit plate—these should be unscrewed and the screws lifted out. The terminal block will then be free from the unit plate and only attached to the motor leads.

Next, while supporting the motor underneath, unscrew the nuts on the three suspension screws, which secure the motor to the unit plate. Before drawing the motor away from the unit plate, make a careful note of the sequence of steel and rubber washers on each suspension screw in order to reassemble correctly when refitting the motor. This is important as the height of the motor in relation to the intermediate wheel is critical.

### PICK-UP DROPPING POSITION.

The Pick-up Arm has been finely adjusted so that the needle comes on to 10 in. records in a 9 $\frac{3}{8}$  in. diameter circle and 12 in. records in a 11 $\frac{3}{8}$  in. diameter circle. These positions were arrived at after checking a very wide selection of records of various makes.

There may be a few records where the record track starts further away from the centre (i.e., nearer the edge), and in these exceptional cases the needle may alight on the record a few grooves from the start of the record. If the pick-up dropping position were set for these exceptional records it would not be suitable for average records.

Should the dropping position of the pick-up require adjustment, the pick-up adjusting screw—accessible through a hole in the unit plate, see Diagram 1, should be turned with the changer in its start position, that is, with the pick-up arm on its rest.

The pick-up adjusting screw should be turned either to the right or left, according to requirements. A quarter of a turn in either direction will give you the maximum adjustment. After adjustment, switch on, check the dropping position and re-adjust if necessary.

### PICK-UP HEIGHT.

If desired the pick-up height can be adjusted by loosening the nut securing the "Eccentric adjustment for pick-up height," Diagram 5, and adjust the eccentric pivot with screwdriver in slot at back. Finally retighten locking nut.

### CAUTION.

When making any adjustments to the Pick-up Arm, it should NEVER on any account be forced into position. If the turntable is turned by hand it should NOT be turned backwards.

If the pick-up does not run into the record grooves after alighting on the record edge, see that the record changer is level by placing a spirit level on a record on the turntable. Also make sure that the flexible wire leading to the pick-up is not twisted or held in such a manner as to prevent the free movement of the pick-up arm; also see that the associated levers are free.

### AUTO TRIP MECHANISM.

The auto trip mechanism is set to operate when the needle reaches a 1 $\frac{1}{8}$  in. radius, or if it oscillates in an eccentric groove.

Occasionally records having a smaller or larger radius at the end of the playing grooves, are encountered. If it is desired to adjust the mechanism to take these exceptional records, the screw visible through hole in unit plate (Diagram 1) should be adjusted.

To make the trip operate earlier for larger radius records loosen the screw, and holding the pick-up arm steady, move the screw a shade towards the turntable. To make the trip operate later for small radius records, move the screw away from the turntable.

After each adjustment check with record, and re-adjust if necessary. Finally retighten the screw.

It is emphasised that this screw should be moved a barely visible amount at each adjustment.

### RECORD PLATFORM ADJUSTMENT.

When despatched from our Works the record platform is set to accommodate records of average dimensions. Occasionally, however, records may be found outside the normal limits; if necessary, therefore, the platform may be adjusted to take them.

To set the platform, the nut locking the "Eccentric adjustment" for Platform, Diagram 5, should be loosened, and with the mechanism set for 12 inch records, the pick-up arm in the playing position, and the largest 12 inch record available loaded on the platform, turn the "Eccentric Adjustment" until there is a gap of not more than  $\frac{1}{8}$ " between the edge of the record and the front edge of the platform pawl. Finally retighten the locking nut.

If the changer fails to drop either 10" or 12" records, the above adjustment should be carried out.

### AUTO STOP.

When the last record on the platform drops on to the turntable, it allows the record clip to fall and this unlocks the auto stop which should switch off the motor at the end of the record. If when the last record has been played and the record clip has fallen the mechanism does not automatically stop, the following procedure should be carried out.

1. Compare the underside of the record changer with diagram in the Service Manual and find the "Swing Lever" and the "Knock-off Lever." Note that in the upper edge of the knock-off lever there is a step. With the record clip lowered and the needle removed from the pick-up head, start the changer with a hand on the turntable, slow it down to the slowest possible speed at which the mechanism will operate. Move the control lever to the "Reject" position. The swing lever should now move outwards until it engages the step on the knock-off lever and should remain engaged until the record changer switches off. If the swing lever does not engage the step but passes over it, proceed as at (a) to correct. If the swing lever engages in the step, set as at (b) following.

- (a) Load two records on the platform spindle in the usual way. Lower the record clip and start the changer. The first record will now drop on to the turntable leaving one remaining on the platform. Again, with the hand operating as a brake to slow down the turntable, move the control lever to the "Reject" position. The tip of the step on the knock-off lever should now clear the surface of the swing lever in its outward movement by  $\frac{1}{64}$ ". If this dimension is incorrect, stop the changer when the swing lever is directly over the step in the knock-off lever. The knock-off lever is divided into two parts which are held together by a screw

- and a rivet. Loosen the screw to adjust the height of the lever until the 1/64" clearance is obtained, then retighten the screw. Finally re-check the changer with the record clip lowered to ensure that the swing lever engages the step. Should the auto stop still fail to operate, set as at (b) below.
- (b) Loosen the screws at D (Diagram 5) and bring the two parts of the lever together in order to shorten slightly the effective length and retighten the screws. Check and repeat the adjustment if necessary until changer operates correctly.

**PICK-UP.**

"GARRARD" Magnetic types of pick-ups are interchangeable with the Crystal type or vice-versa without alteration to the pick-up arm on these Record Changers, provided the pick-up is fitted in a "GARRARD" head.

All "GARRARD" pick-up heads are of the plug-in type, connections being made by two plugs and sockets at the back of the pick-up head.

To remove the pick-up head, unscrew the pick-up fixing screw, withdraw the pick-up, easing the pick-up lead under the arm, and remove the two plug connections from back of pick-up.

If reproduction ceases, or becomes distorted when fitted with a "GARRARD" standard magnetic pick-up, first make sure that the amplifier is in order. Should this be found satisfactory, a slight adjustment to the pick-up may be necessary or the damping rubber may need renewing.

To examine the pick-up proceed as follows:—

Unscrew the two screws located underneath the Base Plate of the Pick-up Head, when the plate carrying the pick-up unit can be removed from the cover. Be careful not to loosen or disturb the two screws located one each side of the needle holder on the inclined portion of the base plate, otherwise the adjustment of the pole pieces will be upset. By viewing the pick-up unit from the front, examine the armature to see that it is in the centre of the gap between the pole pieces.

If it is touching one of the pole pieces, it must be re-centred.

To do this, loosen the two screws holding the adjusting plate, sliding the latter until the armature is in the centre, then tighten the screws.

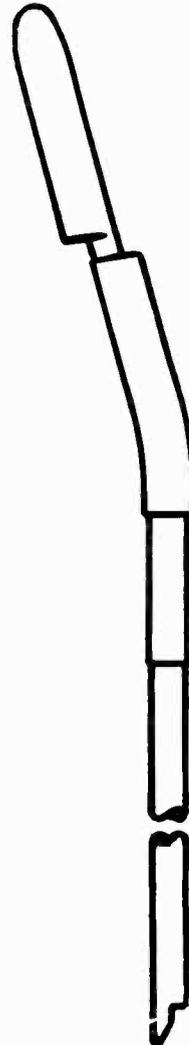


Diagram 6.

If the armature will not retain its centre position, it will be necessary to renew the damping rubber. This can be done by removing the adjusting plate, replacing the rubber and re-assembling of the plate.

Adjust the plate until the armature is centred before tightening the screws.

The top damping rubber tends to perish in time. It should, therefore, be replaced whenever it appears that the needle stiffness has increased, otherwise excessive record wear may occur.

The pick-up coil winding can be checked for continuity with an ohmmeter.

If a Crystal or High Fidelity pick-up is suspect, the pick-up head should be returned for examination. A continuity test cannot be carried out on Crystal pick-ups with an ohmmeter.

Crystal Cartridges or High Fidelity Pick-ups must not be opened or the manufacturers will disclaim all responsibility.

**TEMPLATE FOR RC 70 RECORD SPINDLE.**

Should the record spindle be accidentally bent out of position through being dropped or other reasons, the record dropping will be affected. If trouble is experienced with erratic record dropping, lay the record spindle on the template and check that it conforms to the shape thereof.

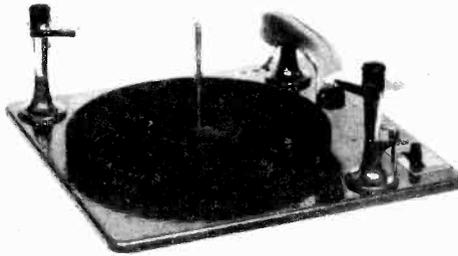
**SPARE PARTS LIST FOR RC 70**

Name of Part.	Ref. No.	Name of Part.	Ref. No.
Record Spindle	A.47408	Pulley (50 cycles)	A.47216
Turntable	B.46744	Pulley (60 cycles)	A.47226
Turntable Cover	A.45395	Cover for Change Over Block	B.45473
Main Spindle Unit	A.46509	Screw for Cover	A.40045
Pick-up Arm	B.47654	P.U. Needle Screw	A.40048
Record Clip	A.46582	Trip Pawl	A.47273
Pick-up Spindle Unit	A.46584	Spring for Trip Pawl	A.41602
Pick-up Lead	A.47786	Switch Contact Spring	A.41597
Platform Housing	A.46572	Pick-up Top Damping Rubber	A.45303
Platform	B.46564	Rotor Spindle with Rotor	A.47168
Inter Wheel Unit	A.46529		



GENERAL ELECTRIC CO.

MODEL P2



### GENERAL

This record changer is designed to operate from a power supply of 105-125 volts a-c, 60 cps. It will automatically play twelve 10-inch records or ten 12-inch records at a single loading.

### MANUAL OPERATION

1. Turn selector arm knobs so that the blades will permit a record to slip down the spindle onto the turntable.
2. Move the control knob to the MANUAL position.
3. Gently place tone arm on the first groove of record and when finished playing return the tone arm to its rest position.
4. Stop turntable rotation by moving switch plate knob to the OFF position.

### AUTOMATIC OPERATION

1. Lift and rotate the selector knobs and position them for 10-inch or 12-inch records, as desired. The arrow should point directly at the spindle.
2. Place up to either twelve 10-inch or ten 12-inch records on selector arms. Do not intermix 10- and 12-inch records.
3. Move control knob on switch plate to REJECT position and release it. The changer will now play the entire stack and repeat the last record.
4. To shut off the record changer before or after all records are played, move control knob to OFF and lift the tone arm and move out to the rest position.
5. If you wish to reject a record before it has finished playing, move the control knob to REJECT and release it. The changer will reject the record and then continue to play the remainder of the stack.
6. To unload records, turn the control knob to OFF. Remove any remaining records on the selector arms. Lift and turn selector arm knob until arm clears records, then remove records from turntable.

### OPERATION PRECAUTIONS

1. Use only unwarped records for automatic operation. For warped, odd-size or home-recorded records, play as for manual operation.
2. Never use force to start or stop the motor or any part of the record changing mechanism.
3. Do not store the records on the record post or on the turntable as they may warp, especially if the temperature is high.
4. Do not allow oil or grease to come in contact with the drive wheels or any rubber part.

### LUBRICATION

Use light grease (Lubriplate or equivalent) on the following:

1. Cam surfaces.
2. Gear teeth.

Use light machine oil on the following:

1. All shafts.
2. Turntable spindle.

Do not lubricate:

1. Clutch engagement lever (6).
2. Idler wheel rim.
3. Turntable rim.

### PICK-UP

A special General Electric magnetic pick-up is used with this changer which will give superior results from the standpoint of high fidelity, low surface noise, and negligible record wear. This pick-up is not replaceable with a crystal pick-up as the ratio of output levels of the two types is at least 70 to 1, the pick-up supplied having an extremely low output.

The pick-up is supplied with a semi-permanent type stylus. Dust and foreign matter should be removed with a soft brush.

Make sure the stylus arm is centered between stops. The clearance should be maintained on both sides at 9 to 11 mils.

### CYCLE OF OPERATION

**NOTE**—All reference numbers used in this explanation are shown on an illustration.

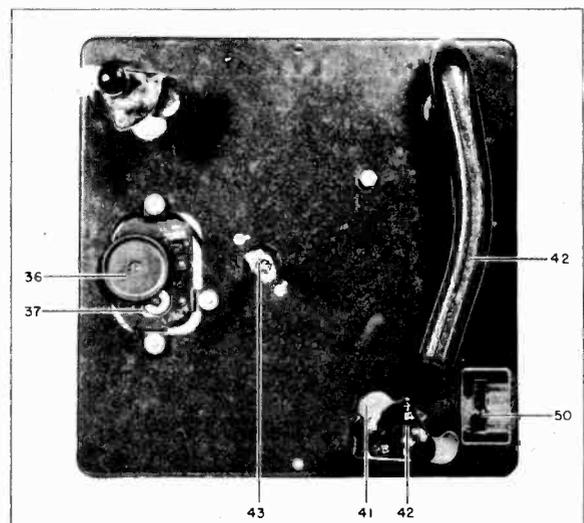
#### INITIATING THE CYCLE:

Pushing the *control button* (50) from OFF to REJECT positions turns the power ON and starts the changer into automatic operation. This movement transferred to the *control slide* (1) causes the *power switch* (2) to be actuated by its arm which rides in the eccentric groove (A) in the control slide. Simultaneously, the *control slide* (1) moves the *reject slide* (4) towards the center of the record changer, which moves the *trip lever* (5) sufficiently to disengage it from the *clutch engagement lever* (6). This *clutch engagement lever* (6) and *trip lever* (5) are mounted on the *drive gear* (8). When the *control knob* is released, it returns from REJECT to AUTO position.

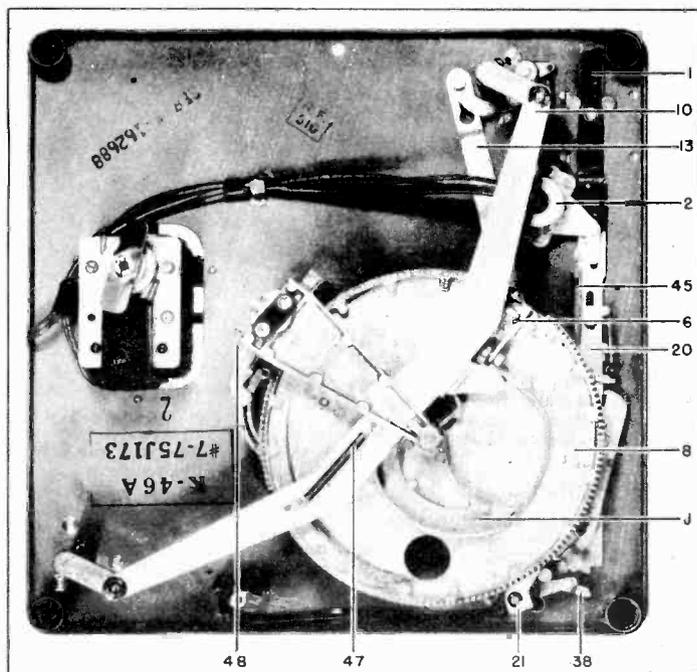
#### CYCLING:

The release of the *clutch engagement lever* (6) caused the *lug* (D) on the rotating *pinion gear* (7) to strike the extended portion of the *clutch engagement lever* (6) so as to push the *drive gear* (8) sufficiently so that its teeth enmesh with the *pinion gear* (7). (The open section of the *drive gear* (8) permits the pinion gear to rotate freely, except during the change cycle.) The rotation of the *drive gear* (8) results in the following cam actions:

1. The vertical *cam* (E) moves the tone arm *lift pin* (9), thus raising the tone arm.
2. The *cam* (J) actuates the *drive link* (10) that induces a quarter turn by which the *selector arms* (42) release a record.
3. *Surface* (H) on the locked *tone arm lever* (11) resets the trip by latching the *clutch engagement lever* (6) to the *trip lever* (5).
4. *Cam surface* (G) moves the tone arm *latch lever* (21) so as to unlatch the *tone arm lever* (11) at the point of latching. Thereafter the *stud* (K) on the *tone arm lever* (11) follows the receding *cam* (F).



Top View of Record Changer



Bottom View of Record Changer

5. Spring pressure from the *tone arm locator* (12) moves the *tone arm lever* (11) and tone arm toward the record. Selector arm settings determine the point at which the *tone arm locator* (12) stops at the surface on the *reset slide* (13).

6. *Stud* (K) is contacted by the *retard lever* (14) holding it in position during the time of the lowering of the needle on the record.

7. *Tone arm lift pin* (9) follows the vertical *cam* (E) on the *drive gear* (8) and lowers the tone arm to the record. After the needle has touched the record, the *booster spring* (15) exerts a slight pressure, causing the needle to enter the starting groove of the record.

8. As the needle starts in the groove, *drive gear* (8) completes its rotation and is locked in open-tooth position by the *drive gear stop lever* (16) in the detent in the *cam* (G).

**TRIP ACTION:**

When the record has finished playing, the needle enters a center spiral groove of the record. This starts a new change cycle by either of two actions releasing the *clutch engagement lever* (6).

1. Minimum diameter cut-off occurs when the *trip shoe* (17) strikes the *trip lever* (5).

2. Eccentric groove cut-off occurs when the tone arm is moved away from the *spindle* (43). The sawtooth edge of the

*trip plate* (fastened to tone arm lever, 11) engages and moves the *trip dog*, causing the *trip lever* (5) to function.

**MANUAL OPERATION:**

With the control knob in the MAN position, the *control slide* (1) causes four conditions to exist.

1. The *motor switch* (2) is turned ON.
2. The end of the *control slide* (1) acting through the *manual latch lock* (38) partially disengages the *tone arm latch lever* (21) from its locked position. It now serves as a detent for the tone arm while in rest position and prevents its movement due to accidental bumping.
3. The *manual lockout* (20) on the *control slide* prevents the *tone arm locator* (12) from moving inward, thereby permitting free movement of the tone arm by hand.
4. The *reject slide* (4) is in position so that the *clutch engagement lever* (6) is held, preventing tripping.

**SERVICE ADJUSTMENTS**

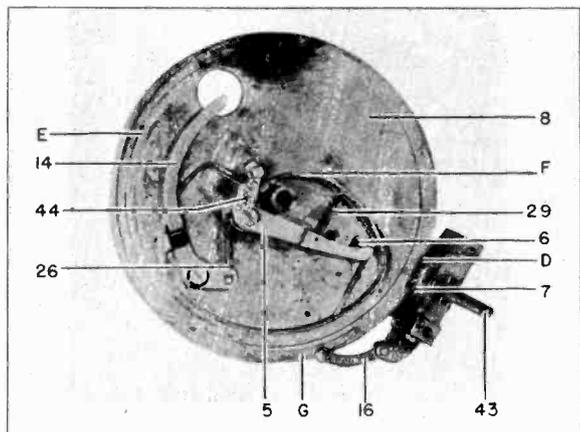
**A. SELECTOR ARM AND BLADE (41) (42):**

The leading edge of the *blades* (41) must be smoothly rounded and well polished. The *blades* (41) must be very free in their mounting so that they will return to normal position by their own weight. The *selector arms* (42) must be parallel with each other, and must be synchronized so that a record will drop evenly onto the turntable.

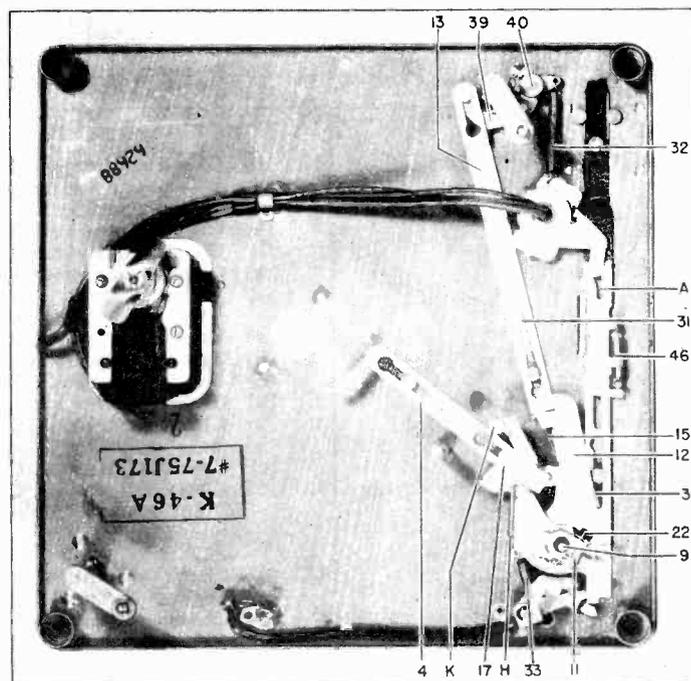
If the blades need adjustment, place a 10-inch record of average thickness (.074 in.) on the selector arms and manually rotate the turntable clockwise until the selector blade contacts the record. The blade must rise after it first contacts the edge of the record. This rising action results whenever pressure is applied to the leading edge of the *selector blade* (41). The blade may be adjusted by bending, very slightly, to correct position (use pliers with tape-lined jaws). The height to which blades are set must be less than the minimum record thickness, otherwise the blade will attempt to change two records at a time, due to the cam action which *always* operates in an *up* direction. When necessary, make the same adjustment on the 12-inch selector blades, using a 12-inch record (approx. .090 in. thick).

**B. INCORRECT LOCATOR SPRING TENSION (33):**

Insufficient tension in the *locator spring* (33) will produce erratic or incorrect tone arm landing since the *locator* (12) will not seat in the fixed 10-inch or 12-inch indexing position. It will also result in jerky action of the *tone arm* (42), since the *tone arm lever* (11) will not accurately follow the cam surface of the *drive gear* (8).



Drive Gear Assembly



Bottom View of Record Changer Less Drive Gear

Excessive tension in the *locator spring* (33) will result in a stiff, heavily loaded "feel" as the tone arm is moved into rest position. It may also produce a stiff action of the *control slide* (1) and cause increased wear of the moving parts.

#### C. TONE ARM HEIGHT:

The height to which the *tone arm* (42) rises is correct when there is an approximate  $\frac{1}{8}$ -inch clearance between it and the bottom of a 10-inch record on the *selector arms* (42). This clearance is regulated by the *tone arm adjusting screw* (23), see Figure 5.

The down position of the tone arm is fixed by *lug* (R) on the tone arm hinge assembly. The correct height is that which will allow the bottom edge of the tone arm and cartridge to clear the turntable surface by approximately  $\frac{1}{8}$  inch. This adjustment may be corrected by a slight bend of the *lug* (R).

#### D. TONE ARM POSITIONING:

If the tone arm landing is not corrected by adjustment B, the following procedure may be used: Set the *control knob* (50) in the OFF position with power plug out and place a 10-inch record on the turntable. Set the *selector arms* (10-inch) so the arrows point directly at the spindle. Loosen the *Allen socket cap screw* (22) just enough to allow the *tone arm lever* (11) to still hold its position. Line up the tone arm's outer edge evenly with the panel edge. This gives the tone arm an approximate setting. Push the control knob to REJECT and release it. Rotate the turntable clockwise and

observe where the needle first touches the record. This should be about one-eighth inch from the edge. Variations should be corrected by slipping the *tone arm lever* (11) in the correct direction. **Caution**—Before tightening the Allen screw, make certain that there is enough vertical clearance in the tone arm shaft to avoid binding while the tone arm swings.

#### E. STYLUS PRESSURE:

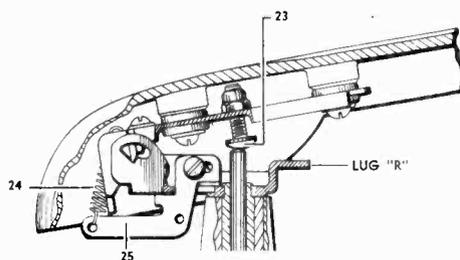
The stylus pressure on the record is controlled by the *counter-balance spring* (24) in back of the tone arm. The pressure is variable through the counter-balance adjusting *slide* (25). The needle pressure should be 1-1½ ozs.

#### F. TRIP SHOE (17):

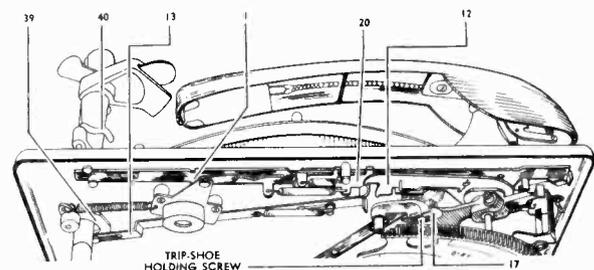
The *trip shoe* (17) located on *tone arm lever* (11) is movable and loosening its holding screw permits it to be adjusted as required. This adjustment is correct when the needle is  $1\frac{7}{8}$  inches from the record center and the trip shoe pushes the *trip lever* (5) which releases the *clutch engagement lever* (6).

#### G. TURNTABLE REMOVAL:

The turntable should be removed by lifting carefully, tapping spindle *lightly* if necessary. This will expose top spindle bearing. When replacing turntable, the slot in hub must seat properly over the spindle pin. (Rotate 180 deg for best fit.) Push idler wheel in while lowering, so rubber rim will not be damaged by turntable edge.



Tone Arm Adjustments



Bottom View of Record Changer

MODEL P2

GENERAL ELECTRIC CO.

**TROUBLE SHOOTING CHART**

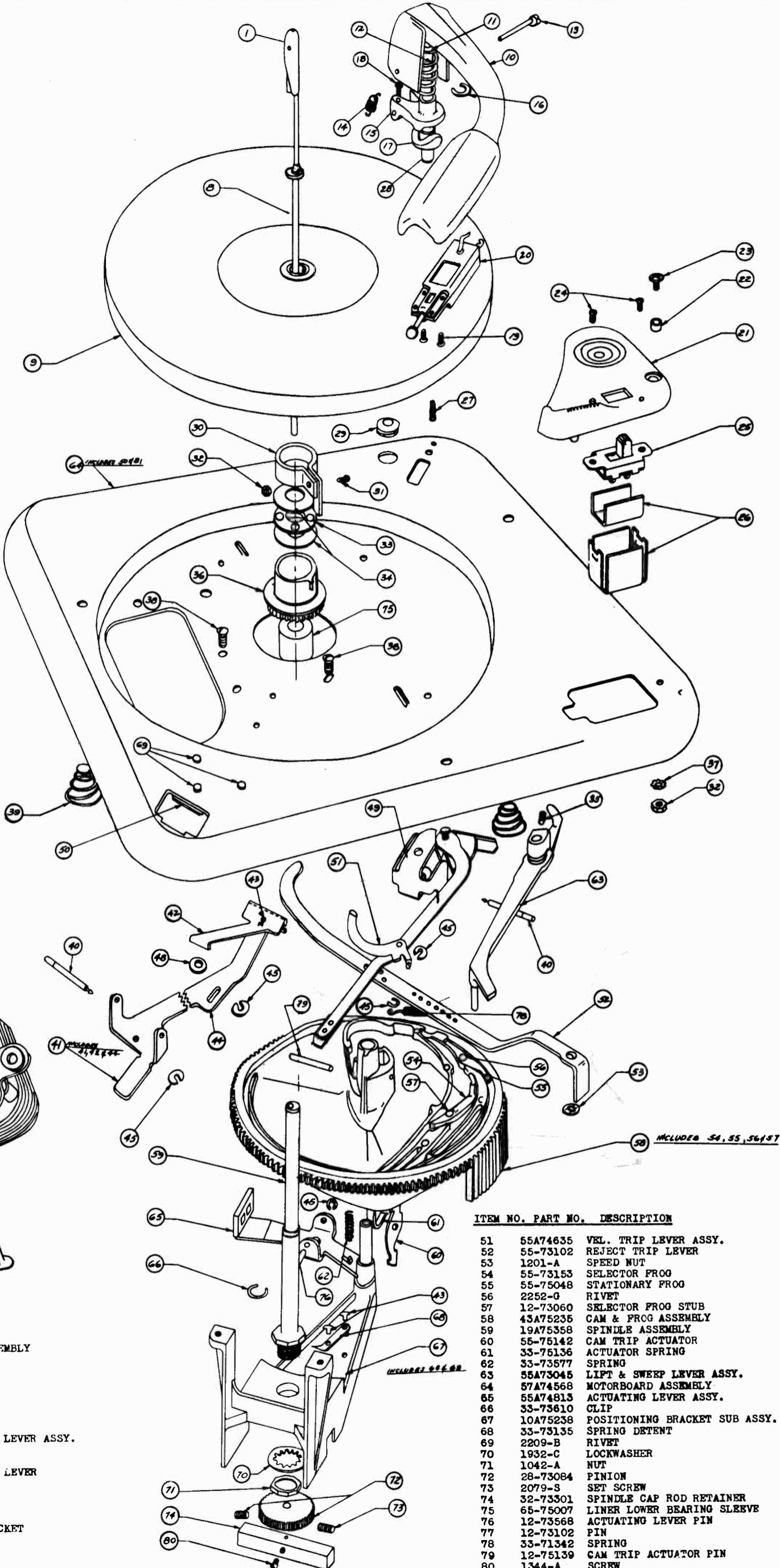
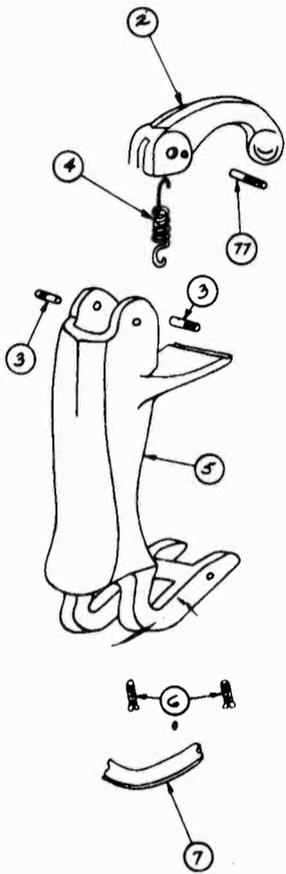
SYMPTOMS	REMEDIES OR CAUSES
<b>RECORD SELECTION</b>	
1. Record jams, prevents changer from working.	1. (a) Check adjustment A. (b) Odd-sized, warped, or damaged records. Play in "MAN" position.
2. Record drops from one side only.	2. (a) Check center hole in records—probably too large. (b) Check adjustment A.
3. Records drop more than one at a time.	3. (a) Check adjustment A.
<b>TONE ARM MOVEMENT</b>	
1. Needle lands incorrectly.	1. (a) Check adjustment B. (b) Tone arm <i>retard lever</i> (14) binds; check spring. (c) Check adjustment D.
2. Needle fails to feed in after landing.	2. (a) Check <i>booster spring</i> (15)—probably too weak.
3. Needle lands properly on record but slides in on record.	3. (a) Check for broken stylus in pick-up. (b) <i>Booster spring</i> (15) too strong. (c) Check adjustment C.
4. Tone arm hits bottom record on selector arms during cycling.	4. (a) Check adjustment C.
<b>TRIPPING-CYCLING</b>	
1. Changer fails to trip.	1. (a) Check adjustment F. (b) Tight tone arm lead wire. (c) <i>Clutch engagement lever</i> (6) not unlatching. Clean, do not lubricate. (d) <i>Trip lever</i> (5) binding at pivot point and failing to unlatch <i>engagement lever</i> (6).
2. Changer repeats tripping.	2. (a) <i>Clutch engagement lever</i> (6) fails to latch. Examine <i>trip lever</i> (5) for bind or weak <i>trip lever spring</i> (29). (b) Control knob binding in REJECT position. Check <i>control slide</i> (1) or its associated assembly. (c) Failure of <i>stop lever</i> (16) to properly detent drive gear.
<b>MOTOR</b>	
1. Change is sluggish or motor overheats.	1. (a) Check lubrication—oil old or gummy. (b) Incorrect line voltage. (c) Defective motor winding. (d) Check binding of moving parts.
2. Motor rumble or "wow" heard in record reproduction.	2. (a) Worn rubber rim on drive wheel. (b) Shipping bolts not removed from motor board. (c) Check for binding of spindle. Oil sparingly if necessary.

**REPLACEMENT PARTS LIST**

Cat. No.	Symbol	Description	Cat. No.	Symbol	Description
RAC-017		COVER—Switch cover	RMP-007		PIN—Stop lever pivot pin
RAX-009		SELECTOR ARM AND BLADE ASSEMBLY—left rear	RMS-057	24	SPRING—Counter-balance spring
RAX-010		BLADE—10-in. selector blade and arm assembly No. 2	RMS-058	47	SPRING—Drive link spring
RBH-005		MOTOR—Phonomotor, 60 cycle	RMS-059	46	SPRING—Manual lockout spring (outer)
RDE-023		ESCUTCHEON—Control escutcheon	RMS-060	45	SPRING—Manual lockout spring (inner)
RDX-029		KNOB—Selector arm knob assembly	RMS-061	32	SPRING—12-in. reset lever spring
RDX-030	50	KNOB—Control knob assembly	RMS-062	33	SPRING—Tone arm locator and latch spring
RHM-029		BUMPER—Trip dog bumper (rubber)	RMS-063	15	SPRING—Tone arm booster spring
RHM-030		BUMPER—Trip lever bumper (rubber)	RMS-064	31	SPRING—12-in. reset slide spring
RHS-001	22	SCREW—Allen socket cap screw	RMS-065	48	SPRING—Stop lever spring
RHS-002	23	SCREW—Tone arm adjusting screw	RMS-066	44	SPRING—Trip dog spring
RHX-006	34	HINGE—Tone arm hinge assembly	RMS-067	29	SPRING—Trip lever spring
RHX-007		BUMPER—Retard lever bumper (rubber)	RMS-068	26	SPRING—Retard lever spring
RMC-015		HUB—Tone arm locator hub	RMS-071	37	SPRING—Idler wheel spring
RMG-001	8	GEAR—Drive gear	RMT-007	49	TURNTABLE—Turntable assembly
RMG-002	7	GEAR—Pinion gear	RMU-017		SHAFT—Selector shaft assembly
RML-001	6	LEVER—Clutch engagement lever	RMU-018	40	ROD—12-in. reset rod
RML-002	21	LEVER—Tone arm latch lever	RMU-019		SHAFT—Drive gear shaft
RML-003	3	LINK—Connecting link	RMW-024	36	WHEEL—Idler wheel
RML-004	14	LEVER—Tone arm retard lever	RMX-060	10	LINK—Drive link assembly
RML-005	38	LOCK—Manual latch lock	RMX-061		ASSEMBLY—Power switch plate assembly
RMM-018	4	SLIDE—Reject slide	RMX-062		LEVER—Reset lever assembly
RMM-019	13	SLIDE—12-in. reset slide	RMX-063	12	LOCATOR—Tone arm locator assembly
RMM-020	17	SHOE—Trip shoe	RMX-064		CRANK—Drive crank assembly
RMM-021	25	SLIDE—Counter-balance adjusting slide	RMX-065	20	LOCKOUT—Manual lockout assembly
RMM-022	30	SHAFT—Tone arm shaft	RMX-066	11	LEVER—Tone arm lever assembly
RMO-002	41	BLADE—Selector blade and arm assembly	RMX-067	16	LEVER—Drive gear stop lever assembly
RMO-003	2	SWITCH—Power switch	RMX-068		ASSEMBLY—Spindle and housing assembly
RMP-006	9	PIN—Tone arm lift pin	RMX-069	5	LEVER—Trip lever assembly
			RMX-070	43	SPINDLE—Turntable spindle assembly
			RPX-010		PICK-UP—Magnetic pick-up

ITEM NO. PART NO. DESCRIPTION

- 1 21A73601 SPINDLE CAP ASSEMBLY
- 2 55-73613 STABILIZER
- 3 12-73057 STUD
- 4 33-73349 SPRING
- 5 62-74536 RECORD SUPPORT
- 6 2087-S SET SCREW
- 7 33-74543 SPRING LOCK
- 8 43A72960 ECCENTRIC ASSEMBLY
- 9 66A75025 TURNTABLE ASSEMBLY
- 10 69-73657 TONE ARM
- 11 32-74055 WASHER
- 12 33-73340 SPRING
- 13 12-75361 ECCENTRIC PIVOT PIN
- 14 33-74053 SPRING
- 15 43-73113 TONE ARM TOP CAM
- 16 32-18893 "C" WASHER
- 17 43-73069 TONE ARM BOTTOM CAM
- 18 1417-A SCREW
- 19 1338-A PICKUP MOUNTING SCREW
- 20 PKR ORDER PICKUP
- 21 10-74368 SWITCH PLATE
- 22 65-73144 SLEEVE
- 23 1399-Y SCREW
- 24 1398-Y SCREW
- 25 58-73096 SWITCH
- 26 7A73831 SHIELD & INSUL. ASSY.
- 27 2073-Z SET SCREW
- 28 12-72975 TONE ARM SUPPORT
- 29 37-73772 GROMMET
- 30 65-73595 DRIVING COLLAR



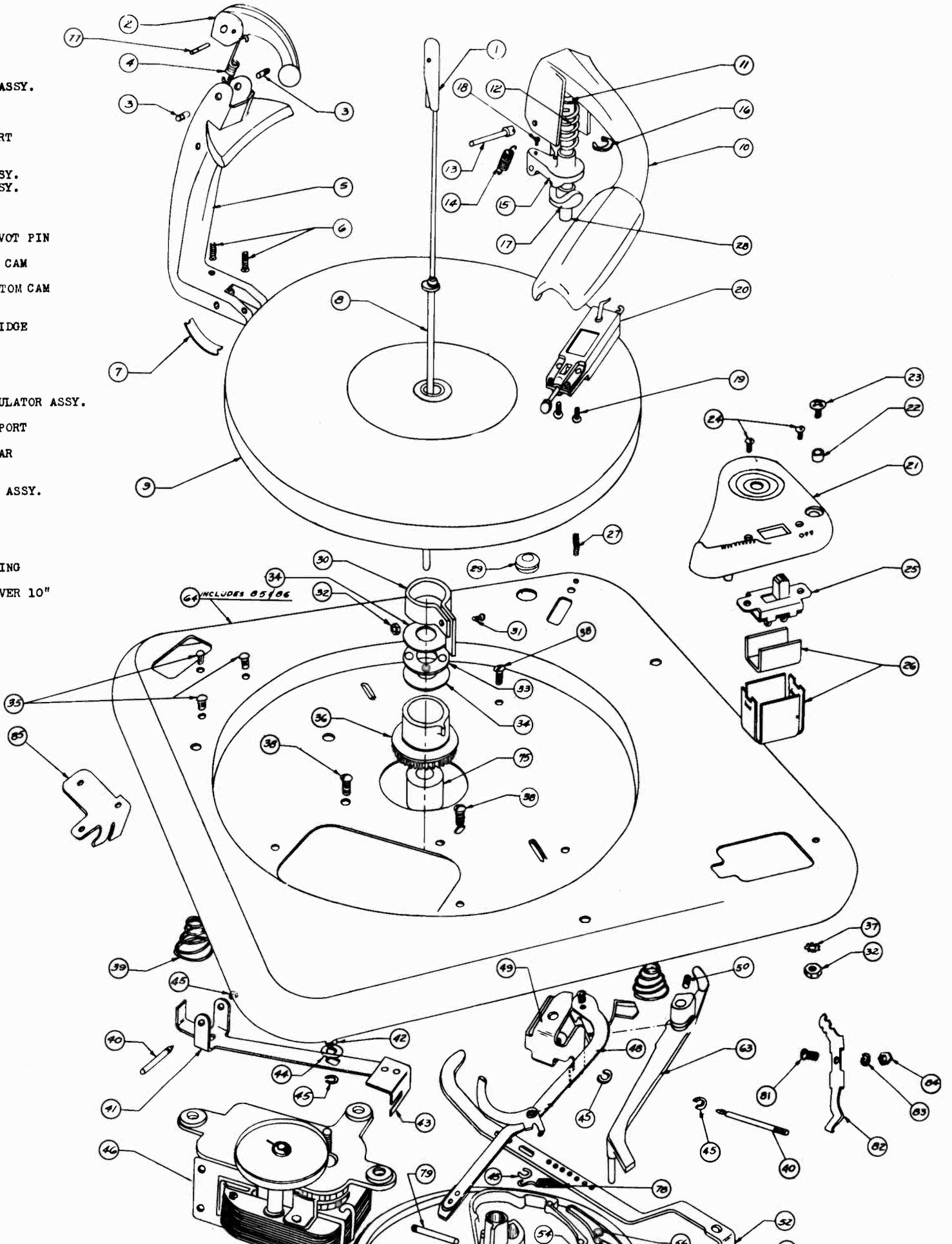
ITEM NO. PART NO. DESCRIPTION

- 51 55A74635 VEL. TRIP LEVER ASSY.
- 52 55-73102 REJECT TRIP LEVER
- 53 1201-A SPEED NUT
- 54 55-73153 SELECTOR FROG
- 55 55-75048 STATIONARY FROG
- 56 2252-G RIVET
- 57 12-73060 SELECTOR FROG STUB
- 58 43A75235 CAM & FROG ASSEMBLY
- 59 19A75358 SPINDLE ASSEMBLY
- 60 55-75142 CAM TRIP ACTUATOR
- 61 33-75136 ACTUATOR SPRING
- 62 33-73577 SPRING
- 63 55A73045 LIFT & SWEEP LEVER ASSY.
- 64 57A74568 MOTORBOARD ASSEMBLY
- 65 55A74813 ACTUATING LEVER ASSY.
- 66 33-73610 CLIP
- 67 10A75238 POSITIONING BRACKET SUB ASSY.
- 68 33-73135 SPRING DETENT
- 69 2209-B RIVET
- 70 1932-C LOCKWASHER
- 71 1042-A NUT
- 72 28-73084 PINION
- 73 2079-S SET SCREW
- 74 32-73301 SPINDLE CAP ROD RETAINER
- 75 65-75007 LINER LOWER BEARING SLEEVE
- 76 12-73568 ACTUATING LEVER PIN
- 77 12-73102 PIN
- 78 33-71342 SPRING
- 79 12-75139 CAM TRIP ACTUATOR PIN
- 80 1344-A SCREW

- 31 2011-A SCREW
- 32 1022-A NUT
- 33 30A72491 THRUST BEARING ASSEMBLY
- 34 32-72485 WASHER
- 35 2089-S SET SCREW
- 36 28A73704 PINION ASSEMBLY
- 37 1906-C LOCKWASHER
- 38 1333-A SCREW
- 39 33-73408 MOUNTING SPRING
- 40 12-73007 PIN
- 41 55A74605 10" FROG ACTUATING LEVER ASSY.
- 42 33-74602 SPRING
- 43 2211-A RIVET
- 44 55-74599 10" FROG ACTUATING LEVER
- 45 32-16901 "C" WASHER
- 46 56-73555 MOTOR
- 47 37-73031 SNAP PASTER
- 48 1695-V WASHER RUBBER
- 49 10-73132 TONE ARM HINGE BRACKET
- 50 33-74530 DETENT SPRING

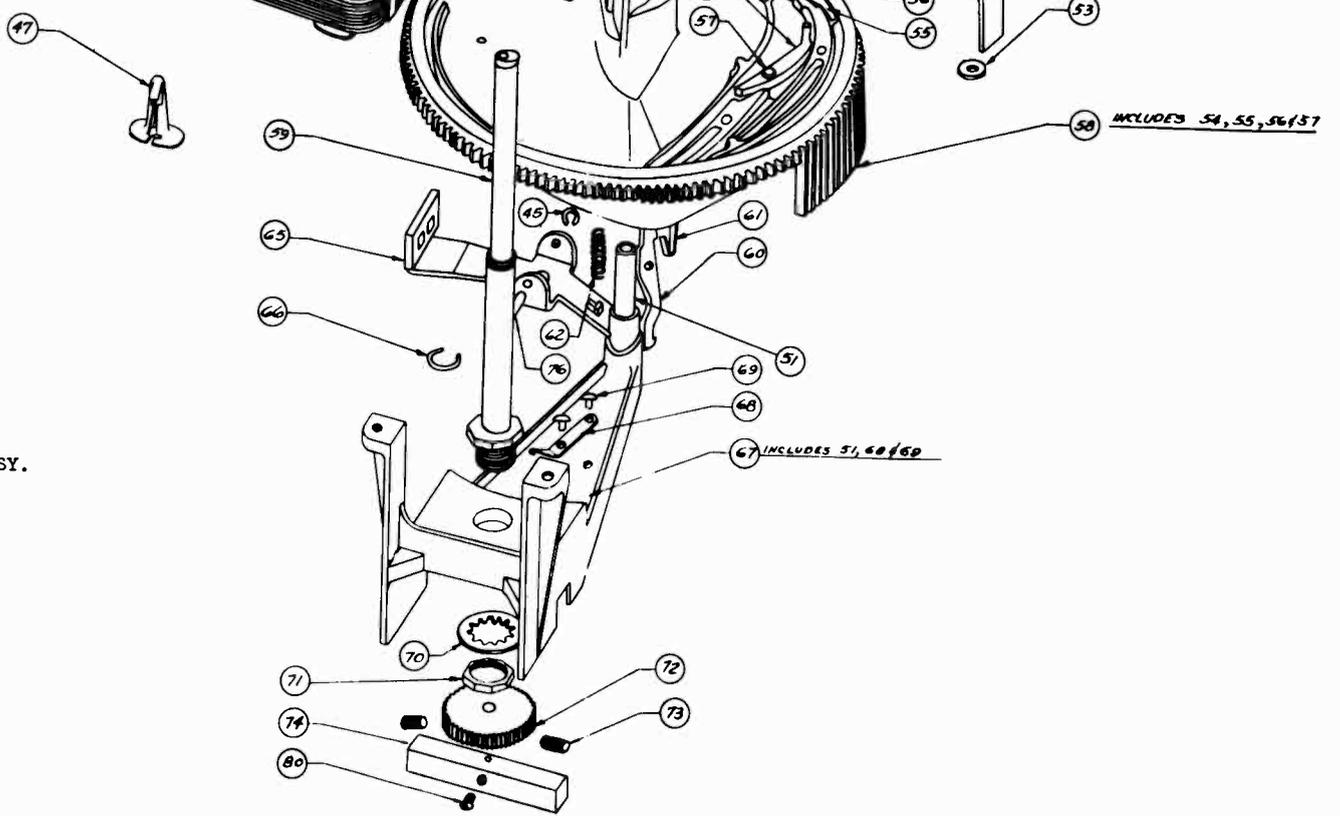
ITEM NO. PART NO. DESCRIPTION

- 1 21A73601 SPINDLE CAP ASSY.
- 2 56-73613 STABILIZER
- 3 12-73057 STUD
- 4 33-73349 SPRING
- 5 62-73820 RECORD SUPPORT
- 6 2087-S SET SCREW
- 7 33-74543 SPRING LOCK
- 8 43A72960 ECCENTRIC ASSY.
- 9 66A75025 TURNTABLE ASSY.
- 10 69-73657 TONE ARM
- 11 32-74055 WASHER
- 12 33-73340 SPRING
- 13 12-75361 ECCENTRIC PIVOT PIN
- 14 33-74053 SPRING
- 15 43-73113 TONE ARM TOP CAM
- 16 32-18893 "C" WASHER
- 17 43-73069 TONE ARM BOTTOM CAM
- 18 1417-A SCREW
- 19 1338-A SCREW
- 20 PER ORDER PICKUP CARTRIDGE
- 21 10-74368 SWITCH PLATE
- 22 65-73144 SLEEVE
- 23 1399-Y SCREW
- 24 1398-Y SCREW
- 25 58-73096 SWITCH
- 26 7A73831 SHIELD & INSULATOR ASSY.
- 27 2073-7 SET SCREW
- 28 12-72975 TONE ARM SUPPORT
- 29 37-73772 GROMMET
- 30 65-73595 DRIVING COLLAR
- 31 2011-A SCREW
- 32 1022-A NUT
- 33 30A72491 BALL BEARING ASSY.
- 34 32-72485 WASHER
- 35 2209-B RIVET
- 36 28A73704 PINION ASSY.
- 37 1906-C LOCKWASHER
- 38 1333-A SCREW
- 39 33-73408 MOUNTING SPRING
- 40 12-73007 PIN
- 41 55-73884 ACTUATING LEVER 10"
- 42 33-73889 SPRING
- 43 33-73881 SPRING
- 44 1612-A WASHER
- 45 32-16901 "C" WASHER



ITEM NO. PART NO. DESCRIPTION

- 46 56-73555 MOTOR
- 47 37-73031 SNAP FASTENER
- 48 55A74635 VELOCITY TRIP ASSY.
- 49 10-73132 TONE ARM HINGE BRACKET
- 50 2089-S SET SCREW
- 51 12-72987 CAM PIVOT STUD
- 52 55-73102 REJECT TRIP LEVER
- 53 1602-A WASHER
- 54 55-73153 SELECTOR FROG
- 55 55-75048 STATIONARY FROG
- 56 2252-G RIVET
- 57 12-73060 STUD
- 58 43A75411 CAM & FROG ASSY.
- 59 19A73025 SPINDLE ASSY.
- 60 55-75142 CAM TRIP ACTUATOR
- 61 33-75136 SPRING
- 62 33-73577 SPRING
- 63 55A73045 LIFT & SWEEP LEVER ASSY.
- 64 57A73290 MOTORBOARD ASSEMBLY
- 65 55A74813 ACTUATING LEVER ASSY.
- 66 33-73610 CLIP
- 67 10A75238 POSITIONING BRACKET SUB ASSY.
- 68 33-73135 SPRING - DETENT
- 69 2211-A RIVET
- 70 1932-C LOCKWASHER
- 71 1042-A NUT
- 72 28-73084 PINION
- 73 2079-S SCREW
- 74 32-73301 SPINDLE CAP ROD RETAINER
- 75 65-75007 LINER
- 76 12-73568 ACTUATING LEVER PIN
- 77 12-73120 PIN
- 78 33-71342 SPRING
- 79 12-75139 CAM TRIP ACTUATING PIN
- 80 1344-A SCREW
- 81 1311-A SCREW
- 82 33-72963 GROUND SPRING
- 83 1900-A LOCKWASHER
- 84 1028-A NUT
- 85 33-74530 DETENT SPRING



## GENERAL INSTRUMENT CORP. MODELS 700F, 700R

All Series 700 Record Changers are of the single post, fully automatic drop type, featuring single button control and eccentric spindle cam record selection. The series 700R Record Changer has the record support platform in the left rear corner. Series 700F has the record support platform in the left front corner.

### OPERATION

Starting - when the switch Button (58-73096) is moved to the "ON" position, power is connected to the Motor (56-73555) causing the Turntable Assy. (66A74682) to rotate, and automatic cycling, which is required to drop the first record, is accomplished by pulling the Switch Plate (10-74368) in the direction indicated by the arrow. When automatic cycling is started the Manual Trip Lever (55-73102) is advanced until it contacts the Cam Trip Lever (55A74833) mounted on the Main Cam (43-73159) which moved sufficiently to permit the spring loaded Pinion Actuating Lever (55A74813) to function, which, in turn, lifts the floating brass Pinion Assy. (28A73704) directly beneath the spindle so that a projection on this floating Brass Pinion is caused to engage a finger on the adjustable collar (65-73595) fastened to the Turntable Hub.

The combination of the foregoing causes the turntable to become connected with the Main Cam which through its single revolution performs all of the required change cycle functions. It is to be noted that, except during the change cycle, the motor power is used only to revolve the Turntable.

Cycling - As the Main Cam rotates, the spring loaded lever which actuates the Floating Pinion is automatically depressed and thus reset for the next change cycle.

At the end of the change cycle the Motor power is disconnected from the change mechanism when the Plastic Washer mounted on the Floating Brass Pinion drops into a depression on the top edge of the rim of the Main Cam. This position, called home position of the Main Cam, is retained by a Leaf Spring (33-72963) detented in the cam hub.

Record Selection - Record Selection is accomplished during one complete revolution of the Eccentric Cam Assy (43A72960) at the top of the lower section of the spindle. This portion of the change cycle is accomplished when the extended section of teeth of the Main Cam engages and rotates the Spindle Cam Pinion (28-73084). The home, or in line position of the Record Selection Eccentric Cam is retained by a Leaf Spring (33-73135) which detents into a slot in the underside of the Spindle Cam Pinion. Successive record drops are accomplished by a repetition of this action.

## MODELS 700F, 700R GENERAL INSTRUMENT CORP.

Pickup Arm Movement - The movement of the Tone Arm Assy. (69A73087) during cycle is controlled entirely by the surface and grooving of the Main Cam. These movements are picked up by the Sweep Lever Assy. (55A73045). After a record has been played or when it is rejected, the Trip mechanism causes the Main Cam to rotate which, in turn, lifts the Tone Arm off the records sweeping it clear to permit a record to drop and returning it to the edge of the record. The Tone Arm Support mechanism is so designed to permit the Tone Arm to be handled during any part of the change cycle without damage to the mechanism. This is accomplished by two spring loaded Mating Cams (43-73069) (43-73113) which disengage when any restraint prevents it from following the motions of the Sweep Lever. The Tone Arm is also vertically spring loaded allowing it to be lifted upward to an almost vertical position to permit ready changing of needles or cartridge.

Automatic Trip - This trip is so designed that it will start the automatic cycling mechanism when the Tone Arm moves toward the Spindle at a rate of speed greater than 1/8" per revolution of the Turntable. This Trip, therefore, is practically universal as it will operate on any center leading groove or center eccentric circle groove records conforming to RMA specifications. However, the Trip does not become operative except within a distance of approximately 3" from the Spindle. Thus, manual resetting of the Tone Arm is possible at distances greater than 3" from the Spindle.

The Velocity Trip is composed of three major elements: The Trip Lever Assy (55A73042), the "V" Lever (55-72966) and the Crescent Lever (55-73066). The Trip Lever and "V" Lever work together through a Friction Clutch (10-72953), the tension for which is maintained by a Coil Spring (33-73334) which is one of the elements in the assembly of these two parts. As the Tone Arm moves toward the spindle center, the sickle shaped section of the Sweep Lever comes into contact with one leg of the "V" lever causing the tip of the Trip Lever to move toward the center of the Turntable by energy transmitted through the Friction Clutch. This movement continues until the tip of the Trip Lever is in the range of the Finger of the adjustable Collar mounted on the Turntable Hub. Once this position is attained and so long as the movement of the needle toward the Spindle is less than 1/8" per revolution the tip of the Trip Lever will be retarded from further movement by being pushed away once during each revolution of the Turntable. This retarding movement means that the Friction Clutch slips a corresponding amount. When the needle moves into a fast spiral or an eccentric center groove of the record, the tip of the Trip Lever will move so rapidly toward the center of the Spindle it will allow the tip of the Crescent Lever to slide off the flat surface of the Cam Trip Lever and engage itself behind the Lever. In the next revolution of the Turntable the finger on the adjustable Collar will force the Trip Lever outward causing the Crescent Lever to move the Cam Trip Lever far enough to unlatch the Floating Pinion Actuating Lever, thus setting up the change cycle as previously described.

10" and 12" Operation - The 10" and 12" indexing is determined by the main cam by allowing the sweep lever pin to enter either the 10" or 12" indexing track. This switching is controlled by means of a Frog (12-73060) which is moved from one side to another by the Frog Actuating Lever Assy. (55A73886 Rear) or (55A74605 Front) extending from the Record Support Assy. (62A73129 Rear) or 62A74720 Front). This lever shunts the sweep lever pin into the indexing track dependent upon whether the record support is pushed toward or away from the spindle for 10" or 12" records.

### ADJUSTMENTS

Tone Arm Index - The tone arm should be indexed at the start of every record approximately  $1/8$ " from the edge for both the 10" and 12". If the needle index is too far in or out, this may be corrected by loosening one of the two set screws found in the lower cam located in the bottom of the tone arm approximately  $1/2$ " above the top of the motorboard, and advancing the other set screw sufficiently to bring about proper indexing. The proper setting having been obtained, both screws should be locked tightly. This action is accomplished by means of the two screws contacting a flat on the vertical shaft at an angle that will cause the shaft to turn with any movement of either screw.

Adjustment of Record Support - When the record is centralized with the lower part of the spindle, the record support platform in both 10" and 12" position should clear the edge of the record by approximately .015" ( $1/64$ ). To move this setting for the 12" record, it is necessary to advance or retract the set screw nearest the spindle on the upper part of the support beneath the motorboard. The screw farthest away from the spindle will adjust the 12" position in a similar manner.

Spindle Alignment - If the spindle eccentric cam is not lined up perfectly with the lower part of the spindle while out of cycle, the main cam should be moved to its home position as determined by its detent spring and the spindle pinion gear should also be moved to its home position as determined by its detent spring. Loosen the set screws in the hub of the spindle pinion gear and line up the eccentric with the spindle, then tighten set screws.

The spindle cap should be positioned so that the slide is pointing towards the center of the record support. This may be positioned by loosening the screws on the square retaining bar found in the lower bracket. There should be approximately .005 total vertical play in the spindle assembly after both adjustments to prevent binding.

Main Cam Frog Movement - When the record support is in the 12" position, the phosphor bronze spring that actuates the 10" or 12" selector Frog pin should be high enough to clear the frog pin. When the record support is in the 10" position this spring should cause an interference with the frog pin enough to move it into position to shunt the sweep lever pin into the 10" indexing track. This spring is slit for the purpose of easy adjustment. If this spring does not move the frog enough, it should be rebent to do this. It should be remembered that the frog is so constructed that as the sweep lever pin goes past it, it will automatically reset the frog in the 12" position, and to play a 10" record this pin must be reset by the spring everytime.

Removing Turntable - To remove the turntable for any reason, remove the small horseshoe-like spring found around the spindle near the turntable top. Then make sure that the trip lever is moved far enough away from the turntable center to allow it to clear the extremities of the bakelite washer of the floating pinion. The turntable may then be removed by lifting up. In replacing the turntable care should be taken to see that the idler tire is properly positioned within the I.D. of the turntable and that the trip lever is also out of the way so that it will not be bent by the bakelite pinion gear washer.

Adjustment of Tone Arm Height - If tone arm needle does not clear a stack of records, loosen the set screw securing the vertical tone arm shaft underneath the motorboard and raise the shaft up. In some extreme cases the zinc sweep lever itself may be bent. If the needle is set too high to play the first record, retract the set screw found on the top of the motorboard directly behind the tone arm.

### DIFFICULTIES

Failure to Feed Record - This could be caused by the spindle eccentric cam not lining up with the lower spindle sleeve at the end of its cycle. First determine whether the detent spring is in the pinion depression. If this is so, and it is still out of alignment, loosen the screw and adjust as previously explained under SPINDLE ALIGNMENT. Secondly, check the position of the record support as previously explained. Check the record thickness for a maximum of .10" at center hole (RMA maximum thickness).

Drops two or more Records at Once. - Check thickness of record at center hole. Record should be not less than .070" at this point. If the records are within this RMA minimum, check the spindle slide. It should be flush to .020" below the bottom of the spindle cap. If it is too low file it off, if it is too high remove the pin in the cap and file the slot to get the proper dimension. This pin is held in the cap by a light knurl fit and can be easily replaced. Be careful not to bend the spindle rod during this process.

If two records still drop, check the record support setting (see above). Note: Proper record diameter for all settings of the record support should be:

9-7/8"     ± 1/32 for the 10" record  
11-7/8"    ± 1/32 for the 12" record (RMA STANDARDS)

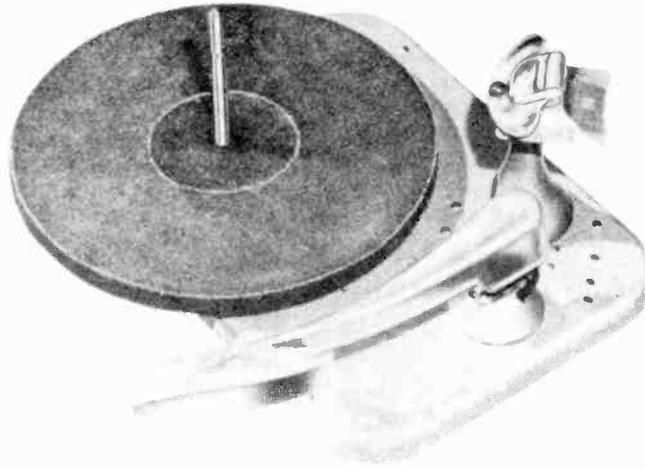
Continuous Trip - This is caused by the floating pinion not dropping far enough away from the projection of the collar on the turntable hub. Make sure the main cam is in home position and that the floating pinion falls in the depression of the cam edge and remains there until the record is completed. Rotate the turntable to make sure that the collar clears it by approximately 1/32. Reject the changer and check to insure approximately 3/64 or better engagement with the collar finger. Check the manual trip lever to make sure it clears the cam trip lever.

No Tripping - If the changer wont trip manually, check the manual trip lever to make sure it moves the cam trip lever enough to unlatch the pinion actuating lever. This action should occur before the switch plate reaches its maximum allowable rotation.

No Automatic Trip - Check the pickup lead to make sure it is not binding the tone arm movement, particularly as the needle approaches the spindle. Check the V lever to make sure it rotates freely and the clutch has movement. Put the cam in home position and make sure the crescent trip lever is free and contacts the flat side of the cam trip lever. Move the V lever and make sure the clutch imparts enough force to the trip lever to allow the crescent lever to move along the flat and drop behind the trip lever. There should be no friction or binds in any of these mechanisms. Non-tripping can be caused by any binds or by too tight or light a spring load on the crescent. This spring load is adjustable by anchoring the crescent lever spring in any one of three holes.



MOTOROLA INC.

MODELS RC-30-A, RC-34,  
RC-35

### GENERAL INFORMATION

**RECORD CHANGER RC-30-A.** Record Changer RC-30-A is a single-post changer designed to play automatically, 10 ten-inch or 8 twelve-inch records, not intermixed. The "motor" and "reject" switches required to operate this changer are part of the radio receiver. Pushing the "R" button will energize an electro-magnet and start the changing cycle. However, from then on, at the end of each record, the cycle is started mechanically and the trip coil is no longer required.

That method of rejecting records is the essential difference between the RC-30 and the RC-30-A changers. The RC-30 used an electrical solenoid coil each time a record was dropped.

The top appearance of the two changers is identical, but the RC-30-A can easily be identified on the under side by the position of the rejecting coil. The coil is near the gear arm on the RC-30, but it is close to the outer edge of the mounting plate on the RC-30-A.

**RECORD CHANGER RC-34.** Same as RC-30-A except all painted parts are red mahogany (instead of green) and rubber shock mounts are used in place of spring cushions for mounting changer in radio cabinet.

**RECORD CHANGER RC-35.** Same as RC-30-A except all painted parts are red mahogany instead of green.

### IMPORTANT POINTS TO REMEMBER WHEN SERVICING RECORD CHANGERS

**WARNING:** Do not lift the record changer by record post or record support platform. Always lift the changer by its base only.

**IMPORTANT:** Final adjustments on record changer are to be made with the changer horizontal and supported by its 4 corners. **AVOID DISTORTING THE BASE WHEN MAKING FINAL ADJUSTMENTS.**

#### CHECK THE RECORD FIRST

Before attempting to service or adjust the record changer, check the records first to make sure they are not causing the trouble. This instrument will handle most of the 10 or 12 inch records available on the market, but it is not guaranteed to handle all of them. Records must be in good mechanical condition and should not be chipped,

particularly around the center hole. Do not try to play automatically, records that are too thick, too thin, or that are oversized or undersized, in regard to the diameter of record or center hole. Do not mix 10 and 12 inch records on the changer.

Warped records can slip on the turntable and introduce "WOWS". Such records may be flattened by placing between the two pieces of flat plate glass and then heating in the sun or oven. Do not over-heat. Allow record to cool for several hours before removing glass.

Old records, made before the days of automatic record changers, may not change automatically, due to the difference in thickness, or to lack of the proper groove at the finish. Most of the old records, however, may be played one at a time.

### RECORD CHANGER OPERATION

*(Throughout the following instructions, refer to Figure 1).*

#### WHICH RECORDS CAN BE PLAYED

As many as 10 ten-inch or 8 twelve-inch records may be placed on the record changer which will play them all in sequence, repeating the last record until the instrument is turned "OFF". Do not overload the instrument by attempting to stack more records on it at one time.

This record changer will accommodate most 10 and 12 inch records now available on the market, but is not guaranteed to handle all of them. Records must be in good condition, as no record changer will operate properly with chipped or warped

records. Records in which the center hole is worn or chipped should not be played automatically on this changer.

Occasionally, a new record may fit tightly over the center spindle due to the label attached to the record not being properly centered. This condition may be readily remedied by reaming out the center hole with a hexagonal lead pencil.

When operating this automatic record changer, play only the size record for which the adjustment on the record support plate indicates. Do not inter-mix 10 and 12 inch records.

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**TO LOAD RECORDS**

1. Adjust the Record Support Plate  
The turning of the record support plate automatically adjusts the changer for either ten or twelve-inch records. For playing ten-inch records the numeral (10) will be nearest the record post.
2. Adjust the Record Clamp  
This clamp is mounted on the record support plate, and serves to steady the stack of records. Flip it away from the turntable.
3. Turn the record post cap so it is out of line with the record post.
4. Load the Records  
Place the records over the record post so they rest on the record support plate and on the small ledge formed by the record release eccentric offset in the spindle. Records may be loaded and played one at a time, or as many as 10 ten-inch or 8 twelve inch records may be loaded at one time. Do not try to play a larger quantity.
5. Readjust the Record Holding Clamp  
Flip the record holding clamp back over the record support so it rests on the rim of the top record and holds the stack of records steady.

**TO PLAY RECORDS AUTOMATICALLY**

1. Turn radio "ON" and set the PHONO-RADIO selector control to PHONO position.

2. Push the "M" button in. The button will lock in and the turntable will now revolve.
3. Momentarily push the "R" button. The first record of the stack will drop to the turntable and be played. After all records have been played in turn, the instrument will repeat the last record until it is turned off. Pushing in the "M" button will now stop the turntable. The "R" button may be pushed in to reject a record before it has been completely played.

**NOTE:** Never touch the pickup arm when the instrument is in a changing cycle. Should you move it out of adjustment, stop the changer and gently move the pickup arm from side to side until you hear it "snap" back into position.

**TO UNLOAD RECORDS**

1. Allow the instrument to go through its complete cycle and start to play the last record over.
2. As soon as this occurs, push the "M" button to stop turntable. (Alternate pushes start and stop the motor).
3. Lift the pickup arm off the record and place it on its resting post.
4. Turn the record post cap so it is in line with the record post.
5. Lift the records off.

**HOW TO REPLACE NEEDLE**

This record player is equipped with a permanent point long-life needle that is good for several thousand plays unless damaged by mishandling. To replace phonograph needle, loosen the small knurled nut that holds the needle in place. The nut is accessible from the bottom of pickup arm.

Use a pair of long nose pliers or tweezers to avoid damaging the crystal cartridge. Recommended replacement needle is Motorola Part No. 47K471596.

**CAUTION:** Standard type needles will not work.

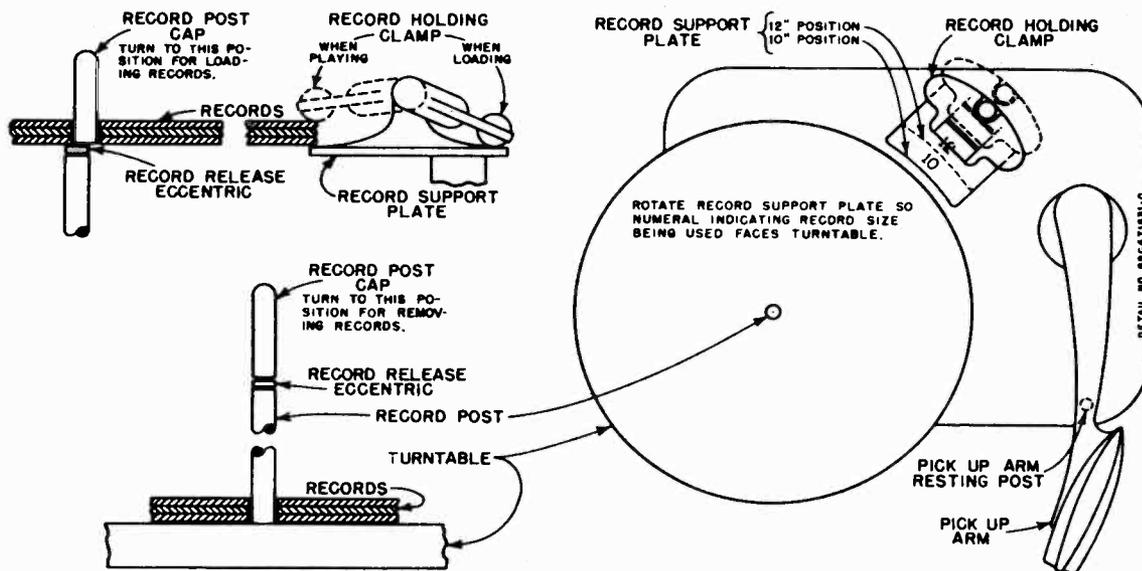


FIGURE 1. OPERATING INSTRUCTION DETAIL

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## THEORY OF OPERATION

**NOTE:** Numbers in parenthesis ( ) refer to parts shown in Figures 2, 3, 4, 5 & 6.

The turntable is rim driven. Power is transmitted to it from the motor shaft by means of a rubber-tired drive wheel (84). The record post (48) does not revolve; it is fixed to the record changer base.

The heart of the record changer is the cam wheel (11). On it are cast all the cams, extrusions, etc., required to perform all the operations during the changing cycle. See Figure 2.

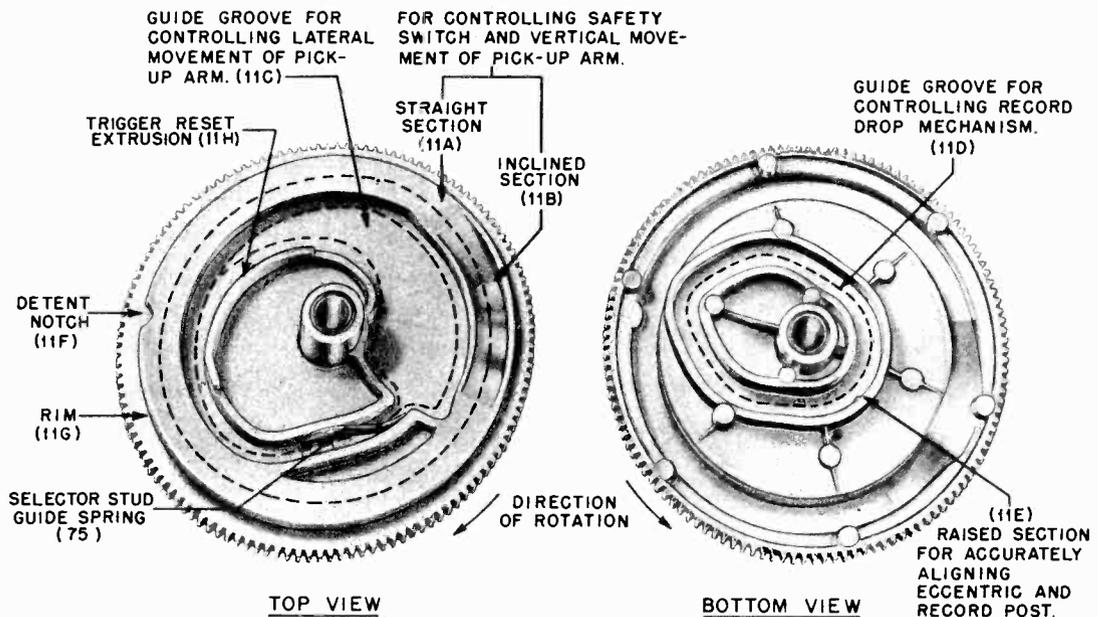


FIGURE 2. CAM WHEEL

The only mechanism that operates during the playing of a record, is the motor and turntable. The changing mechanism is disengaged until the change cycle starts.

The change cycle starts when the phono pickup needle comes within 1-7/8" of the record post. This causes screw (55) on trip arm (82) to actuate trip link (97) which trips the trigger by moving the latch arm (96) and allowing the small trip arm (105) to slip from its notch. Now spring (103) through bell crank lever (94) moves the drive arm (22) so that drive pulley (23) comes in contact with the inside rim of the revolving turntable, starting the change cycle.

With the same motion of the bell crank lever, its roller (94A) leaves the detent notch (11F) in the rim of the cam wheel and the cam wheel revolves. The roller (94A) now rides on the rim (11G) of the cam wheel and in this manner, holds the drive pulley (23) firmly against the turntable. The pressure with which the drive pulley bears against the turntable is adjusted by means of eccentric stud (94B).

As the cam wheel revolves, the pickup lift rod (54) rides up the inclined section (11B), lifting the pickup arm off the record. After the pickup arm is elevated, continued rotation of the cam wheel swings the pickup arm outward. The lateral movement of the arm is controlled by the selector stud (82A) which rides in a specially shaped groove (11C) in the cam wheel.

The gear arm roller (25A), riding in the specially shaped groove (11D) located on the bottom of the cam wheel, controls the dropping of records. Movement of the gear arm (25) causes the eccentric (24) to turn through 180°. When the eccentric (24) is in line with cap (12), it picks up a record and when it rotates back into line with the record post (48), the record is dropped onto the turntable.

Continued rotation of the cam wheel swings the pickup arm (by action of the selector stud (82A) riding in groove 11C) back over the first groove in the record and the arm is gently lowered onto the record when the inclined section (11B) reaches the pickup lift rod (54).

As the cam wheel approaches the full 360 degree point of its rotation, the trigger reset extrusion (11H) pushes against the trigger reset roller (105A) of the small trip arm, causing the trigger to be "cocked" ready for the next cycle, and in the same motion applies spring tension through the torsion spring (103) to the bell crank lever (109) so that when the cam wheel detent notch (11F) reaches the bell crank lever roller (94A), the roller falls into it pulling the cycle drive pulley (23) away from the turntable rim and the cam wheel stops, ending the cycle.

After the drive pulley is pulled away from the turntable, its motion is arrested immediately by a brake (See Figure 3) to prevent re-cycling.

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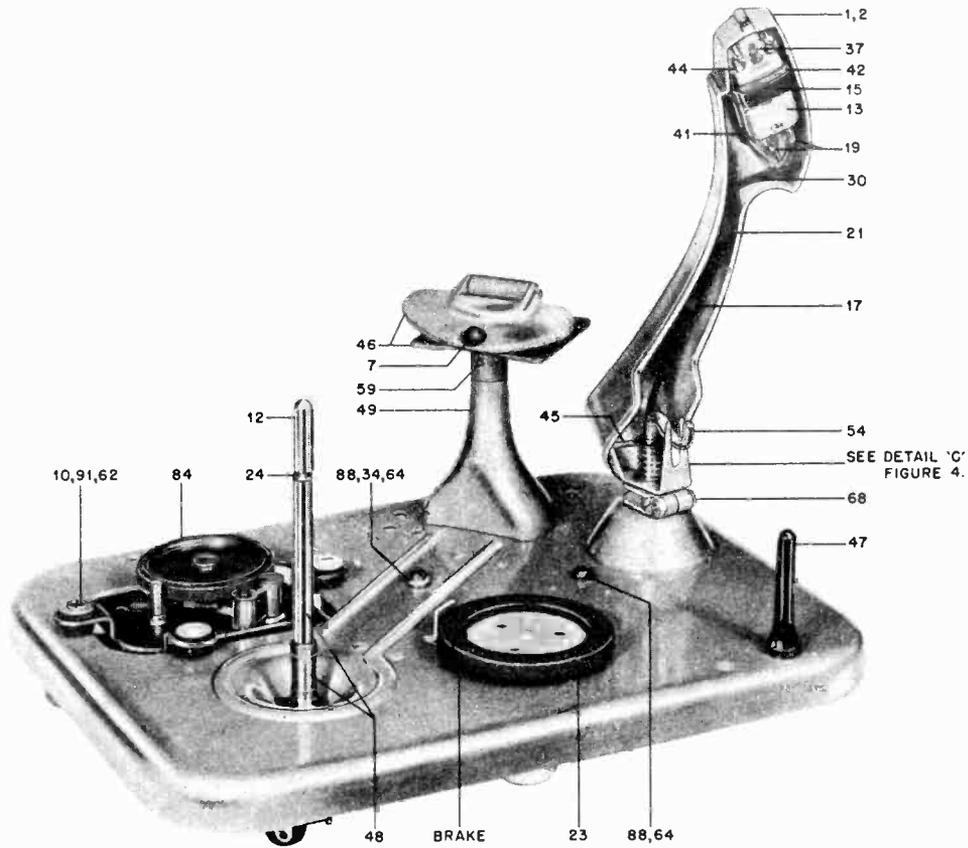


FIGURE 3. PARTS LOCATION - TOP VIEW

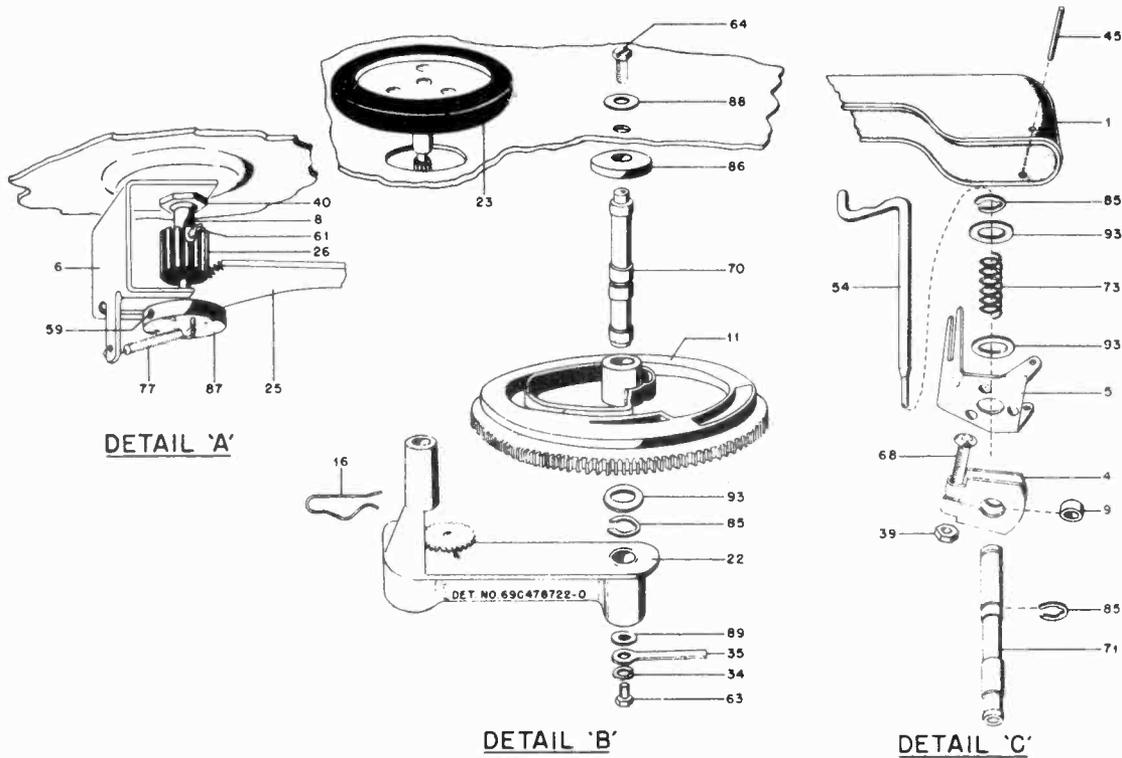


FIGURE 4. PARTS LOCATION - DETAILED ASSEMBLIES

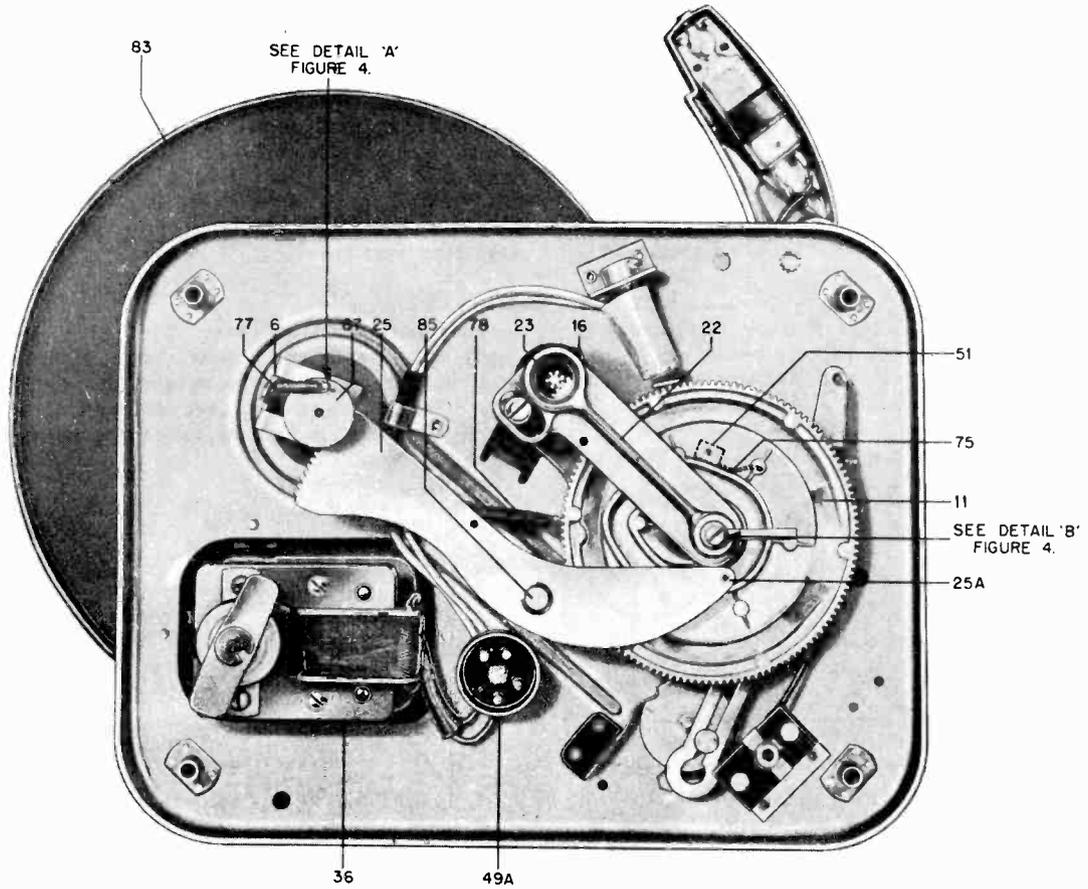


FIGURE 5. PARTS LOCATION - BOTTOM - COMPLETE

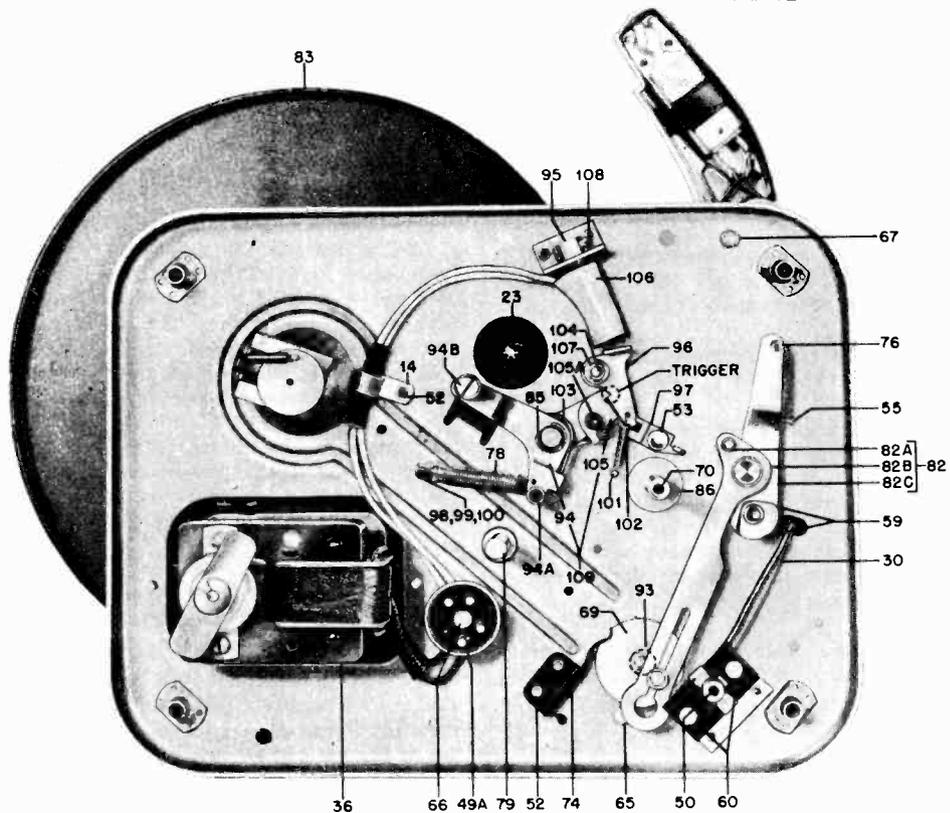


FIGURE 6. PARTS LOCATION - BOTTOM - PARTLY DISASSEMBLED

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Turning the record support plate (46), to accommodate the size record being used, automatically sets the mechanism so the needle set-down point will be correct for the size records being played. Selector lever (82B) is moved by the stud on selector plate (69), changing the angle between trip arm (82C) and selector lever (82B).

An external momentary contact (REJECT) switch is used to manually start the change cycle or to reject a record before it has been completely

played. Pushing the "R" button will energize the trip coil (106) and will move the latch arm (96), allowing the changer to cycle as previously described.

A special clutch device, built into the base of the pickup arm, prevents damage to the mechanism should the arm be accidentally touched while the instrument is in cycle. Should the arm be accidentally moved out of adjustment, stop the changer and move the arm from side to side until you hear it snap back into position.

### USE OF TEST CORD

To operate this record changer independently of the radio receiver, it will be necessary to obtain or construct a test cord. Figure 8 shows the hookup and parts required.

-Order Part No. 1X471448 - List \$2.70. It will only be necessary to attach a wall outlet plug to the red and gray leads to prepare this cord for use. The black lead is not used and can be cut off. (This cord is the same as used on some 1947 Motorola home sets).

A ready-made cord can be obtained from Motorola

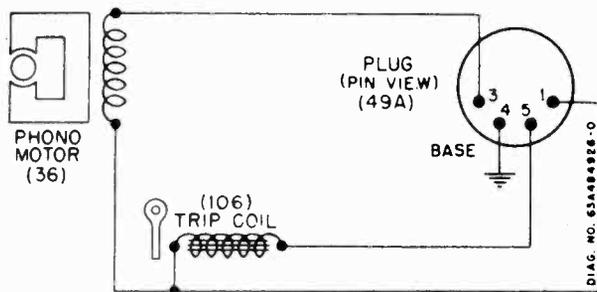


FIGURE 7. RC-30-A WIRING DIAGRAM

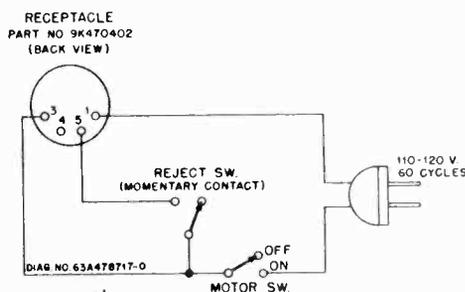


FIGURE 8. TEST CORD WIRING DIAGRAM

### ADJUSTMENTS

**NOTE:** Reference numbers in parenthesis refer to Figures 3, 4, 5 & 6.

#### ECCENTRIC STUD ADJUSTMENT

This adjustment is one of the most important for dependable cycling of the record changer. It must be followed closely, as too tight an adjustment will cause slow cycling and undue motor wear, or the changer may keep cycling continuously; a loose adjustment may prevent changer from cycling at all.

1. Set changer in cycle and stop turntable when pickup arm comes back to within one inch of right of turntable (almost the set-down position.)
2. Loosen eccentric stud (94B) completely, so drive pulley (23) moves completely free of the turntable.
3. Rotate turntable by hand (counterclockwise) 90° (1/4 turn) and back (clockwise). Pickup arm should not move.
4. With a screwdriver, turn eccentric stud until pickup arm begins to move when rotating turntable by hand clockwise. Do not hold screwdriver on eccentric stud while checking adjustment.
5. When pickup arm moves down with the clockwise rotation of turntable without slipping, but not up with counterclockwise rotation, the critical position of the adjustment has been reached.
6. Then tighten the eccentric just far enough to pick up the pickup arm when rotating the turntable counterclockwise and setting is complete.

7. To check for too tight adjustment, complete cycle of changer with motor operating. Complete change cycle should not take more than 7 seconds; if it takes longer, eccentric stud should be re-adjusted.

#### RECORD SUPPORT PLATFORM ADJUSTMENT

It is important that all points on the "lip" of the record support platform be equi-distant from the center point of the spindle. This will assure that all points of the record will leave the platform at the same time. If the record support is too far out of alignment, the record would actually hang on the point nearest the spindle and fail to drop properly from the record post.

1. Turn the spindle cap (12) so it is in line with record post (48). Turn record support platform (46) to the 10" position, making sure it is turned so that the selector spring (74) falls into the dent notch.
2. Place a standard 10" record on the record spindle and hold it in line with the record support platform (46) and eccentric (24).
3. If parts are adjusted and aligned correctly, the record should clear the lip of the record support platform equally at all points and the gap between record and record support platform should be just large enough to let the record clear the platform.

**NOTE:** The 10" record used should have a diameter of 9-7/8" ± 1/64".

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4. If one point of the record support platform (46) is nearer the record than the other, the position of the platform may be adjusted after loosening the two Allen head screws (59) located directly under record support platform (46). (Use a #6 Allen head driver -Motorola Part No. 66X10704).

5. Spacing between the record post (48) and record support platform (46) can be varied by loosening the two screws (65) located underneath record support post (49). Correct spacing is indicated as in Step 3 above.

**NOTE:** A "standard gauge" (Motorola Part Number 66A75278) can be used in place of a record when adjusting the platform.

6. **TEST:** After tightening the setscrews, test the adjustment by running a ten-inch record through a complete cycle and check the point where the needle falls. If the needle misses the record by one inch, the record support platform (46) is 180 degrees out of line with the detent plate (69) and should be turned one-half turn without turning the detent plate.

### NEEDLE SET-DOWN POINT

1. Turn the record support to the twelve-inch position.
2. Place a standard twelve-inch record on the turntable.
3. Start the changer and allow it to go through its cycle.
4. Note the point at which the needle contacts the record. It should contact the record in the middle of the area between the first groove and the edge of the record.
5. If the needle doesn't come down at the proper point, cycle the changer and stop it just as the pickup arm is coming down on the record.
6. Place a full stack (eight) of twelve-inch records on the turntable.

**IMPORTANT:** It is imperative to make this adjustment while the selector stud (82A) is still riding in the groove of the cam wheel (11). If the record player is stopped just before the needle contacts the top record of a full stack of records, the selector stud (82A) will still be in the cam wheel groove and the pickup arm will not be free to move annoyingly about while the adjustment is being made. This is the reason for using a full stack of records on the turntable. If excessive pickup arm side play is noted at this point, check selector stud guide spring (75) on cam wheel. Excessive play between the selector stud (82A) and cam wheel groove will prevent needle from coming down at exactly the same spot on the record each time.

7. Loosen the adjustment lock screw (68) and then move the pickup arm until phono needle is positioned correctly over the middle of the area between the edge and the first groove in the record.

8. After adjustment, tighten the adjustment lock screw.

9. Check the adjustment by putting the changer through its cycle.

10. If necessary, repeat above steps.

11. Check adjustment, using a 10 inch record. If necessary, make minor compromise adjustments so needle will come down properly on both ten and twelve-inch records.

### TRIP ADJUSTMENT

This adjustment must be made after the needle set-down point has been adjusted.

1. Draw a 3-3/4" diameter circle on a piece of paper, punch out a 1/4" diameter hole in exact center of the circle and slip the paper over the record post.
2. Turn the support platform to 12 inch record position.
3. Cycle the changer once; at end of cycle, pickup arm will rest along side turntable. Do not turn off changer.
4. Grasp the pickup arm and slowly move it towards the record post. As the pickup needle crosses the circle line, a click should be heard, indicating start of change cycle.
5. If change cycle start does not occur as needle crosses circle line, adjust screw (55) on trip arm (82) till cycle starts at correct point. Turn adjustment screw (55) clockwise if change cycle starts after needle crosses circle line, and counterclockwise if change cycle starts too soon.

### RECORD DROP MECHANISM

Cycle the record changer once. At the end of the change cycle, stop the changer and carefully observe the position of the eccentric (24) with respect to record post (48). They should line up perfectly. If not, re-adjust as described below:

1. Put the record changer in cycle and slowly revolve the turntable by hand until the gear arm roller (25A) is resting on the raised section (11E) of the record drop groove on the cam wheel. The raised section of the groove is very small and resembles what is often taken for "flash" on castings. It serves to narrow down the groove at this point and in this manner, insures closer alignment of the eccentric (24) and record post (48).
2. Loosen the slab head setscrew (61) in the spindle gear (26). The eccentric (24) will now turn freely.
3. Turn the eccentric (24) so it is in perfect alignment with the record post (48).
4. Tighten slab head setscrew (61) in spindle gear (26). **WARNING: DO NOT USE EXCESSIVE PRESSURE WHEN TIGHTENING SLAB HEAD SETSCREW. EXCESSIVE PRESSURE MAY DENT THE ECCENTRIC TUBE AND CAUSE BINDING.**

### VERTICAL ADJUSTMENT OF PICK-UP ARM

The pickup lift rod (54) controls the vertical movement of the pickup arm. If this adjustment is not correct, the needle may not rest properly on the first record, the needle may not clear a full stack of records, or the pickup arm may rub against the bottom record on the support post.

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## LUBRICATION

1. After the changer has completed its cycle and pickup arm is resting in playing position, stop the changer. The pickup lift rod (54) will now be resting on the bottom of the inclined section (11B) of the cam wheel (11) and the pickup arm will be at its lowest point of vertical travel.

2. The pickup now should be resting by the side of the turntable and the needle should be exactly level with the top of the turntable. If it isn't, lift the pickup arm straight up, exposing the pickup lift rod (54). With long nose pliers, bend the pickup lift rod (along its flat portion) in the required direction till the pickup needle point is exactly level with the top of the turntable.

Factory lubrication should be sufficient for a long period of service. However, if the record changer is subjected to severe operation conditions, it is best to clean and re-lubricate all moving parts.

Use Univis P-48 oil (Motorola Part Number 11M2340) on the eccentric and tube assembly (24) and Stay-Put grease (Motorola Part No. 11M476047) on all other moving parts. Use grease and oil sparingly; do not overlubricate.

**CAUTION:** Do not allow grease or oil to come in contact with any rubber parts. The motor spindle and inside rim of turntable must be perfectly clean of grease. If grease gets on any of these surfaces, it should be removed immediately with carbon-tetrachloride.

## SERVICE INFORMATION

## MECHANISM IS SLOW IN STARTING OR MOTOR HEATS UP

1. Check lubrication.
2. Dirt in bearings. Wash dirt out with carbon tetrachloride or similar solvent and re-lubricate. Use Univis P-48 oil in the phono motor and turntable bearings and Stay-Put grease on all other bearings and moving parts.
3. Check line voltage and frequency.
4. Motor damaged. Replace motor.
5. Room temperature abnormally low.
6. Eccentric stud adjustment (94B) set at maximum throw, causing cycle drive wheel to drag on turntable rim. Correct by setting eccentric stud per instructions under ECCENTRIC STUD ADJUSTMENT.
7. Slow motor. Replace motor.
8. Grease on rubber rim idler wheel and/or inner rim of turntable. Clean off with carbon tetrachloride.

## MOTOR FAILS TO RUN

1. Check to see that power is being supplied to motor.
2. Trouble in motor winding. If easily seen, repair; otherwise, replace.
3. Damaged or frozen bearings. Replace motor.
4. Gunned oil or foreign material between armature and pole-piece. Clean out.

## SQUEAKS OR OTHER NOISES DURING PLAYING OF RECORDS

1. Check lubrication (if squeaks are heard, they will usually be found to come from the records - not from mechanism.)
2. Compare the squeaks with and without a load of records. If squeak disappears when records are removed, the noise is obviously from records. Correct by rubbing a little wax on the record post.

## CHANGER IS NOISY WHEN IN CYCLE

1. Check lubrication.
2. See if any part has become loose or bent and is rubbing against a moving part.
3. Check center post eccentric tube (24) lubrication.

## "WOW" IN RECORD REPRODUCTION

1. Record is warped or otherwise defective, or the instrument is not being operated at normal room temperature (70°F). See CHECK THE RECORD FIRST.
2. May be caused by slippage due to grease on idler wheel or inside rim of turntable.

## PICK-UP ARM TRIPS OUT OF GROOVES

1. Record changer not level.
2. Pickup arm shaft (71) binding in bearing.  
(A) Ream out the hole.

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(B) Sometimes the trip arm (82) may be too close to the base, causing a bind. To remedy, loosen its two setscrews (59) and space slightly.

3. Selector lever (82B) may be bent out of shape and binding against detent plate (69). Straighten.

4. Selector lever (82B) slot or retaining rivet on detent plate (69) may be undersize or oversize, respectively, effectively causing a binding feeling on the pickup arm. Correct by spreading slot in selector lever (82B).

5. Needle defective. Replace.

**CHANGER KEEPS CYCLING**

1. Eccentric stud adjustment (94B) set too tight. Correct per instructions found under ECCENTRIC STUD ADJUSTMENT.

2. Defective reject switch on radio. Repair or replace.

3. Bell crank arm (94) or drive arm (22) binding on their shafts.

**RECORD WILL NOT DROP WHILE CYCLING**

1. Eccentric (24) out of line with record post (48). Correct as shown in ADJUSTMENT OF RECORD DROP MECHANISM.

2. Setscrew (61) loose on spindle gear. Tighten after readjusting.

3. Record platform (46) not set correctly. See RECORD SUPPORT PLATFORM ADJUSTMENT.

**CHANGER WILL NOT CYCLE**

1. Open trip coil (106). Replace.

2. Defective wiring.

3. Binding drive arm (22), bell crank arm (94) or cam wheel (11) on shafts. Replace parts or remove burrs.

4. Eccentric adjustment stud (94B) set at minimum throw. Cycling drive wheel (23) is not against inner rim of turntable. Correct by setting up as shown under ECCENTRIC STUD ADJUSTMENT.

5. Record finish groove may be too far from center. Trip switch will not be actuated until needle comes within 1-7/8" of record post. Use standard records.

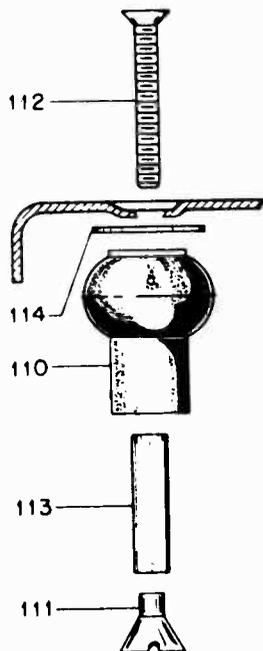


FIGURE 9. RC-34 SHOCK MOUNT ASSEMBLY

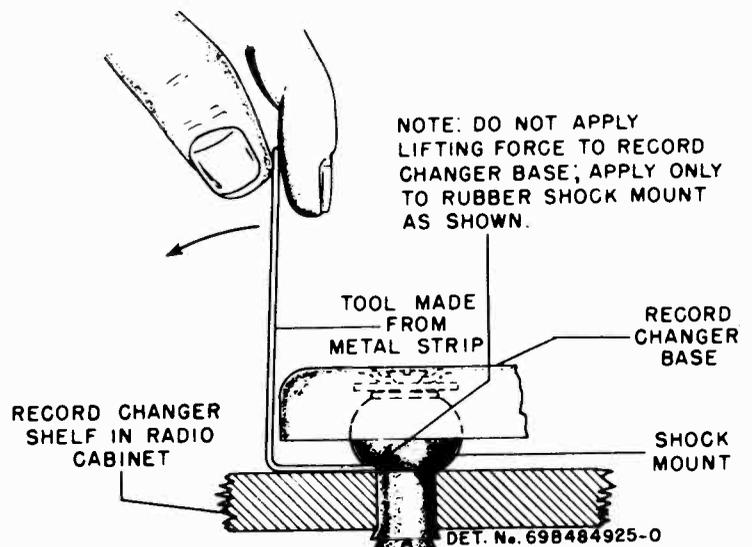


FIGURE 10. HOW TO REMOVE RECORD CHANGER RC-34 FROM RECORD CHANGER SHELF

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NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
1	45K470538	Arm, pickup: arm only; painted green (RC-30-A) .....	60	3S3376	Screw: #6 x 1/4 PKZ slotted hex head sheet metal screw; cadmium plated .....
	45K482820	Arm, pickup: arm only; painted red mahogany (RC-34 & RC-35) .....	61	3S7109	Screw: 6-32 x 5/16 slab head setscrew; cadmium plated (trip coil) .....
2	1X470570	Arm, pickup: complete; includes crystal cartridge, needle, connecting lead and shaft assembly; arm painted green (RC-30-A) .....	62	3S7342	Screw: 6-32 x 5/8 slotted binderhead machine screw; cadmium plated .....
	1X484298	Arm, pickup: complete; includes crystal cartridge, needle, connecting lead and shaft assembly; arm painted red mahogany (RC-34 & RC-35) .....	63	3S7374	Screw: 6-32 x 5/16 slotted hex head machine screw; cadmium plated .....
			64	3S2291	Screw: 8-32 x 5/16 slotted hex head machine screw; antique copper finish...
4	1X478181	Bracket, adjustment: includes screw and nut .....	65	3S8177	Screw: #8 x 3/8 PKZ slotted hex head sheet metal screw; cadmium plated .....
5	7B471487	Bracket, pickup arm & guide .....	66	3S2957	Screw: 8-32 x 1/2 slotted hex head machine screw; cadmium plated .....
6	7B470266	Bracket, spindle .....			
7	35A470831	Bumper, rubber .....	67	3S2878	Screw: #8 x 5/8 plain locking hex head sheet metal screw; cadmium plated .....
8	43K4780	Bushing: .250 x .171 x .187 .....	68	3S476110	Screw: 8-32 x 3/4 Phillips round head machine screw; cadmium plated .....
9	43A478167	Bushing, shaft pickup .....			
10	43K71249	Bushing, spacer .....	69	1X470480	Selector Shaft & Plate Assembly .....
11	1X471999	Cam Wheel & Spring Assembly .....	70	47B470269	Shaft, cam .....
12	1B470509	Cap & Spindle Assembly .....	71	47A471471	Shaft, pickup .....
13	59A471595	Cartridge, crystal: needle included .....	72	41A471469	Spring, compression .....
14	42K13135	Clamp, cable: 1/2" .....	73	41A71635	Spring, selector .....
15	42A75809	Clip, cartridge retainer .....	74	41A471995	Spring, selector stud guide .....
16	42A76484	Clip, drive wheel retainer .....	75	41A471681	Spring, tension coil .....
17	42A72314	Clip, retainer: 7/8"; blued .....	76	41A14244	Spring, tension coil: 1/8 x 23/32 .....
19	9A72670	Contact, pin terminal .....	77	41A470592	Spring, tension coil: 1/4" x 1" .....
21	35A72628	Cushion, pickup arm: 3/8" x 1/2" sponge rubber .....	78	46A470257	Stud, gear arm .....
			79	1X470539	Trip Arm & Selector Lever Assembly .....
22	1X470584	Drive Arm Assembly: complete with bearing and idler gear .....	80	59C470590	Turntable, phono: includes oilite bearing; green (RC-30-A) .....
23	1X71795	Drive Pulley & Shaft .....			
24	1B470524	Eccentric & Tube Assembly .....			
25	1X470593	Gear Arm & Bushing Assembly .....			
26	44B71634	Gear, spindle .....	84	59K482840	Turntable, phono: includes oilite bearing; brown (RC-34 & RC-35) .....
30	1X470532	Lead, pickup connecting .....	85	4A21941	Tire, phono motor idler pulley .....
33	4S7657	Lockwasher: #8 external; cadmium plated .....	86	4A470946	Washer, "C" .....
			87	49A470239	Washer, cam shaft .....
34	4S7671	Lockwasher: #8 split; cadmium plated .....	88	4S7623	Wheel, spindle stop & pin .....
35	29R5239	Lug, soldering: #8, long tab .....			
36	59K470458	Motor, phono: 105-120V, 60C; complete with rubber tired idler pulley .....	89	4S7597	Washer: 3/8 x 11/64 x .033 thick; antique copper finish .....
37	47K471596	Needle, phono: long-life .....	90	4S7695	Washer: 7/16 x .171 x .033 thick; cadmium plated .....
39	2S1375	Nut: 8-32 x 11/32 hex; cadmium plated .....	91	4S1765	Washer: 1/2 x .147 x 1/64 thick; cadmium plated .....
40	2S7004	Nut: 3/8-32 x 9/16 hex; cadmium plated .....	92	4K76609	Washer: 9/16 x .315 x .010 thick; brass .....
41	35A74664	Pad, cartridge (large): rubber .....	93	4A21491	Washer: 9/16 x .315 x .020 thick; brass .....
42	35A74665	Pad, cartridge (small) .....	94	1X481432	Bell Crank Lever Assembly .....
44	47A74866	Pin, cartridge locating: rubber .....	95	1A481442	Bracket & Bushing; coil mounting .....
45	47A71685	Pin, pickup arm support .....	96	1X481447	Latch Arm & Bushing Assembly .....
46	1X470535	Plate & Clamp Assembly; painted green (RC-30-A) .....	97	45A74582	Link, trip .....
			98	4S7695	Lockwasher: #5 internal; cadmium plated (soldering lug) .....
	1X482826	Plate & Clamp Assembly; painted red mahogany (RC-34 & RC-35) .....	99	29R3004	Lug, soldering: #6, bent .....
47	46K470827	Post, pickup resting: green plastic (RC-30-A) .....	100	5S7716	Rivet: .122 x 5/32 steel; antique copper (soldering lug) .....
	46K482816	Post, pickup resting: red mahogany plastic (RC-34 & RC-35) .....	101	3S2689	Screw: #4 x 5/16; PKZ Phillips binderhead; antique copper .....
48	47B470276	Post, record & bushing .....	102	41A76681	Spring, ratchet .....
49	46B470831	Post, record support: painted green (RC-30-A) .....	103	41A71876	Spring, torsion .....
			104	46A71810	Stud, shoulder (latch arm) .....
	46K482817	Post, record support: painted red mahogany (RC-34 & RC-35) .....	105	1X76787	Trip arm, small .....
			106	24B481418	Trip coil & core .....
49A	28A470534	Plug, 4 pin .....	107	4K24125	Washer, "C" (latch arm) .....
50	9A470260	Receptacle, phono output .....	108	3S7109	Setscrew: 6-32 x 5/16 slab head, cup point machine screw .....
51	5S2834	Rivet: .062 x 9/64 brass; nickel plated .....			
52	5S2824	Rivet: .122 x 5/32 steel; burnished brass finish .....	109	1X481431	Bell Crank Lever & Arm Assembly: includes 94, 103 & 105 .....
53	5K21337	Rivet, shoulder: .130 x .230 .....	110	35A481870	Mount, shock rubber .....
54	47A471481	Rod, pickup lift .....	111	2A484296	Nut, shock mount tapered tee .....
55	3S2697	Screw: #2 x 5/8 PKZ plain hex head sheet metal screw; cadmium plated .....	112	3S488108	Screw: 10-32 x 1-3/8 Phillips flathead machine screw; antique copper finish ..
59	3S9700	Setscrew: 6-32 x 3/16 Allen head; cadmium plated .....	113	43A484295	Sleeve, shock mount: rolled .....
			114	4S8214	Washer: 7/8 x .203 x .087; cad. pl .....

## DESCRIPTION OF OPERATING CYCLE

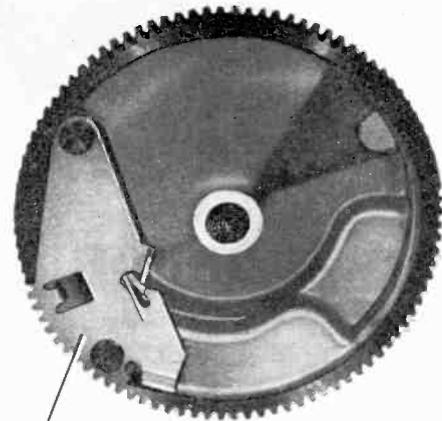
Power for the motor is applied through the on-off switch. The turntable is rim-driven by a rubber-tired idler wheel mounted between the motor shaft and the turntable rim.

The turntable hub is a combined shaft and gear (figure 1). This small hub gear engages a large cam gear (figure 2) when the retractable segment of the cam gear is brought into position by the action of the trip mechanism; the cam gear, in turn, operates the changer mechanism.

The tone arm is operated by two link assemblies attached to actuator levers (figure 3) which are in contact with the cam surface of the cam gear.

The record-shelf push-off mechanism is connected, through a series of bars (figure 4), to a push-off actuator; the mechanism is operated when a roller on the cam gear comes in contact with the actuator.

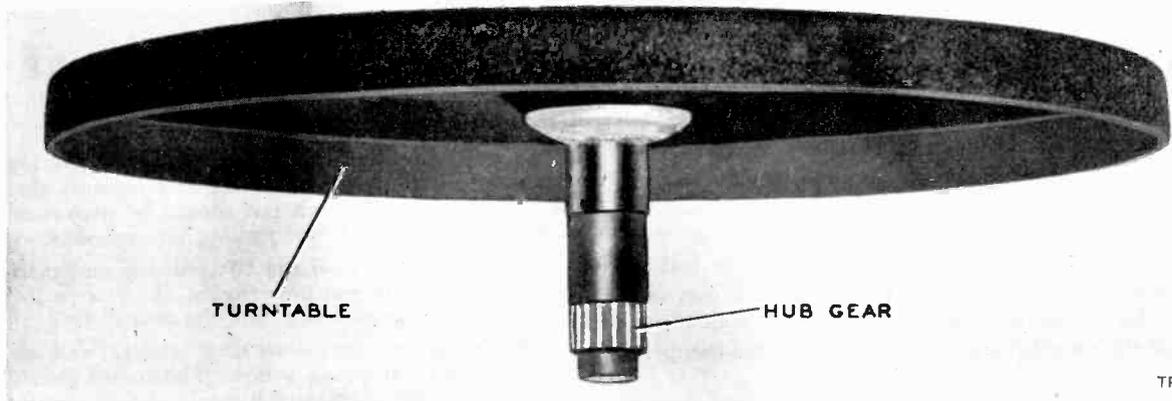
The trip mechanism is operated by a trip finger, riding over a ratchet screw (figure 5), which starts the change cycle when the needle is traveling in the eccentric finish groove of the record. The trip mechanism is locked in a disengaged position when the control button is in the manual position.



RETRACTABLE SEGMENT

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Figure 2—CAM GEAR, SHOWING RETRACTABLE SEGMENT



TURNTABLE

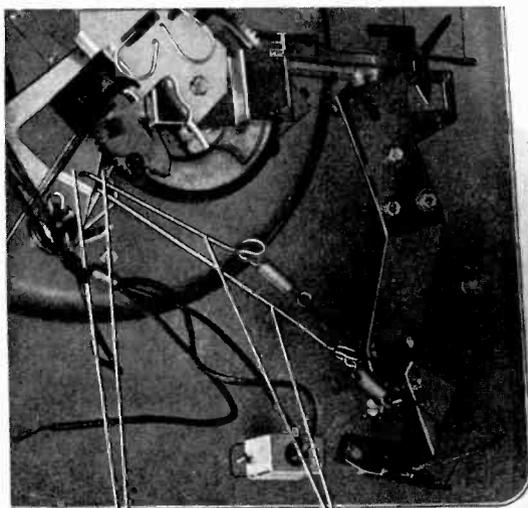
HUB GEAR

TP-4184

TP-4181

TP-4101

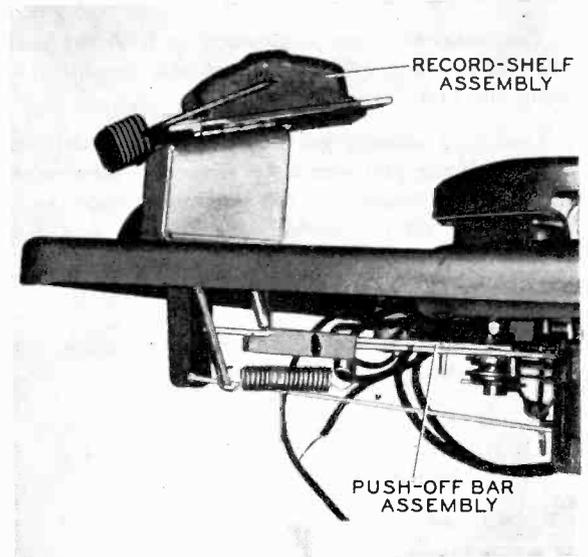
Figure 1—TURNTABLE AND HUB GEAR



ACTUATOR LEVERS

LINK ASSEMBLIES

Figure 3—LINK ASSEMBLIES AND ACTUATOR LEVERS



RECORD-SHELF ASSEMBLY

PUSH-OFF BAR ASSEMBLY

Figure 4—RECORD-SHELF AND PUSH-OFF ASSEMBLIES

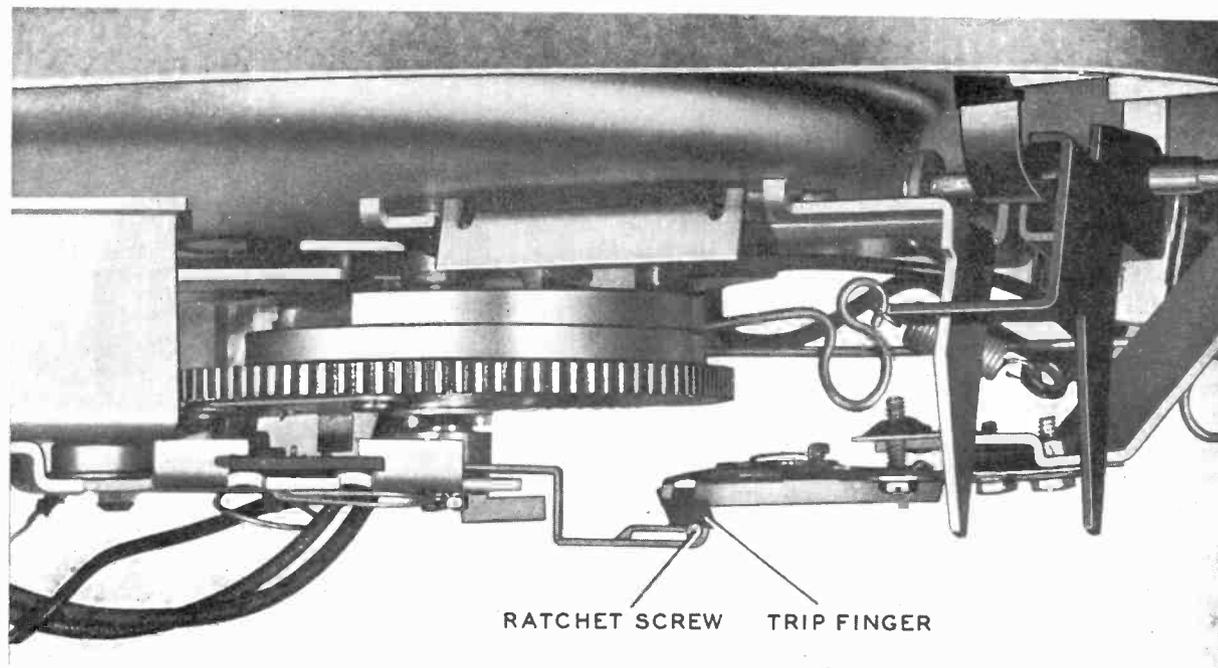


Figure 5—TRIP FINGER AND RATCHET SCREW

TP-4135

## PHILCO RADIO-PHONOGRAPH TROUBLE-SHOOTING PROCEDURE

The following tests are given for quickly localizing trouble in either the radio or phonograph section of the radio-phonograph combination. Be sure to make each test, in the order given, before removing either the radio chassis or the record changer from the cabinet. If the trouble is found to be in the audio amplifier, refer to the radio service manual for the particular model under test. If the trouble is in some part of the record changer, refer to this record-changer manual.

### Audio-Amplifier Test

The audio amplifier is common to both the radio and the phonograph sections of the combinations using the M-8 changer.

Tune in a station, and note the volume and tone quality. If the performance is abnormal, refer to the radio service manual for the particular model under test, and correct the trouble.

### Pickup Test

Play a familiar record on the phonograph, and again note the volume and tone quality.

#### NOTE

It is advisable to carry a familiar record as a part of the service test equipment.

If distortion is noted when playing the record, first try a new needle. If the distortion continues, a faulty crystal pickup is indicated.

### Changer-Mechanism Test

The following series of record-changer operating tests is given for quickly locating any troubles that may be encountered. Each test should be performed with several records before making any adjustments.

Set the record shelf to the 10" position and place the tone arm on the rest post (figure 6). Place a 10" record over the spindle and onto the record shelf.

Push the control button to REJ (reject), and observe the record-dropping action. The record should fall smoothly, the edge leaving the lips of the record shelf *after* the center has started to fall.

TP-4103



Figure 6—CHANGER, RECORD SHELF IN 10" POSITION

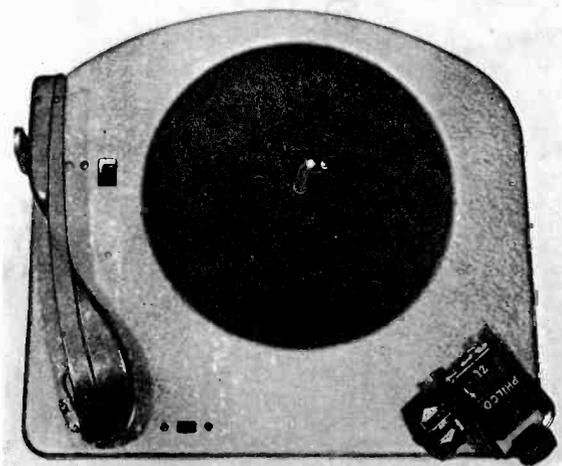


Figure 7—CHANGER, RECORD SHELF IN 12" POSITION

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The tone arm should rise from the rest post, and the needle should come down on the record, starting about  $\frac{1}{8}$ " from the outer edge.

Play the record through and observe the tripping action; the trip mechanism should operate within the first two or three revolutions after the needle has entered the eccentric finish groove.

Remove the record from the turntable and set the record shelf to the 12" position (figure 7). Place a 12" record over the spindle and onto the record shelf. Push the control button to REJ., and observe the record-dropping action. The record should leave the lips of the record shelf *after* the center has started to fall. Refer to — — — — the record-shelf adjustment, if needed. The tone arm should rise from the rest post,

and the needle should come down on the record, starting about  $\frac{1}{8}$ " from the outer edge.

Play the record through and observe the tripping action. Trip adjustments are given on page 10.

Observe whether the lower edge of the tone arm, during a change cycle, clears the top of the hook on the tone-arm rest post by a minimum of  $\frac{1}{8}$ ". Take the tone arm off the rest post, and place the pickup over the changer base plate; the needle point should clear the base plate by at least  $\frac{1}{16}$ ", and should be no higher than the turntable top.

## Turntable and Motor Test

### NOTE

Before making this test, warm up the motor by allowing it to run for at least ten minutes.

Set the control button to MAN. (manual), load the turntable with ten 12" records, and place the tone arm on the top record.

Place a stroboscope disc, such as Philco Part No. 45-2900, on the record, and illuminate the disc with a lamp (preferably a neon bulb) operated on 60-cycle a.c. The dots in the row calibrated for 78 r.p.m. should appear to remain stationary, or drift *very* slowly, but smoothly, backward or forward.

If the turntable speed is steady, but is appreciably below 78 r.p.m., refer to the lubrication data on the turntable upper bearing, motor bearings, and motor idler plate, given under CLEANING AND LUBRICATION, — — — — if the lubrication appears to be adequate, the motor is probably defective.

Unsteady drift of the dots on the stroboscope disc indicates uneven turntable speed, the cause of wows; see UNEVEN TURNTABLE SPEED (WOWS),

## CLEANING AND LUBRICATION

The M-8 record changer, like any other mechanism, requires lubrication after long periods of use. Whenever a major part or assembly is to be replaced, the changer should be cleaned and lubricated. Carbon tetrachloride or other similar cleaning fluids may be used to remove old gease, oil, and dirt. Apply lubricants sparingly. All lubrication points are shown in figures 8 and 9. It may be necessary to remove some parts and assemblies in order to lubricate their bearings—for example, the actuator and cam gear must be removed to lubricate the actuator stud and the cam-gear spindle.

### PARTS NOT TO BE LUBRICATED

The following parts should not be lubricated at any time: Trip receiver; trip finger; ratchet screw on trip plate; selector.

### PARTS TO BE GREASED

The following parts are to be lubricated with a grease having the consistency of vaseline:

#### Record-Shelf Assembly (point A of figure 9)

Four protruding dimples.

#### Bridge Assembly and Slider Control Bar (point B of figure 8)

Three dimples and four upturned ears.

#### Cam Gear (point C of figure 8)

Cam-gear teeth, cam surfaces, and cam-gear spindle.

#### Main Assembly (points D, figures 8, 9, and 13)

Trip-plate ear where contact is made with gear segment.

Actuator stud.

All parts with ears sliding on changer base plate.

Index-lever surface which slides on base plate.

Push-off-actuator dimples which slide on base plate.

Turntable shaft (upper bearing).

Tone-arm shaft.

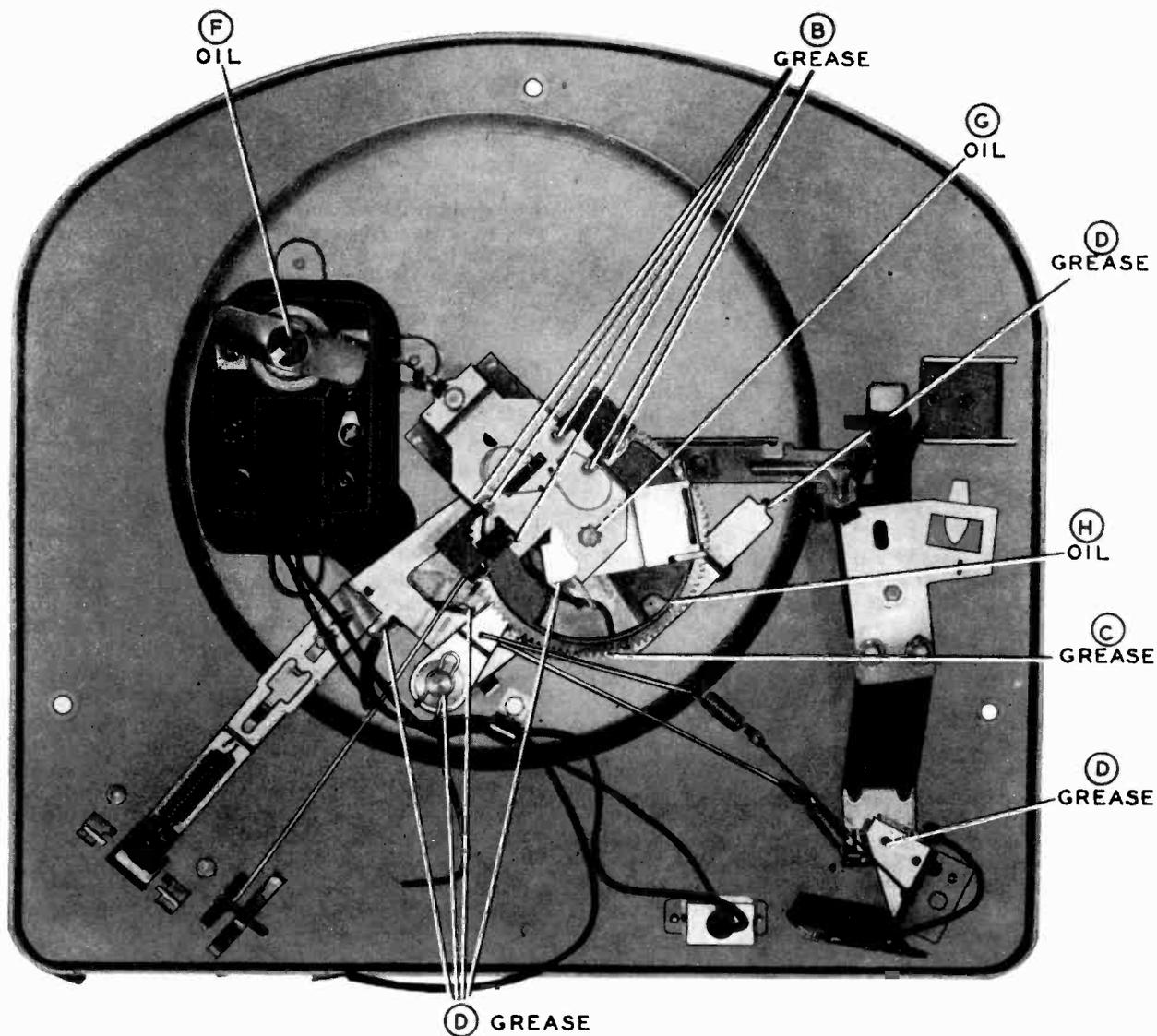


Figure 8—BOTTOM VIEW OF CHANGER, SHOWING LUBRICATION POINTS

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#### PARTS TO BE OILED

The following parts are to be lubricated with S.A.E. 20 oil:

##### Tone Arm (point E of figure 9)

Tone-arm pivot pin where pin rides in elongated hole of tone arm—apply one drop with a pointed rod.

##### Motor (points F, figures 8 and 9)

Motor idler plate—one or two drops in each dimple.

Motor bearings.

##### Trip-Plate Bushings (point G of figure 8)

##### Cam-Gear Roller (point H of figure 8)

#### CAUTION

Do not get any oil or grease on the motor shaft or the idler-wheel tire. Should this occur, remove the oil or grease immediately with carbon tetrachloride.

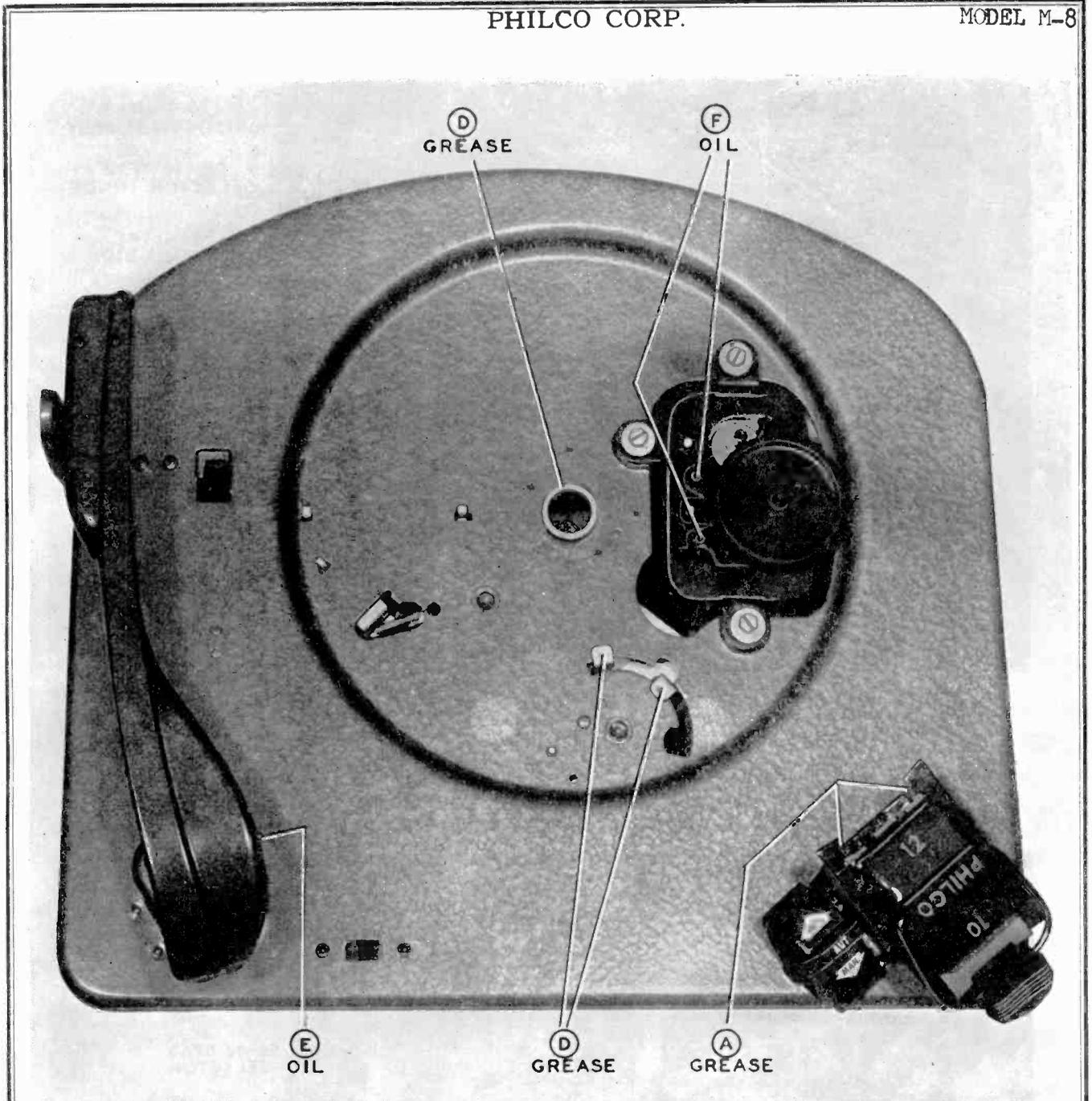


Figure 9—TOP VIEW OF CHANGER, SHOWING LUBRICATION POINTS

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## ADJUSTMENTS

### 10" Index Adjustment

Set a 10" record on the turntable; push the control button to REJ., and rotate the turntable  $4\frac{1}{2}$  turns by hand. The tone arm should then be approximately  $\frac{1}{2}$ " above the record.

Loosen the clamp screw on the trip arm (figure 10). Hold the tone arm (steady)  $\frac{1}{8}$ " in from the edge of the record, and set the trip arm so that the trip-arm stop is in contact with the selector hinge. See figure 10.

Tighten the clamp screw, leaving  $\frac{1}{32}$ " vertical play, or clearance, between the trip arm and the base plate.

### 12" Index Adjustment

Make the 10" index adjustment first. The 12" indexing will ordinarily be satisfactory after the 10" adjustment is made; if not, bend the selector, 56-4618FA3, slightly to the right or left as required for proper indexing of the needle on the record, as shown in figure 11.

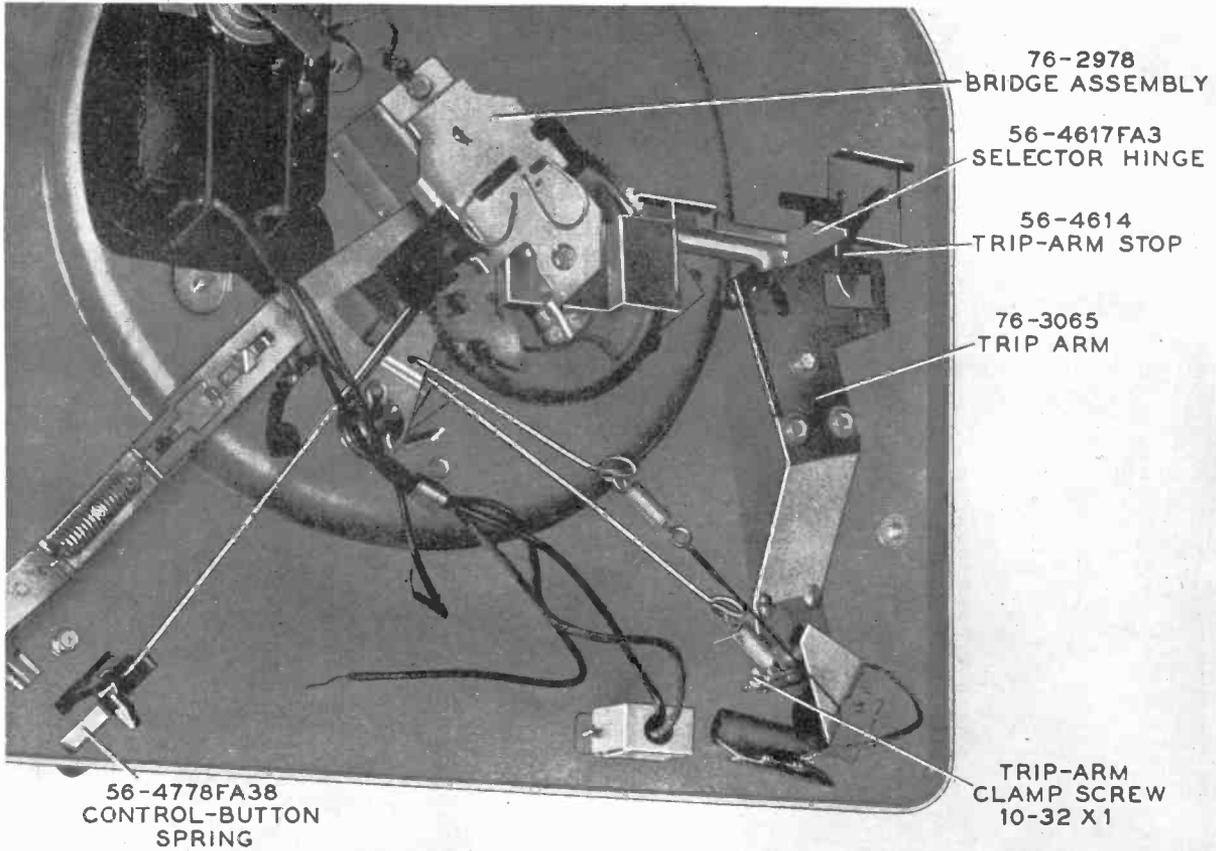
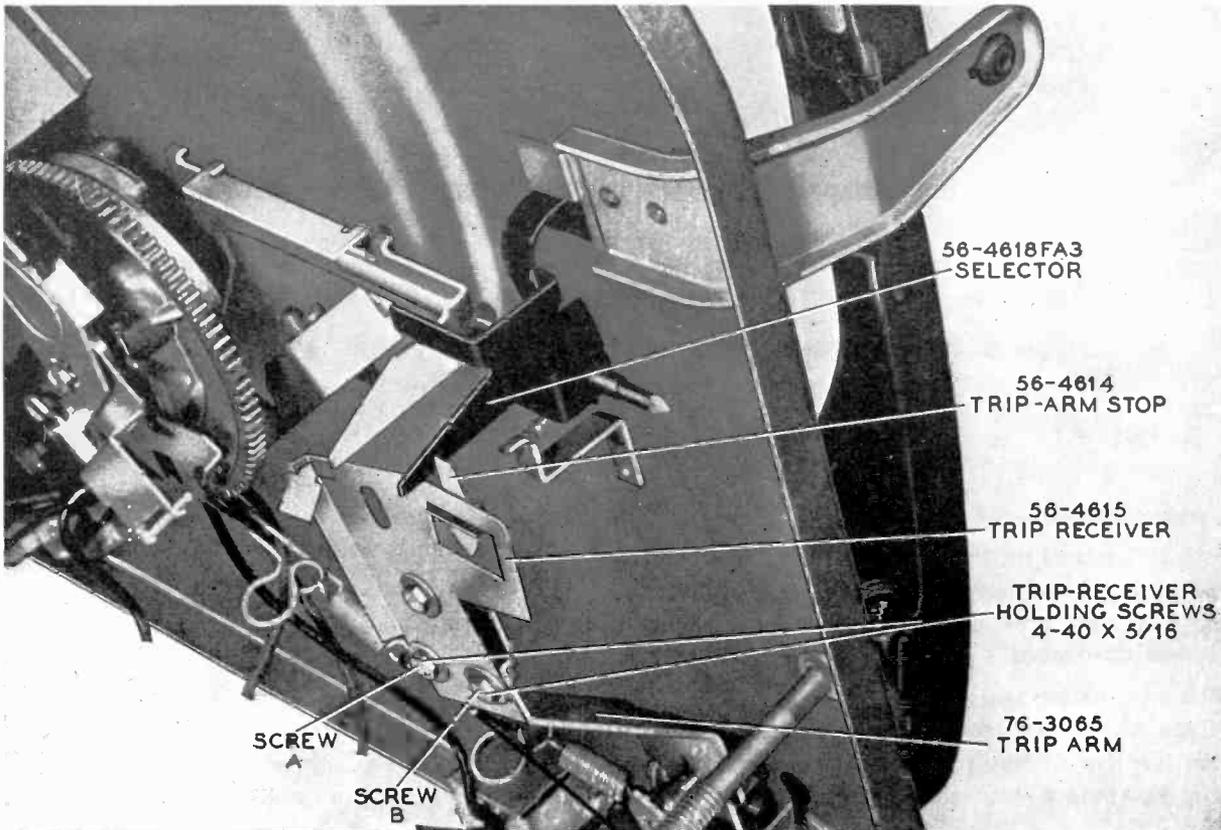
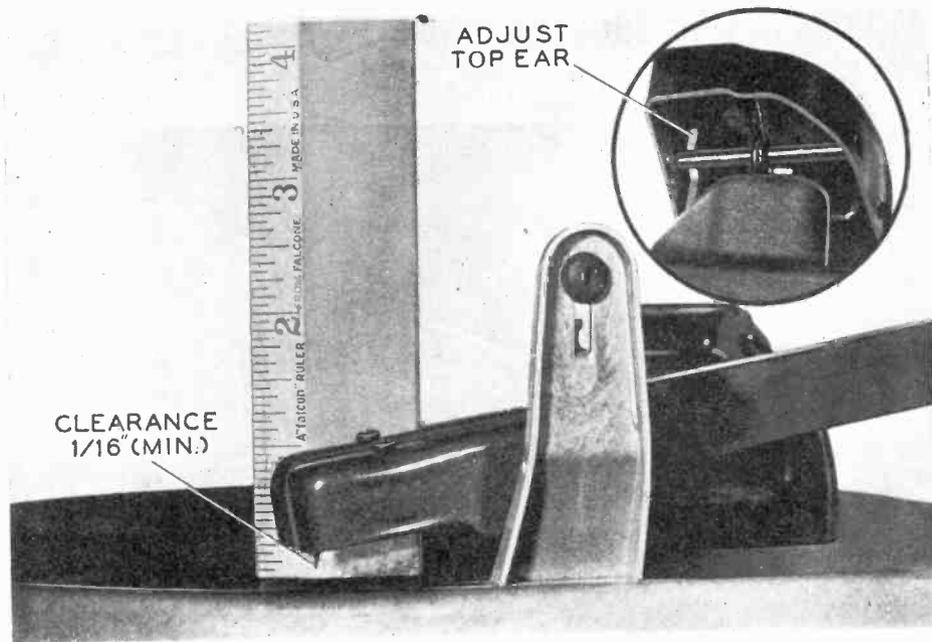


Figure 10—10" INDEXING ADJUSTMENT  
Figure 11—12" INDEXING AND TRIP-RECEIVER ADJUSTMENTS

TP 4101

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TP-4000

**Figure 12—TONE-ARM HEIGHT ADJUSTMENT**  
**Tone-Arm Height and Lift Adjustments**      **Tone-Arm Vertical and Horizontal Timing Adjustments**

With the changer out of cycle (change cycle completed; tone arm lowered), and the tone arm off the rest post, the needle point should clear the changer base plate by at least  $\frac{1}{16}$ " , and should not be higher than the turntable top. See figure 12. To adjust the height, shape the *top* ear of the tone-arm swivel, shown in figure 12 (bending the ear downward raises the tone arm).

To adjust the lift, take the tone arm off the rest post, push the control button to REJ., and rotate the turntable (approximately  $1\frac{1}{2}$  turns) by hand until the tone arm comes against the rest post. See figure 13; the lower edge of the tone arm should clear the top of the protruding hook on the rest post by not less than  $\frac{1}{8}$ " , and not more than  $\frac{1}{4}$ " . Adjust by shaping the *lower* ear of the tone-arm swivel (bending the ear downward raises the tone arm).

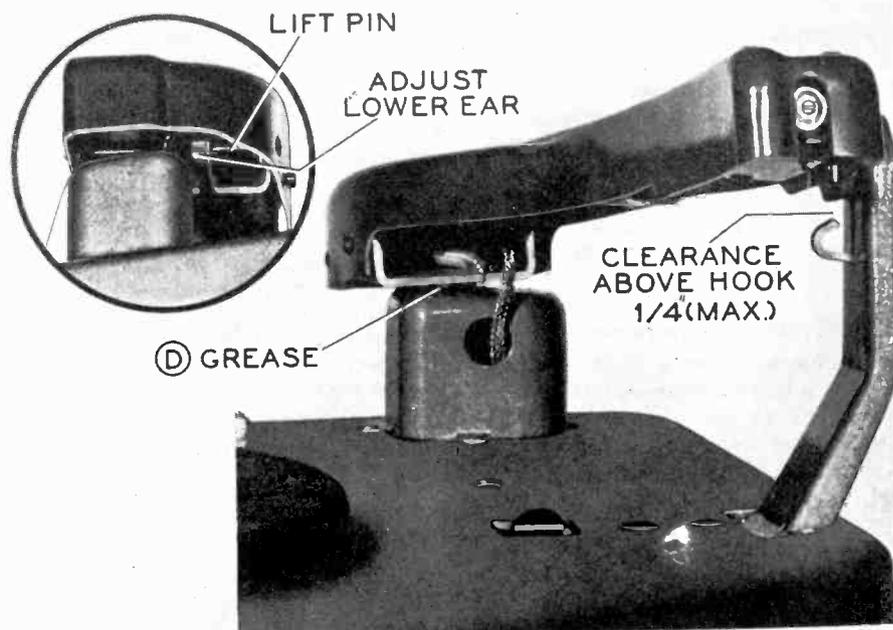
**NOTE**

Before making these adjustments, make the tone-arm height and lift adjustments given above.

For the vertical adjustment, start with the changer out of cycle, push the control button to REJ., and rotate the turntable, by hand, three-quarters of a revolution; this setting can be obtained more accurately by making a mark on the turntable to coincide with some starting point. At the three-quarter-revolution point, the leading edge of the cam surface is approximately  $\frac{1}{4}$ " from the end of the lift actuator lever; this is the lower actuator lever, shown in figure 14. Adjust the wire loop of the short link (link, cord, and spring assembly), attached to the tone-arm lift pin, by squeezing or opening the loop until the tone-arm lift pin makes contact with the lower ear of the tone-arm swivel (figure 13).

**Figure 13—TONE-ARM LIFT ADJUSTMENT**

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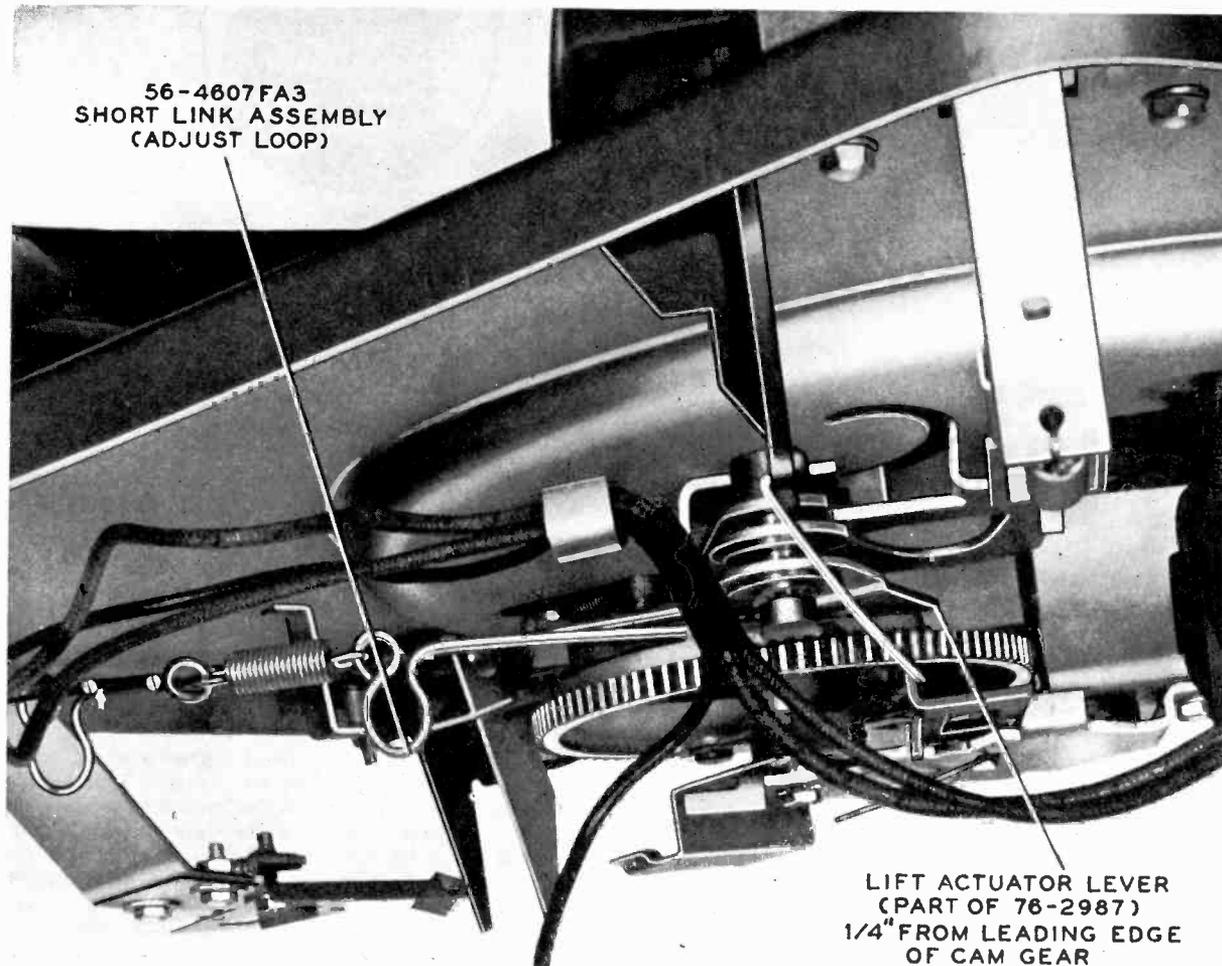


Figure 14—TONE-ARM VERTICAL TIMING ADJUSTMENT

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For the horizontal adjustment, rotate the turntable another three-quarter revolution from the point at which the vertical adjustment was made. At this point, the leading edge of the cam surface is approximately  $\frac{1}{4}$ " from the end of the horizontal-return actuator lever; this is the upper actuator lever, shown in figure 15. Adjust the wire loop of the long link and spring assembly, attached to the trip arm, by squeezing or opening the loop until the tone arm makes contact with the rubber bumper on the tone-arm rest post.

#### Trip-Finger and Trip-Receiver Adjustments

For the trip-finger adjustment, move the tone arm toward the spindle. Adjust the screw on the trip-receiver plate (figure 16) so that the trip finger, when riding over the ratchet screw on the trip plate, assumes an angle of  $25^\circ$  to  $30^\circ$  with respect to the screw. Do *not* bend the trip finger to obtain the correct angle.

For the trip-receiver adjustment, place the tone arm on a record with the needle resting in the eccentric finish groove. The vertical center line of the trip finger should coincide with the center line of the ratchet screw. To adjust the centering of the trip finger over the ratchet screw, loosen screw B slightly, and screw A completely (see figure 11). Rotate the trip receiver about screw B, as a center, to obtain the correct adjustment (see figure 16). Tighten the screws.

Approximately  $\frac{1}{8}$ " of the trip-arm stop should engage the selector (see figure 11). To adjust the engagement of the trip-arm stop, loosen screw A slightly, and screw B completely (see figure 11). Rotate the trip receiver about screw A, as a center, to obtain the correct adjustment. Tighten the screws.

The above adjustments will affect each other slightly; therefore, it may be necessary to repeat each adjustment until both are correct.

After making the above adjustments, it will be necessary to correct the index adjustments.

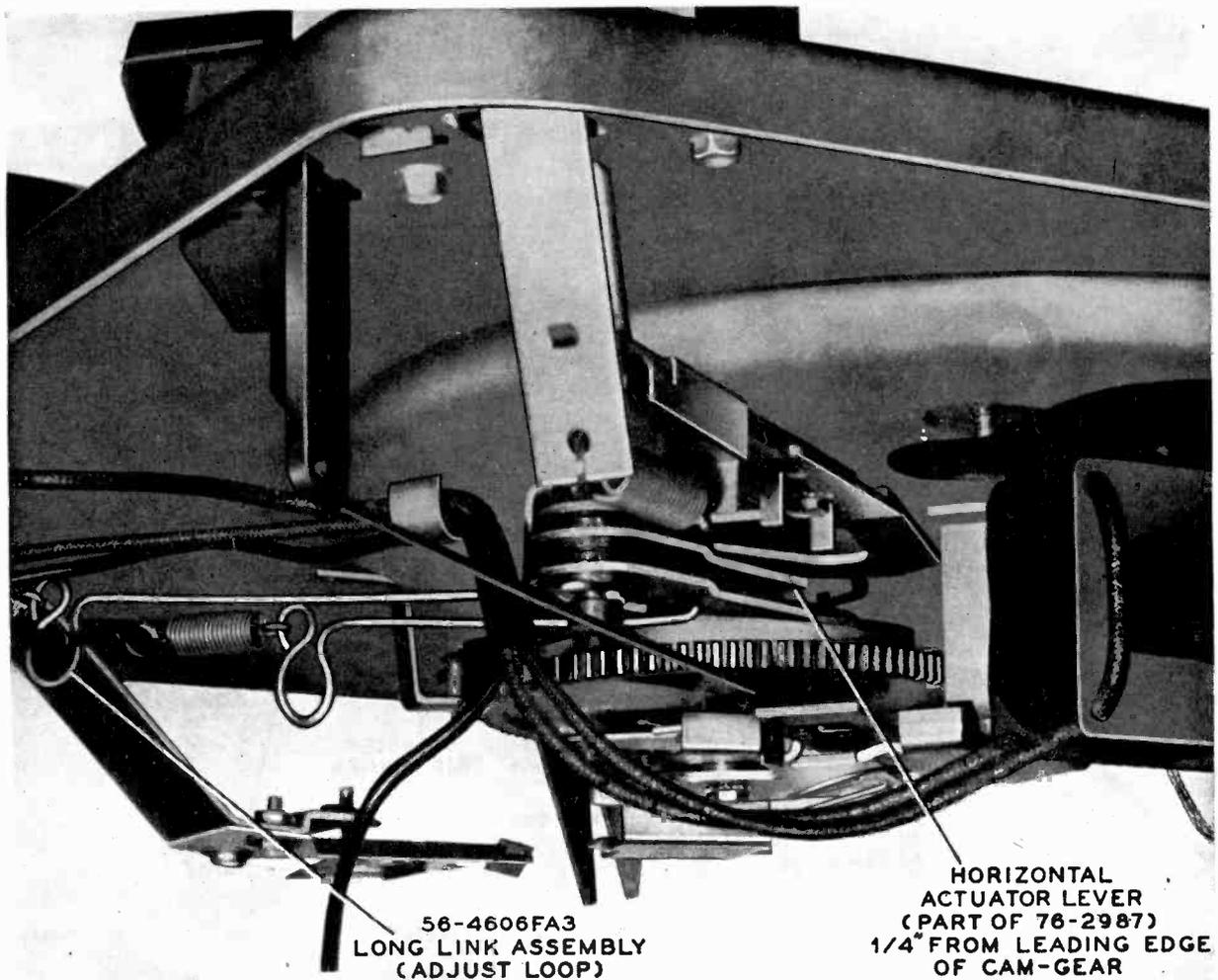


Figure 15—TONE-ARM HORIZONTAL TIMING ADJUSTMENT

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#### Record-Shelf Adjustment

Place the shelf in the 10" position, and the changer out of cycle. Place the Philco record-shelf gauge, 45-1470 (also used for M-4), over the spindle and onto the record shelf, as shown in figure 17. Loosen the two hex-head screws which hold the record-shelf assembly to the changer base plate (figure 18). Move the record-shelf assembly away from the record spindle until the large curved part of the gauge drops even with the record-shelf lips, as shown in figure 17. Now push the record shelf and gauge lightly against the spindle, taking out all play toward the spindle; keep the lips of the record shelf in even

contact with the edge of the gauge. Tighten the two hex-head screws.

#### Push-Off Adjustment

Push the control button to REJ., and rotate the turntable  $2\frac{1}{2}$  revolutions, by hand; at this point, the push-off actuator is in its most forward position, in contact with the roller on the cam gear (see figure 19). Loosen the push-off-bar locking screw, shown in figure 18. Squeeze the push-off-bar ears toward each other to the point where the slider blade on the record shelf extends  $\frac{1}{32}$ " beyond the lips of the shelf. Tighten the hex-head locking screw.

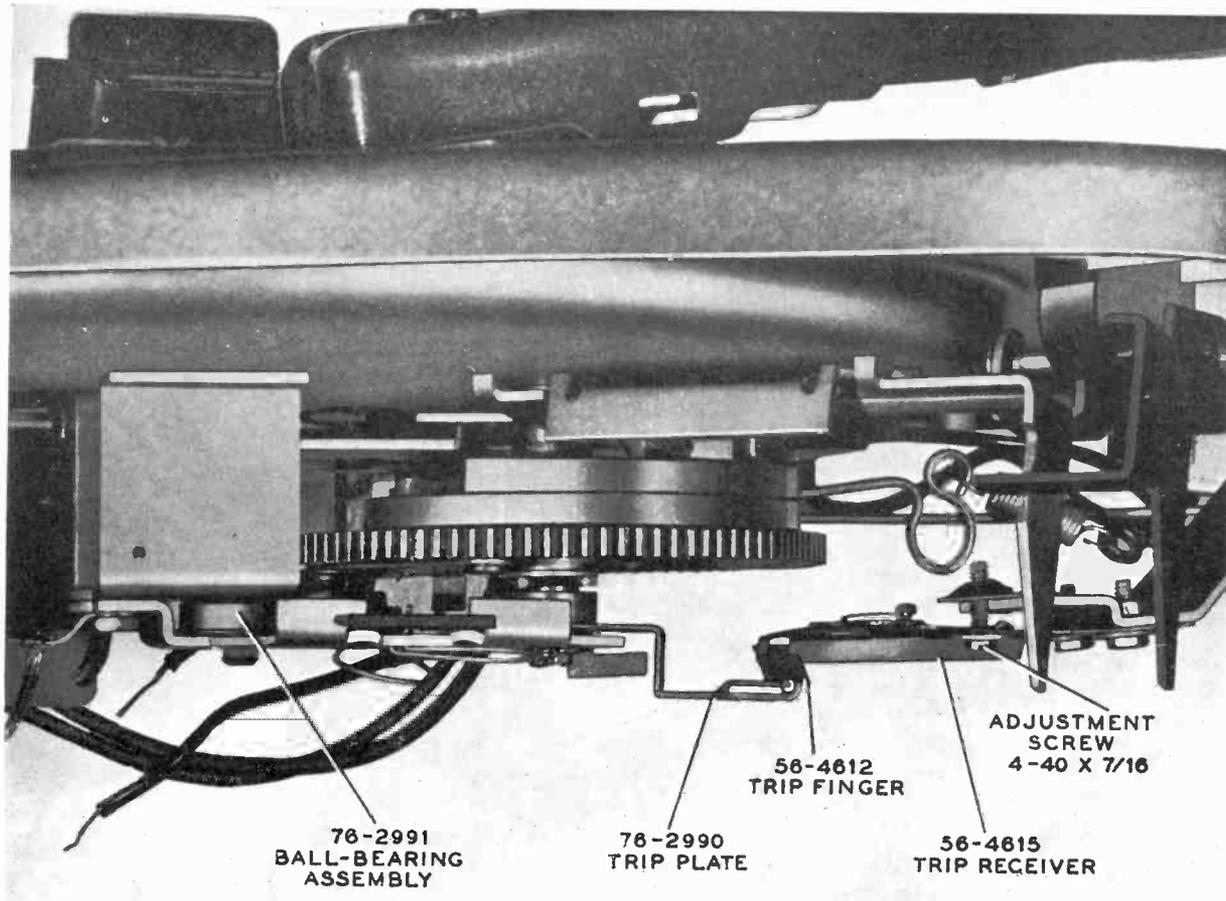
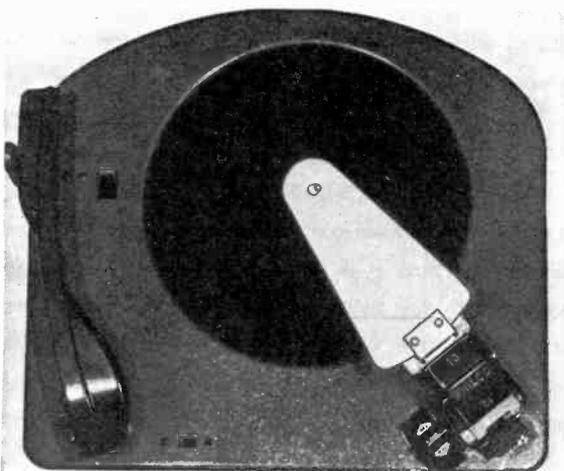


Figure 16—TRIP-FINGER ADJUSTMENT

TP-4135

Figure 17—SPECIAL GAUGE, SHOWN IN CORRECT POSITION ON RECORD SHELF AND SPINDLE



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**Uneven Turntable Speed (Wows)**

Uneven turntable speed (wows) may be caused by the following:

Dirt under and around the turntable or idler-wheel assembly. Remove the turntable and clean out the dirt. Be careful to lift the turntable straight up. When replacing the turntable, be sure the idler is behind the turntable rim before the turntable is fully lowered (the spindle may be used to hold the idler back).

Flat or worn spots, or grease, on the rubber tire of the idler wheel.

Defective turntable shaft or bearing assembly.

Replace the defective parts as directed under REPLACEMENT OF PARTS AND ASSEMBLIES.

Lack of lubrication on idler-wheel assembly. Follow the directions under CLEANING AND LUBRICATION

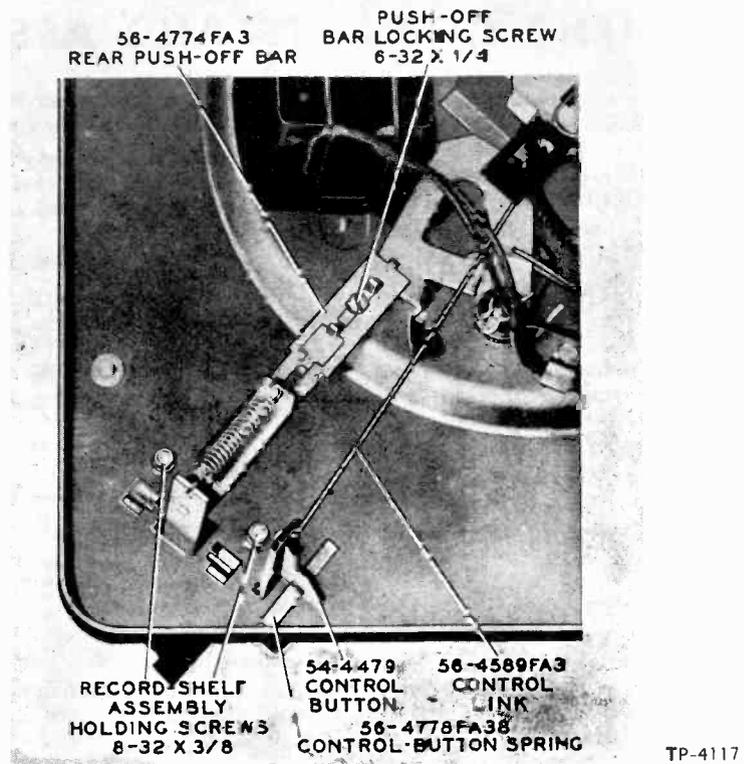
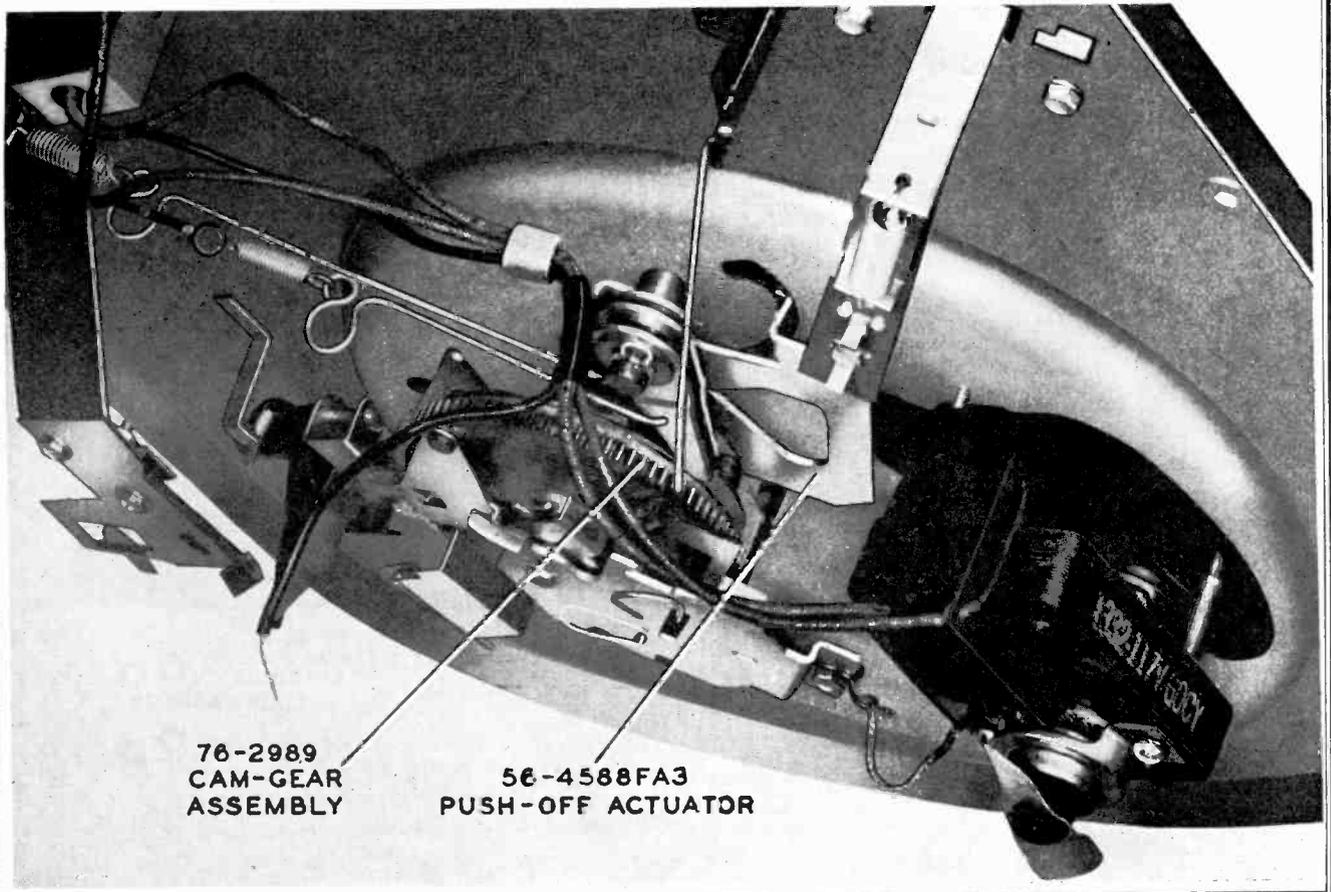


Figure 18—PUSH-OFF-LEVER ADJUSTMENT

Figure 19—PUSH-OFF ACTUATOR AGAINST CAM ROLLER

TP-4134



## REPLACEMENT OF PARTS AND ASSEMBLIES

The following procedures are recommended for correct replacement of parts and assemblies. The part should be replaced by reversing the order of removal, and adjusted according to the directions given in the ADJUSTMENTS section of this manual.

When any part is to be removed, the control button should be in the AUT. (automatic) position, and the changer should be out of cycle.

### 1. Needle

There are two types of needle chucks, depending upon the type of pickup cartridge in the tone arm. One type of chuck has a setscrew, for vertical needle insertion; the other has a knurled nut, for horizontal needle insertion.

To remove needle from tone arm, loosen setscrew or knurled nut in front of crystal cartridge, and pull needle out.

### 2. Crystal-Pickup Cartridge

At the present time, the pickup cartridge may be either of two types, one identified by vertical needle insertion, and the other by horizontal needle insertion. The cartridge type may be identified by the part number stamped on the bottom of the cartridge. Since the loading circuit in the radio differs for each type of pickup, the two cartridges are not interchangeable.

- a. Bring tone arm toward center of turntable.

- b. Remove the two screws, nuts, lock washers, and spacers which hold cartridge to tone arm.

- c. Drop cartridge below tone arm sufficiently to allow removal of the two clips from cartridge, as shown in figure 20. If pickup leads are shielded, unsolder shield.

#### NOTE

When mounting cartridge, be sure to insert long spacer in side toward spindle. For cartridge 35-2643, use mounting spacers 56-4601 and 56-4601-1; for cartridge 35-2671-1, use mounting spacers 56-4601-2 and 56-4601-3.

### 3. Motor

- a. Push control button to MAN. position.

- b. Remove spindle. Remove turntable by pulling straight out.

- c. Remove switch cover, and unsolder motor lead from switch contact.

- d. Loosen screw of clamp which holds wire against base plate, and pull wire through clamp.

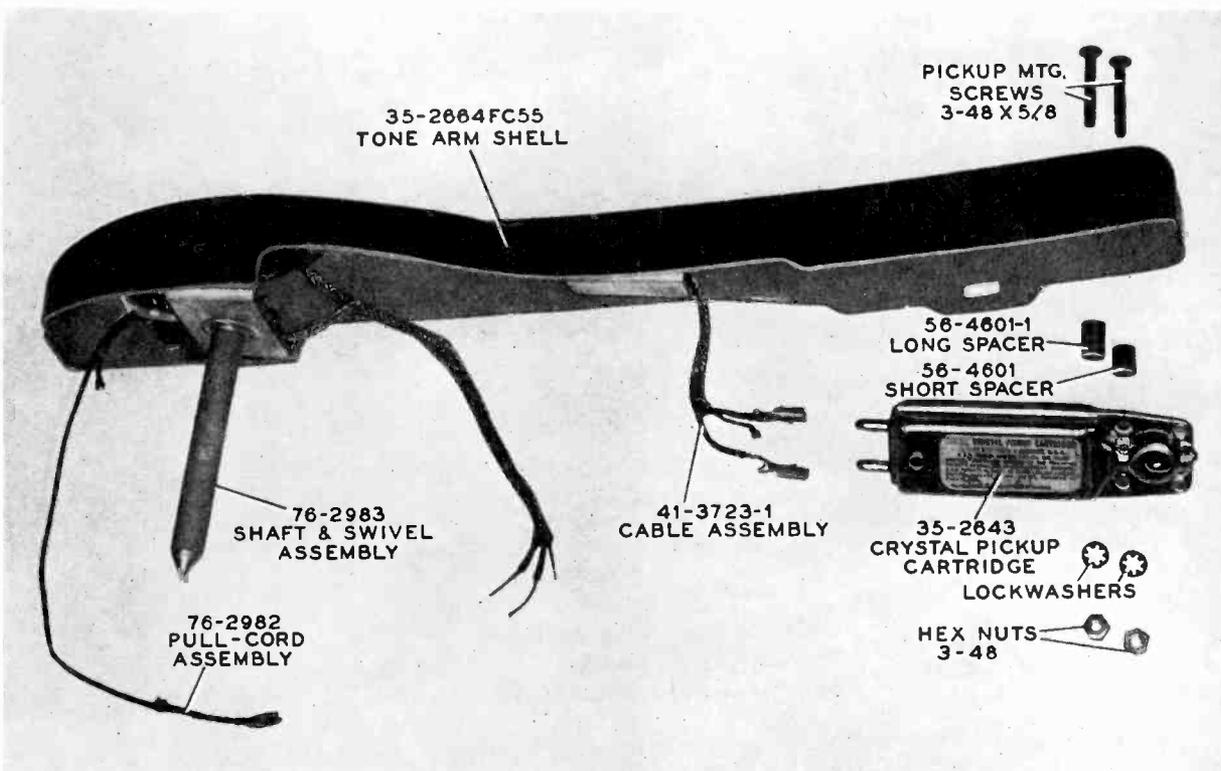
- e. Unsolder second motor lead from power plug or disconnect at splice from chassis power lead, whichever is used.

- f. Remove ground lead from lug on motor.

- g. Remove the three screws, washers, and bushings from motor frame (figure 21), and lift motor out.

Figure 20—TONE ARM (35-2663), CRYSTAL CARTRIDGE (35-2643) REMOVED

TP-4130



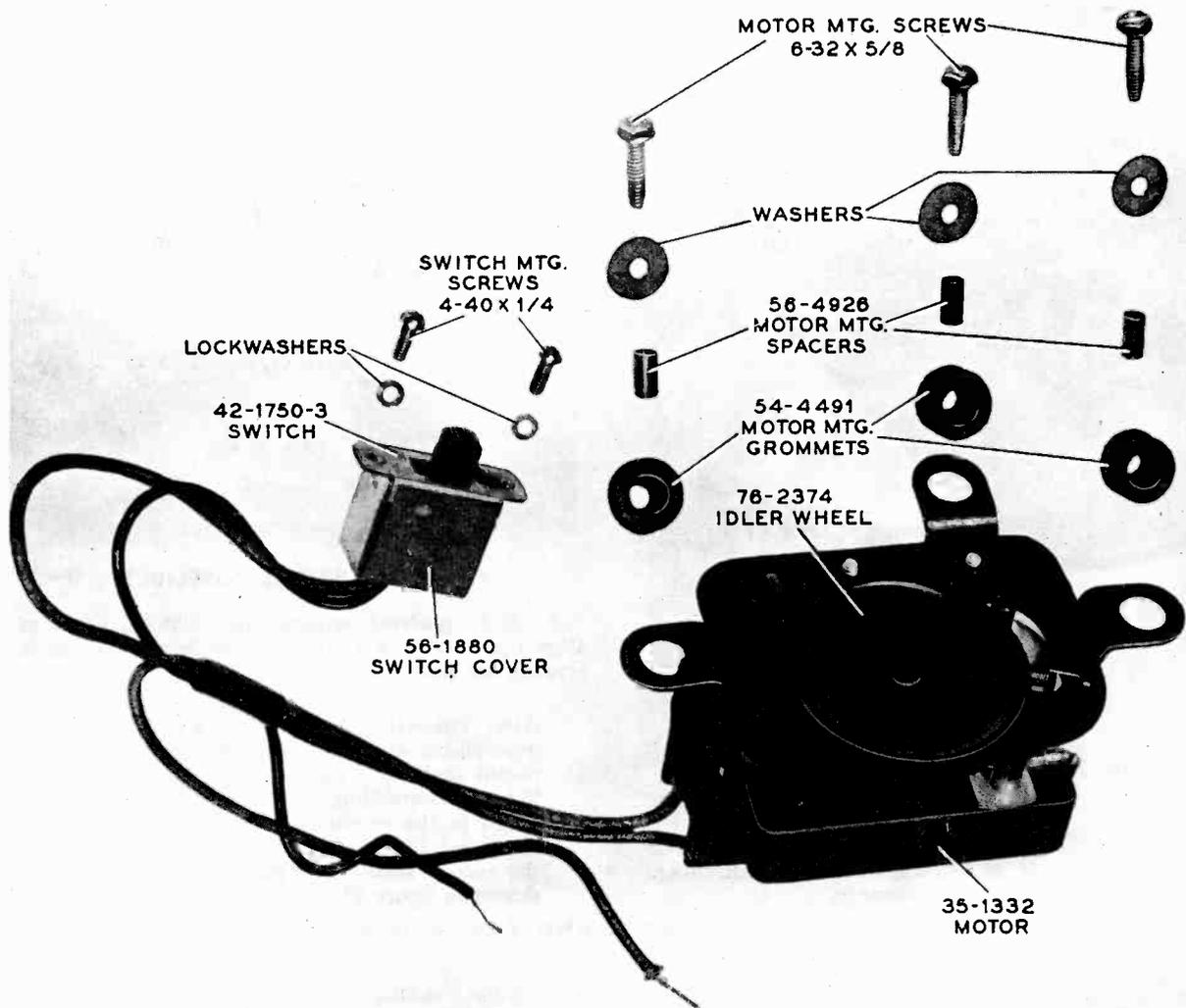


Figure 21—MOTOR, SWITCH, AND MOUNTING HARDWARE

TP-4133

#### 4. Tone-Arm Assembly

- a. Unsolder tone-arm lead wires from terminal panel on underside of changer base plate.
- b. Remove pull cord from spring and short link, 56-4607FA3.
- c. Loosen clamp screw which holds trip arm to tone-arm shaft, 76-2983 (figure 22). Lift out tone arm and shaft.

#### 5. Bridge Assembly

- a. Remove the two hex-head screws from bridge plate.
- b. Remove link rod, 56-4589FA3, from slider control bar. Complete assembly of bridge is shown in figure 23.

#### 6. Trip Plate

- a. Remove bridge assembly, 76-2978, as directed in paragraph 5.
- b. Slide trip plate, 76-2990, off cam-gear spindle.

#### 7. Cam-Gear Assembly

- a. Remove bridge assembly and trip plate, as directed in paragraphs 5 and 6.
- b. Remove ball-bearing assembly, 76-2991 (figure 16), by pulling it off.
- c. Remove large hairpin, 1W42706FA1, from cam-gear spindle, and slide washer off.
- d. Slide cam gear off spindle. Figure 24 shows cam-gear assembly.

#### 8. Tone-Arm Actuator Levers

- a. Remove large hairpin, 1W42706FA1, from actuator stud.
- b. Slide lower actuator lever from stud, and remove short link, 56-4607FA3.
- c. Remove upper actuator lever from stud, and disengage long link, 56-4606FA3. Figure 24 shows actuator-lever assembly.

#### 9. Push-Off Actuator

- a. Remove two motor-mounting screws, and loosen the third one; swing motor to one side.
- b. Remove tone-arm actuator levers, 76-2987, as directed in paragraph 8.

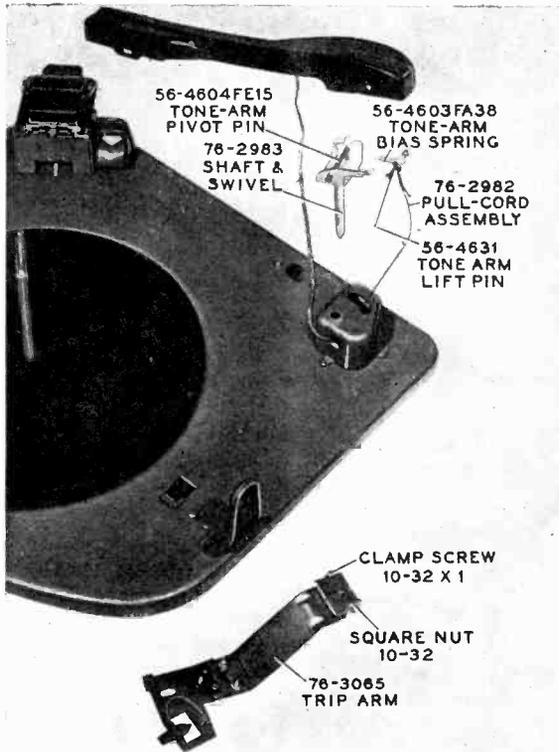


Figure 22—TONE ARM AND TRIP ARM, REMOVED TP-4132

c. Press push-off rod, 56-4595FA3, and push-off hanger bar, 56-4596FA3, together, and pull downward, releasing the entire assembly.

Figure 24—CAM GEAR, PUSH-OFF ACTUATOR AND TONE-ARM ACTUATOR LEVERS TP-4182

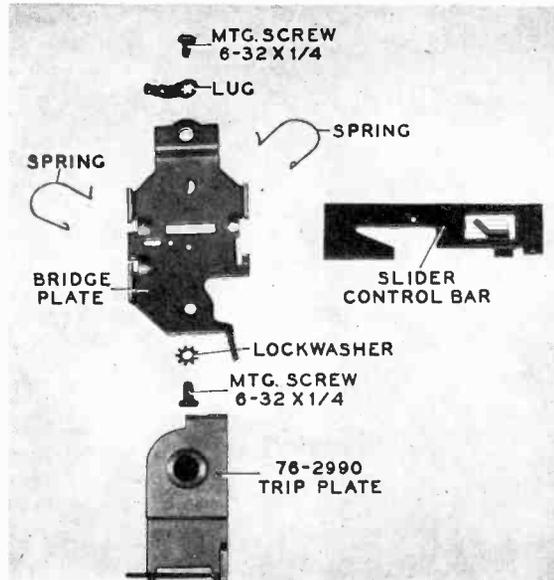
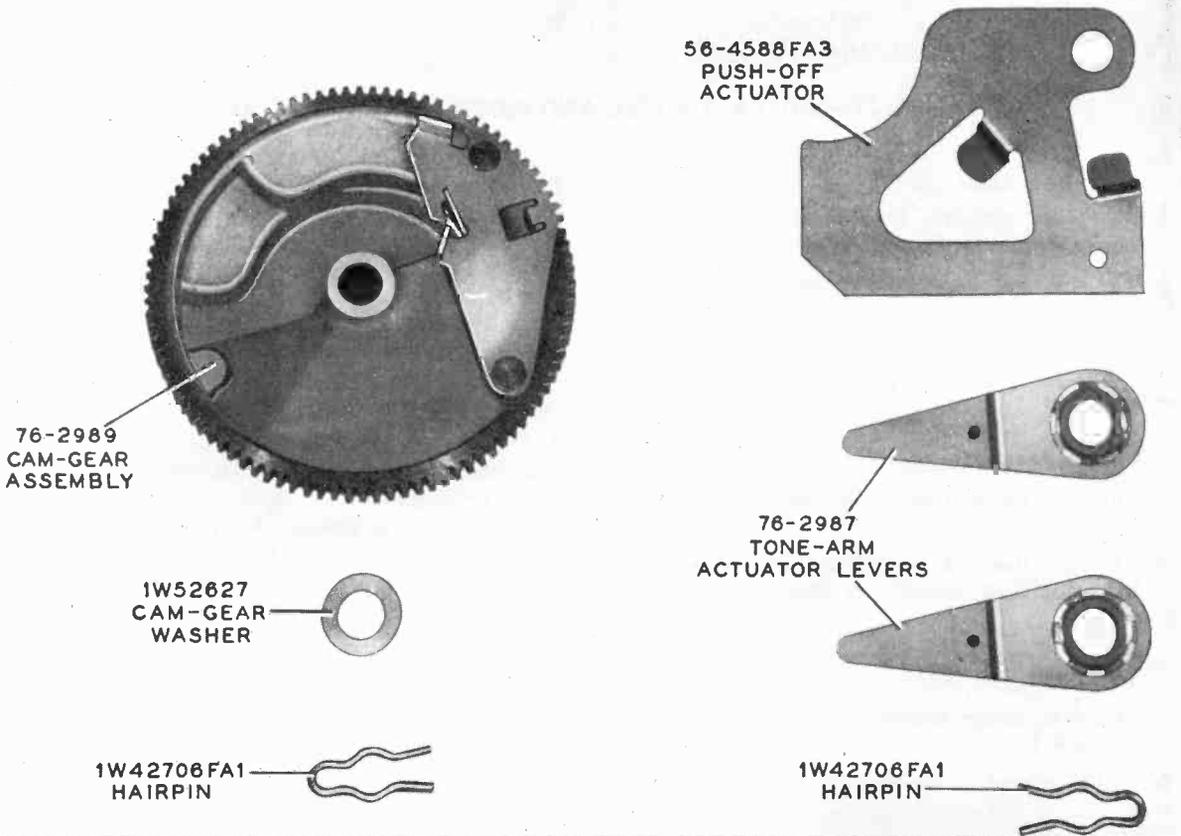


Figure 23—BRIDGE ASSEMBLY TP-4180

d. Slide push-off actuator, 56-4588FA3, over, to align upturned ears with cutout in base plate. Slide actuator off stud.

**NOTE**

After removing the push-off actuator and push-off-bar assembly, the slider blade on the record shelf may slide out of the assembly. When reassembling, this blade should be inserted in the record-shelf assembly with the elongated hole toward the 12" position of the record shelf. The push-off assembly is shown in figure 25.

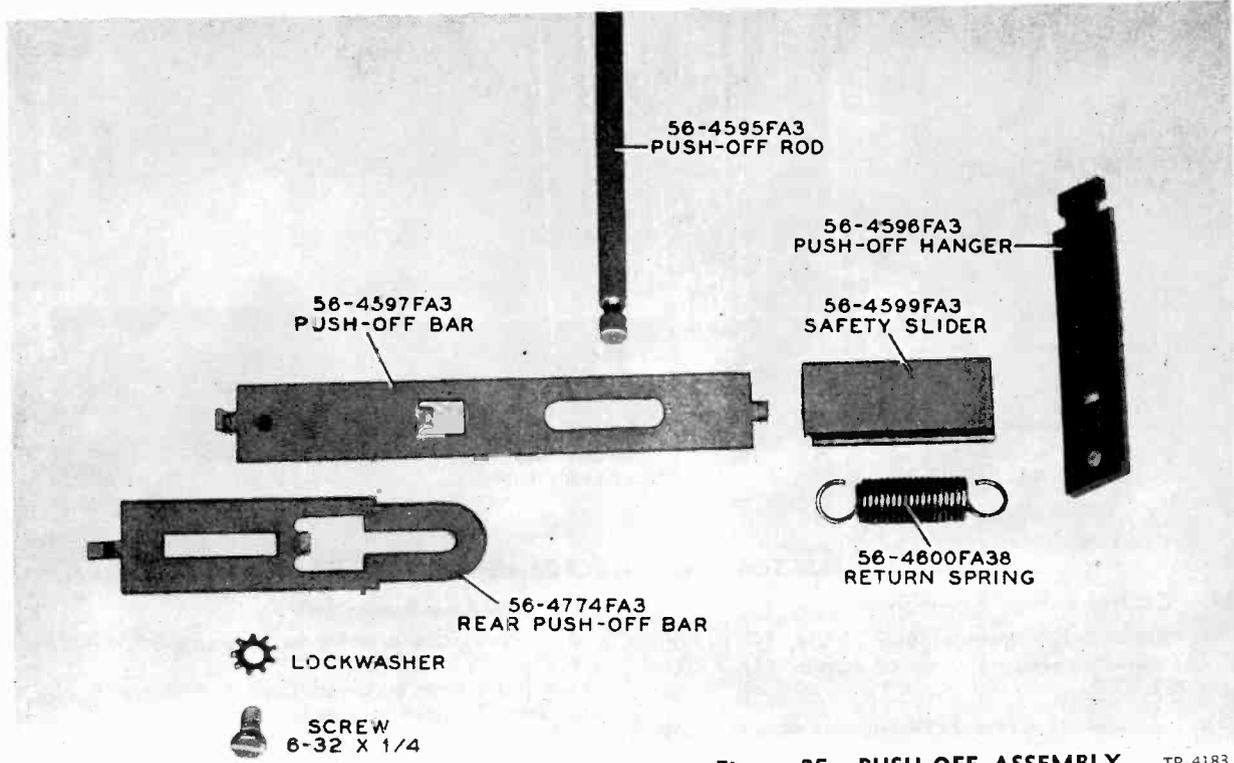


Figure 25—PUSH-OFF ASSEMBLY TP-4183

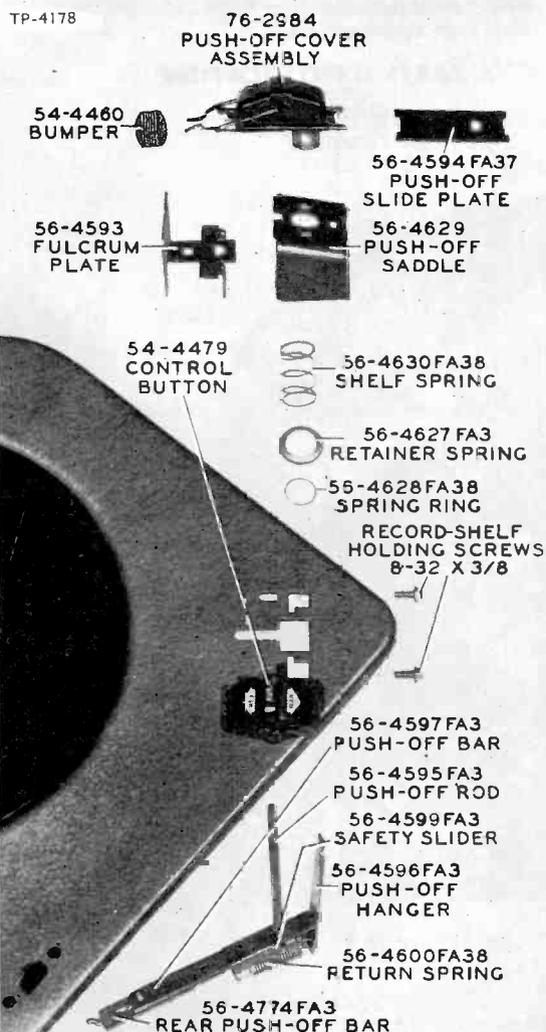
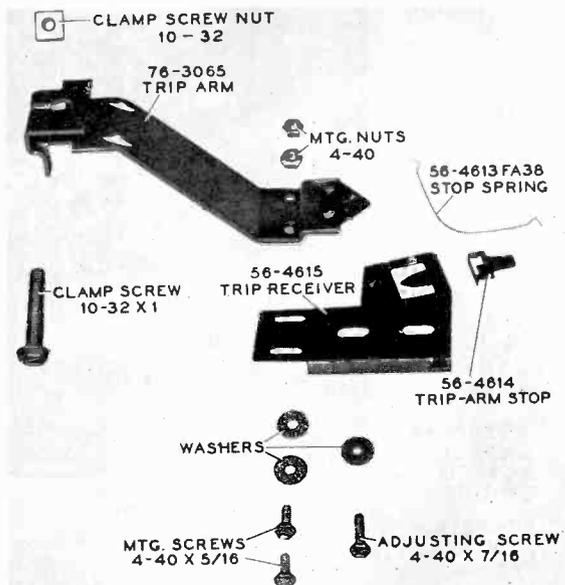


Figure 26—RECORD-SHELF AND PUSH-OFF ASSEMBLIES, REMOVED

10. Record-Shelf Assembly

- a. Remove push-off actuator assembly as directed in paragraph 9.
- b. Remove the two hex-head screws which hold record-shelf assembly to base plate (figure 18).
- c. Align ears on record-shelf assembly with cut-out on base plate. Lift out record-shelf assembly. Record-shelf assembly is shown in figure 26.

Figure 27—TRIP-ARM AND TRIP-RECEIVER ASSEMBLIES TP-4227



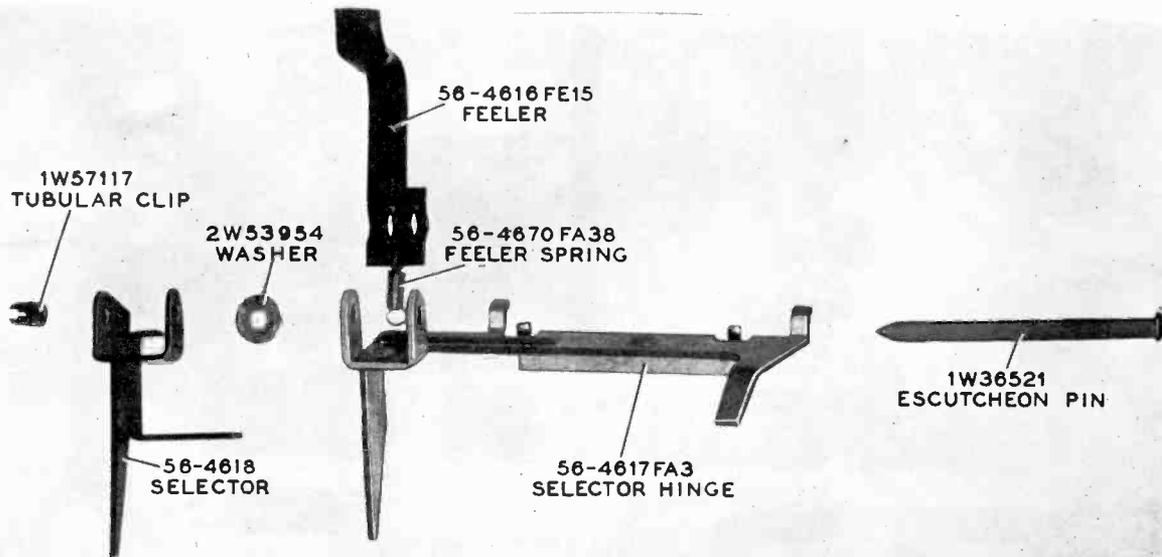


Figure 28—SELECTOR AND SELECTOR-HINGE ASSEMBLY

TP-4123

**11. Control-Button Assembly**

- a. Remove flat spring, 56-4778FA38, by sliding it laterally through underside of button (figures 10 and 18).
- b. Remove the two hex-head screws and drop bridge assembly, 76-2978 (shown in figure 10).
- c. Disengage control link, 56-4589FA3, from underside of control button. Lift out control button.

**12. Trip-Arm Assembly**

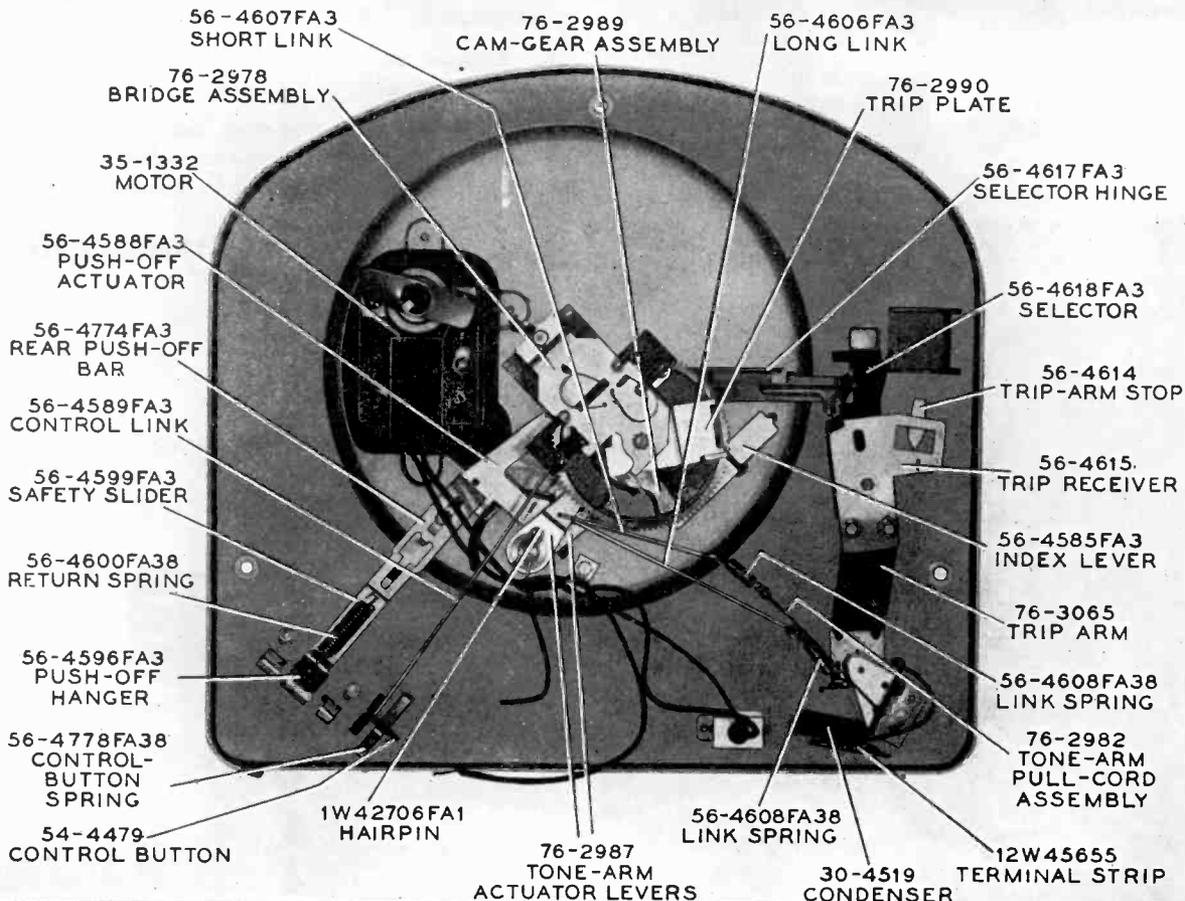
- a. Loosen clamp screw on trip arm, 76-3065 (figure 27).
- b. Raise tone arm and shaft sufficiently to clear trip arm. Remove trip arm.

**NOTE**

When assembling, maintain  $\frac{1}{32}$ " vertical play (clearance between trip arm and base plate) in tone-arm shaft.

Figure 29—BOTTOM VIEW OF CHANGER, WITH PARTS IDENTIFICATION

TP-4107



**13. Trip-Receiver Assembly**

Remove the three screws, washers, and nuts from trip arm (figure 27).

Remove trip receiver.

**14. Selector Assembly**

Remove cam gear as directed in paragraph 7. Remove feeler spring from attachment point on motor board. Tilt selector assembly, and remove from base plate.

**NOTE**

When assembling selector assembly, be sure to maintain .005" clearance between selector hinge, 56-4617FA3, and washer, 2W53954. For correct assembly refer to figures 28 and 11.

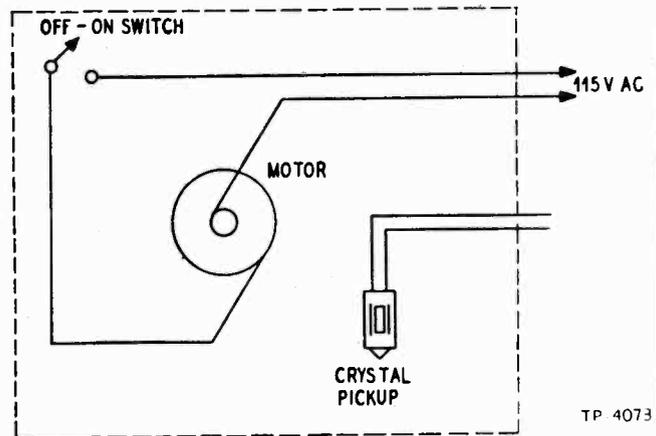


Figure 30—CHANGER WIRING DIAGRAM

**REPLACEMENT PARTS LIST**

SERVICE PART NO.	DESCRIPTION	SERVICE PART NO.	DESCRIPTION	SERVICE PART NO.	DESCRIPTION
35-1332	Motor	56-4593	Plate, fulcrum	56-4630FA38	Spring, shelf
35-2643	Crystal - pickup cartridge (vertical needle insertion)	56-4594FA37	Plate, push-off slide	56-4631	Tone-arm lift pin
35-2663	Tone-arm assembly (for cartridge 35-2643)	56-4595FA3	Rod, push-off	56-4670FA38	Spring, feeler
35-2663-2	Tone-arm assembly (for cartridge 35-2671-1)	56-4596FA3	Hanger, push-off	56-4774FA3	Push-off bar, rear
35-2669	Needle (for pickup cartridge 35-2643)	56-4597FA3	Bar, push-off	56-4778FA38	Spring, control-button
35-2670	Needle (for pickup cartridge 35-2671-1)	56-4599FA3	Slider, safety	56-4926	Spacer, motor mtg.
35-2671-1	Crystal - pickup cartridge (horizontal needle insertion)	56-4600FA38	Spring, return	76-1794-1	Plug (M-8 console)
35-2672	Tone-arm shell	56-4601	Spacer, 7/32" (for cartridge 35-2643)	76-2172	Cable, motor assembly
35-3066	Turntable assembly	56-4601-1	Spacer, 9/32" (for cartridge 35-2643)	76-2374	Idler wheel (for motor 35-1332)
41-3704	Cable assembly, shielded, tone arm (M-8 console)	56-4601-2	Spacer, 3/8" (for cartridge 35-2671-1)	76-2978	Bridge assembly
42-1750-3	Switch	56-4601-3	Spacer, 7/16" (for cartridge 35-2671-1)	76-2982	Pull-cord assembly, tone arm
54-4460	Bumper	56-4603FA38	Spring, tone-arm bias	76-2983	Shaft-and-swivel assembly
54-4479	Button, control	56-4604FE15	Pin, tone-arm pivot	76-2984	Push-off cover assembly
54-4491	Grommet, motor mtg.	56-4606FA3	Link, long	76-2987	Levers, tone-arm actuator
56-1880	Cover, switch	56-4607FA3	Link, short	76-2988	Base-plate assembly
56-2027	Plug	56-4608FA38	Spring, link	76-2989	Cam-gear assembly
56-2071-2	Cover, plug, motor-assembly cable (M-8 console)	56-4612	Finger, trip	76-2990	Trip plate
56-4585FA3	Lever, index	56-4613FA38	Spring, stop	76-2991	Ball-bearing assembly
56-4587FA8	Spindle	56-4614	Stop, trip-arm	76-3065	Trip arm
56-4588FA3	Actuator, push-off	56-4615	Trip receiver	76-3556	Idler wheel (for motor 35-1339)
56-4589FA3	Link, control	56-4616FE15	Feeler	76-3557	Idler wheel (for motor 35-1341)
		56-4617FA3	Hinge, selector	1W36521	Escutcheon pin
		56-4618FA3	Selector	1W42706FA1	Hairpin
		56-4627FA3	Spring, retainer	1W52627	Cam-gear washer
		56-4628FA38	Spring ring	1W57117	Clip, tubular
		56-4629	Saddle, push-off	2W53954	Washer, selector
				12W45655	Terminal strip

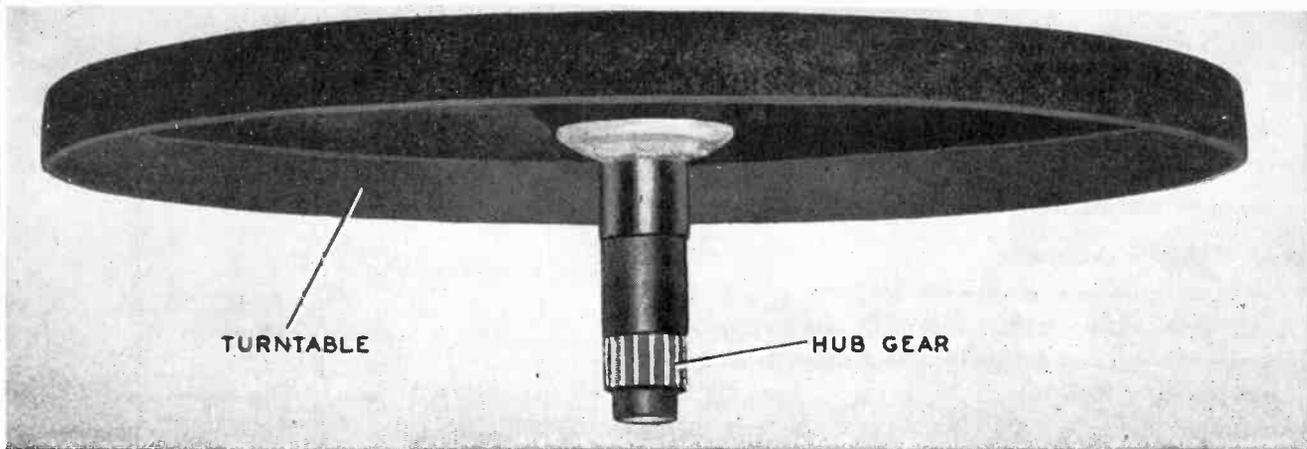
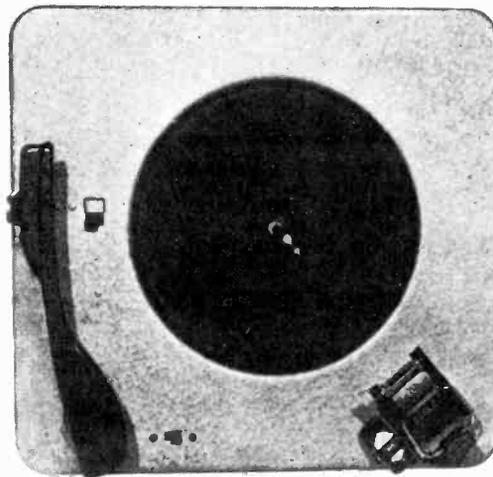
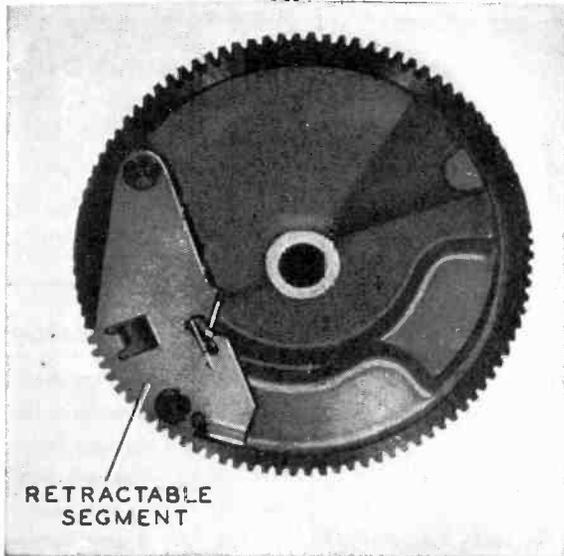


Figure 1—TURNTABLE AND HUB GEAR

TP-4184



TP-4182

TP6340

Figure 2—CAM GEAR, SHOWING RETRACTABLE SEGMENT

TP-4101A

TP-4181

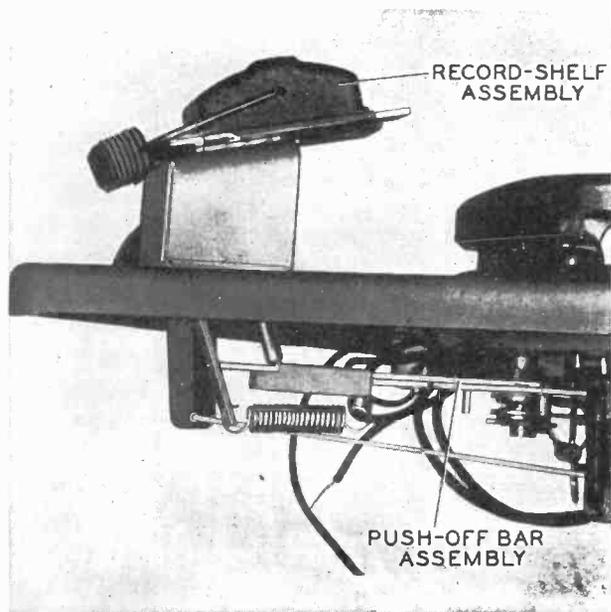
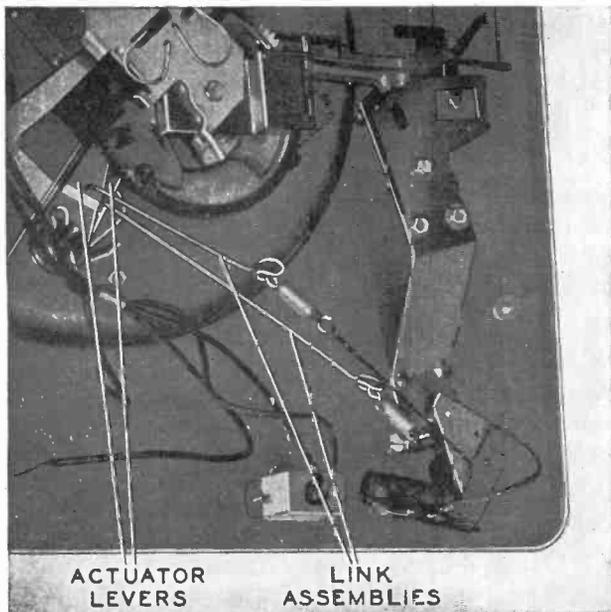


Figure 3—LINK ASSEMBLIES AND ACTUATOR LEVERS

Figure 4—RECORD-SHELF AND PUSH-OFF ASSEMBLIES

## DESCRIPTION OF OPERATING CYCLE

Power for the motor is applied through the on-off switch. The turntable is rim-driven by a rubber-tired idler wheel mounted between the motor shaft and the turntable rim.

The turntable hub is a combined shaft and gear (figure 1). This small hub gear engages a large cam gear (figure 2) when the retractable segment of the cam gear is brought into position by the action of the trip mechanism; the cam gear, in turn, operates the changer mechanism.

The tone arm is operated by two link assemblies

The following tests are given for quickly localizing trouble in either the radio or phonograph section of the radio-phonograph combination. Be sure to make each test, in the order given, before removing either the radio chassis or the record changer from the cabinet. If the trouble is found to be in the audio amplifier, refer to the radio service manual for the particular model under test. If the trouble is in some part of the record changer, refer to this record-changer manual.

### Audio-Amplifier Test

The audio amplifier is common to both the radio and the phonograph sections of the combinations using the M-9 changer.

Tune in a station, and note the volume and tone quality. If the performance is abnormal, refer to the radio service manual for the particular model under test, and correct the trouble.

### Pickup Test

Play a familiar record on the phonograph, and again note the volume and tone quality.

attached to actuator levers (figure 3) which are in contact with the cam surface of the cam gear.

The record-shelf push-off mechanism is connected, through a series of bars (figure 4), to a push-off actuator; the mechanism is operated when a roller on the cam gear comes in contact with the actuator.

The trip mechanism is operated by a trip finger, riding over a ratchet screw (figure 5), which starts the change cycle when the needle is traveling in the eccentric finish groove of the record. The trip mechanism is locked in a disengaged position when the control button is in the manual position.

## PHILCO RADIO-PHONOGRAPH TROUBLE-SHOOTING PROCEDURE

### NOTE

It is advisable to carry a familiar record as a part of the service test equipment.

If distortion is noted when playing the record, first try a new needle. If the distortion continues, a faulty crystal pickup is indicated.

### Changer-Mechanism Test

The following series of record-changer operating tests is given for quickly locating any troubles that may be encountered. Each test should be performed with several records before making any adjustments.

Set the record shelf to the 10" position and place the tone arm on the rest post. Place a 10" record over the spindle and onto the record shelf.

Push the control button to REJ. (reject), and observe the record-dropping action. The record should fall smoothly, the edge leaving the lips of the record shelf *after* the center has started to fall.

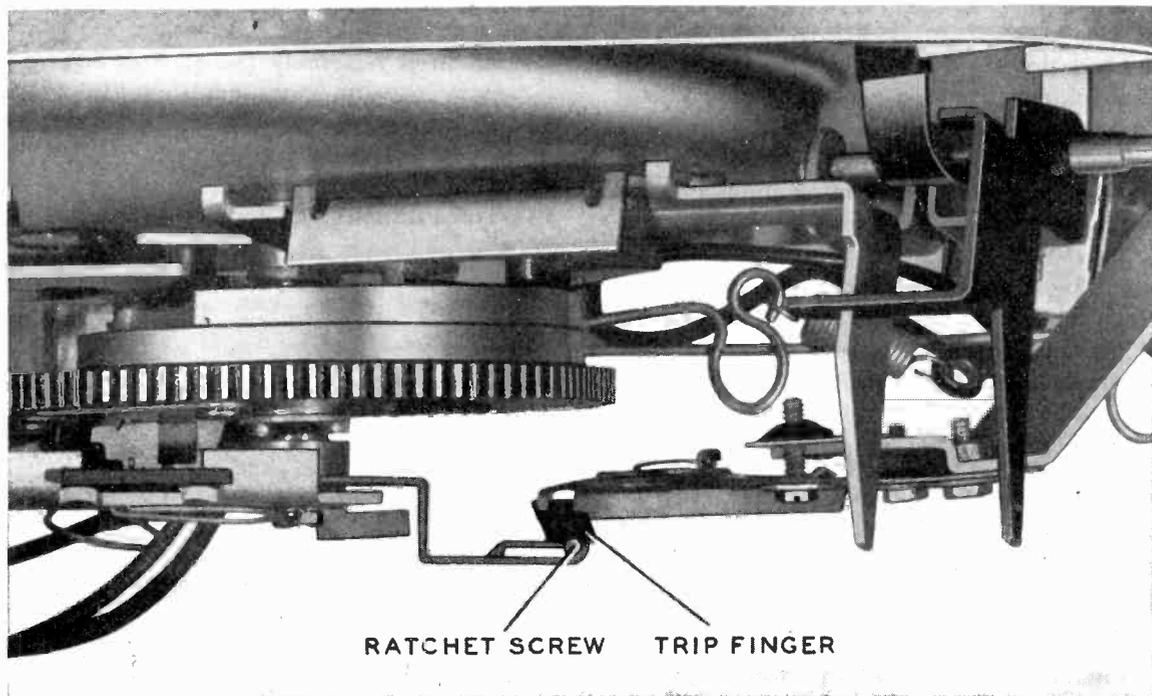


Figure 5—TRIP FINGER AND RATCHET SCREW

TP-4135-1

The tone arm should rise from the rest post, and the needle should come down on the record, starting about  $\frac{1}{8}$ " from the outer edge.

Play the record through and observe the tripping action; the trip mechanism should operate within the first two or three revolutions after the needle has entered the eccentric finish groove.

Remove the record from the turntable and turn the record shelf to the 12" position. Place a 12" record over the spindle and onto the record shelf. Push the control button to REJ., and observe the record-dropping action. The record should leave the lips of the record shelf *after* the center has started to fall. Refer to page 11 for the record-shelf adjustment, if needed. The tone arm should rise from the rest post, and the needle should come down on the record, starting about  $\frac{1}{8}$ " from the outer edge.

Play the record through and observe the tripping action.

Observe whether the lower edge of the tone arm, during a change cycle, clears the top of the hook on the tone-arm rest post by a minimum of  $\frac{1}{8}$ ". Take the tone arm off the rest post, and place the pickup over the changer base plate; the needle point should clear the base plate by at least  $\frac{1}{16}$ ", and should be no

higher than the turntable top.

## Turntable and Motor Test

### NOTE

Before making this test, warm up the motor by allowing it to run for at least ten minutes.

Set the control button to MAN. (manual), load the turntable with ten 12" records, and place the tone arm on the top record.

Place a stroboscope disc, such as Philco Part No. 45-2900, on the record, and illuminate the disc with a lamp (preferably a neon bulb) operated on 60-cycle a.c. The dots in the row calibrated for 78 r.p.m. should appear to remain stationary, or drift *very* slowly, but smoothly, backward or forward.

If the turntable speed is steady, but is appreciably below 78 r.p.m., refer to the lubrication data on the turntable upper bearing, motor bearings, and motor idler plate, given under CLEANING AND LUBRICATION, — — — if the lubrication appears to be adequate, the motor is probably defective.

Unsteady drift of the dots on the stroboscope disc indicates uneven turntable speed, the cause of wows; see UNEVEN TURNTABLE SPEED (WOWS).

## CLEANING AND LUBRICATION

The M-9 record changer, like any other mechanism, requires lubrication after long periods of use. Whenever a major part or assembly is to be replaced, the changer should be cleaned and lubricated. Carbon tetrachloride or other similar cleaning fluids may be used to remove old grease, oil, and dirt. Apply lubricants sparingly. All lubrication points are shown in figures 6 and 7. It may be necessary to remove some parts and assemblies in order to lubricate their bearings—for example, the actuator and cam gear must be removed to lubricate the actuator stud and the cam-gear spindle.

### PARTS NOT TO BE LUBRICATED

The following parts should not be lubricated at any time: Trip receiver; trip finger; ratchet screw on trip plate; selector.

### PARTS TO BE GREASED

The following parts are to be lubricated with a grease having the consistency of vaseline:

#### Record-Shelf Assembly (point A of figure 7)

Four protruding dimples.

#### Bridge Assembly and Slider Control Bar (point B of figure 6)

Three dimples and four upturned ears.

#### Cam Gear (point C of figure 6)

Cam-gear teeth, cam surfaces, and cam-gear spindle.

#### Main Assembly (points D, figures 6, 7, and 11)

Trip-plate ear where contact is made with gear segment.

Actuator stud.

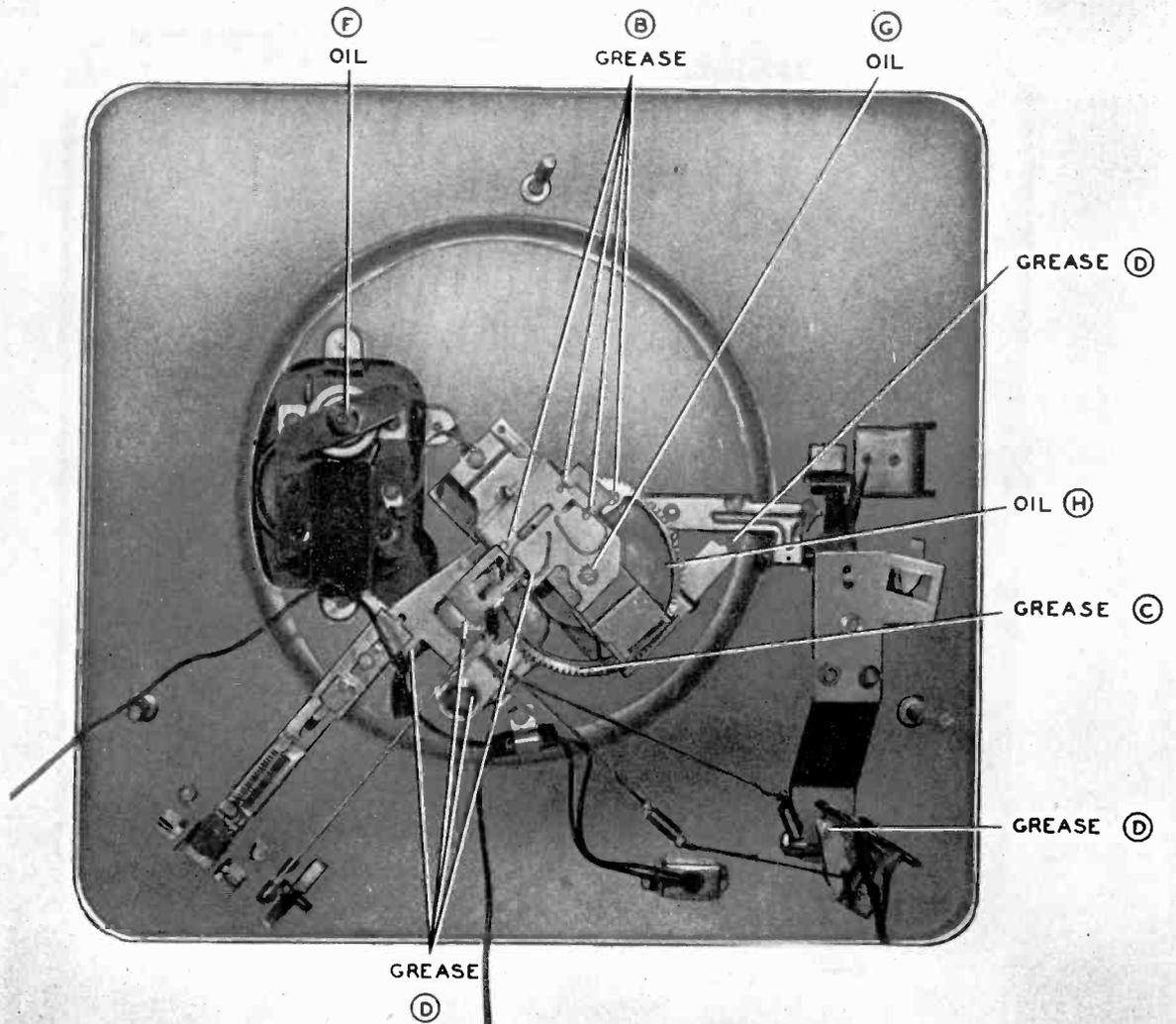
All parts with ears sliding on changer base plate.

Index-lever surface which slides on base plate.

Push-off-actuator dimples which slide on base plate.

Turntable shaft (upper bearing).

Tone-arm shaft.



TP 6539

Figure 6—BOTTOM VIEW OF CHANGER, SHOWING LUBRICATION POINTS

#### PARTS TO BE OILED

The following parts are to be lubricated with S.A.E. 20 oil:

##### Tone Arm (point E of figure 7)

Tone-arm pivot pin where pin rides in elongated hole of tone arm—apply one drop with a pointed rod.

##### Motor (points F, figures 6 and 7)

Motor idler plate—one or two drops in each dimple.

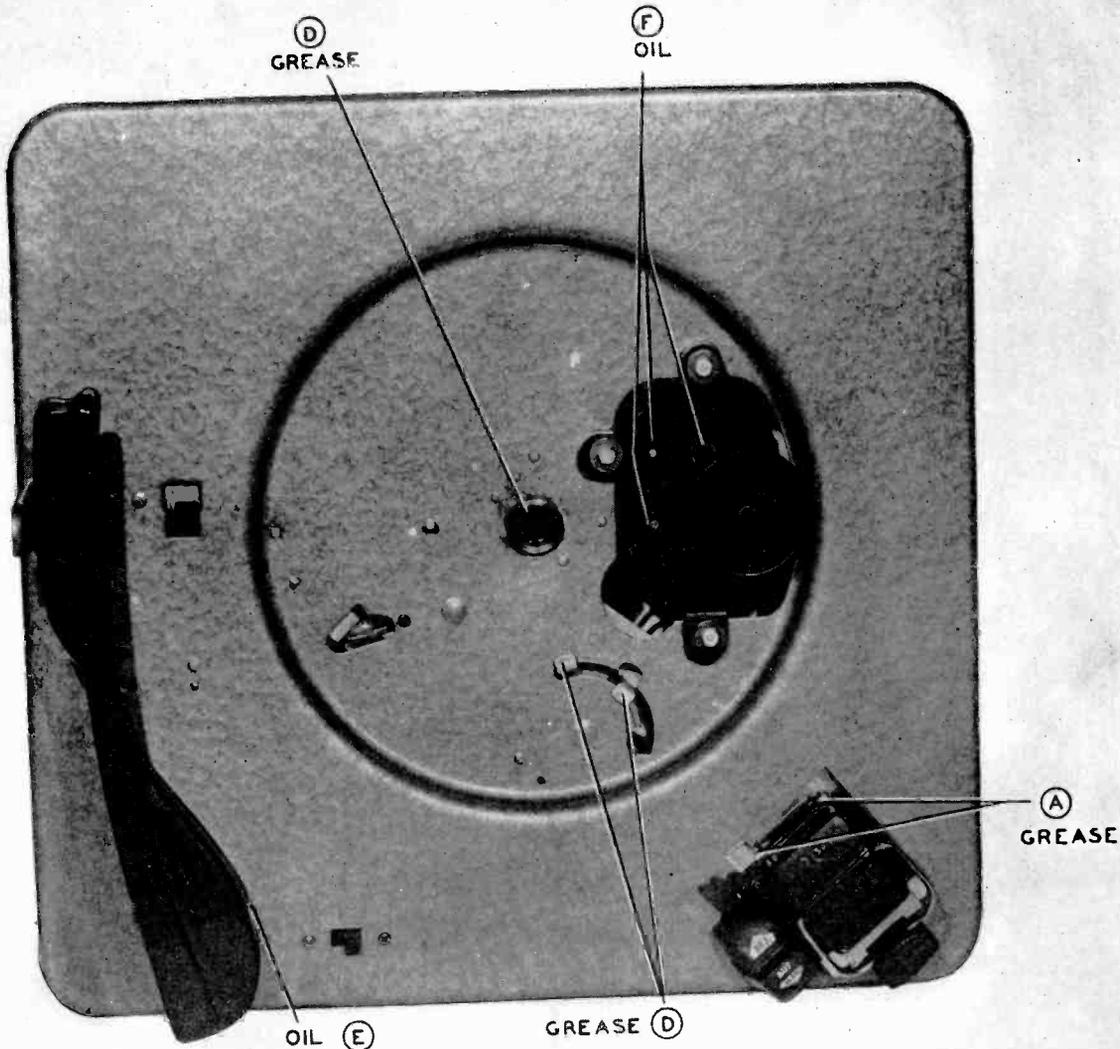
Motor bearings.

##### Trip-Plate Bushings (point G of figure 6)

##### Cam-Gear Roller (point H of figure 6)

#### CAUTION

Do not get any oil or grease on the motor shaft or the idler-wheel tire. Should this occur, remove the oil or grease immediately with carbon tetrachloride.



TP6537

Figure 7—TOP VIEW OF CHANGER, SHOWING LUBRICATION POINTS

## ADJUSTMENTS

### 10" Index Adjustment

Set a 10" record on the turntable; push the control button to REJ., and rotate the turntable  $4\frac{1}{2}$  turns by hand. The tone arm should then be approximately  $\frac{1}{2}$ " above the record.

Loosen the clamp screw on the trip arm (figure 8). Hold the tone arm (steady)  $\frac{1}{8}$ " in from the edge of the record, and set the trip arm so that the trip-arm stop is in contact with the selector hinge. See figure 8.

Tighten the clamp screw, leaving  $\frac{1}{32}$ " vertical play, or clearance, between the trip arm and the base plate.

### 12" Index Adjustment

Make the 10" index adjustment first. The 12" indexing will ordinarily be satisfactory after the 10" adjustment is made; if not, bend the selector, 56-4618FA3, slightly to the right or left as required for proper indexing of the needle on the record, as shown in figure 9.

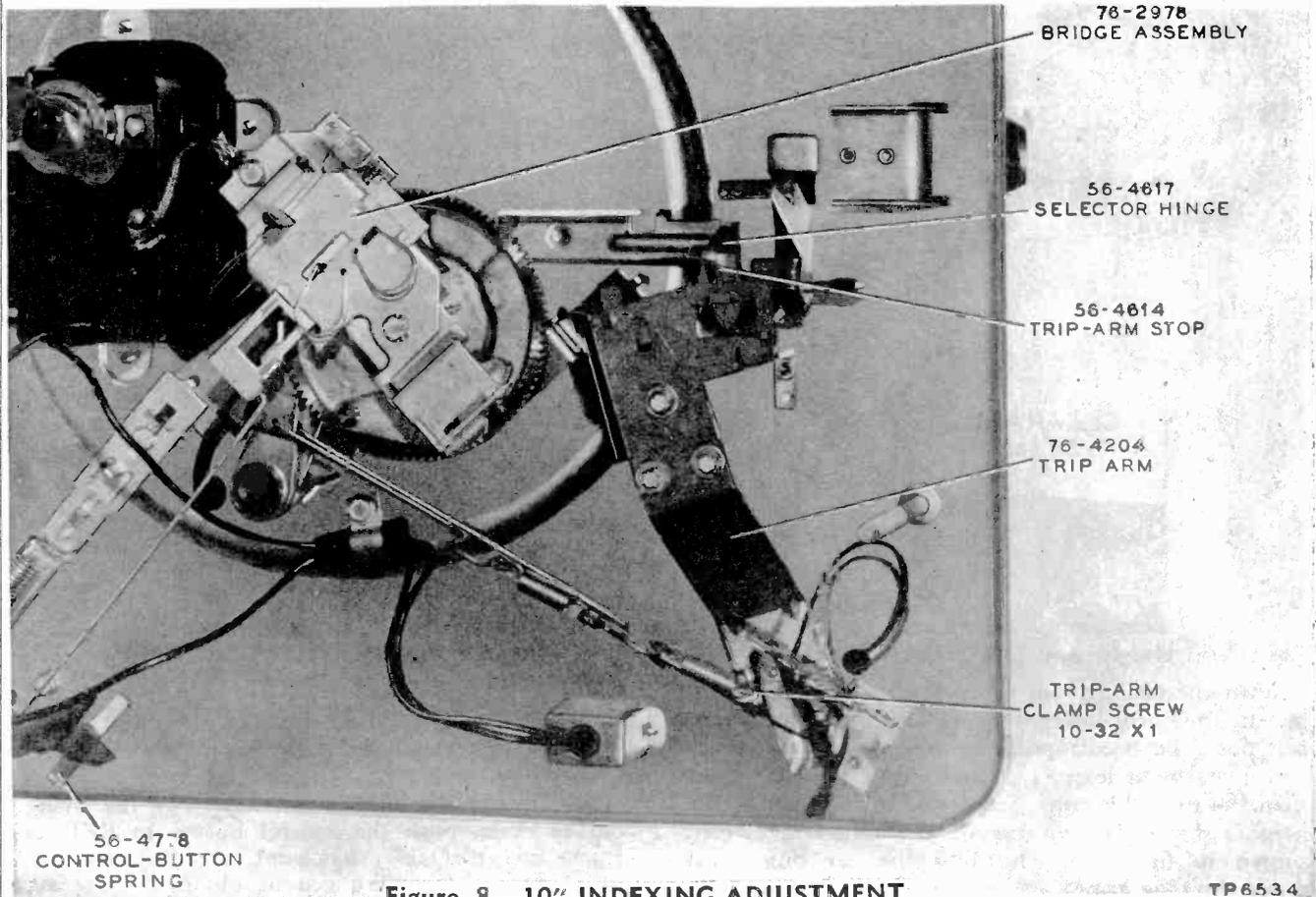


Figure 8—10" INDEXING ADJUSTMENT

TP6534

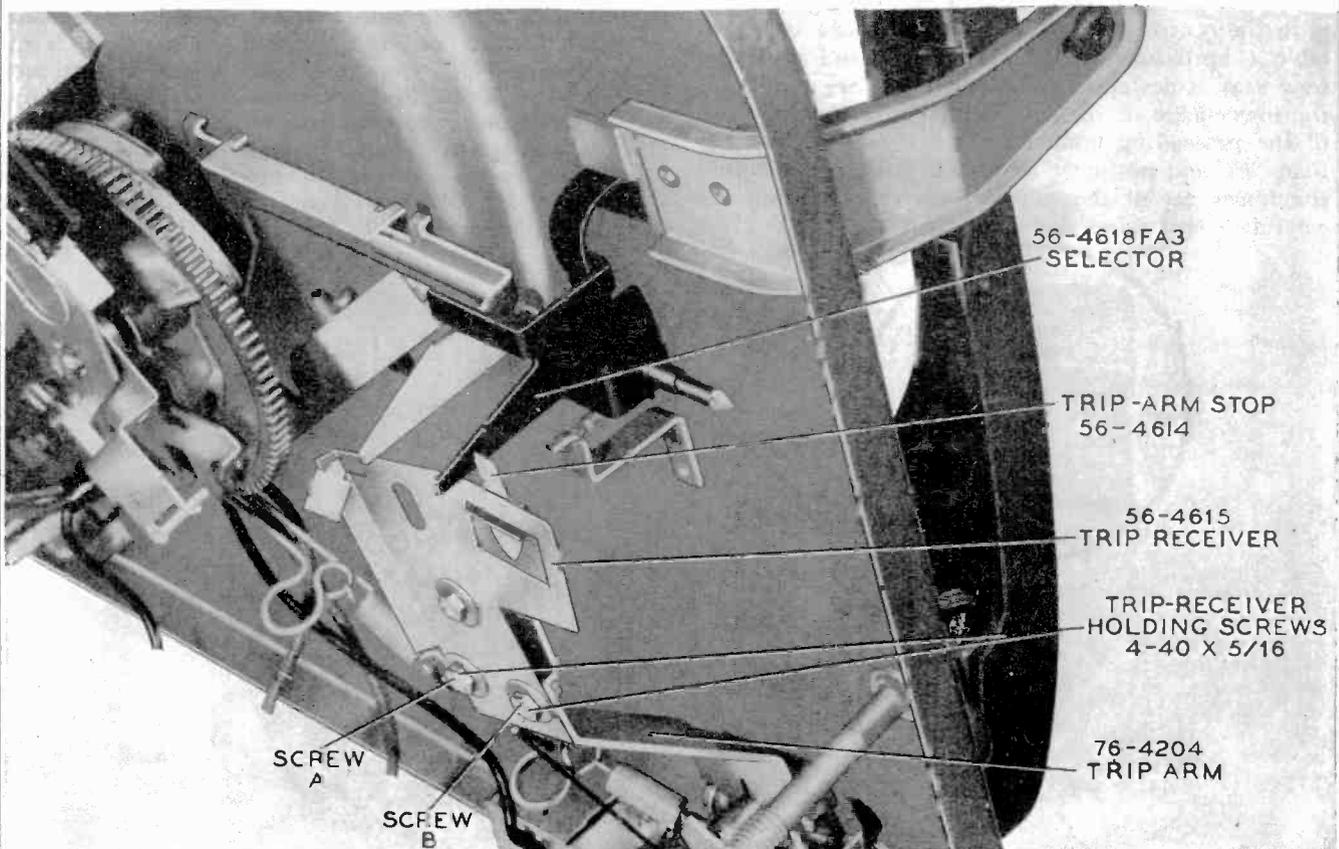


Figure 9—12" INDEXING AND TRIP-RECEIVER ADJUSTMENTS

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MODEL M-9

PHILCO CORP.

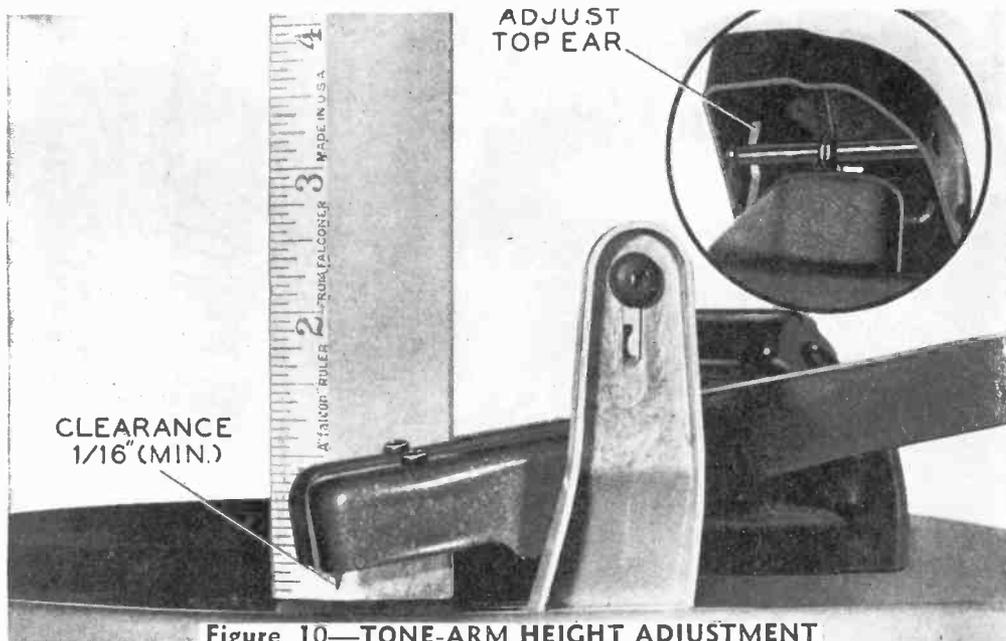


Figure 10—TONE-ARM HEIGHT ADJUSTMENT

TP-4000

**Tone-Arm Height and Lift Adjustments**

With the changer out of cycle (change cycle completed; tone arm lowered), and the tone arm off the rest post, the needle point should clear the changer base plate by at least  $\frac{1}{16}$ " , and should not be higher than the turntable top. See figure 10. To adjust the height, shape the *top* ear of the tone-arm swivel, shown in figure 10 (bending the ear downward raises the tone arm).

To adjust the lift, take the tone arm off the rest post, push the control button to REJ., and rotate the turntable (approximately  $1\frac{1}{2}$  turns) by hand until the tone arm comes against the rest post. See figure 11; the lower edge of the tone arm should clear the top of the protruding hook on the rest post by not less than  $\frac{1}{8}$ " , and not more than  $\frac{1}{4}$ " . Adjust by shaping the *lower* ear of the tone-arm swivel (bending the ear downward raises the tone arm).

**Tone-Arm Vertical and Horizontal Timing Adjustments**

*NOTE*

Before making these adjustments, make the tone-arm height and lift adjustments given above.

For the vertical adjustment, start with the changer out of cycle, push the control button to REJ., and rotate the turntable, by hand, three-quarters of a revolution; this setting can be obtained more accurately by making a mark on the turntable to coincide with some starting point. At the three-quarter-revolution point, the leading edge of the cam surface is approximately  $\frac{1}{4}$ " from the end of the lift actuator lever; this is the lower actuator lever, shown in figure 12. Adjust the wire loop of the short link (link, cord, and spring assembly), attached to the tone-arm lift pin, by squeezing or opening the loop until the tone-arm lift pin makes contact with the lower ear of the tone-arm swivel (figure 11).

TP-4102

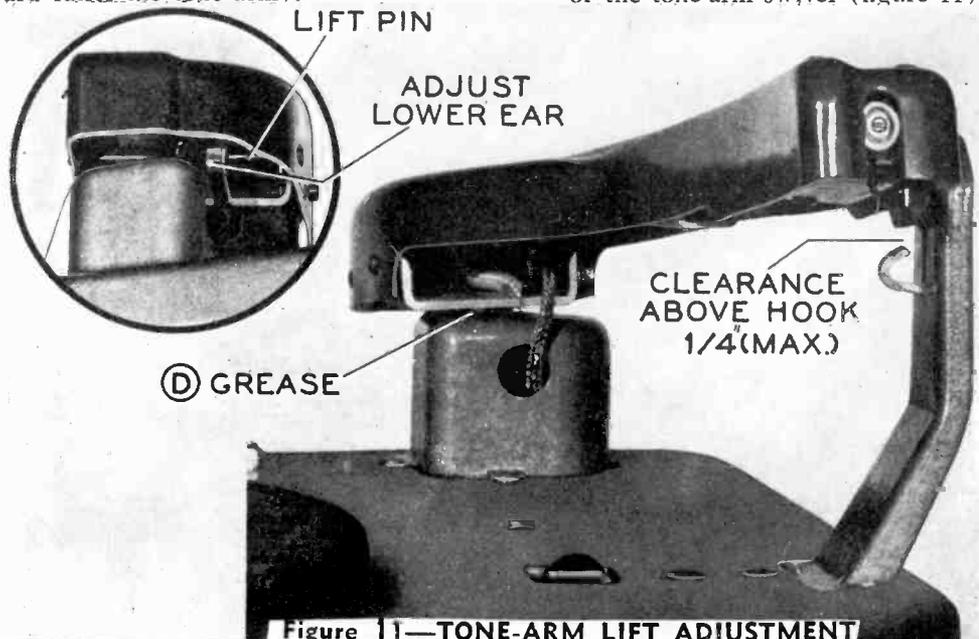


Figure 11—TONE-ARM LIFT ADJUSTMENT

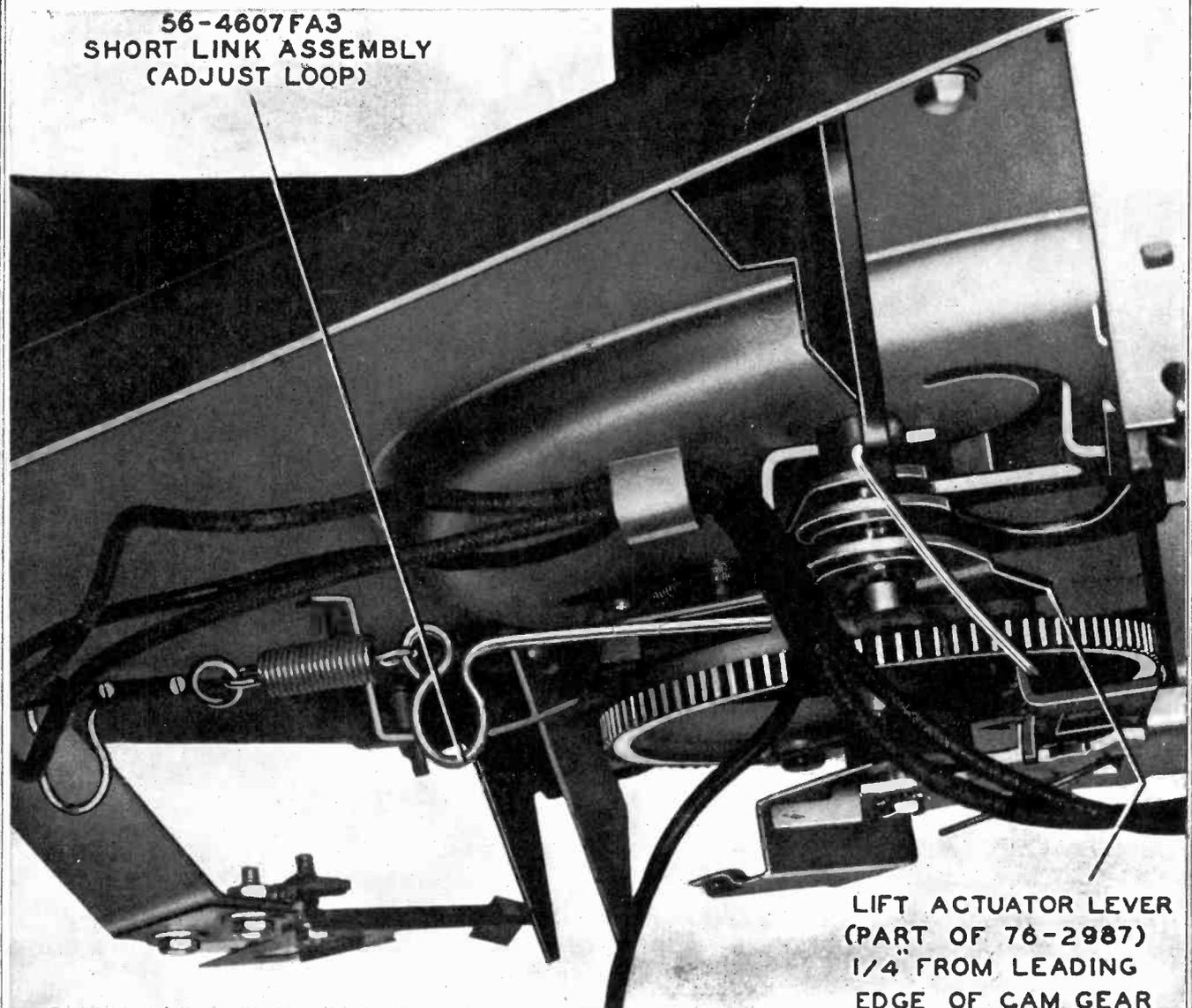


Figure 12—TONE-ARM VERTICAL TIMING ADJUSTMENT

TP-4116-1

For the horizontal adjustment, rotate the turntable another three-quarter revolution from the point at which the vertical adjustment was made. At this point, the leading edge of the cam surface is approximately  $\frac{1}{4}$ " from the end of the horizontal-return actuator lever; this is the upper actuator lever, shown in figure 13. Adjust the wire loop of the long link and spring assembly, attached to the trip arm, by squeezing or opening the loop until the tone arm makes contact with the rubber bumper on the tone-arm rest post.

#### Trip-Finger and Trip-Receiver Adjustments

For the trip-finger adjustment, move the tone arm toward the spindle. Adjust the screw on the trip-receiver plate (figure 14) so that the trip finger, when riding over the ratchet screw on the trip plate, assumes an angle of  $25^\circ$  to  $30^\circ$  with respect to the screw. Do *not* bend the trip finger to obtain the correct angle.

For the trip-receiver adjustment, place the tone arm on a record with the needle resting in the eccentric finish groove. The vertical center line of the trip finger should coincide with the center line of the ratchet screw. To adjust the centering of the trip finger over the ratchet screw, loosen screw B slightly, and screw A completely (see figure 9). Rotate the trip receiver about screw B, as a center, to obtain the correct adjustment (see figure 14). Tighten the screws.

Approximately  $\frac{1}{8}$ " of the trip-arm stop should engage the selector (see figure 9). To adjust the engagement of the trip-arm stop, loosen screw A slightly, and screw B completely (see figure 9). Rotate the trip receiver about screw A, as a center, to obtain the correct adjustment. Tighten the screws.

The above adjustments will affect each other slightly; therefore, it may be necessary to repeat each adjustment until both are correct.

After making the above adjustments, it will be necessary to correct the index adjustments.

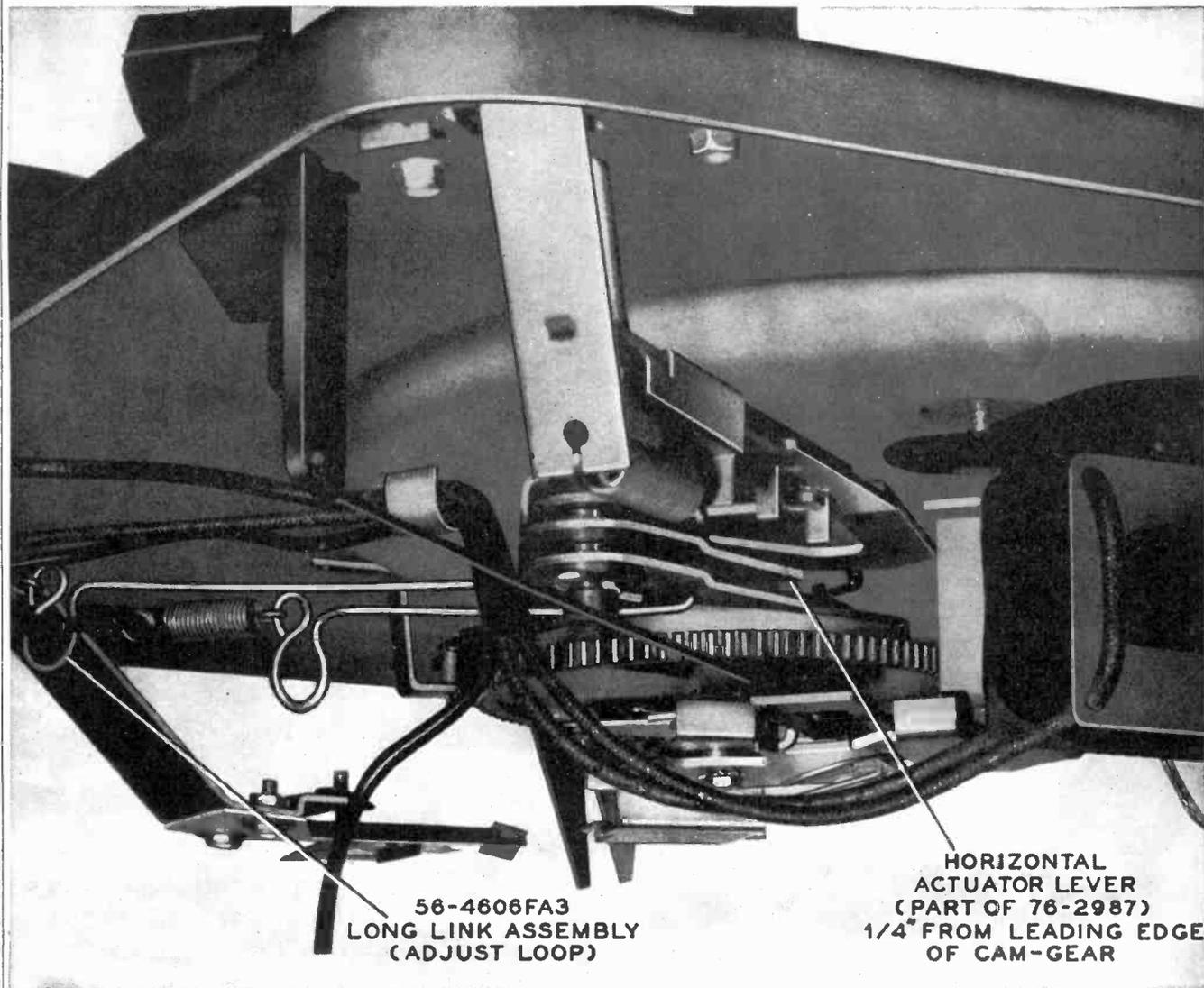


Figure 13—TONE-ARM HORIZONTAL TIMING ADJUSTMENT

TP-4129

#### Record-Shelf Adjustment

Place the shelf in the 10" position, and the changer out of cycle. Place the Philco record-shelf gauge, 45-1470 (also used for M-4), over the spindle and onto the record shelf, as shown in figure 15. Loosen the two hex-head screws which hold the record-shelf assembly to the changer base plate (figure 16). Move the record-shelf assembly away from the record spindle until the large curved part of the gauge drops even with the record-shelf lips, as shown in figure 15. Now push the record shelf and gauge lightly against the spindle, taking out all play toward the spindle; keep the lips of the record shelf in even

contact with the edge of the gauge. Tighten the two hex-head screws.

#### Push-Off Adjustment

Push the control button to REJ., and rotate the turntable  $2\frac{1}{2}$  revolutions, by hand; at this point, the push-off actuator is in its most forward position, in contact with the roller on the cam gear (see figure 17). Loosen the push-off-bar locking screw, shown in figure 16. Squeeze the push-off-bar ears toward each other to the point where the slider blade on the record shelf extends  $\frac{1}{32}$ " beyond the lips of the shelf. Tighten the hex-head locking screw.

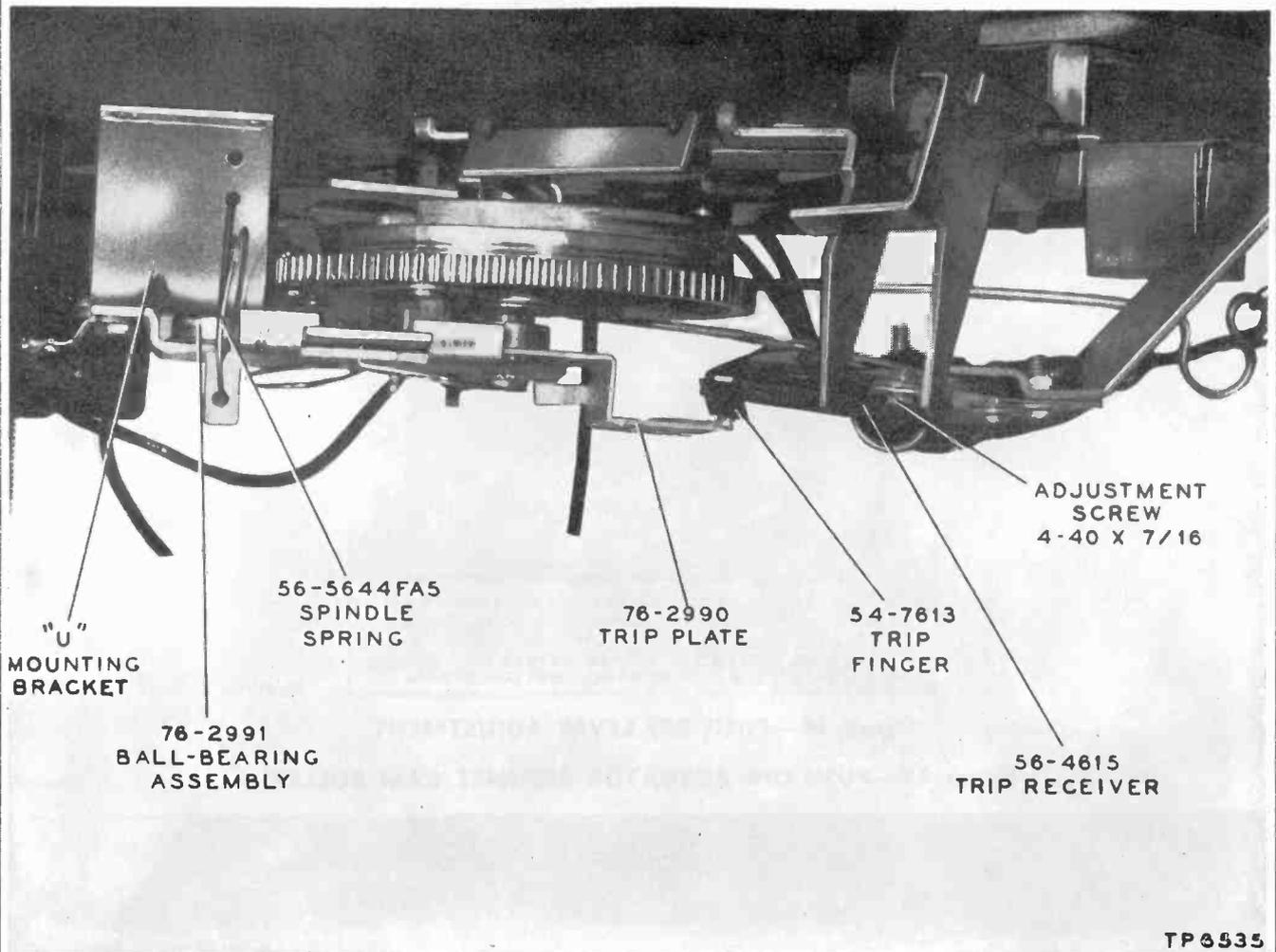
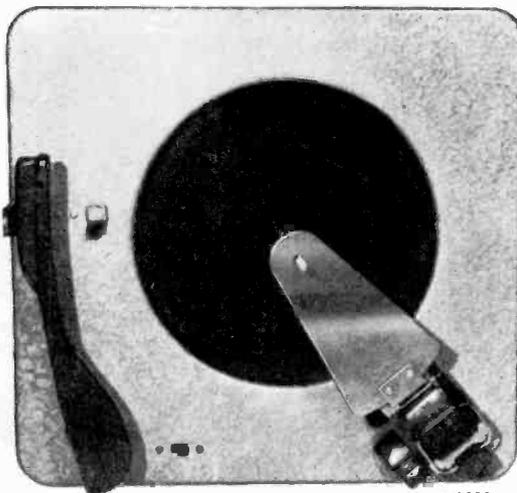


Figure 14—TRIP-FINGER ADJUSTMENT

Figure 15—SPECIAL GAUGE, SHOWN IN CORRECT POSITION ON RECORD SHELF AND SPINDLE



TP6538

#### Uneven Turntable Speed (Wows)

Uneven turntable speed (wows) may be caused by the following:

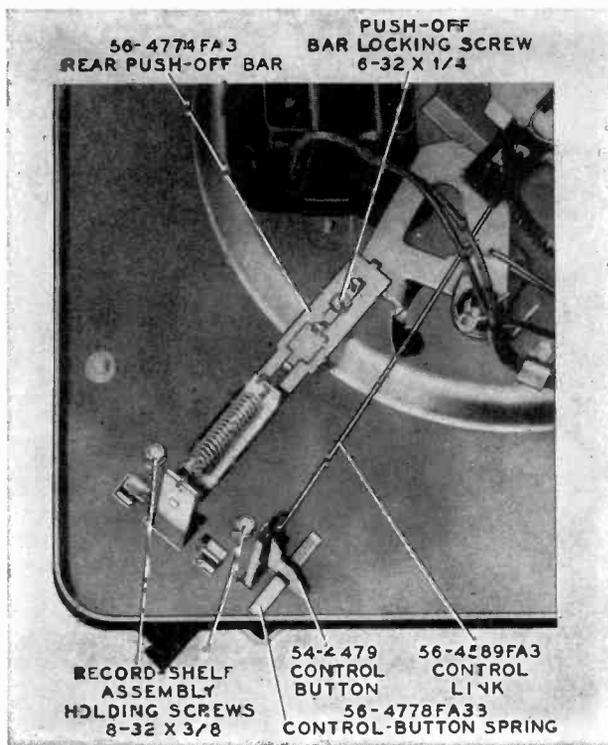
Dirt under and around the turntable or idler-wheel assembly. Remove the turntable (see Spindle and Turntable) ----- and clean out the dirt. Be careful to lift the turntable straight up. When replacing the turntable, be sure the idler is behind the turntable rim before the turntable is fully lowered.

Flat or worn spots, or grease, on the rubber tire of the idler wheel.

Defective turntable shaft or bearing assembly.

Replace the defective parts as directed under REPLACEMENT OF PARTS AND ASSEMBLIES.

Lack of lubrication on idler-wheel assembly. Follow the directions under CLEANING AND LUBRICATION.

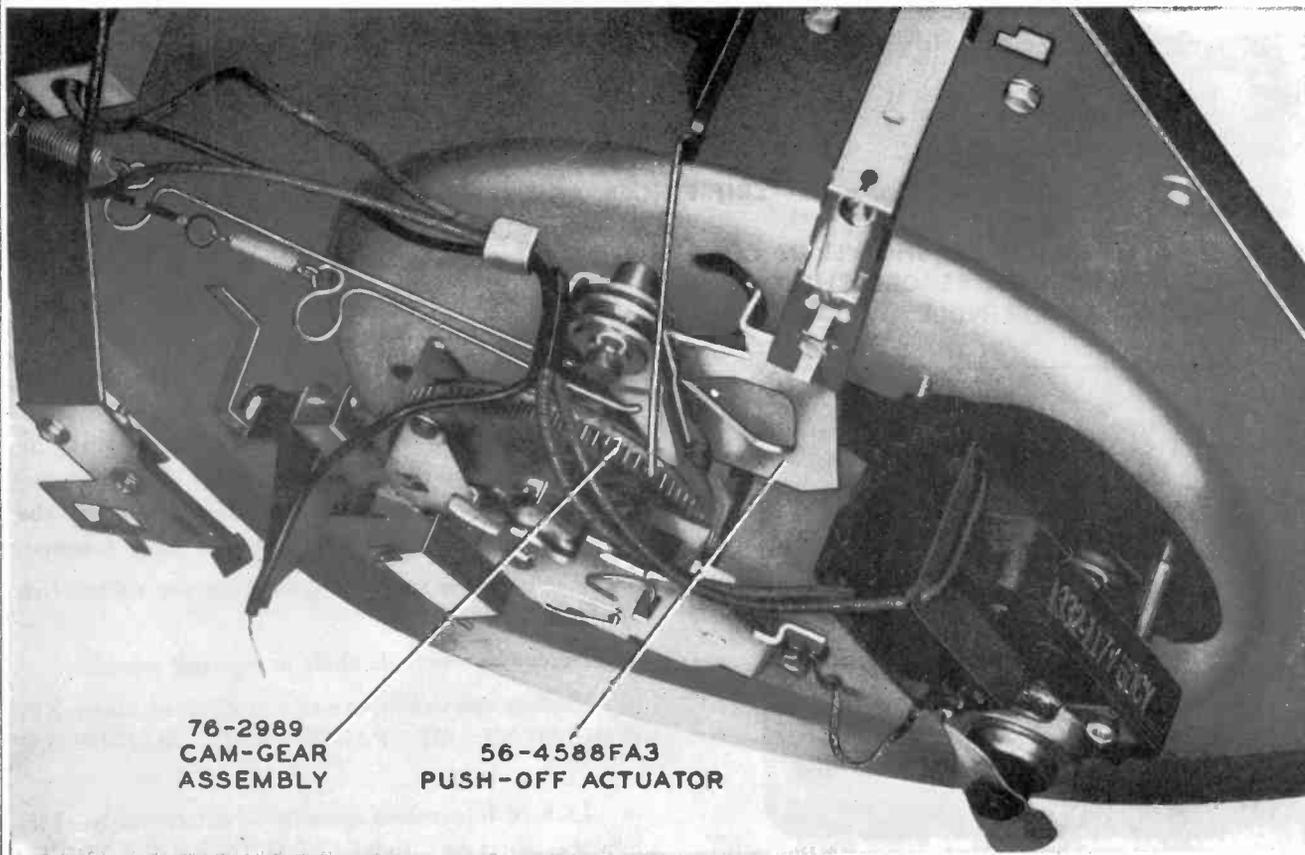


TP-4117A

Figure 16—PUSH-OFF-LEVER ADJUSTMENT

Figure 17—PUSH-OFF ACTUATOR AGAINST CAM ROLLER

TP-4134



## REPLACEMENT OF PARTS AND ASSEMBLIES

The following procedures are recommended for correct replacement of parts and assemblies. The part should be replaced by reversing the order of removal, and adjusted according to the directions given in the ADJUSTMENTS section of this manual.

When any part is to be removed, the control button should be in the AUT. (automatic) position, and the changer should be out of cycle.

### 1. Needle

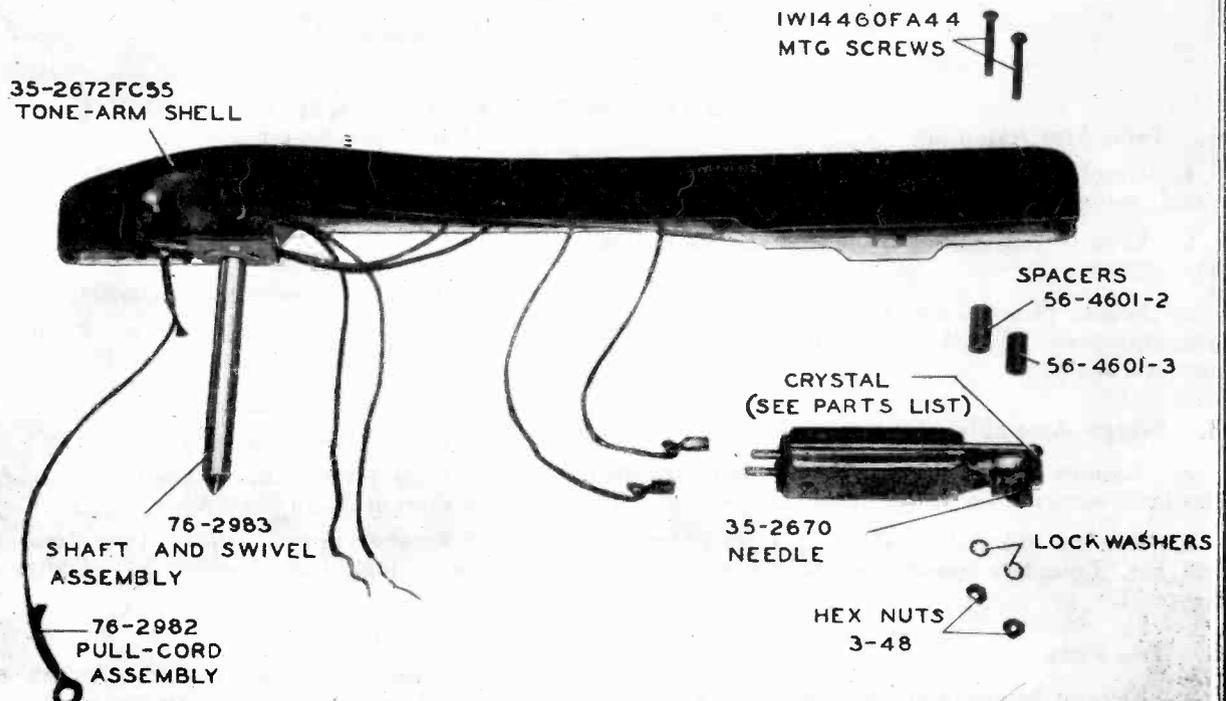
To remove the needle, loosen knurled nut from under front end of crystal cartridge, and slide needle out horizontally.

When replacing needle, tighten thumb nut and add a dab of cement in thumb-nut hole to prevent nut from loosening due to vibration.

### 2. Crystal Pickup Cartridge

- Bring tone arm toward center of turntable.
- Remove the two screws, nuts, lock washers, and spacers which hold cartridge to tone arm.
- Drop cartridge below tone arm sufficiently to allow removal of the two clips from cartridge, as shown in figure 18. If pickup leads are shielded, unsolder shield.

Figure 18—TONE ARM (35-2663-2), CRYSTAL CARTRIDGE REMOVED



### NOTE

When mounting cartridge, be sure to insert long spacer in side toward spindle.

### 2A. Spindle and Turntable

- Unhook both ends of spindle spring from "V" mounting bracket (figure 14).
- Uncoil spring wire through spindle hole.
- Pull out spindle.
- Remove turntable by pulling straight up.

### 3. Motor

- Push control button to MAN. position.
- Remove spindle and turntable, as directed in paragraph 2A.
- Remove switch cover, and unsolder motor lead from switch contact.
- Loosen screw of clamp which holds wire against base plate, and pull wire through clamp.
- Unsolder second motor lead from power plug or disconnect at splice from chassis power lead, whichever is used.
- Remove ground lead from lug on motor.
- Remove the three screws, washers, and bushings from motor frame (figure 19), and lift motor out.

MODEL M-9

PHILCO CORP.

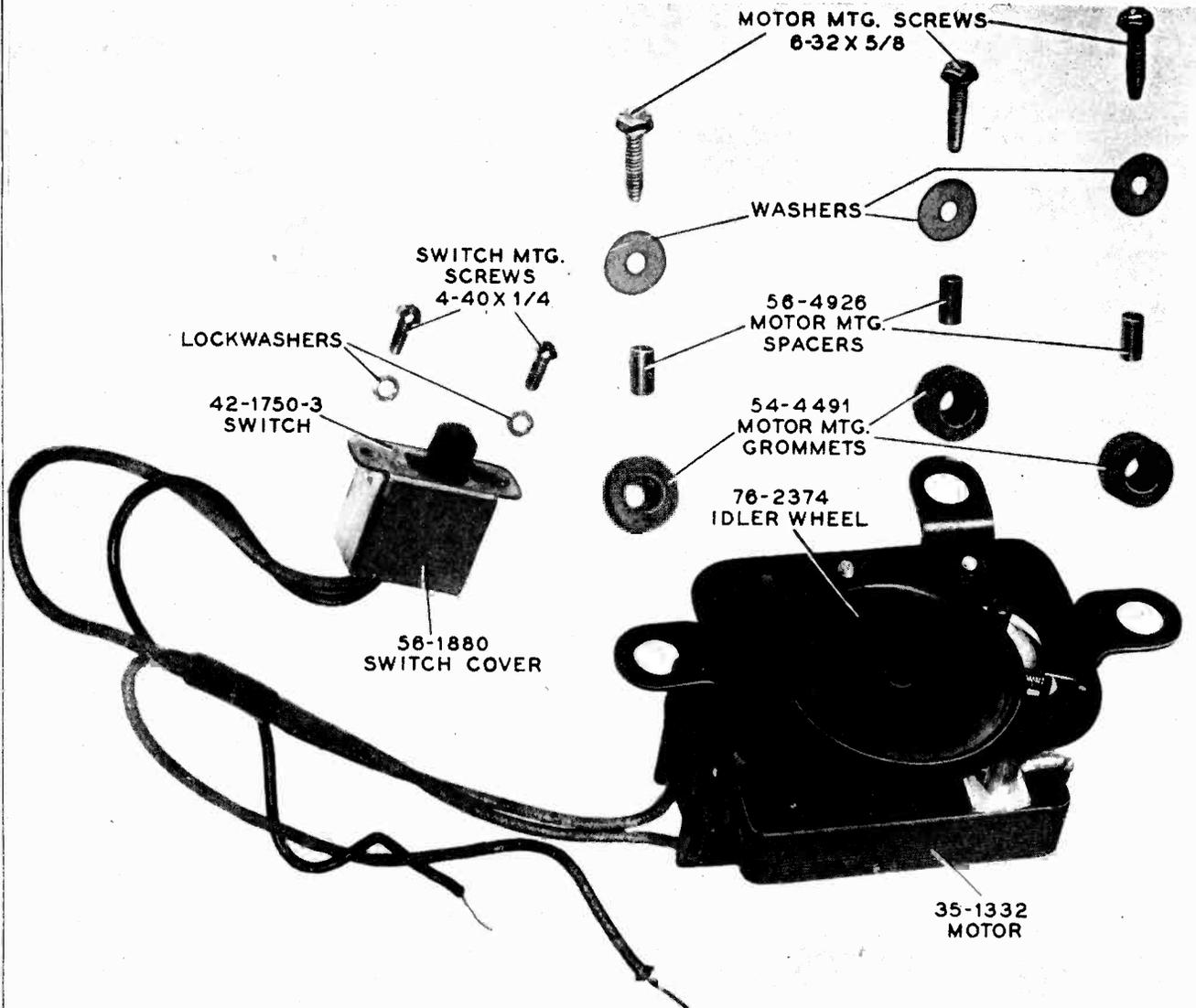


Figure 19—MOTOR, SWITCH, AND MOUNTING HARDWARE

TP-4133

**4. Tone-Arm Assembly**

- a. Unsolder tone-arm lead wires from terminal panel on underside of changer base plate.
- b. Remove pull cord from spring and short link, 56-4607FA3.
- c. Loosen clamp screw which holds trip arm to tone-arm shaft, 76-2983 (figure 20). Lift out tone arm and shaft.

**5. Bridge Assembly**

- a. Remove spindle spring; then remove the two hex-head screws from bridge plate.
- b. Remove link rod, 56-4589FA3, from slider control bar. Complete assembly of bridge is shown in figure 21.

**6. Trip Plate**

- a. Remove bridge assembly, 76-2978, as directed in paragraph 5.
- b. Slide trip plate, 76-2990, off cam-gear spindle.

**7. Cam-Gear Assembly**

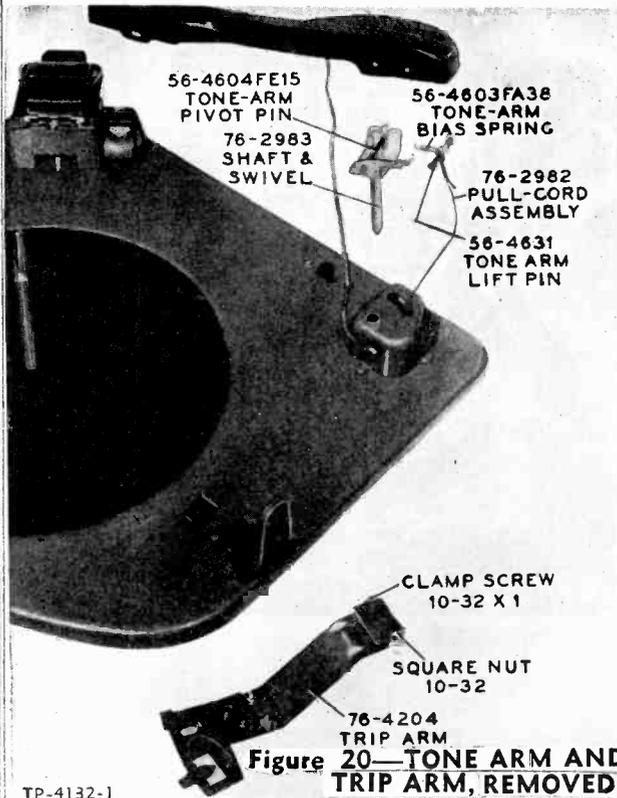
- a. Remove bridge assembly and trip plate, as directed in paragraphs 5 and 6.
- b. Remove ball-bearing assembly, 76-2991 (figure 16), by pulling it off.
- c. Remove "E" washer, 1W60980FE5.
- d. Slide cam gear off spindle. Figure 22 shows cam-gear assembly.

**8. Tone-Arm Actuator Levers**

- a. Remove "E" washer, 1W60980FE5.
- b. Slide lower actuator lever from stud, and remove short link, 56-4607FA3.
- c. Remove upper actuator lever from stud, and disengage long link, 56-4606FA3. Figure 22 shows actuator-lever assembly.

**9. Push-Off Actuator**

- a. Remove two motor-mounting screws, and loosen the third one; swing motor to one side.
- b. Remove tone-arm actuator levers, 76-2987, as directed in paragraph 8.

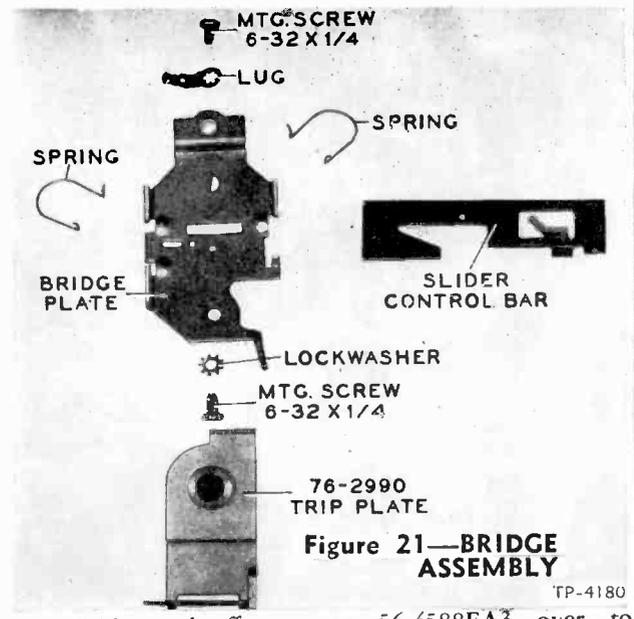
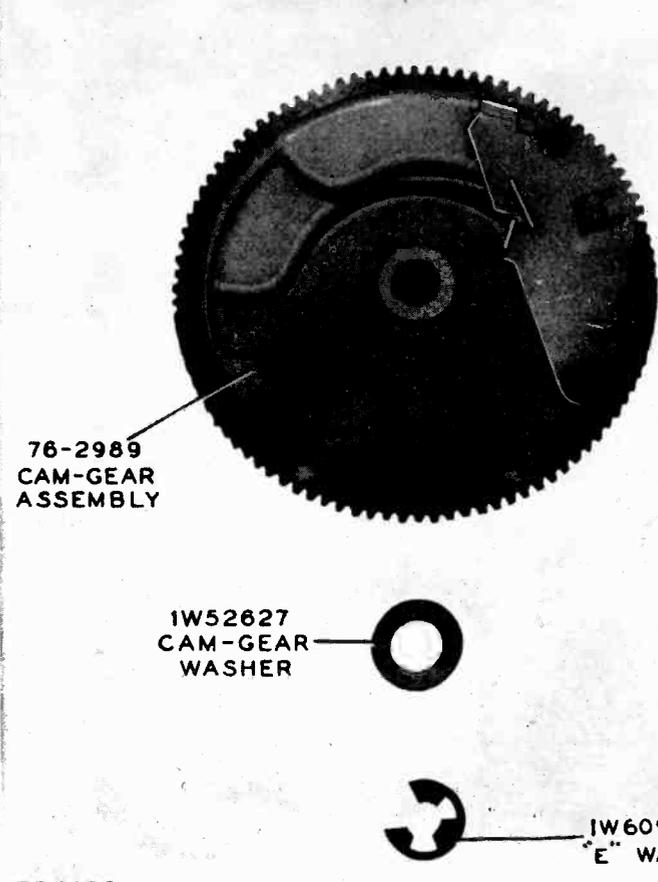


**Figure 20—TONE ARM AND TRIP ARM, REMOVED**

TP-4132-1

c. Press push-off rod, 56-4595FA3, and push-off hanger bar, 56-4596FA3, together, and pull downward, releasing the entire assembly.

**Figure 22—CAM GEAR, PUSH-OFF ACTUATOR AND TONE-ARM ACTUATOR LEVERS**

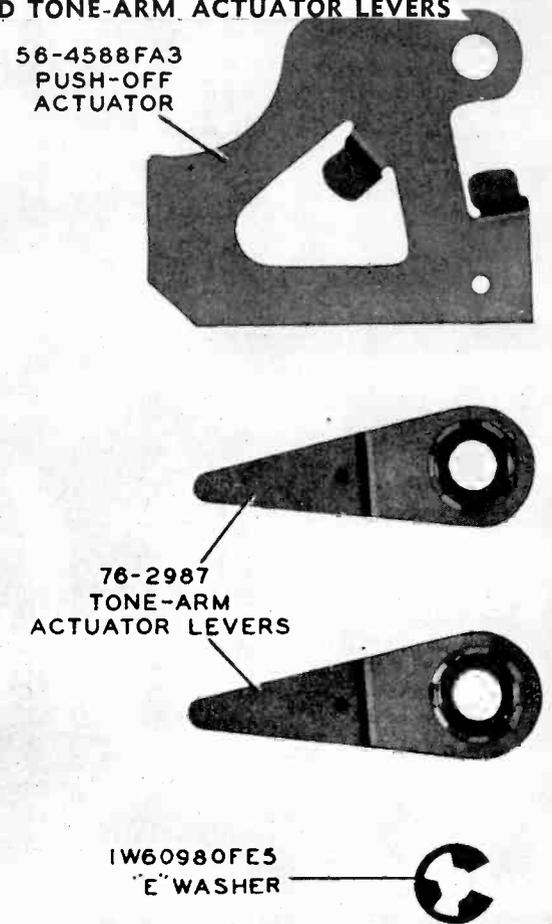


**Figure 21—BRIDGE ASSEMBLY**

TP-4180

d. Slide push-off actuator, 56-4588FA3, over, to align upturned ears with cutout in base plate. Slide actuator off stud.

**NOTE** After removing the push-off actuator and push-off-bar assembly, the slider blade on the record shelf may slide out of the assembly. When reassembling, this blade should be inserted in the record-shelf assembly with the elongated hole toward the 12" position of the record shelf. The push-off assembly is shown in figure 23.



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MODEL M-9

PHILCO CORP.

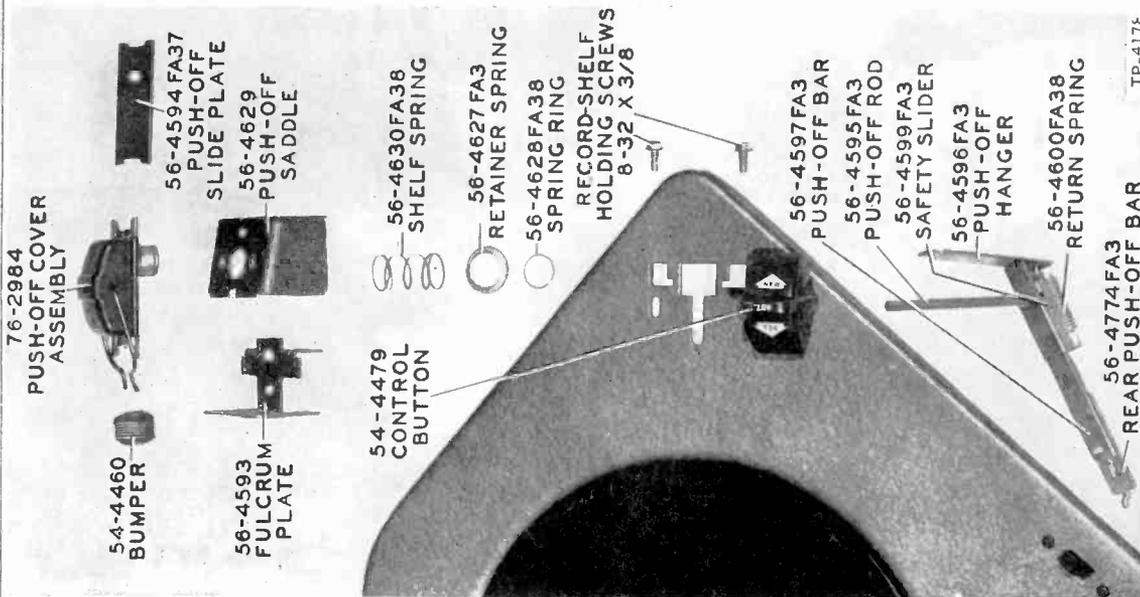


Figure 24—RECORD-SHELF AND PUSH-OFF ASSEMBLIES, REMOVED

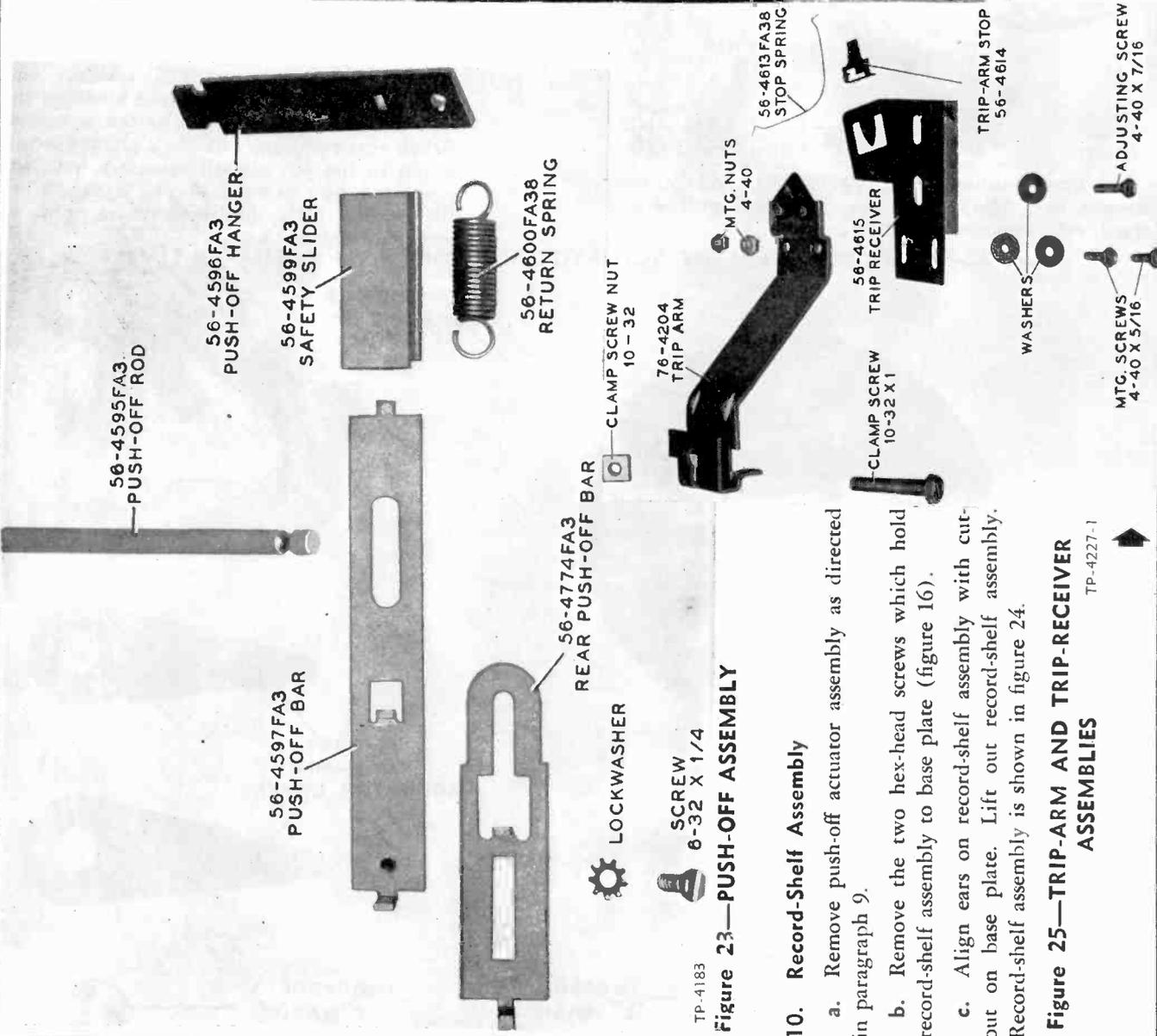


Figure 23—PUSH-OFF ASSEMBLY

10. Record-Shelf Assembly

- a. Remove push-off actuator assembly as directed in paragraph 9.
- b. Remove the two hex-head screws which hold record-shelf assembly to base plate (figure 16).
- c. Align ears on record-shelf assembly with cut-out on base plate. Lift out record-shelf assembly. Record-shelf assembly is shown in figure 24.

Figure 25—TRIP-ARM AND TRIP-RECEIVER ASSEMBLIES

TP-4227-1

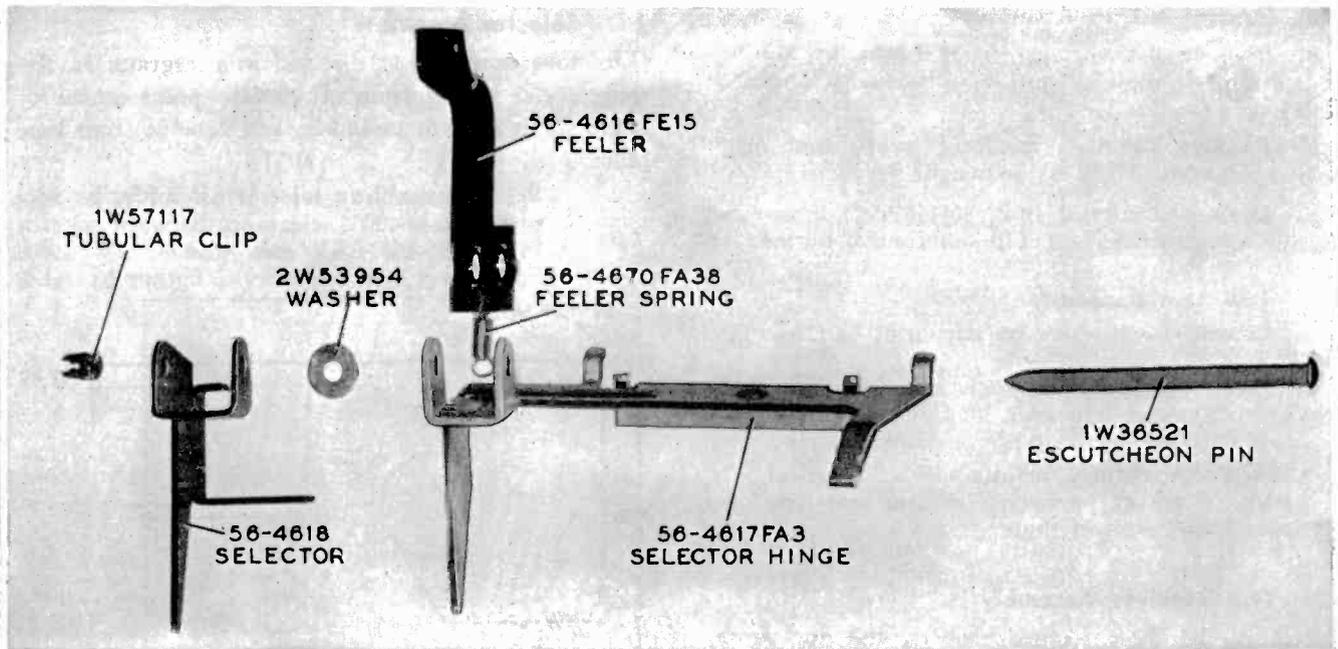
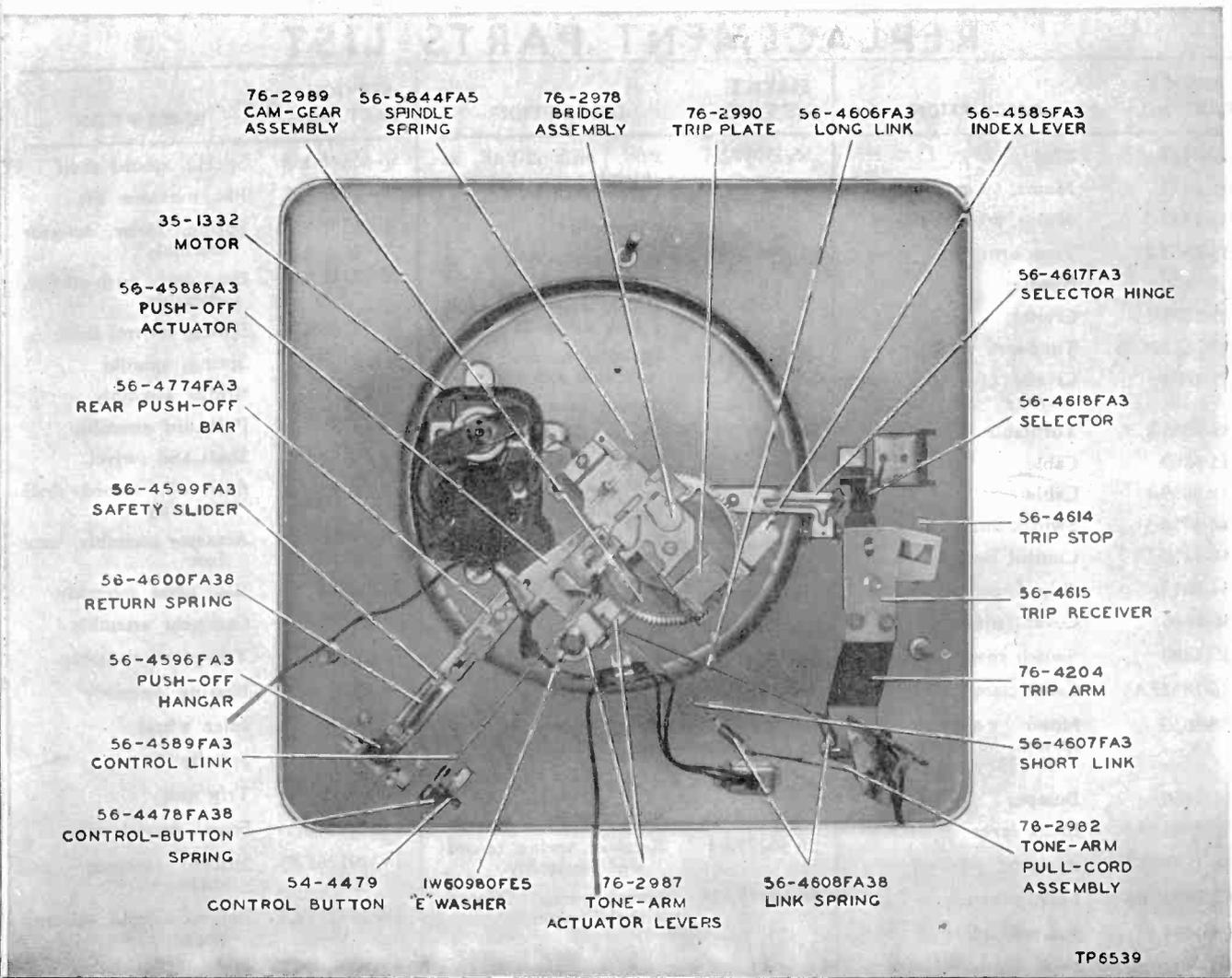


Figure 26—SELECTOR AND SELECTOR-HINGE ASSEMBLY

TP-4123

Figure 27—BOTTOM VIEW OF CHANGER, WITH PARTS IDENTIFICATION



TP6539

**11. Control-Button Assembly**

a. Remove flat spring, 56-4778FA38, by sliding it laterally through underside of button (figures 8 and 16).

b. Remove the two hex-head screws and drop bridge assembly, 76-2978 (shown in figure 8).

c. Disengage control link, 56-4589FA3, from underside of control button. Lift out control button.

**12. Trip-Arm Assembly**

a. Loosen clamp screw on trip arm, 76-4204 (figure 25).

b. Raise tone arm and shaft sufficiently to clear trip arm. Remove trip arm.

**NOTE**

When assembling, maintain  $\frac{1}{32}$ " vertical play (clearance between trip arm and base plate) in tone-arm shaft.

**13. Trip-Receiver Assembly**

Remove the three screws, washers, and nuts from trip arm (figure 25).

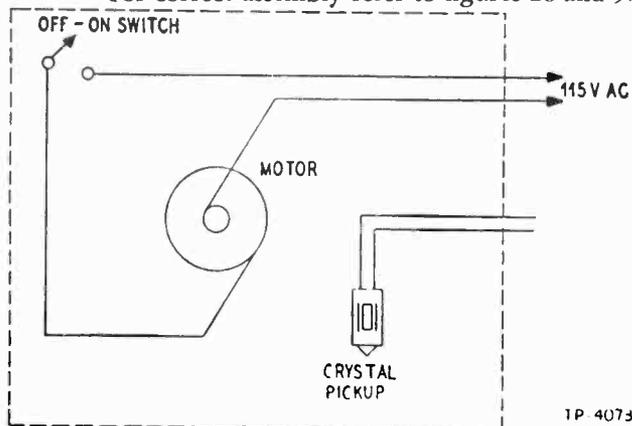
Remove trip receiver.

**14. Selector Assembly**

Remove cam gear as directed in paragraph 7. Remove feeler spring from attachment point on motor board. Tilt selector assembly, and remove from base plate.

**NOTE**

When assembling trip selector assembly, be sure to maintain .005" clearance between selector hinge, 56-4617FA3, and washer, 2W53954. For correct assembly refer to figures 26 and 9.

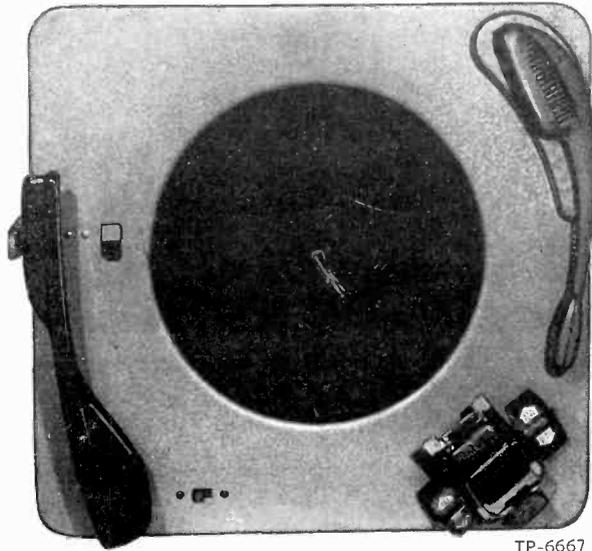


TP 4073

Figure 28—CHANGER WIRING DIAGRAM

**REPLACEMENT PARTS LIST**

SERVICE PART NO.	DESCRIPTION	SERVICE PART NO.	DESCRIPTION	SERVICE PART NO.	DESCRIPTION
27-4787	Plug	56-4595FA3	Rod, push-off-link assembly	56-4630FA38	Spring, record shelf
35-1332	Motor, 60 cycles	56-4596FA3	Hanger, push-off-link assembly	56-4631FE15	Pin, tone-arm lift
35-1332-2	Motor, 50/60 cycles	56-4597FA3	Bar, push-off-link assembly	56-4670FA38	Spring, feeler, selector assembly
35-2663-2	Tone arm	56-4599FA3	Slider, safety, push-off-link assembly	56-4774FA3	Bar, rear, push-off-link assembly
35-2670	Needle	56-4600FA38	Spring, return, push-off-link assembly	56-4778FA38	Spring, control knob
35-2671-1	Crystal	56-4601-2	Spacer, tone arm	56-5644FA5	Spring, spindle
35-2672FC55	Tone-arm shell	56-4601-3	Spacer, tone arm	76-2978	Bridge assembly
35-2674	Crystal (for tropic use only)	56-4603FA38	Spring, index and tone-arm bias	76-2982	Pull-cord assembly
35-3066-2	Turntable	56-4604FE15	Pin, tone-arm pivot	76-2983FA3	Shaft and swivel
41-3869	Cable	56-4606FA3	Link, long	76-2984	Push-off, record-shelf assembly
41-3869-1	Cable	56-4607FA3	Link, short	76-2987	Actuator assembly, tone arm
42-1750-3	Switch, motor, 50 cycles	56-4608FA38	Spring	76-2988-3	Base plate assembly
54-4479-1	Control button	56-4613FA38	Spring, stop	76-2989	Cam-gear assembly
54-7613	Trip finger	56-4614	Stop, trip arm	76-2990	Trip-plate assembly
56-1146	Cover (plug)	56-4615	Trip receiver	76-2991	Bearing assembly
56-1880	Switch cover, 50 cycles	56-4616FE15	Feeler, selector assembly	76-3556	Idler wheel
56-2832FA3	Cable clamp	56-4617FA3	Hinge, selector assembly	76-3926	Spindle
56-3630	Motor conversion spring, 50 cycles (for 35-1332-2 only)	56-4618FA3	Selector	76-4204	Trip arm
56-4460	Bumper	56-4626-1FA7	Record shelf	1W14460FA44	Screw, crystal mtg.
56-4585FA3	Index lever	56-4627FA3	Retainer, spring, record-shelf assembly	1W29126FA3	Spacer, selector assembly
56-4588FA3	Actuator, push-off	56-4628FA38	Spring ring, record-shelf assembly	1W36521FA3	Pin, escutcheon, selector assembly
56-4589FA3	Link, control	56-4629	Push-off saddle, record-shelf assembly	1W60980FE5	"E" washer
56-4593	Fulcrum plate				
56-4594FA37	Plate, push-off slide				



TP-6667

Figure 1. Philco Record Changer and Record Player Combination, Model M-9C

## INTRODUCTION

The Philco Automatic Record Changer and Record Player Model M-9C, figure 1, which is used in several 1949 Philco radio-phonograph combinations, incorporates the use of

two tone arms. One tone arm is used in conjunction with the record-changer mechanism, which plays ten 12" records or twelve 10" records automatically at the standard speed of 78 r.p.m. The other tone arm is used manually, to play the new Columbia Long Playing Records at a speed of 33-1/3 r.p.m.; the record player shuts off automatically at the end of the Long Playing Record.

## DESCRIPTION OF OPERATING CYCLES

Power is applied to the motor through an off-on switch and a mercury switch which is controlled by the position of the record-player tone arm. The two switches are connected in series.

A control is mounted on each side of the record-shelf assembly. The REJ.—AUT.—MAN. control controls the record-changer section of the combination. The STD. PLAY—LONG PLAY control has two functions. When it is pushed to LONG PLAY, a link underneath the base plate pulls a selector lever mounted on the base plate. The selector lever is connected to a shift lever which is part of the motor. On this shift lever is mounted a pulley which is connected

by a belt to the motor shaft, as shown in figure 2. When the control is in LONG PLAY position, this pulley, which is larger in diameter than the motor shaft, engages and drives the idler wheel, which in turn drives the turntable at the slow speed of 33-1/3 r.p.m. When the control is at STD. PLAY, the larger pulley is retracted and the motor shaft engages the idler wheel, to provide a turntable speed of 78 r.p.m. By action of the STD. PLAY—LONG PLAY control, the double-pole, single-throw switch, mounted on the base plate under the turntable, is actuated. To this switch are connected the output leads of the two tone arms. When the control is at LONG PLAY position,

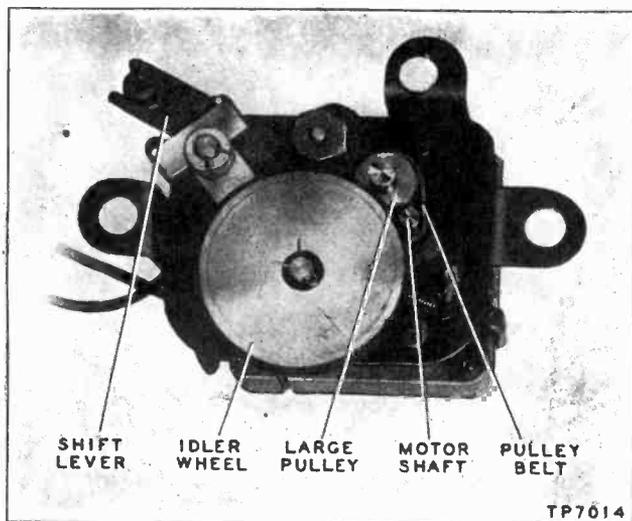


Figure 2. Motor, Showing Pulley, Bolt, and Shift Lever

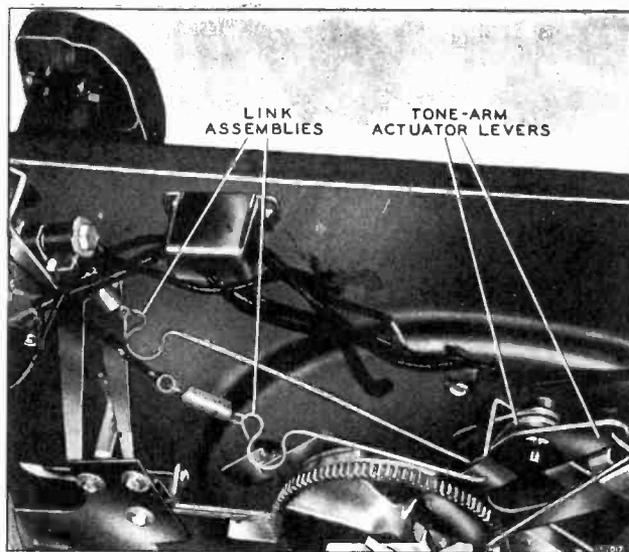


Figure 4. Link Assemblies and Actuator Levers

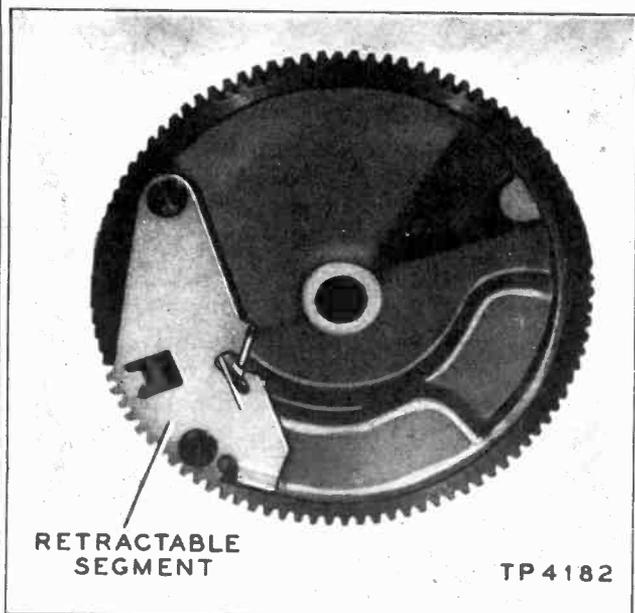


Figure 3. Cam Gear, Showing Retractable Segment

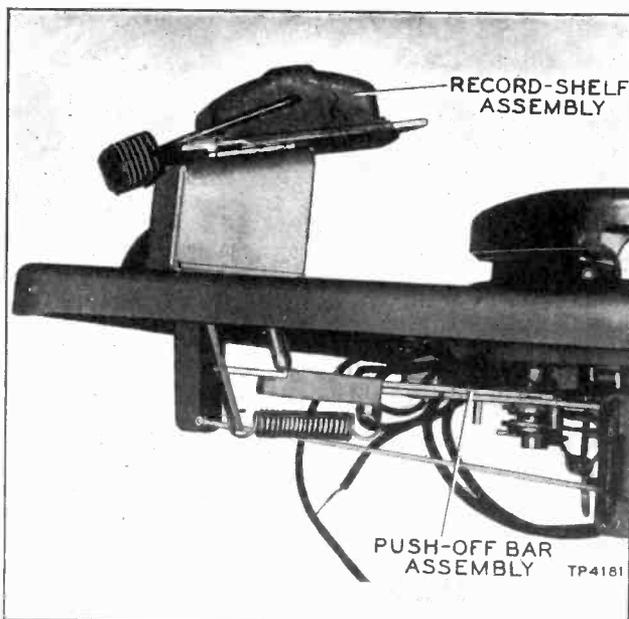


Figure 5. Record-Shelf and Push-Off Assemblies

the switch cuts out the output from the record-changer tone arm and closes the circuit for the record-player tone arm. When the control is at STD. PLAY, the reverse action takes place.

The record-changer change cycle takes place when the turntable hub gear, which is part of the turntable shaft, engages the cam gear through a retractable segment mounted on the cam gear; see figure 3. This retractable segment is brought into position by the action of the trip mechanism. The cam then operates the changer mechanism.

The record-changer tone arm is operated by two link assemblies (figure 4) attached to actuator levers,

which are in contact with the cam surface of the cam gear. The record-shelf push-off mechanism is connected through a series of bars, to a push-off actuator (figure 5). The mechanism is operated when a roller, mounted on the cam gear, comes in contact with the actuator. The trip mechanism is operated by a trip finger riding over a ratchet screw (figure 6), which starts the change cycle when the needle is traveling in the eccentric finish groove of the record. The trip mechanism is locked in a disengaged position when the REJ.—AUT.—MAN. control is in the MAN. position.

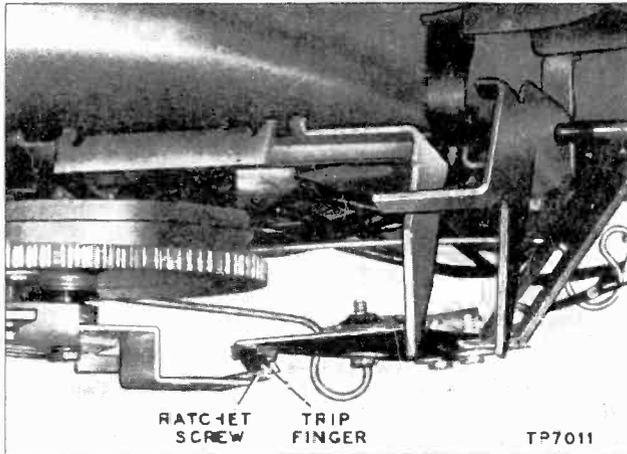


Figure 6. Trip Finger and Ratchet Screw

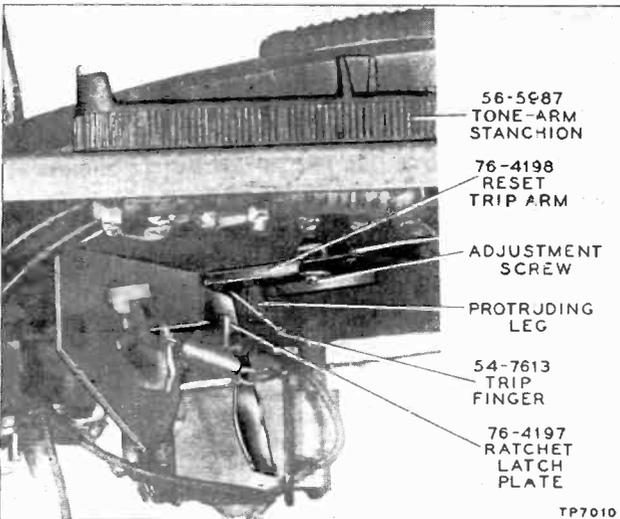


Figure 7. Trip Assembly, Showing Trip Finger Riding Over Ratchet Plate

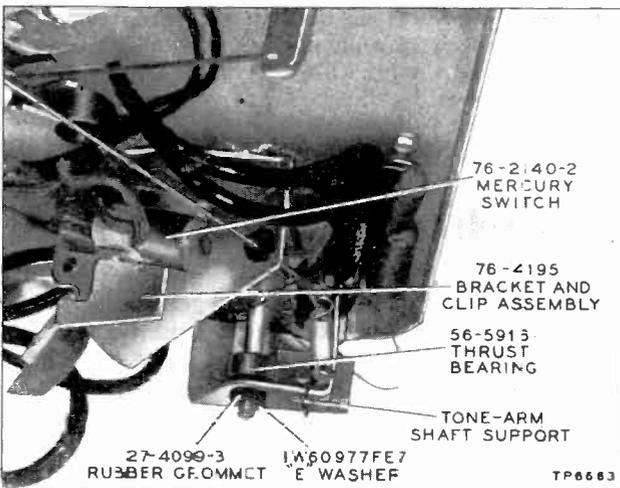


Figure 8. Mercury Switch, Shown in ON Position

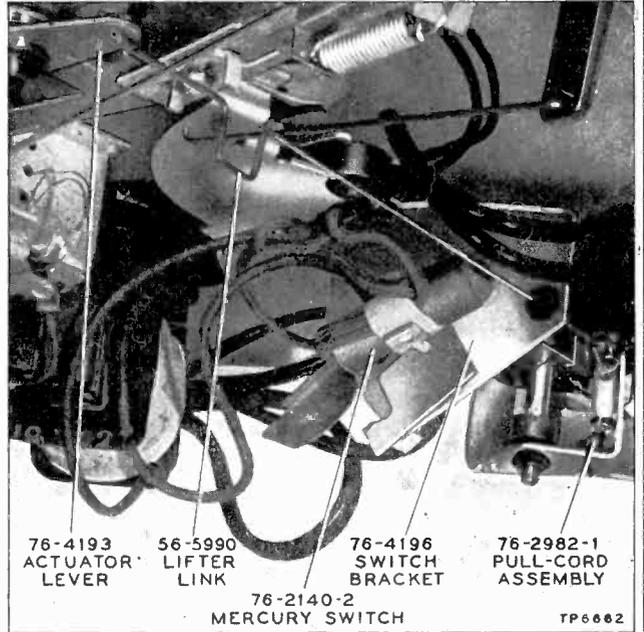


Figure 9. Mercury Switch, Shown in OFF Position

The record-player section contains a separate tone arm. Attached to this tone arm is a reset and trip-arm assembly, which has a protruding leg and trip finger (figure 7). When the tone arm of the record player is resting on the rest post, the leg on the reset trip arm contacts an ear of the bracket-clip assembly (mounted on the switch bracket), and this tips the mercury switch mounted on it to the ON position, (figure 8). The motor circuit is now controlled only by the on-off switch.

When the record-player tone-arm needle is traveling in the eccentric finish groove of the record, the trip finger, which is mounted on the reset trip arm, rides over a ratchet on the ratchet latch plate. The ratchet latch plate is mounted on the switch assembly (figure 7), and trips the latch, causing the bracket-clip assembly to drop and tip the mercury switch to the OFF position (figure 9). This opens the motor circuit and stops the turntable.

A pull cord and link assembly is attached to the record-player tone arm, and is connected to a link-actuator lever. This permits the tone arm to be lifted and set on its rest post if the record changer is put into a change cycle. The pull-cord assembly, Part No. 76-2982-1, and the link-actuator lever, Part No. 76-4193, are shown in figure 9.

## RECORD-CHANGER TESTING AND TROUBLE-SHOOTING PROCEDURE

### Pickup Test

Play a familiar record on the phonograph and note the volume and tone quality.

#### NOTE

It is advisable to carry a familiar record as a part of the service test equipment.

If distortion is noted, try a new needle. If the distortion persists, a faulty crystal pickup is indicated; refer to page 12.

### Changer-Mechanism Test

The following series of record-changer operating tests is given for quickly locating any trouble that may be encountered. Each test should be performed with several records before making any adjustments.

Set the record shelf to the 10" position and place the tone arm on the rest post. Place a 10" record over the spindle and onto the record shelf. Push the STD. PLAY—LONG PLAY control to STD. PLAY.

Push the REJ.—AUT.—MAN. control to REJ. and observe the record-dropping action. The record should fall smoothly, with the edge of the record leaving the lips of the record shelf *after* the center has started to fall. Adjustment of the record shelf is given on page 9.

The tone arm should rise from the rest post, and the needle should come down on the record, about  $\frac{1}{8}$ " from the outer edge. The index adjustment is given on page 7.

Play the record through and observe the tripping action; the trip mechanism should operate within the first two or three revolutions after the needle has entered the eccentric finish groove. Trip adjustments are given on page 9.

Remove the record from the turntable and set the record shelf to the 12" position. Place a 12" record over the spindle and onto the record shelf. Push the

REJ.—AUT.—MAN. control to REJ., and observe the record-dropping action. The edge of the record should leave the lips of the record shelf *after* the center has started to fall. (Refer to page 9 for the record-shelf adjustment, if needed.) The tone arm should rise from the rest post and the needle should come down on the record, about  $\frac{1}{8}$ " from the outer edge. If the index adjustment is required, refer to page 7.

Observe whether the lower edge of the tone arm, during a change cycle, clears the top of the hook on the tone-arm rest post by a minimum of  $\frac{1}{8}$ ". Take the tone arm off the rest post, and place the pickup over the changer base plate; the needle point should clear the base plate by at least  $\frac{1}{16}$ ", and should be no higher than the turntable top. Lift and height adjustments are given on page 7.

### Turntable and Motor Test

#### NOTE

Before making this test, warm up the motor by allowing it to run for at least ten minutes.

Set the REJ.—AUT.—MAN. control to MAN., and set the STD. PLAY—LONG PLAY control to STD. PLAY. Load the turntable with ten 12" records, and place the tone arm on the top record.

Place a stroboscope disc, such as Philco Part No. 45-1614, on the record, and illuminate the disc with a lamp (preferably a neon bulb) operated on 60-cycle a.c. The dots in the row calibrated for 78 r.p.m. should appear to remain stationary, or to drift very slowly, but smoothly, backward or forward.

If the turntable speed is steady, but is appreciably below 78 r.p.m., refer to the lubrication data on the turntable upper bearing, and check the idler wheel, idler spring, wiring, etc.

Unsteady drift of the dots on the stroboscope disc indicates uneven turntable speed, which is the cause of wows; see UNEVEN TURNTABLE SPEED (WOWS), page 11.

## RECORD-CHANGER CLEANING AND LUBRICATION

The Model M-9C record changer, like any other mechanism, requires lubrication after long periods of use. Whenever a major part or an assembly is to be replaced, the changer should be cleaned and lubricated. Carbon tetrachloride or other similar cleaning fluids may be used to remove old grease, oil, and dirt. Apply lubricants sparingly.

All lubrication points are shown in figures 10 and 11. It may be necessary to remove some parts and as-

semblies in order to lubricate their bearings—for example, the actuator and cam gear must be removed to lubricate the actuator stud and the cam-gear spindle.

### PARTS NOT TO BE LUBRICATED

The following parts should not be lubricated at any time: Trip receiver, trip finger, ratchet screw on trip plate, selector, and all parts of the record-player section.

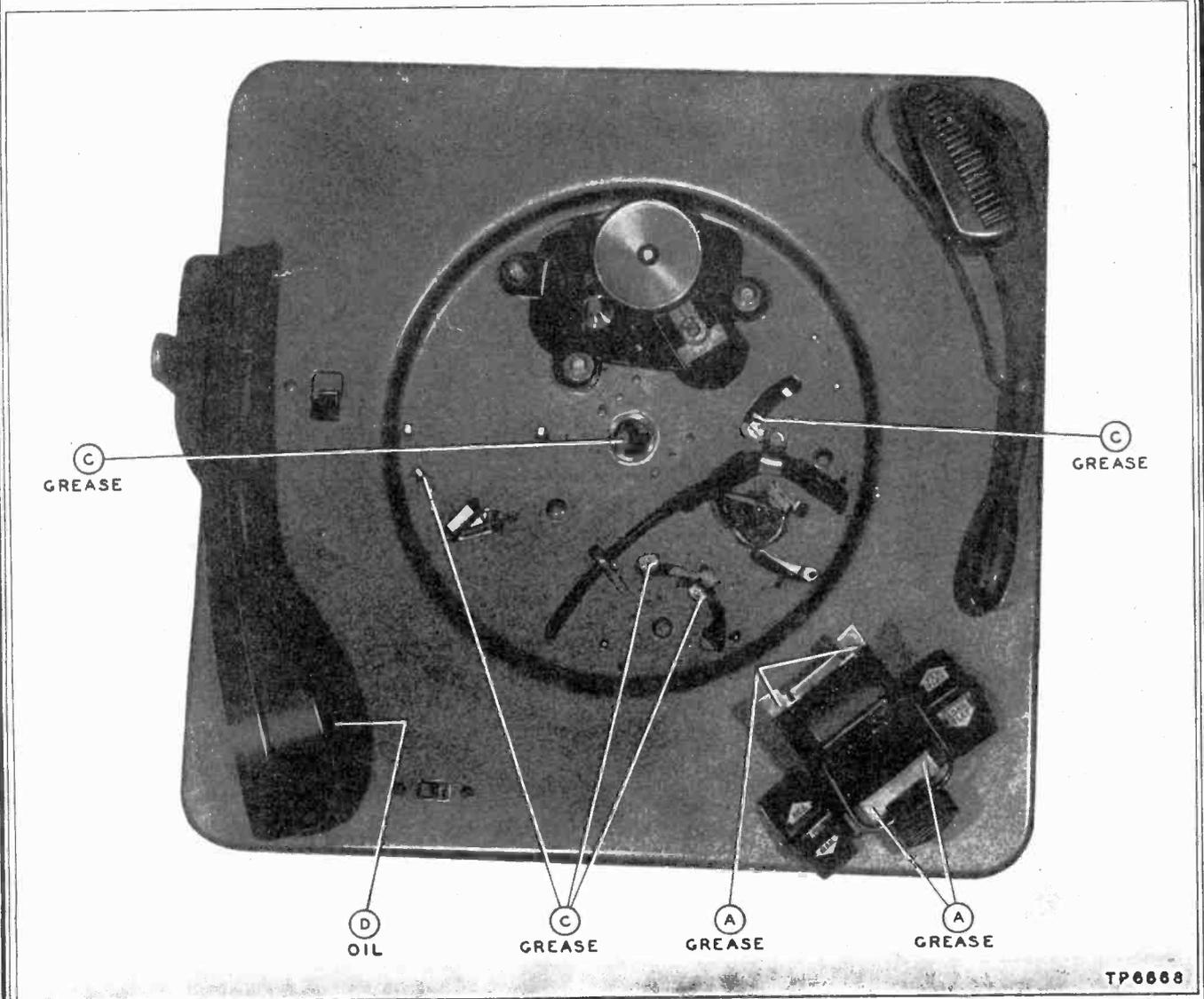


Figure 10. Top View, Showing Lubrication Points

### PARTS TO BE GREASED

The following parts are to be lubricated with a grease having the consistency of vaseline:

#### Record-Shelf Assembly (Point A of Figure 10)

Four protruding dimples.

#### Bridge Assembly and Slider Control Bar (Point B of Figure 11)

Three dimples and four upturned ears.

#### Cam Gear (Point C of Figure 11)

Cam-gear teeth, cam surfaces, and cam-gear spindle.

#### Main Assembly (Points C of Figures 10 and 11)

Trip-plate ear where contact is made with gear segment.

Actuator stud.

All parts with ears sliding on changer base plate.

Index-lever surface which slides on base plate.

Push-off-actuator dimples which slide on base plate.

Turntable shaft (upper bearing).

Tone-arm shaft.

### PARTS TO BE OILED

The following parts are to be lubricated with S.A.E. 20 oil:

#### Tone Arm (Point D of Figure 10)

Tone-arm pivot pin where pin rides in elongated hole of tone arm—apply one drop with a pointed rod.

#### Trip-Plate Bushings (Point E of Figure 11)

#### Spindle (Point E of Figure 11)

#### Cam-Gear Roller (Point E of Figure 11)

### CAUTION

Do not get any oil or grease on the motor shaft or the idler-wheel tire. Should this occur, remove the oil or grease immediately with carbon tetrachloride.

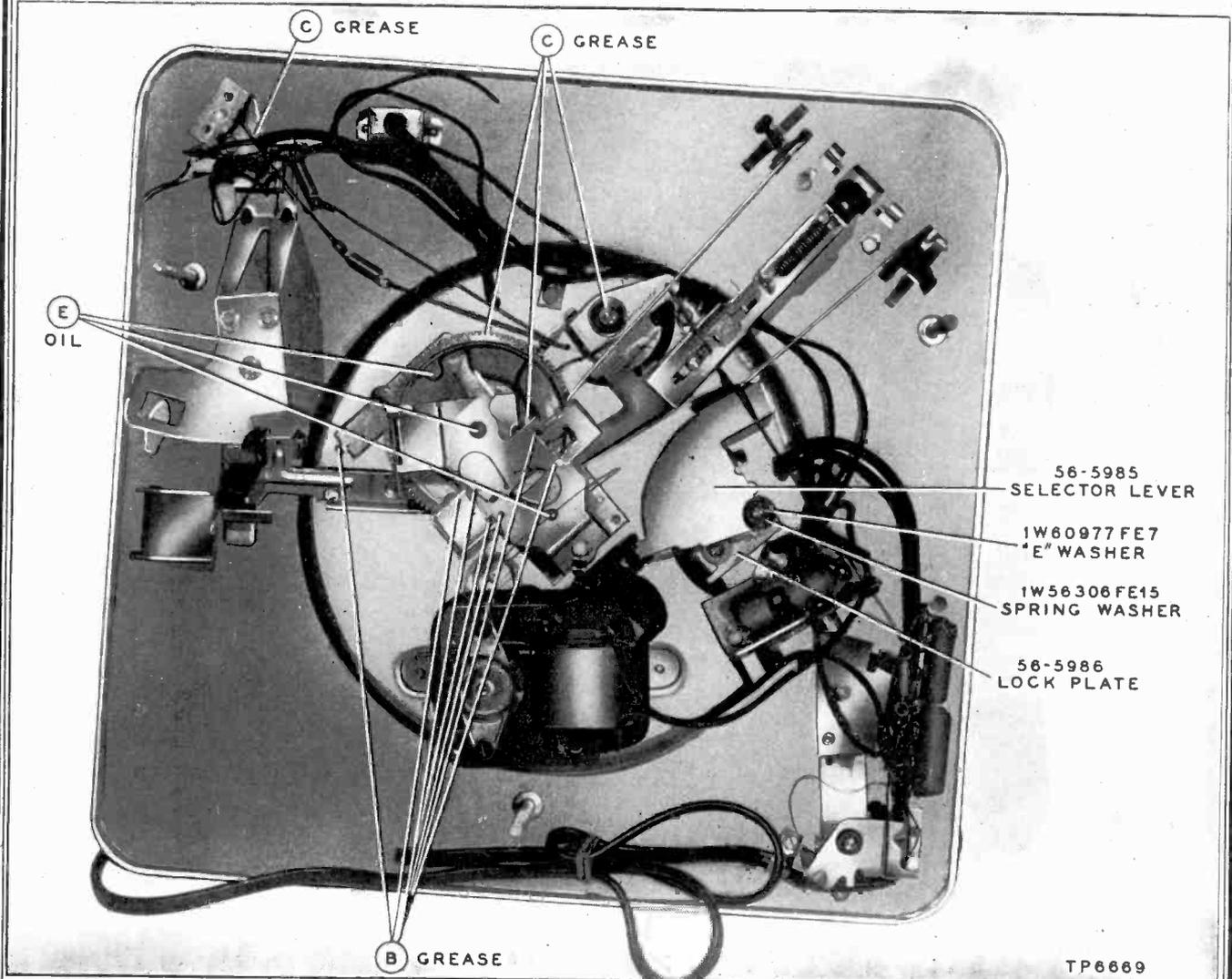


Figure 11. Bottom View, Showing Lubrication Points

## RECORD-CHANGER ADJUSTMENTS

### 10" Index Adjustment

Place a 10" record on the turntable, push the REJ.—AUT.—MAN. control to REJ., and rotate the turntable  $4\frac{1}{2}$  turns by hand. The tone arm should then be approximately  $\frac{1}{2}$ " above the record.

Loosen the clamp screw on the trip arm (figure 12). Hold the tone arm (steady)  $\frac{1}{8}$ " in from the edge of the record, and set the trip arm so that the trip-arm stop is in contact with the selector hinge (Part No. 56-4617FA3). See figure 13.

Tighten the clamp screw, leaving  $\frac{1}{32}$ " vertical play, or clearance, between the trip arm and the base plate.

### 12" Index Adjustment

Make the 10" index adjustment first. The 12" indexing will ordinarily be satisfactory after the 10"

adjustment is made; if not, bend the selector, Part No. 56-4618FE15, slightly to the right or left as required for proper indexing of the needle on the record, as shown in figure 14.

### Tone-Arm Height and Lift Adjustments

With the changer out of cycle (change cycle completed; tone arm lowered), and the tone arm off the rest post, the needle point should clear the changer base plate by at least  $\frac{1}{16}$ ", and should not be higher than the turntable top. To adjust the height, shape the top ear of the tone-arm swivel, shown in figure 15 (bending the ear downward raises the tone arm).

To adjust the lift, take the tone arm off the rest post, push the REJ.—AUT.—MAN. control to REJ., and rotate the turntable approximately  $1\frac{1}{2}$  turns by

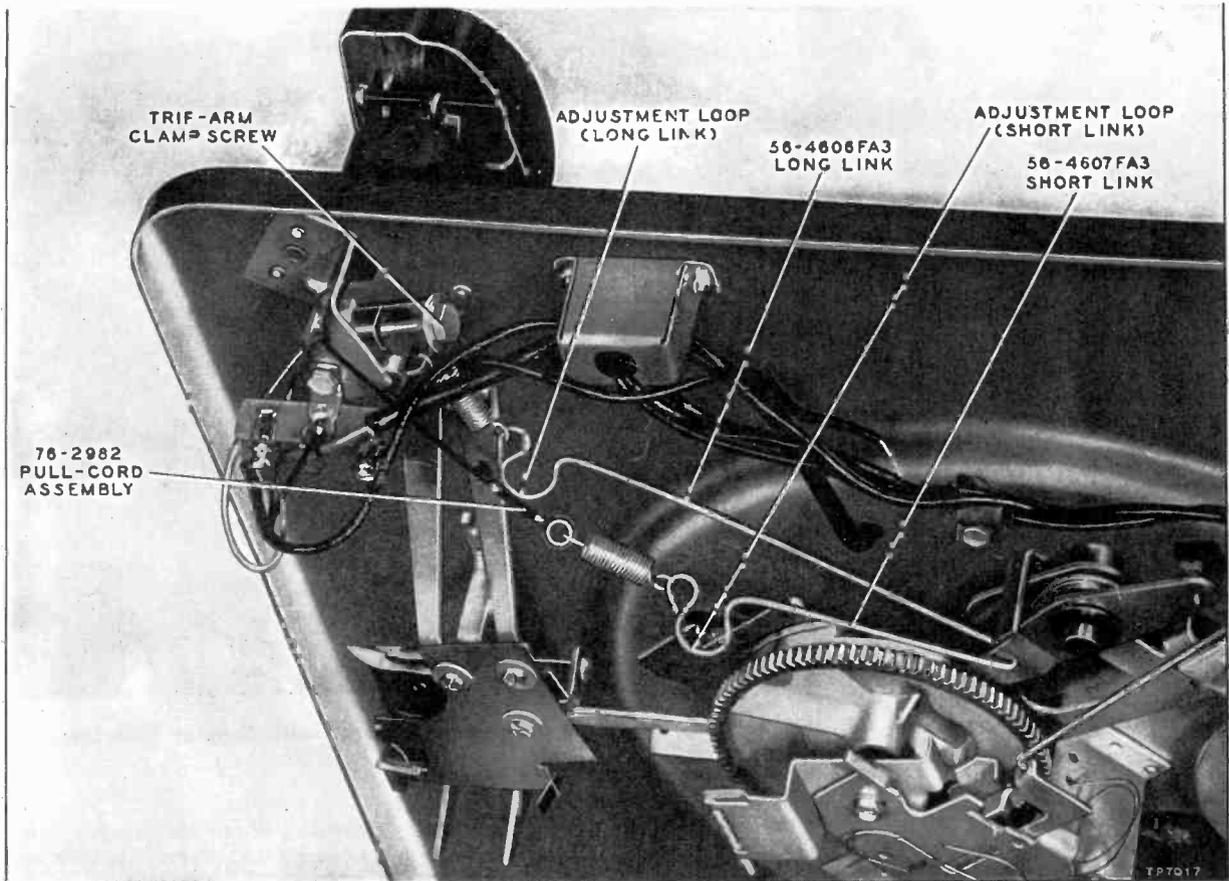


Figure 12. Loop Adjustments and Trip-Arm Clamp Screw

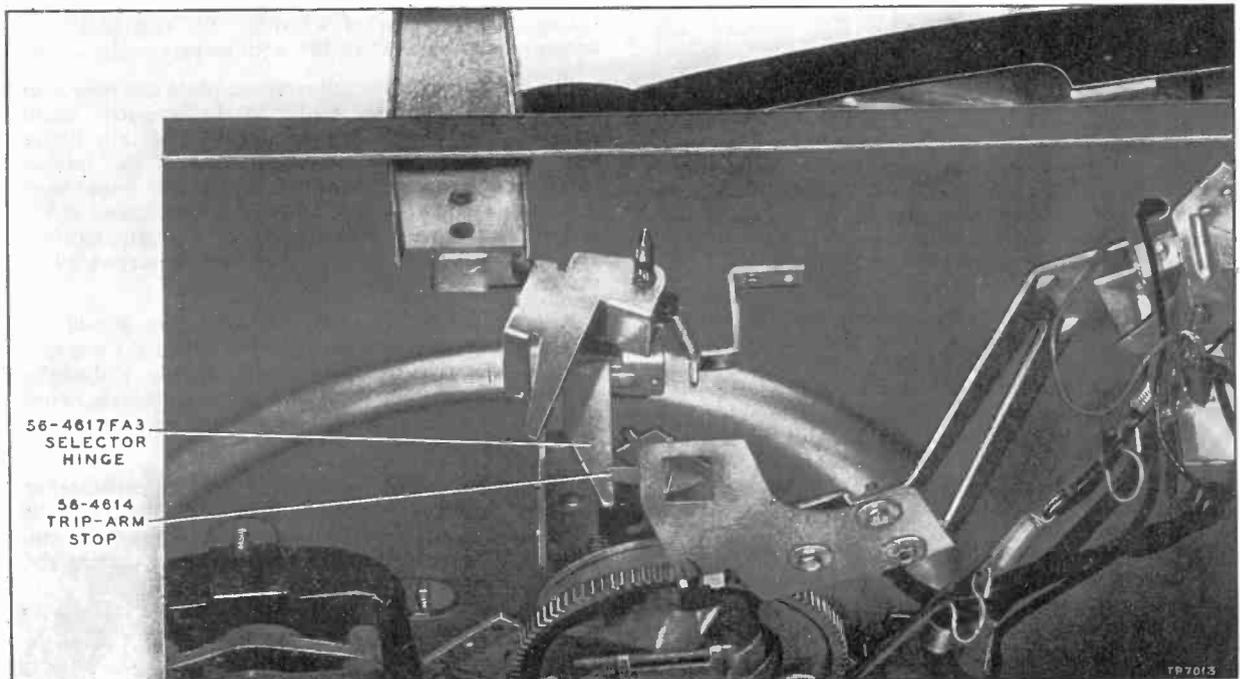


Figure 13. 10' Indexing Adjustment

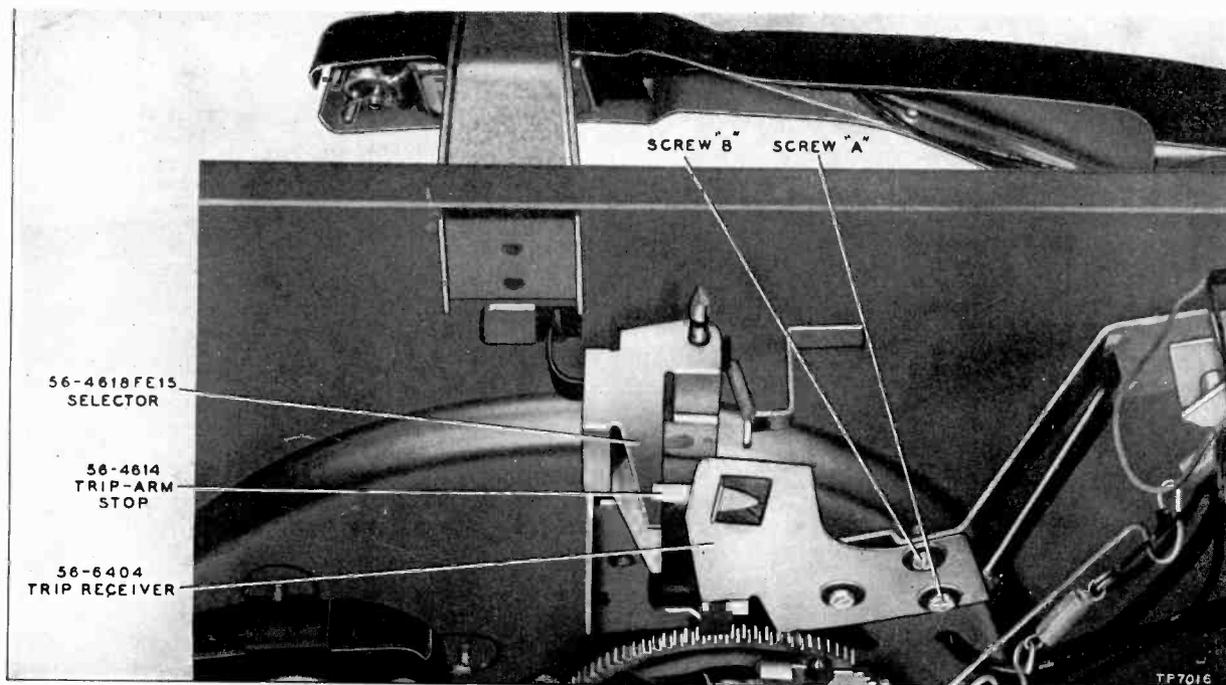


Figure 14. 12" Indexing Adjustment, Showing Trip Stop Arm in Contact with Outside Selector

hand until the tone arm comes against the rest post. The lower edge of the tone arm should clear the top of the protruding hook on the rest post by not less than  $\frac{1}{8}$ ", and not more than  $\frac{1}{4}$ ". Adjust by shaping the lower ear of the tone-arm swivel, shown in figure 16 (bending the ear downward raises the tone arm).

### Tone-Arm Vertical and Horizontal Timing Adjustments

#### NOTE

Before making these adjustments, make the tone-arm height and lift adjustments given above.

For the vertical adjustment, start with the changer out of cycle. Push the REJ.—AUT.—MAN. control to REJ., and rotate the turntable, by hand, three-quarters of a revolution; this setting can be obtained more accurately by making a mark on the turntable to coincide with some starting point. At the three-quarter-revolution point, the leading edge of the cam surface is approximately  $\frac{1}{4}$ " from the end of the lift actuator lever, Part No. 76-4193; this is the lower actuator lever, shown in figure 17. Adjust the wire loop of the short link, cord, and spring assembly (figure 12), attached to the tone-arm lift pin, by squeezing or opening the loop until the tone-arm lift pin makes contact with the lower ear of the tone-arm swivel.

For the horizontal adjustment, rotate the turntable another three-quarters revolution from the point at which the vertical adjustment was made. At this point, the leading edge of the cam surface is approximately  $\frac{1}{4}$ " from the end of the horizontal-return actuator lever; this is the upper actuator lever, Part No. 76-2987, shown in figure 18. Adjust the wire loop of the long link and spring assembly (figure 12), attached

to the trip arm, by squeezing or opening the loop until the tone arm makes contact with the rubber bumper on the tone-arm rest post.

### Trip-Finger and Trip-Receiver Adjustments

For the trip-finger adjustment, move the tone arm toward the spindle. Adjust the screw on the trip-receiver plate (figure 19) so that the trip finger, when riding over the ratchet screw on the trip plate, assumes an angle of  $25^\circ$  to  $30^\circ$  with respect to the screw.

For the trip-receiver adjustment, place the tone arm on a record with the needle in the eccentric finish groove. The vertical center line of the trip finger should coincide with the center line of the ratchet screw. To adjust the centering of the trip finger over the ratchet screw, loosen screw B slightly, and screw A completely; see figure 19. Rotate the trip receiver about screw B, as a center. Tighten the screws when the trip finger is centered.

Approximately  $\frac{1}{8}$ " of the trip-arm stop should engage the selector; see figure 19. To adjust the engagement of the trip-arm stop, loosen screw A slightly, and screw B completely. Rotate the trip receiver about screw A, as a center, to obtain the correct adjustment. Tighten the screws.

The above adjustments will affect each other slightly; therefore, it may be necessary to repeat each adjustment until both are correct. After making the above adjustments, it will be necessary to correct the index adjustments.

### Record-Shelf Adjustment

Place the shelf in the 10" position, and the changer out of cycle. Place the Philco record-shelf gauge, Part No. 45-1470 (also used for M-4), over the spindle and

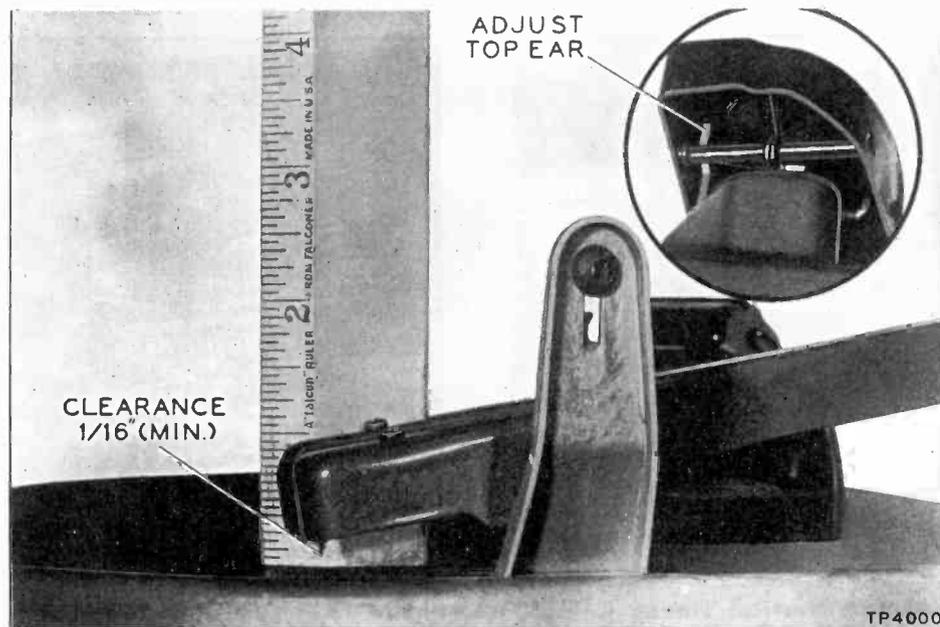


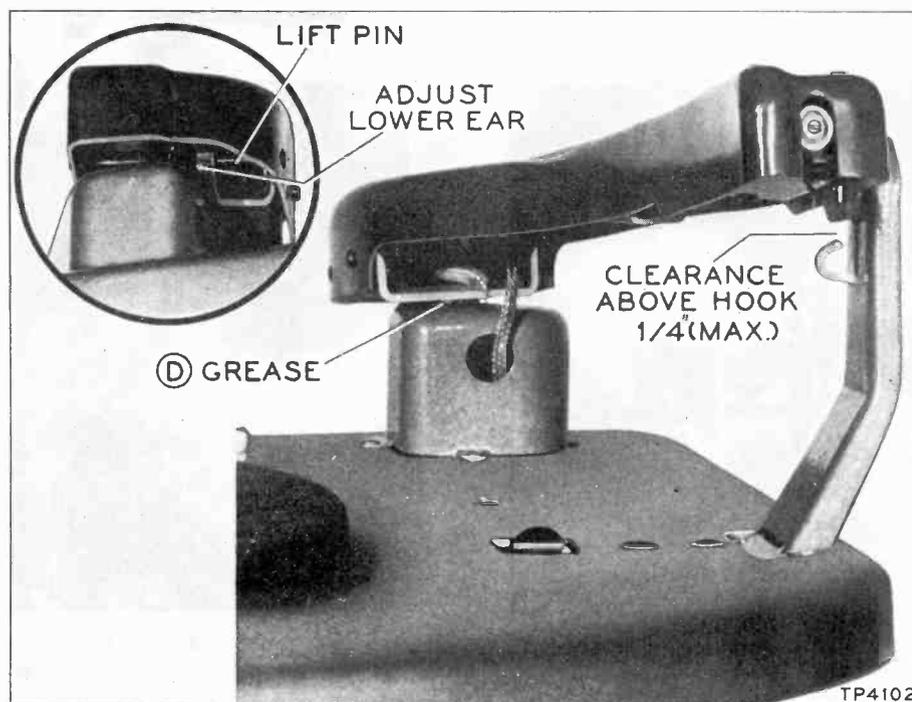
Figure 15. Tone-Arm Height Adjustment

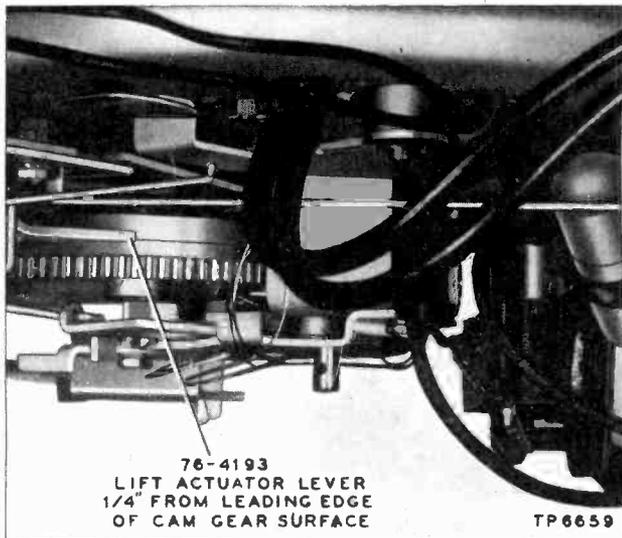
onto the record shelf, as shown in figure 20. Loosen the two hex-head screws which hold the record-shelf assembly to the changer base plate. Move the record-shelf assembly away from the record spindle until the large curved part of the gauge drops even with the record-shelf lips, as shown in figure 20. Now push the record shelf and gauge lightly against the spindle, taking out all play toward the spindle; keep the lips of the record shelf in even contact with the edge of the gauge. Tighten the two hex-head screws.

**Push-Off Adjustment**

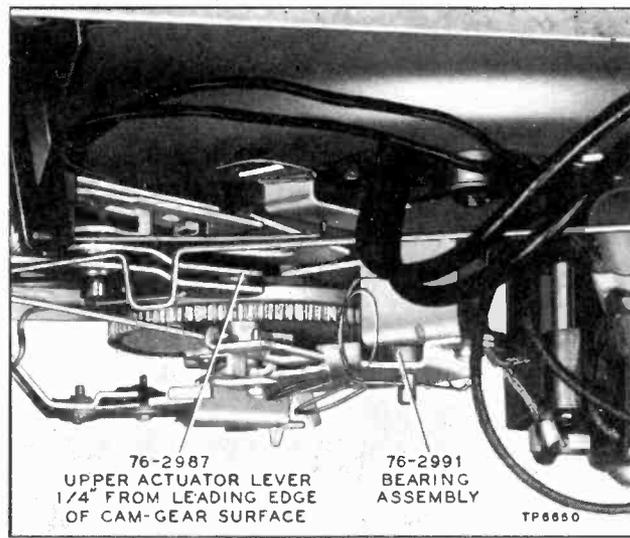
Push the REJ.—AUT.—MAN. control to REJ., and rotate the turntable 2½ revolutions, by hand; at this point, the push-off actuator, Part No. 56-4588FA3, is in its most forward position, in contact with the roller on the cam gear; see figure 21. Loosen the push-off-bar locking screw, shown in figure 21. Squeeze the push-off-bar ears toward each other to the point where the slider blade on the record shelf extends ½” beyond the lips of the shelf. Tighten the hex-head locking screw.

Figure 16. Tone-Arm Lift Adjustment





**Figure 17. Tone-Arm Vertical Timing Adjustment, Showing Lower Actuator Lever in Contact with Cam Gear**



**Figure 18. Tone-Arm Horizontal Timing Adjustment, Showing Upper Actuator Lever in Contact with Cam Gear**

**Uneven Turntable Speed (Wows)**

Uneven turntable speed (wows) may be caused by the following:

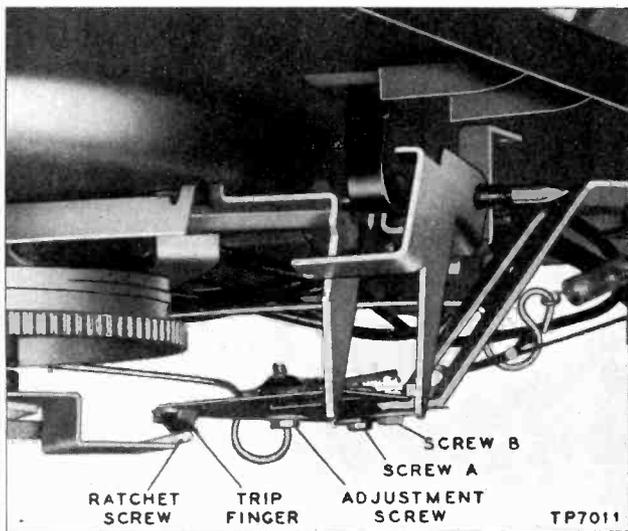
Dirt under and around the turntable or idler-wheel assembly. Remove the turntable and clean out the dirt. Be careful to lift the turntable straight up after removing the spindle first (see page 12). When replacing the turntable, be sure that the idler is behind the turntable rim before the turntable is fully lowered

(the spindle may be used to hold the idler back).

Flat or worn spots, or grease, on the rubber tire of the idler wheel.

Defective turntable shaft or bearing assembly.

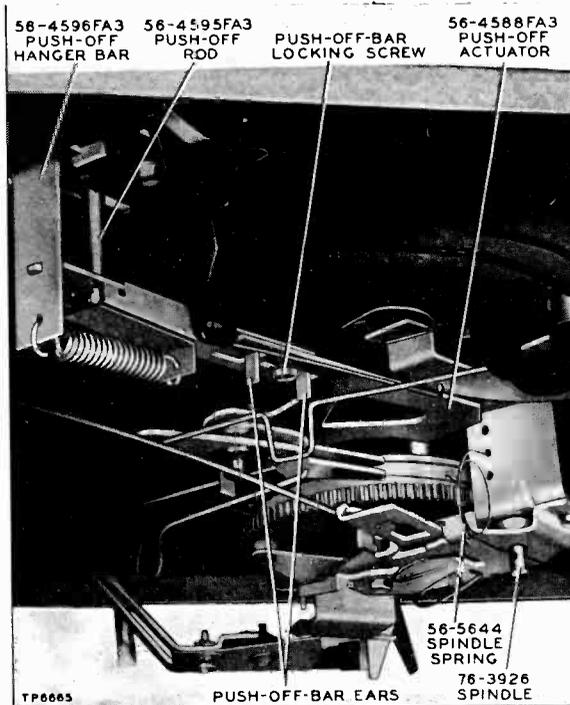
Replace the defective parts as directed under REPLACEMENT OF PARTS AND ASSEMBLIES, page 12. If the 33-1/3 r.p.m. speed is incorrect, replace pulley belt, Part No. 45-6479 (remove idler wheel to replace belt).



**Figure 19. Trip-Finger and Trip-Receiver Adjustments**



**Figure 20. Shelf Gauge, Shown in Correct Position on Record Shelf and Spindle**



**Figure 21. Push-Off Adjustment, Showing Push-Off Actuator in Contact with Roller on Cam Gear**

## REPLACEMENT OF PARTS AND ASSEMBLIES ON RECORD CHANGER

The following procedures are recommended for correct replacement of parts and assemblies on the record changer. The part should be replaced by reversing the order of removal, and adjusted according to the directions given in the RECORD-CHANGER ADJUSTMENTS section of this manual.

When any part is to be removed, the REJ.—AUT.—MAN. control should be in the AUT. position, and the changer should be out of cycle.

### 1. Needle, Part No. 45-1597

To remove needle, loosen knurled nut under crystal cartridge, and pull needle out.

### 2. Crystal-Pickup Cartridge, Part No. 35-2671-1

- Bring tone arm toward center of turntable.
- Remove the two screws, nuts, lock washers, and spacers which hold cartridge to tone arm.
- Drop cartridge below tone arm sufficiently to allow removal of the two clips from cartridge, as shown in figure 22. If pickup leads are shielded, unsolder shield.

#### NOTE

When mounting cartridge, be sure to insert long spacer in side toward spindle.

### 3. Spindle, Part No. 76-3926

- Unhook both ends of spindle spring, Part No. 56-5644, from "U"-shaped bracket mounted under changer base plate (figure 21).
- Uncoil ends of spring through spindle.
- Pull out spindle.

### 4. Motor, Part No. 35-1371

- Push REJ.—AUT.—MAN. control to MAN. position.
- Remove spindle as directed in paragraph 3 above.
- Unsolder motor lead from mercury switch.
- Disconnect second motor lead by unsoldering it at splice from switch lead. The motor assembly is shown in figure 23.
- Remove ground lead from lug on motor.
- Remove the three screws, washers, and bushings from motor frame (figure 23), and lift out motor.

### 5. Tone-Arm Assembly, Part No. 35-2663-2

- Unsolder tone-arm leads from terminal panel on underside of changer base plate.
- Loosen clamp screw which holds trip arm to tone-arm shaft, Part No. 76-2983FA2 (figure 12). Lift out tone arm and shaft. The tone-arm assembly is shown in figure 22.

### 6. Bridge Assembly, Part No. 76-2978

- Remove the two hex-head screws from bridge plate.
- Remove link rod, Part No. 56-4589FA3, from slider control bar. Complete assembly of bridge is shown in figure 24.

### 7. Trip Plate, Part No. 76-2990

- Remove bridge assembly, Part No. 76-2978, as directed in paragraph 6 above.
- Slide trip plate, Part No. 76-2990, off cam-gear spindle.

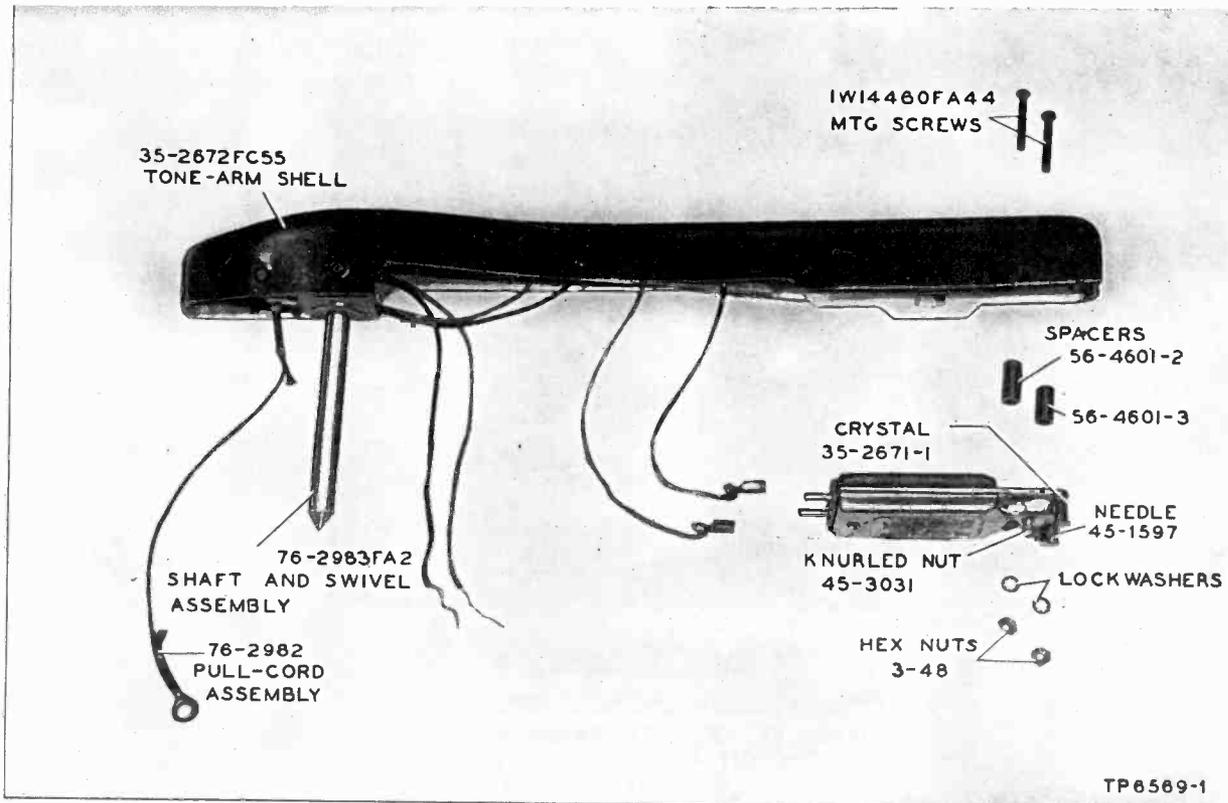


Figure 22. Record-Changer Tone-Arm Assembly, Part No. 35-2663-2

**8. Cam-Gear Assembly, Part No. 76-2989**

- a. Remove bridge assembly and trip plate as directed in paragraphs 6 and 7 above.
- b. Remove ball-bearing assembly, Part No. 76-2991 (figure 18), by pulling it off.
- c. Remove large "E" washer, Part No. 1W60980FE5, from cam-gear spindle, and slide off cam washer, Part No. 1W52627.

- d. Slide cam gear off spindle. The cam-gear assembly is shown in figure 25.

**9. Tone-Arm-Actuator Levers, Part No. 76-2987**

- a. Remove "E" washer, Part No. 1W60980FE5, from actuator stud.
- b. Disengage short link, Part No. 56-4607FA3, from link spring.

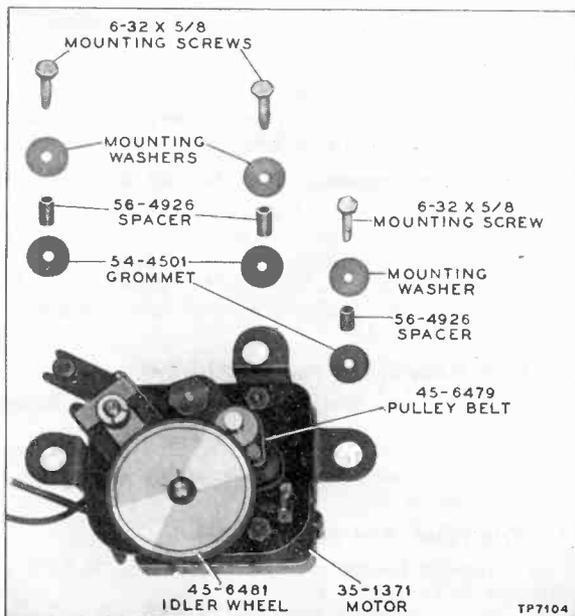


Figure 23. Motor Assembly

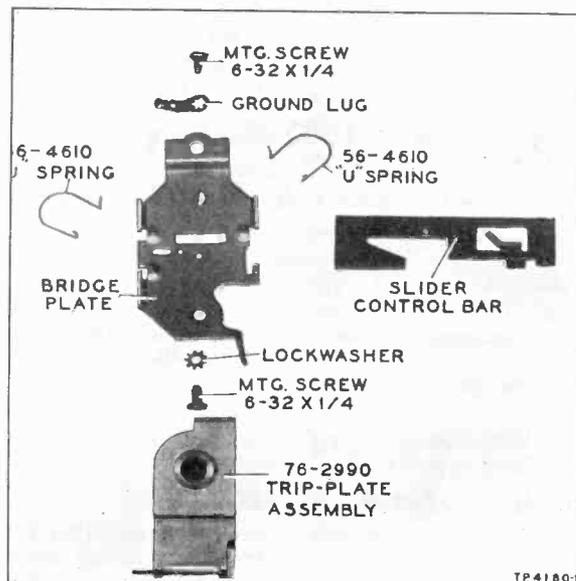


Figure 24. Bridge Assembly

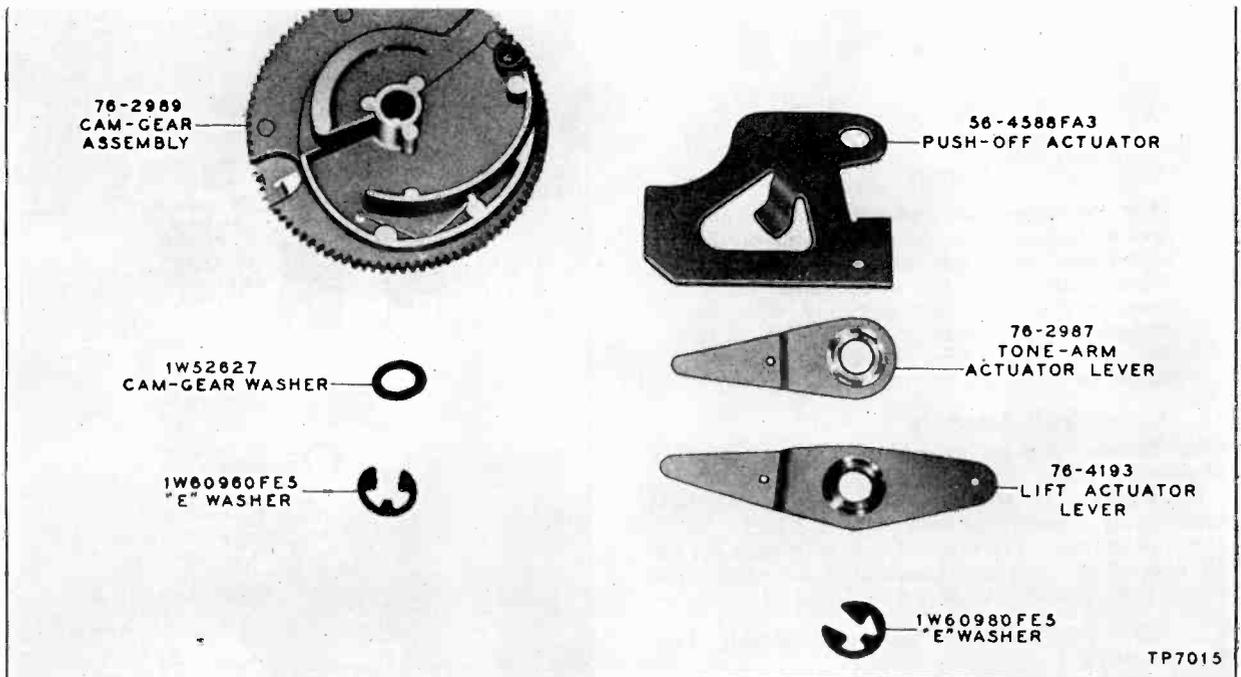


Figure 25. Cam-Gear Assembly and Actuator Levers

- c. Slide lower actuator lever from stud.
- d. Disengage lifter link, Part No. 56-5990, from actuator lever.
- e. Remove upper actuator lever from stud, and disengage long link, Part No. 56-4606FA3. The actuator-lever assembly is shown in figure 25.

**10. Push-Off Actuator, Part No. 56-4588FA3**

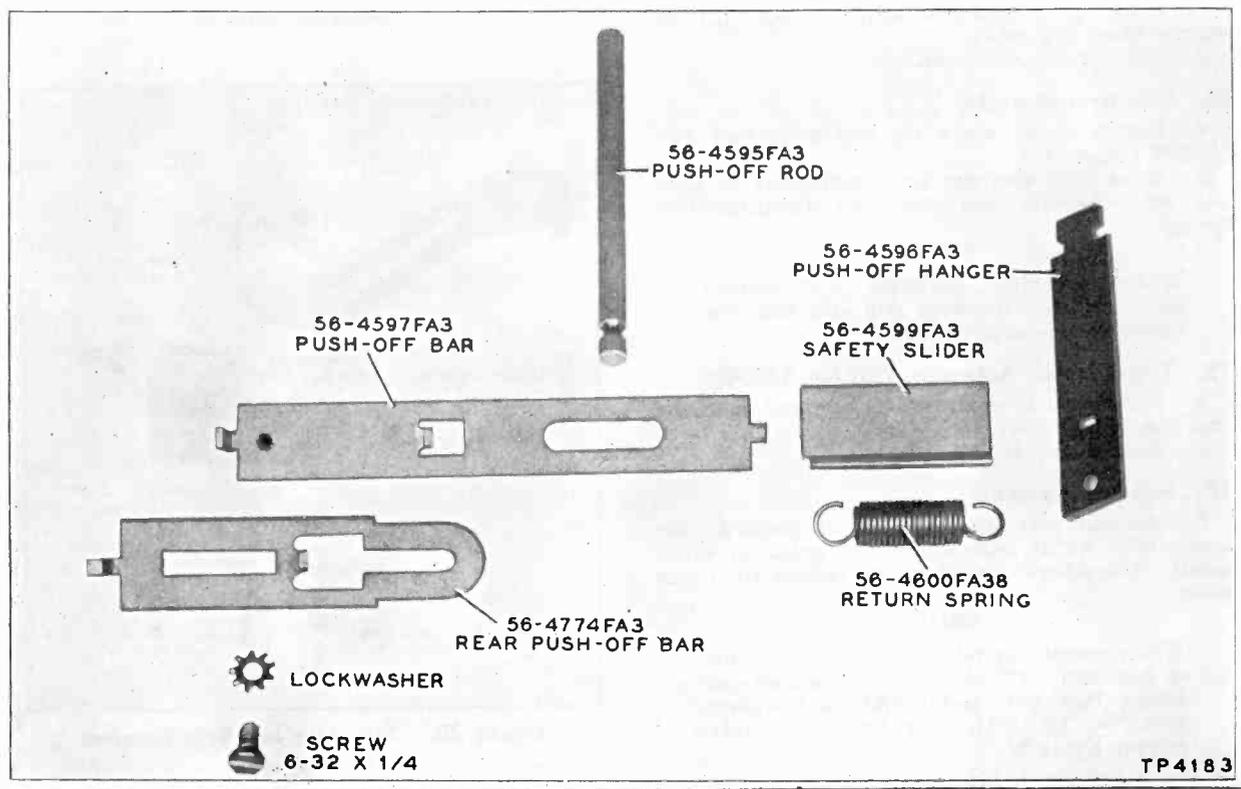
- a. Remove selector lever, Part No. 56-5985, as directed on page 20, paragraph 8.

- b. Remove tone-arm actuator levers as directed in paragraph 9 above.

- c. Press push-off rod, Part No. 56-4595FA3, and push-off hanger bar, Part No. 56-4596FA3 (figure 21), together and pull downward, to release the entire assembly.

- d. Slide push-off actuator, Part No. 56-4588FA3, over, to align upturned ears with cut out in base plate. Slide actuator off stud.

Figure 26. Push-Off Assembly



**NOTE**

After removing the push-off actuator and push-off-bar assembly, the slider blade on the record shelf may slide out of the assembly. When reassembling, this blade should be inserted in the record-shelf assembly, with the elongated hole toward the 12" position of the record shelf. The push-off assembly is shown in figure 26.

**11. Record-Shelf Assembly**

- Remove push-off assembly as directed in step c of paragraph 10.
- Remove the two hex-head screws which hold record-shelf assembly to base plate.
- Align ears on record-shelf assembly with cut out on base plate. Lift out record-shelf assembly. The record-shelf assembly is shown in figure 27.

**12. REJ.—AUT.—MAN. Control Assembly, Part No. 54-4479-1**

- Remove flat spring, Part No. 56-4778FA38, by sliding it laterally through underside of button (figure 21).
- Remove the two hex-head screws, and drop bridge assembly, Part No. 76-2978.
- Disengage control link, Part No. 56-4589FA3, from underside of control button (figure 8). Lift out control button.

**13. STD. PLAY—LONG PLAY Control, Part No. 54-4634**

- Remove flat spring, Part No. 56-4778FA38, by sliding it laterally through underside of button.
- Remove selector lever, Part No. 56-5985, as directed in paragraph 8, page 20.
- Disengage selector link, Part No. 56-5991, from selector lever (figure 8).
- Lift out control button.

**14. Trip-Arm Assembly**

- Loosen clamp screw on trip arm, Part No. 76-4204 (figure 12).
- Raise tone arm and shaft sufficiently to clear trip arm. Remove trip arm, and disengage link spring.

**NOTE**

When assembling, maintain  $\frac{1}{32}$ " vertical play (clearance between trip arm and base plate) in tone-arm shaft.

**15. Trip-Receiver Assembly, Part No. 56-6404**

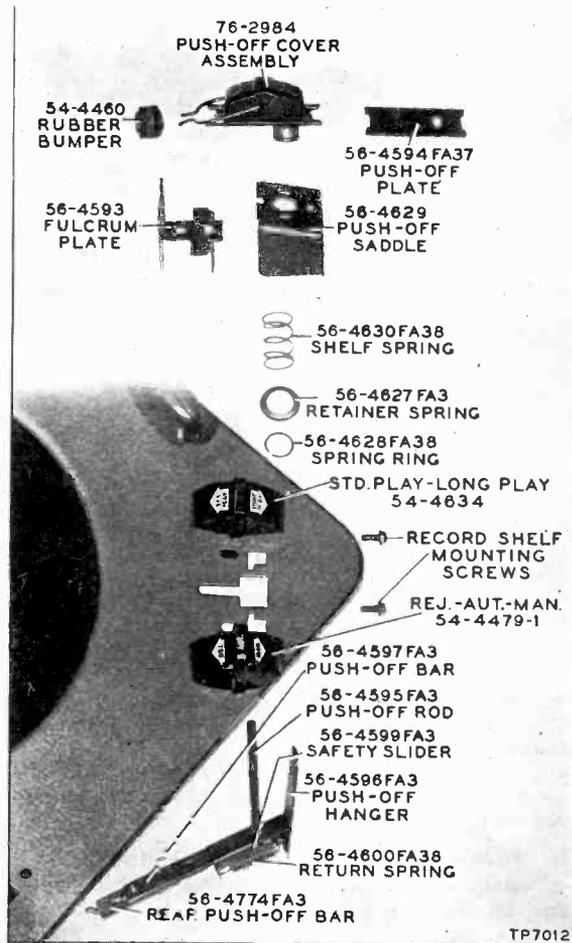
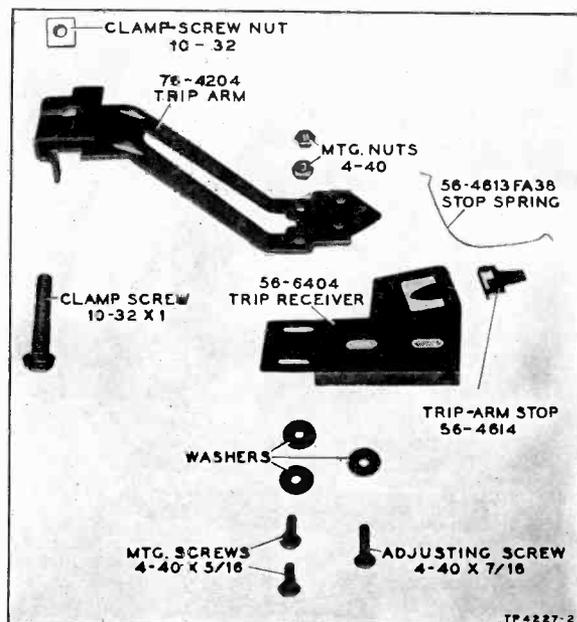
- Remove the three screws, washers, and nuts from trip arm (figure 28).
- Remove trip receiver.

**16. Selector Assembly**

Remove cam gear as directed in paragraph 8. Remove feeler spring from attachment point on motor board. Tilt selector assembly, and remove from base plate.

**NOTE**

When assembling selector assembly, be sure to maintain .005" clearance between selector hinge, Part No. 56-4617FA3, and washer, Part No. 2W53954. For correct assembly, refer to figure 29.

**Figure 27. Record-Shelf Assembly****Figure 28. Trip-Arm and Trip-Receiver Assemblies**

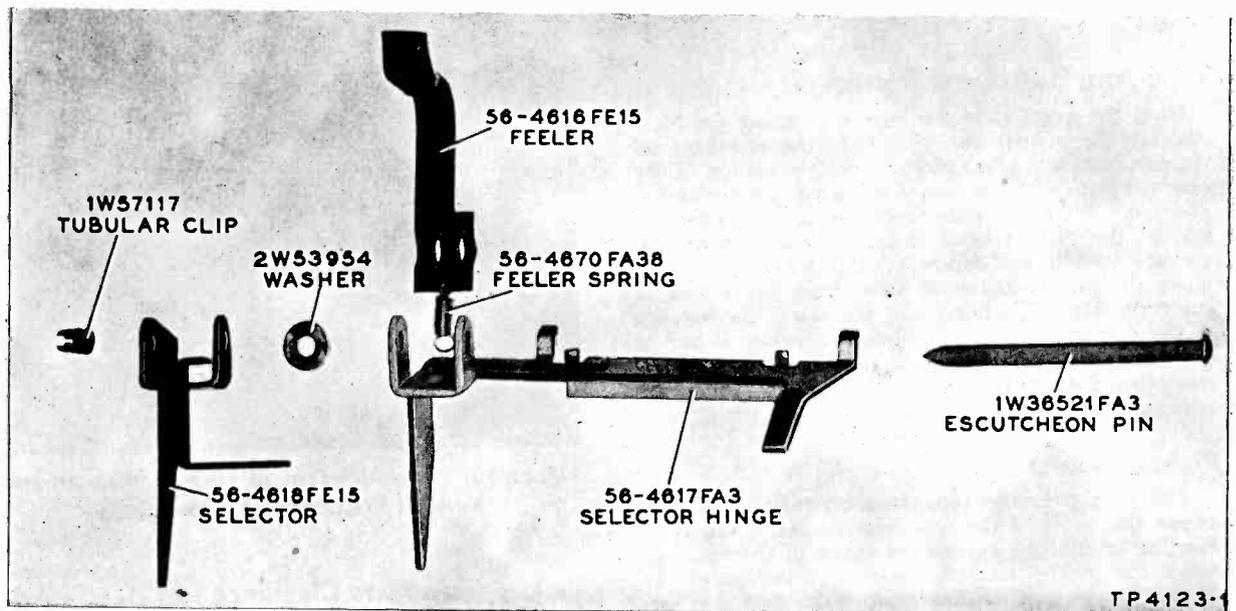


Figure 29. Selector Assembly

## RECORD-PLAYER TESTING AND TROUBLE-SHOOTING PROCEDURE

### Pick-Up and Needle Test

Place a 12" Columbia Long Playing Record on the turntable, lift the tone arm from the rest post, and place it on the starting groove of the record. Listen to the tone of the record. If distortion is noted, replace crystal cartridge as directed on page 12. If trouble persists, check for loose wiring, bad contact points, etc.

### Shut-Off Test

Place the tone arm in the finish groove of the record and observe the shut-off action. The record player should shut off within three revolutions of the turntable, after the pickup needle has entered the finish groove of the record. The trip adjustments are shown on page 9.

### Clearance Test

Remove the record from the turntable and place the tone arm over the base plate. Observe whether there is a minimum of  $\frac{1}{16}$ " clearance between the needle point and base plate. Refer to page 7 for adjustment.

### Turntable and Motor Test

Allow the motor to run for at least five minutes; then place a stroboscope, such as Philco Part No. 45-1614, on the turntable, and illuminate the disc with a lamp operating on 60-cycle a.c. The dots in the row calibrated for  $33\frac{1}{3}$  r.p.m. should appear to remain stationary or to drift very slowly, but smoothly, forward and backward. If the dots are moving in either direction very fast or with a jerky motion, refer to UNEVEN TURNTABLE SPEED (WOWS), page 11.

## RECORD-PLAYER ADJUSTMENTS

### Tone-Arm Needle Pressure and Vertical Friction

Hold the Philco Gram Scale, Part No. 45-9531, on its side and set the pointer to the center line of the scale. This is the 0 point, and each small division on either side of 0 is equal to one gram. After the scale has been set to 0, place it on the turntable with the guard on the scale in an open position, at right angles to the scale, as shown in figure 30. Now set the needle of the tone arm into the hole at the end of the pointer and observe the reading on the scale. This reading is the needle pressure; the correct needle pressure is 6 to  $7\frac{1}{2}$  grams.

To determine the vertical friction proceed as follows: Press down on the head of the pickup, then let it return to its normal position, and note the reading. Raise the pickup slightly, then gently lower it to the normal position, and again note the reading. The vertical friction is the difference between the two readings obtained. For example: if the scale reading is  $7\frac{1}{4}$  grams after the pickup is depressed and released, and is  $6\frac{3}{4}$  grams after the pickup is raised and lowered, the vertical friction is  $7\frac{1}{4}$  minus  $6\frac{3}{4}$  or  $\frac{1}{2}$  gram. The vertical friction should not exceed 2 grams.

### Tone-Arm Horizontal Friction

Hold the gram scale flat in the palm of the hand and set the pointer to "0". Take the tone-arm off the rest post, and place a counterweight on top of the rear end until the tone arm is balanced in a horizontal position. Place the pointer of the scale against the side of the pickup head (figure 31) and move the pickup toward the center of the turntable. Then move the pickup outward, away from the center of the turntable. The horizontal friction is the average of the two readings taken, when the pickup is moved both inward and outward. At no time should it take more than 2 grams pressure on the pointer to move the tone arm.

### Pickup Holder

The pickup holder should be centrally spaced between the walls of the tone arm so that there is no binding or rubbing against the inside of the tone arm when the pickup cartridge is moved vertically. To obtain proper spacing, first remove the tone arm (see page 19); loosen the screw which holds the pickup bracket mounting. Move the mounting until it is centrally spaced between the walls of the tone arm, and maintain  $\frac{1}{32}$ " clearance between the tip of the ears on the holder and the inside surface at the front end of the tone arm, as shown in figure 33.

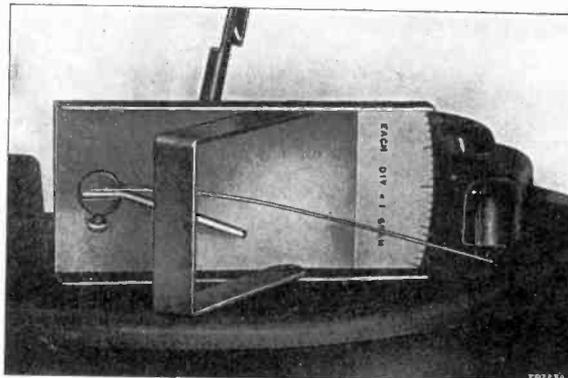


Figure 30. Measurement of Needle Pressure and Vertical Friction with Gram Scale

### Pickup-Base-Plate Clearance and Height Adjustment

With the tone arm off the rest post and resting over the base plate, the needle should be at least  $\frac{1}{16}$ " and not more than  $\frac{3}{16}$ " above the base plate, as shown in figure 34. To adjust, grasp the tone arm and raise or lower (whichever is required) with a little pressure

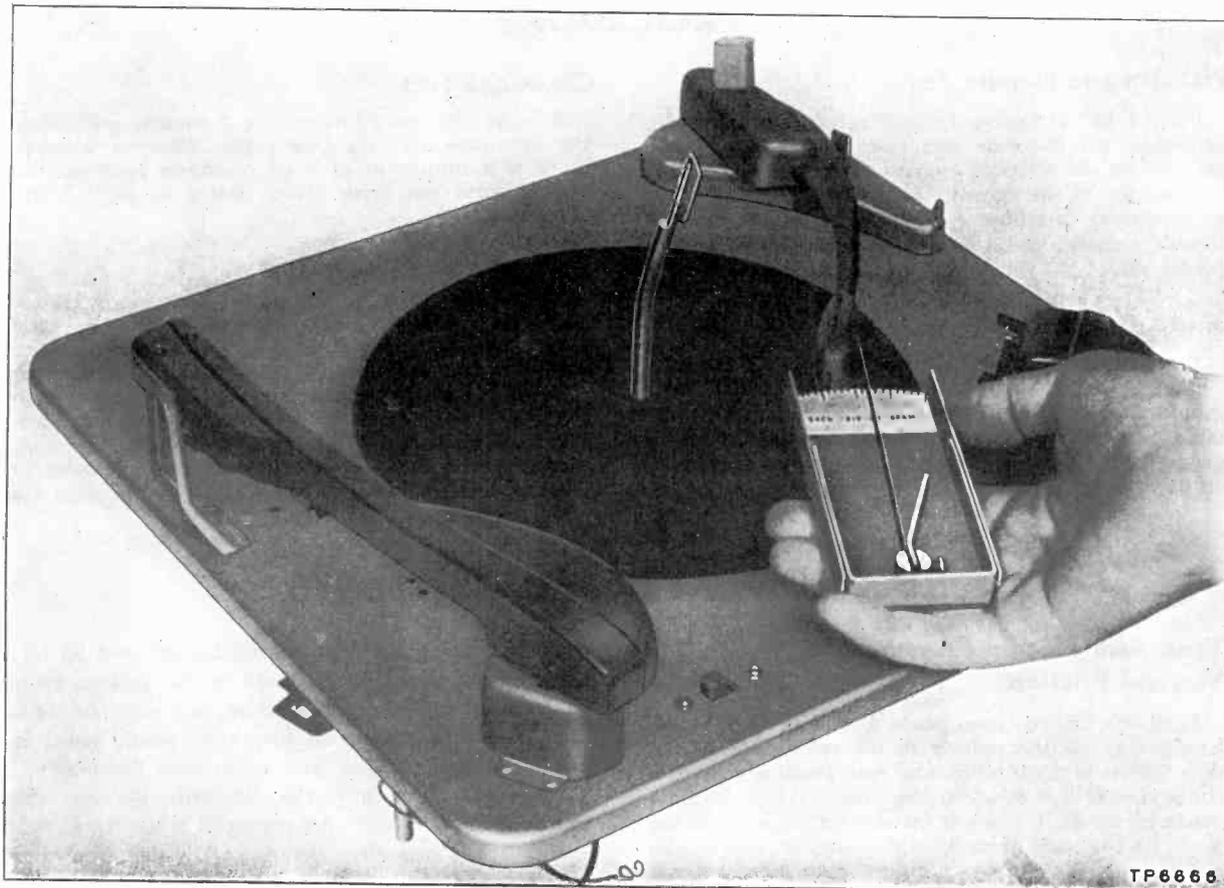


Figure 31. Measurement of Horizontal Pressure

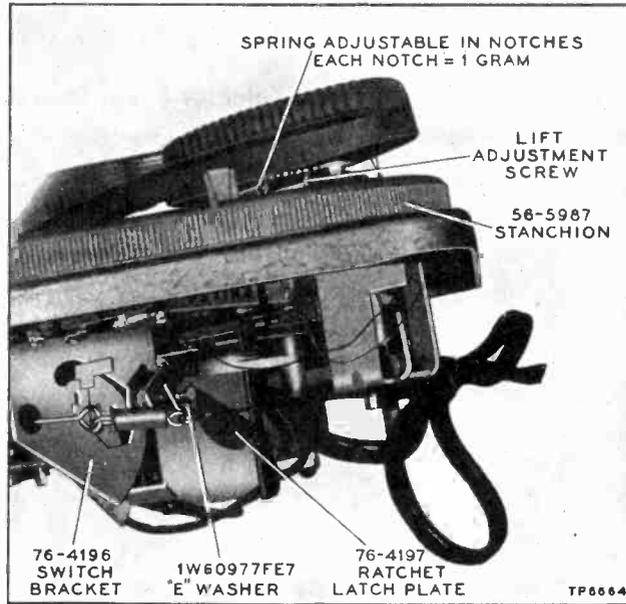


Figure 32. Needle-Pressure Adjustment

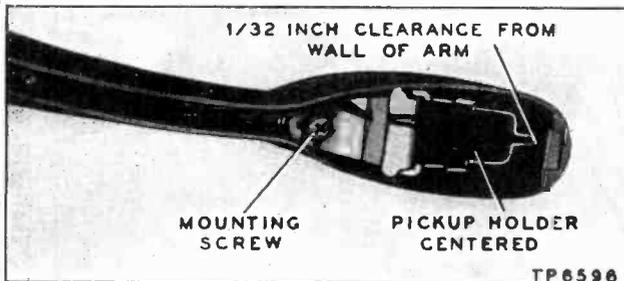


Figure 33. Pickup-Holder Adjustment

to obtain the correct clearance. Then adjust the screw on the pivot assembly (figure 32) so that the tone arm will clear the rest hook on the stanchion, Part No. 56-5987.

### Trip-Switch Adjustments

With the tone-arm on the rest post, the mercury switch attached to the bracket-and-clip assembly, Part No. 76-4195, should be in a horizontal or ON position, as shown in figure 8. To adjust, loosen the reset-trip-arm clamp screw (figure 35), and while holding the tone arm on the rest post, move the trip arm until the leg on the reset trip arm engages the bracket-and-clip ear, and at the same time, the long ear of the bracket and clip is approximately  $\frac{1}{32}$ " above the cut-out notch on the ratchet-plate assembly, Part No. 76-4197, as shown in figure 35.

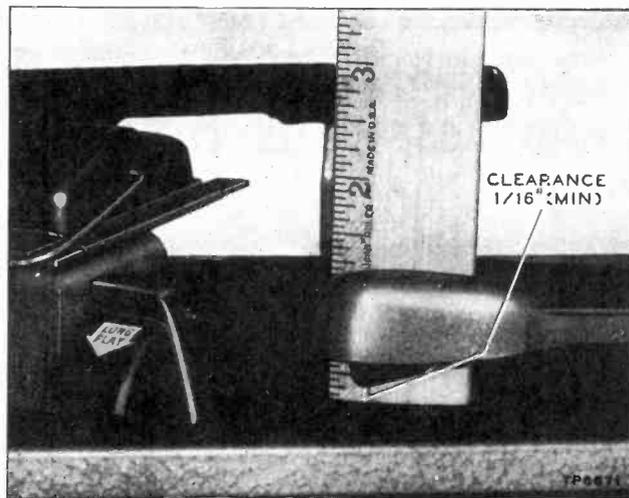


Figure 34. Tone-Arm Height Adjustment

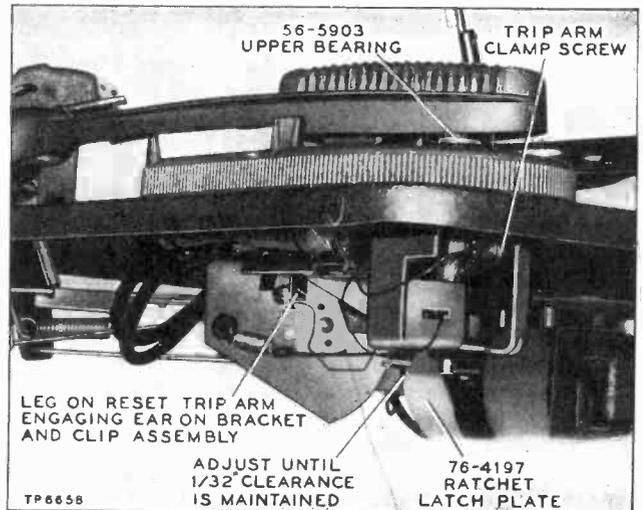


Figure 35. Trip-Switch Adjustment

### Trip-Finger Adjustments

Place the tone-arm needle in the finish groove of a record, and observe the trip finger riding over the ratchet on the ratchet-plate assembly, Part No. 76-4197. The trip finger should assume an angle of  $25^{\circ}$  to  $30^{\circ}$  while riding over the ratchet, as shown in figure 7. Adjust the screw on the trip-arm receiver to obtain the proper angle.

### Selector-Lever Stop Adjustment

The selector-lever "throw" is adjusted by loosening the screw in the lock plate, Part No. 56-5986 (figure 11), and centering the lock plate so that when the STD. PLAY—LONG PLAY control is in either position, the shift lever on the motor will not bind against either side.

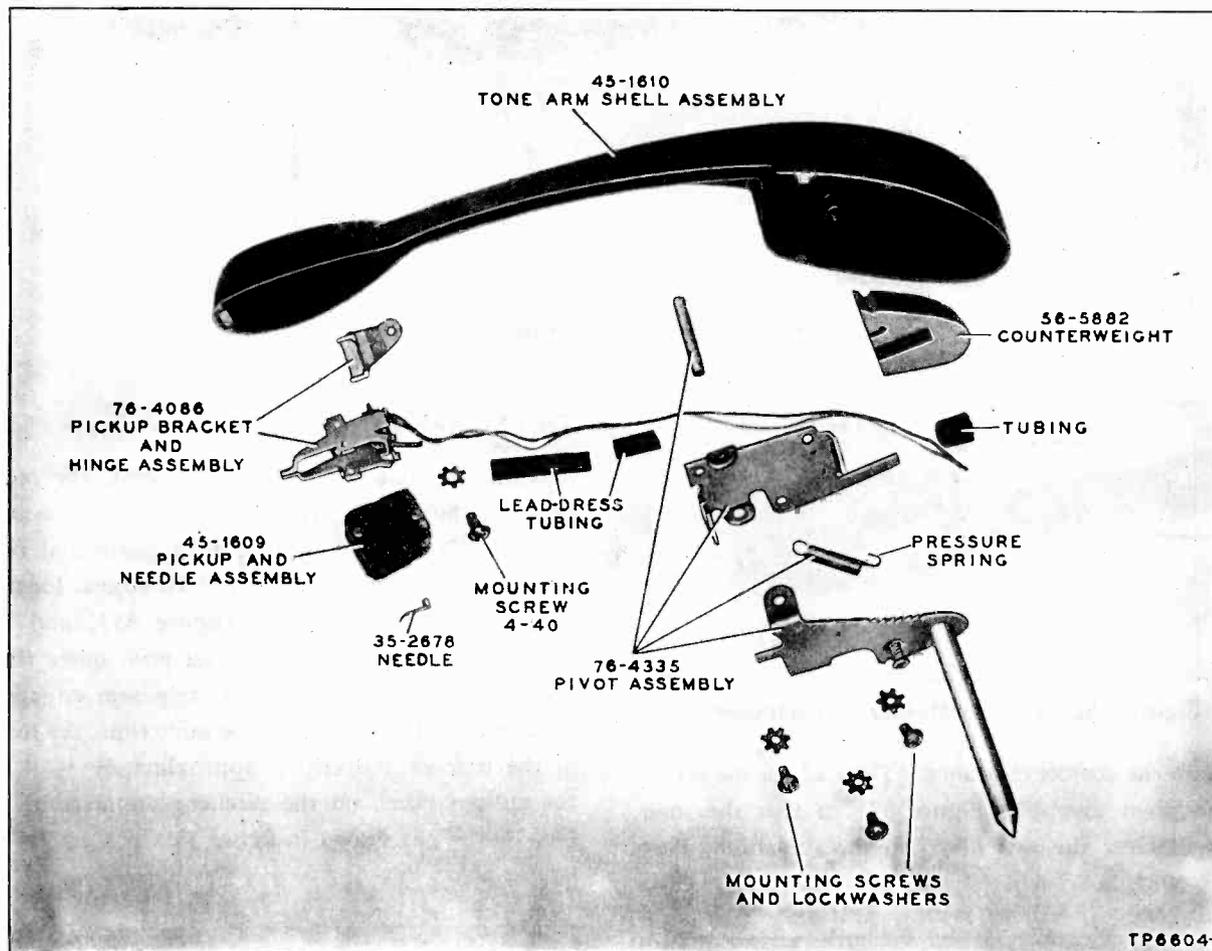


Figure 36. Record-Player Tone-Arm Assembly, Part No. 35-2686

## REPLACEMENT OF PARTS AND ASSEMBLIES ON RECORD PLAYER

### 1. Crystal-Cartridge Assembly, Part No. 45-1609

To remove the crystal cartridge, grasp the crystal by its sides, and pull it down and out. When replacing the cartridge, push it up into the head of the tone arm, until it is seated in position.

### 2. Tone-Arm Assembly, Part No. 35-2686

a. Unsolder tone-arm leads from terminal panel on underside of changer base plate. The tone-arm assembly is shown in figure 36.

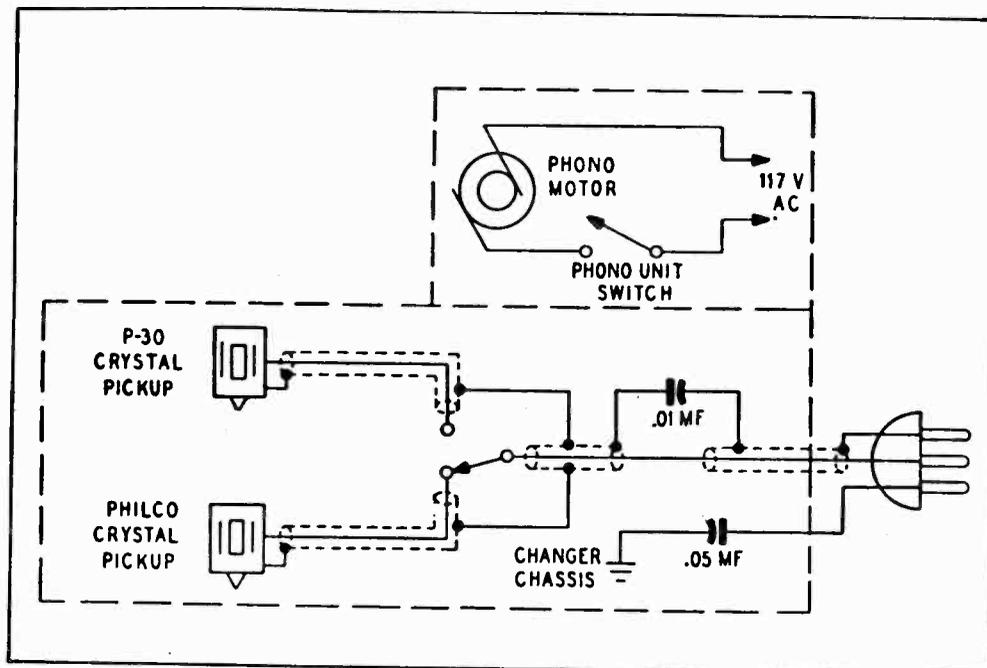
b. Unhook pull cord, Part No. 76-2982-1, from spring and link assembly, Part No. 56-5990 (figure 9).

c. Loosen clamp screw which holds reset trip arm to tone-arm shaft.

d. Lift out tone arm.

### 3. Tone-Arm Thrust Bearing, Part No. 56-5916

a. Remove tone arm as directed in paragraph 2 above.



TP-6447

Figure 37. Model M-9C, Wiring Diagram

b. Remove "E" washer, Part No. 1W60977FE7, from bearing shaft (figure 8).

c. Lift bearing out of rubber grommet, Part No. 27-4099-3, mounted on tone-arm-shaft support.

#### 4. Tone-Arm Stanchion, Part No. 56-5987

a. Remove tone arm as directed in paragraph 2 above.

b. Remove hex-head screw from each end of tone-arm stanchion, under changer base plate.

c. Lift out stanchion (figure 7).

#### 5. Tone-Arm Upper Bearing, Part No. 56-5903

a. Remove tone-arm stanchion, Part No. 56-5987, as directed in paragraph 4 above.

b. Remove "E" washer, Part No. 1W60981FE7, from bearing shaft mounted on tone-arm stanchion (figure 35).

c. Remove bearing from grommet, Part No. 54-4624, by sliding it out from underside of stanchion.

#### 6. Ratchet Latch Plate, Part No. 76-4197

a. Remove "E" washer, Part No. 1W60977FE7, from switch bracket, Part No. 76-4196 (figure 32).

b. Slide ratchet plate off switch bracket.

#### 7. Switch Bracket, Part No. 76-4196

a. Remove mercury switch, Part No. 76-2140-2, from clip.

b. Unhook pull-cord spring, Part No. 76-2982-1, from link.

c. Remove two hex-head screws which hold switch bracket to base plate.

d. Unhook link from actuator.

#### 8. Selector Lever, Part No. 56-5985

a. Remove "E" washer, Part No. 1W60977FE7, from stud which mounts selector lever, Part No. 56-5985, underneath base plate (figure 11).

b. Remove spring washer, Part No. 1W56306FE15, from stud.

c. Remove "U"-shaped spring, Part No. 56-5995, between selector lever and base plate.

d. Loosen lock-plate screw (figure 11).

e. Loosen motor-mounting screws and cock motor to one side.

f. Set STD. PLAY—LONG PLAY control to STD. PLAY position.

g. Align ears of selector lever with cut out on base plate, and pull out selector lever from stud on underside of base plate.

h. Disengage selector lever from control-button link.

MODEL M-9C

## REPLACEMENT PARTS LIST

Service Part No.	Description	Service Part No.	Description
35-1371	Motor	56-4631FA15	Pin, tone-arm lift
35-2663-2	Tone-arm assembly, record changer	56-4670FA38	Spring, feeler (selector assembly)
35-2671-1	Crystal, standard	56-4774FA3	Bar, push-off (rear)
35-2672FC55	Tone-arm shell	56-4778FA38	Spring, control knob
35-2678	Needle for special crystal	56-4926	Spacer, motor
35-2686	Tone-arm assembly, record player	56-5644	Spring, spindle
35-3066-2	Turntable	56-5882	Counterweight
41-3869-2	Cable and plug	56-5903	Bearing, upper
42-1750-3	Switch, motor	56-5916	Thrust bearing
42-1873	Switch	56-5981	Trip receiver, record-player tone arm
45-1597	Needle	56-5985	Lever, selector
45-1609	Pickup-and-needle assembly	56-5986	Plate, lock
45-1610	Tone-arm assembly (shell)	56-5987	Stanchion, record-changer tone arm
45-3031	Nut, knurled	56-5990	Link, lifter
45-6479	Pulley belt	56-5991	Link, selector
45-6481	Idler wheel	56-5995	Spring, "U" (selector lever)
54-4479-1	Control, REJ.—AUT.—MAN.	56-6404	Trip receiver, record-player tone arm
54-4460	Bumper	76-2140-2	Switch, mercury
54-4501	Motor-mounting grommet	76-2978	Bridge assembly
54-4634	Control, STD. PLAY—LONG PLAY	76-2982	Pull-cord assembly, record-changer tone arm
54-7613	Trip finger	76-2982-1	Pull-cord assembly, record-player tone arm
56-1880	Cover, switch	76-2983FA2	Shaft and swivel, record-changer tone arm
56-2832FA3	Clamp, cable	76-2984	Push-off, cover
56-4585FA3	Index lever	76-2987	Actuator lever, record-changer tone arm
56-4588FA3	Actuator, push-off	76-2989	Cam-gear assembly
56-4589FA3	Link, control	76-2990	Trip-plate assembly
56-4593	Plate, fulcrum	76-2991	Bearing assembly
56-4594FA37	Plate, push-off slide	76-3926	Spindle
56-4595FA3	Rod, push-off	76-4086	Bracket (pickup and hinge)
56-4596FA3	Hanger, push-off	76-4192	Base plate
56-4597FA3	Bar, push-off	76-4193	Actuator, lift lever
56-4599FA3	Slider, safety	76-4194	Trip-switch assembly
56-4600FA38	Spring, return	76-4195	Bracket-and-clip assembly
56-4601-2	Spacer	76-4196	Switch-bracket assembly
56-4601-3	Spacer	76-4197	Ratchet latch plate
56-4603FA38	Index spring	76-4198	Reset trip arm
56-4604FE15	Pin, tone-arm pivot	76-4204	Trip arm (subassembly)
56-4606FA3	Link, long	76-4335	Pivot assembly, record-player tone arm
56-4607FA3	Link, short	1W14460FA44	Screw (3-48x $\frac{3}{8}$ "), crystal mounting
56-4608FA38	Spring	1W36521FA3	Pin, escutcheon
56-4610	Spring, "U" (bridge assembly)	1W52627	Cam-gear washer
56-4613FA38	Stop spring	1W56306FE15	Spring washer, selector-lever assembly
56-4614	Trip-arm stop	1W57117	Tubular clip
56-4616FE15	Feeler (selector assembly)	1W60977FE7	"E" washer (for selector lever, ratchet plate, and thrust bearing)
56-4617FA3	Hinge (selector assembly)	1W60980FE5	"E" washer (for cam and actuator stud)
56-4618FE15	Selector	1W60981FE7	"E" washer (for upper bearing)
56-4626-1FA7	Record shelf	2W53954	Washer, selector assembly
56-4627FA3	Retainer, spring (record-shelf assembly)		
56-4628FA38	Spring, ring		
56-4629	Saddle, push-off (record-shelf assembly)		
56-4630FA38	Spring, record shelf		

### INTRODUCTION

The Philco DeLuxe Automatic Record Changer and Record Player Combination, Model M-12C, is used in several Philco Radio-Phonograph combinations. It incorporates two tone arms. The changer tone arm is used with the record-changer mechanism to play ten 12" records or twelve 10" records, automatically, at the standard speed of 78 r.p.m. The long-play tone arm is used with the manual record player, which plays the new Columbia Long-Playing Records (33 1/3 r.p.m.). This tone arm employs the new Philco Balanced-Fidelity Reproducer, which applies the extremely low needle pressure of 1/3 ounce. The motor is shut off automatically at the end of the record.

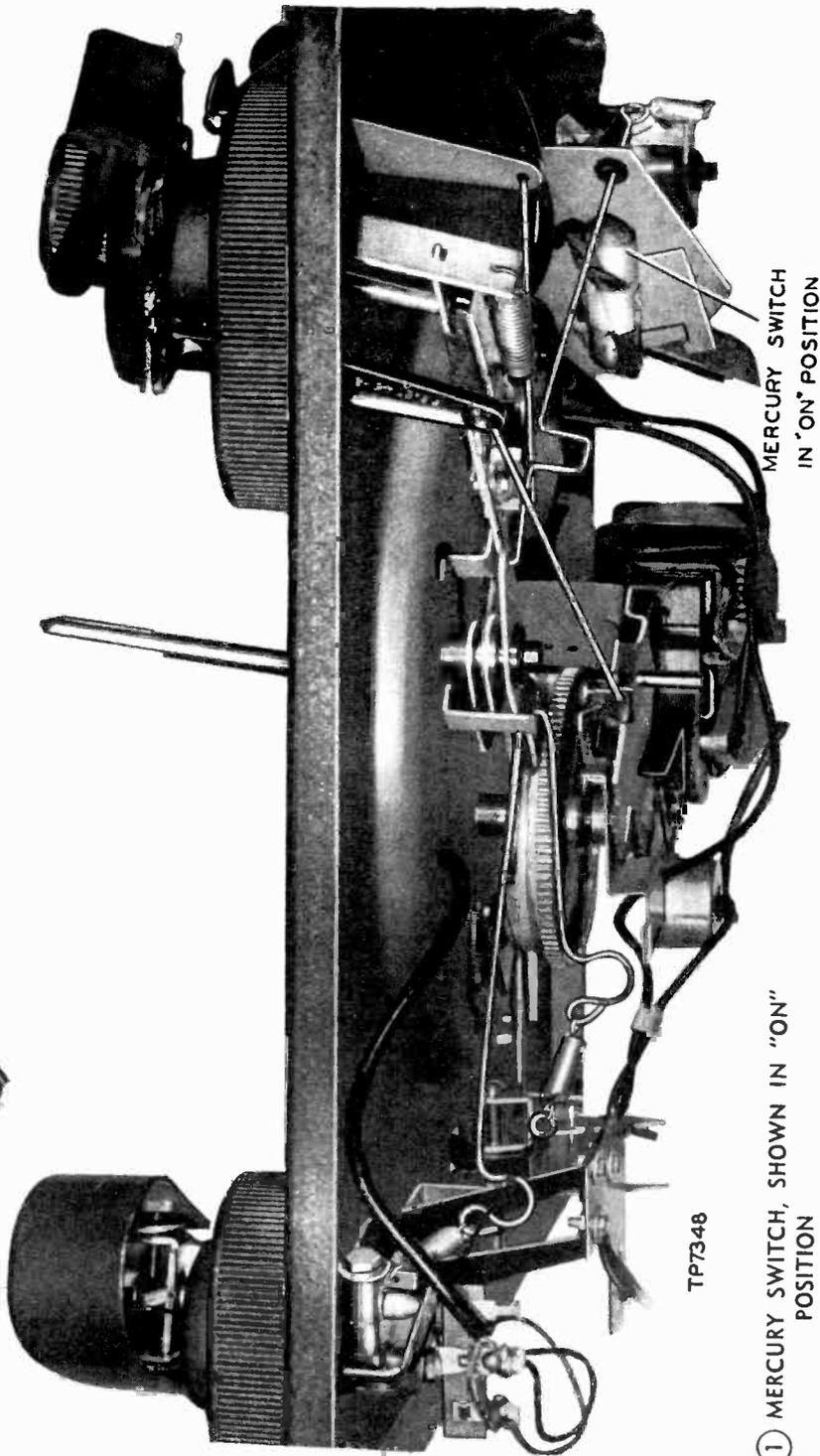


FIGURE 1 MERCURY SWITCH, SHOWN IN "ON" POSITION

## DESCRIPTION OF OPERATING CYCLES

Power for the motor is obtained through two switches connected in series electrically. One is an on-off switch mounted on the bridge assembly, Part No. 76-3998 (figure 7), and is operated manually by the control button with positions OFF, MAN, AUT, and REJ. This button is located to the left of the record-shelf assembly on the top of the record changer.

The other switch is a mercury-type switch, mounted on a switch bracket, and is operated by the long-play tone arm. When the tone arm is on the rest post, a leg on the reset trip arm, connected to the tone-arm shaft, is in contact with an ear on the bracket-and-clip assembly to which the mercury switch is attached, and the switch is set in the "on" position (figure 1); when the switch is in this position, the motor circuit is controlled by the OFF-MAN-AUT-REJ control.

When the long-play tone arm is placed on a record, the mercury switch is held in the "on" position by a ratchet latch plate mounted on the switch-bracket assembly (figure 20); this ratchet plate has a cutout, in which rests a protruding ear of the bracket-and-clip assembly which contains the mercury switch. As the tone arm enters the finish groove of a record, a trip finger (attached to the reset trip arm) rides over the ratchet latch plate and trips it; this releases the bracket-and-clip assembly, causing the mercury switch to tip into the "off" position (see figure 2), thus opening the motor circuit and stopping the turntable.

The record changer has two speeds, controlled by the play control button, with positions STD PLAY and LONG PLAY. This button is located to the right of the record-shelf assembly on the top of the record changer. When the play control is set to STD PLAY, the idler wheel on the motor engages the motor shaft directly, driving the turntable at a speed of 78 r.p.m. When the play control is set to LONG PLAY, a selector link, one end of which is attached to the base of the control under the changer, actuates a selector lever mounted on the changer base plate. This selector lever engages a shift lever mounted on the motor (figure 3). A large pulley on the shift lever is connected to the motor shaft by means of a small rubber belt. The idler wheel engages this large pulley, driving the turntable at a speed of  $33\frac{1}{3}$  r.p.m. The play control also actuates a single-pole, double-throw switch, which is mounted on the base plate under the turntable (figure 3). The output leads of the two tone arms are connected to this switch. When the play control is set to the LONG PLAY position, the switch cuts off the output of the changer tone arm, and closes the circuit for the long-play tone arm. The reverse of this action takes place when the play control is set to the STD PLAY position.

The changer mechanism of the record changer is brought into action when a small retractable gear segment, mounted on the cam gear, is released, and engages the hub gear of the turntable shaft, causing the cam gear to be driven. While a record is playing, the retractable gear segment is held in the retracted position

by the trip-plate ear; the segment is released either manually, by pushing the OFF-MAN-AUT-REJ control to REJ, or automatically, when the changer tone arm follows the finish groove of a record; automatic tripping is initiated by the trip arm, which is attached to the tone-arm shaft, and which rides over the trip-plate ratchet screw, causing the cam-gear segment to be released.

The tone arm of the record changer is operated by two link assemblies (figure 12) attached to actuator levers, which are in contact with the cam surface of the cam gear. When the cam gear starts, the lower actuator lever is pushed outward first, and the short link assembly attached to it raises the tone arm off the record. (The same action also raises the long-play tone arm, at the end of a record, by means of the long link assembly, which is also attached to the lower actuator lever.) As the cam gear continues to turn, the upper actuator lever is pushed outward, and its link assembly pulls the tone arm out against the rest post; at this instant, a roller on the cam gear makes contact with the push-off actuator (which is connected to the record-shelf assembly through a series of push-off bars), and operates the record-dropping mechanism.

## TESTING AND TROUBLE-SHOOTING PROCEDURE

The following series of operating tests is given to aid in localizing troubles. Each test should be performed with several good records before making any adjustments.

With both tone arms on their rest posts, set the record shelf to the 10" position, and place a 10" record over the spindle and onto the record shelf. Set the play control to STD PLAY, and push the OFF-MAN-AUT-REJ control knob to REJ. Observe the record-dropping action; the record should fall smoothly onto the turntable. The tone arm should rise from the rest post, and the needle should come down on the record at about  $\frac{1}{8}$ " from the outer edge. Play the record through, and observe the tripping action; the trip mechanism should operate within the first two or three revolutions after the needle has entered the eccentric finish groove of the record.

Remove the record from the turntable, turn the record shelf to the 12" position, place a 12" record on the spindle and record shelf, and repeat the above testing procedure.

During a change cycle, the lower edge of the tone arm should clear the top of the rest-post hook by a minimum of  $\frac{1}{16}$ ".

Remove the record from the turntable, place the changer tone arm over the changer base plate, and observe the clearance between the needle point and the base plate; the clearance should be not less than  $\frac{1}{16}$ "; however, the needle should be no higher than the top of the turntable.

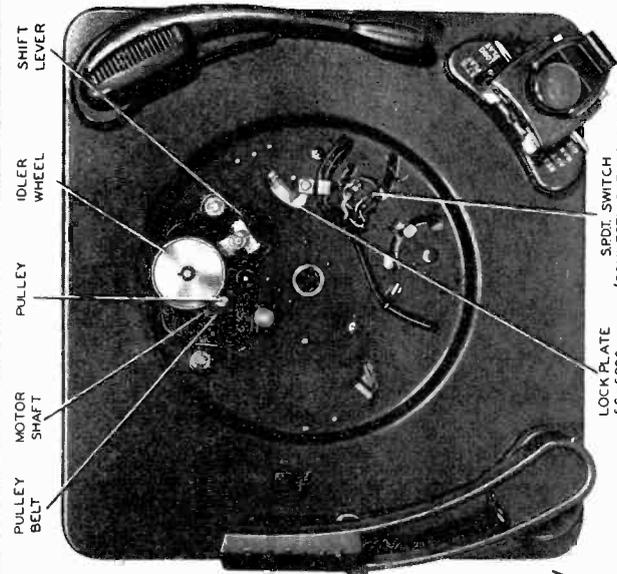


FIGURE 2 MERCURY SWITCH, SHOWN IN "OFF" POSITION

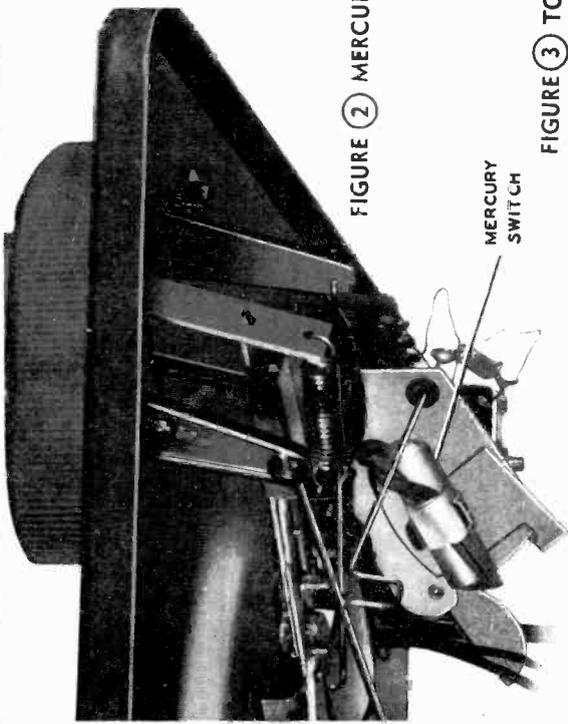


FIGURE 3 TOP VIEW, TURNTABLE REMOVED, SHOWING MOTOR ASSEMBLY AND SPDT SWITCH

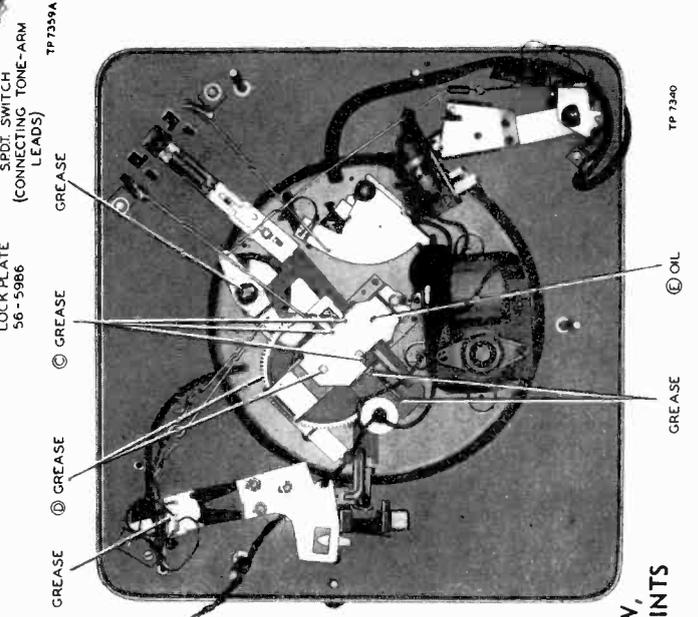


FIGURE 4 TOP VIEW, SHOWING LUBRICATION POINTS

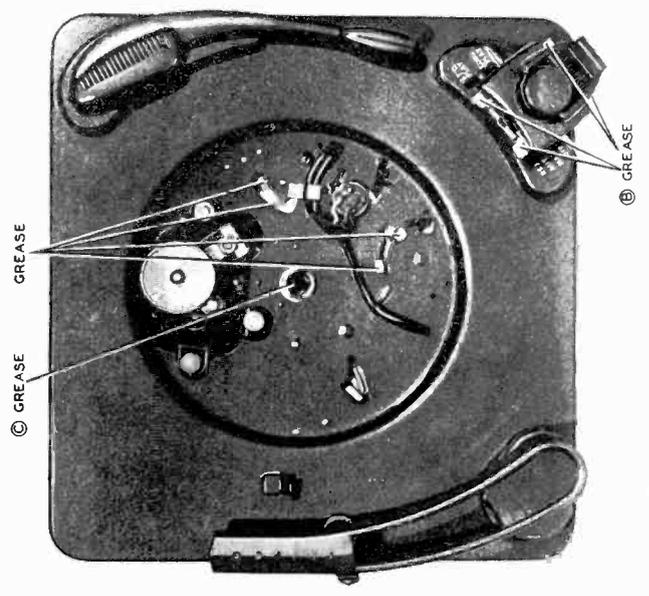


FIGURE 5 BOTTOM VIEW, SHOWING LUBRICATION POINTS

MODEL M-12C

PHILCO CORP.

**PARTS NOT TO BE LUBRICATED**

The following parts should not be lubricated at any time:

- Both trip receivers and trip fingers.
- Ratchet screw on trip plate.
- Selector assembly.
- All parts of long-play tone arm and its subassemblies
- All parts of trip-switch assembly.

**PARTS TO BE GREASED**

- Record-Shelf Assembly**  
Each of four dimples, and both sides of slide plate (point B of figure 4).
- Bridge Assembly**  
Three dimples (points C of figure 5).
- Cam Gear**  
Cam-gear teeth and all outer surfaces of gear (points D of figure 5).
- Main Assembly**  
Cam-gear spindle.  
Actuator stud.  
Turntable-shaft upper bearing (point C of figure 4).  
Changer tone-arm-shaft base (fill dimple with grease).  
All assemblies that have ears, and dimples that slide on the main base plate.

**PARTS TO BE OILED**

Use S.A.E. 20 oil on the following parts:

- Trip-Plate Bushing**  
Apply one or two drops to inside of bushing.
- Spindle**  
Apply one or two drops to base of spindle where it slides vertically in the bridge plate (point E of figure 5).

**SERVICING THE RECORD CHANGER**

Some of the record-changer troubles that may be encountered, also the methods of servicing, are given below. The serviceman should become thoroughly familiar with the operation of all parts in the mechanisms before attempting to service the record changer. Some troubles may be caused by a lack of lubrication or an accumulation of dirt. Before making the final tests and adjustments, make sure that the changer is well cleaned and lubricated.

**TESTING AND TROUBLE-SHOOTING PROCEDURE (Continued)**

Place the tone arm on the rest post, set the OFF-MAN-AUT-REJ control to MAN, and the play control to LONG PLAY. Place a 12" Columbia Long-Playing (micro-groove) record on the turntable, and set the long-play tone arm on the record. Play the record for a few minutes and listen to its tone, then place the tone arm in the finish groove of the record, and observe the shut-off action. The turntable should stop within three revolutions after the tone arm has entered the finish groove.

Remove the record from the turntable, place the tone arm over the base plate, and observe the clearance between the needle point and the base plate; the clearance should be not less than  $\frac{1}{16}$ ". Now raise the tone arm over the rest post; it should clear the post by a maximum of  $\frac{1}{32}$ ".

**TURNTABLE AND MOTOR TEST**

Place a stroboscope disc, such as the Philco Part No. 45-1614, on the turntable, and illuminate the disc with a lamp operating on 60-cycle a.c. Set the OFF-MAN-AUT-REJ control to MAN, and the play control to LONG PLAY, and observe the dots in the row calibrated for 33 $\frac{1}{3}$  r.p.m. on the stroboscope disc. The dots should appear to remain stationary, or have very little drift, either to the right or to the left.

Remove the stroboscope disc from the turntable, place a stack of ten 12" records onto the turntable, and place the stroboscope disc on the top record. Set the play control to ST'D PLAY, set the OFF-MAN-AUT-REJ control to MAN, and illuminate the stroboscope with a lamp operating on 60-cycle a.c. Observe the dots in the row calibrated for 78 r.p.m.; they, too, should appear to remain stationary, or have very little drift to the right or left.

**CLEANING AND LUBRICATION**

When the record changer is brought in for service, it should be well cleaned, by using carbon tetrachloride. Remove all dirt and all grease and oil. When applying new grease and oil, use it sparingly. All lubrication points are shown in figures 4 and 5. It may be necessary to remove some parts and assemblies in order to lubricate them properly. For example, the cam gear and actuator levers should be removed to lubricate the cam-gear spindle and the actuator stud.

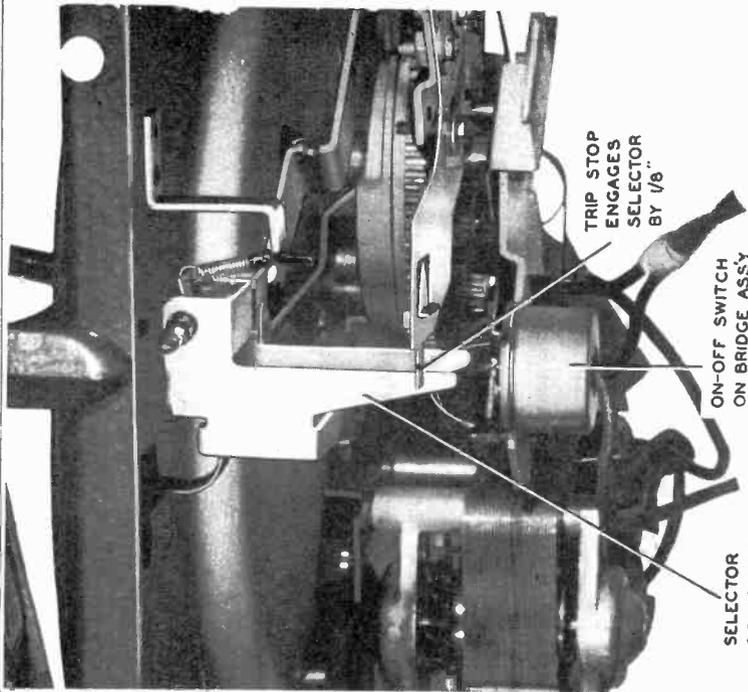


FIGURE 6 10" INDEX SET-DOWN ADJUSTMENT

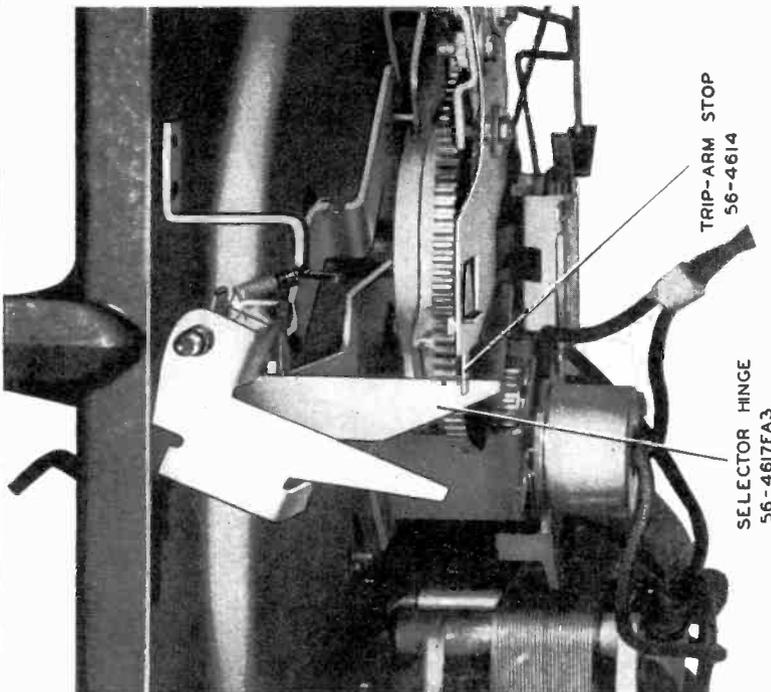
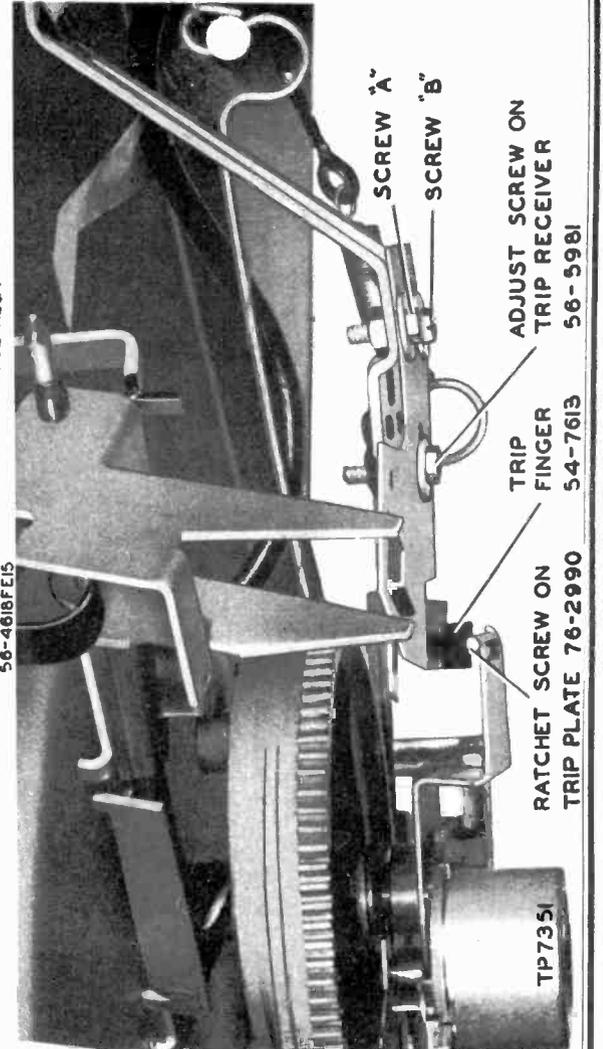


FIGURE 7 12" INDEX SET-DOWN ADJUSTMENT

FIGURE 8 TRIP-FINGER AND TRIP-RECEIVER ADJUSTMENTS



BEND EAR TO OBTAIN CORRECT BASE-PLATE CLEARANCE

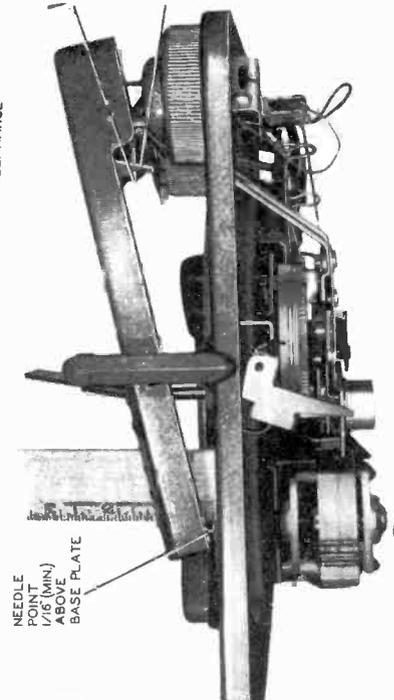


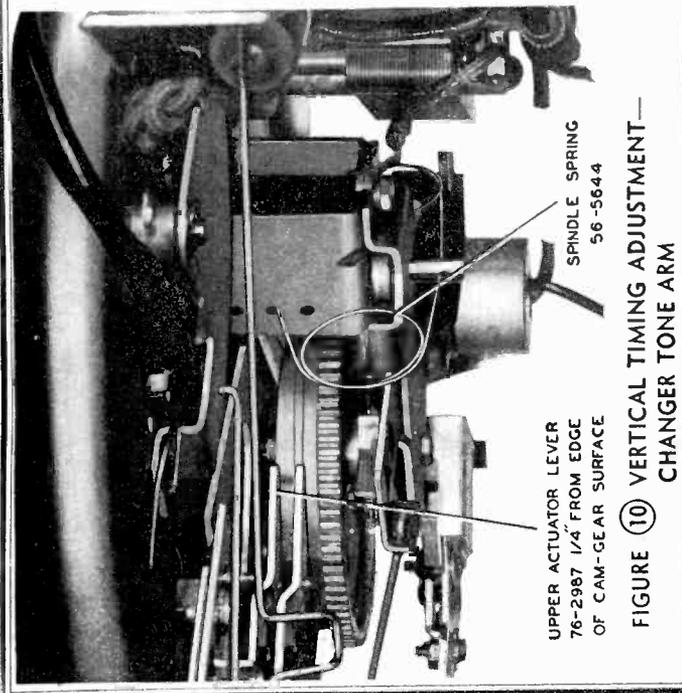
FIGURE 9 BASE PLATE CLEARANCE ADJUSTMENT—CHANGER TONE ARM

MODEL M-12C

PHILCO CORP.

**CORRECTION OF TROUBLES**

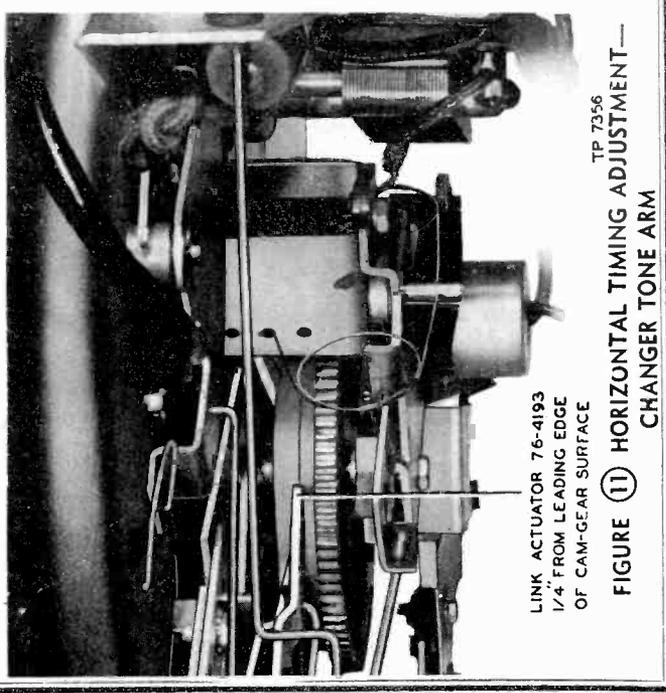
1. Changer tone arm fails to rise off the rest post when the OFF-MAN-AUT-REJ control is set to REJ.  
 Changer tone arm does not clear the top record when a full stack of records (ten 12", or twelve 10") is on the turntable.  
 Check the tone-arm height and lift adjustments, as directed on page 15, and the tone-arm vertical and horizontal timing adjustments, as directed
2. Changer tone-arm needle does not set down on the record properly. Changer tone arm sets on the record, then falls off.  
 Check the 10" and 12" index and set-down adjustments.
3. Sound is distorted, weak, or intermittent, on the changer tone arm.  
 Replace the needle                      Make sure that the knurled thumb nut on the chuck is tightened securely.  
 Replace the crystal  
 Check for bad wiring connections.  
 Check the tone arm for binding. Absence of vertical end play in the tone-arm shaft will cause excessive horizontal drag, resulting in distortion or groove jumping.  
 Check for uneven turntable speed
4. Changer fails to cycle at the end of a record.  
 Check the trip-finger adjustment                      Observe whether the records being used contain an eccentric finish groove in the center.
5. Changer fails to drop the record automatically.  
 Record holes becoming enlarged.  
 Check the record-shelf and push-off adjustments.
6. Long-play tone arm does not raise and lower on the rest post when the changer is put into cycle, or does not clear the rest post when lifted off the record.  
 Check the tone-arm height clearance and the raise adjustment.
7. Sound is distorted, weak, or intermittent, on the long-play tone arm.  
 Try a new needle and cartridge  
 Check all wiring.  
 Make sure that only long-playing records are being used at the slow speed.  
 Check the speed with a stroboscope disc, as directed  
 Check the selector-lever throw adjustment.  
 Check the pulley belt on the motor, as direct  
 Check the needle pressure, the horizontal friction, and the pickup holder adjustments



UPPER ACTUATOR LEVER  
76-2987 1/4" FROM  
OF CAM-GEAR SURFACE

SPINDLE SPRING  
56-5644

FIGURE 10 VERTICAL TIMING ADJUSTMENT—  
CHANGER TONE ARM



LINK ACTUATOR 76-4193  
1/4" FROM LEADING  
OF CAM-GEAR SURFACE

TP 7356

FIGURE 11 HORIZONTAL TIMING ADJUSTMENT—  
CHANGER TONE ARM

## CORRECTION OF TROUBLES (Continued)

8. Record changer fails to shut off when the long-play tone arm rides the eccentric finish groove of a long-play record.

Check the trip-finger and the trip-switch adjustments (page 21).

Check the mercury switch; when it is properly set in the clip assembly, the red dot on the switch should be on top.

## ADJUSTMENTS FOR THE RECORD CHANGER

### 10" Index or Set Down

Set a 10" record on the turntable, push the OFF-MAN-AUT-REJ control to REJ, and rotate the turntable by hand approximately  $4\frac{1}{2}$  turns. The tone-arm needle should be  $\frac{1}{2}$ " above the record at this point. Loosen the clamp screw on the trip arm slightly (figure 12); then hold the tone arm steady,  $\frac{1}{8}$ " in from the edge of the record, and set the trip arm so that the trip-arm stop, 56-4614, is in contact with the inside selector hinge, 56-4617FA3, as shown in figure 6.

Tighten the clamp screw, leaving  $\frac{1}{32}$ " vertical play, or clearance, between the trip arm and the base plate.

### 12" Index or Set Down

Make the 10" index adjustment first, then remove the 10" record from the turntable and place a 12" record in its place. Reject the changer, and rotate the turntable until the needle point is  $\frac{1}{2}$ " above the record. The trip-arm stop should be against the outside selector, 56-4618FE15, as shown in figure 7.

Ordinarily, the 12" index is satisfactory after the 10" index adjustment is made; if not, bend the selector slightly to the right or left, as required, for the proper set-down of the needle on the record ( $\frac{1}{8}$ " in from the edge of the record).

### Trip Finger

With a record on the turntable, place the tone arm in the finish groove of the record. The trip finger, 54-7613, is now riding over the ratchet screw of the trip plate, 76-2990, as shown in figure 8. The trip finger should assume an angle of  $25^\circ$  to  $30^\circ$  with respect to the ratchet screw. To obtain the correct angle, adjust the screw on the trip receiver, 56-5981, as indicated in figure 8. Make certain that the vertical center line of the trip finger coincides with the center line of the ratchet screw. To obtain this alignment, loosen screw "A" slightly, and screw "B" completely, on the trip receiver, 56-5981, and swing the trip receiver to the right or left until the trip finger is centered over the ratchet screw; then tighten the screws

When this adjustment is made, care should be taken to prevent the trip receiver from being pulled in toward the trip arm too far, as this will prevent the trip-arm stop, 56-4614, from engaging the selector hinge by a minimum of  $\frac{1}{8}$ ", as shown in figure 7. A happy medium between the above adjustments should be reached.

Also, the index, or set-down, adjustment may be slightly affected when making the above adjustments, so it is well to remember that these three adjustments are interrelated, and that, when any one of them is made, the other two should be rechecked.

### Tone-Arm Height and Lift

With the changer out of cycle, and the tone arm free, set the arm over the base plate. The needle point should be approximately  $\frac{1}{16}$ " above the base plate. To adjust, bend the protruding ear of the swivel post (bending the ear upward increases the clearance), shown in figure 9. Now raise the tone arm to its maximum height, and place it against the rest post. There should be a minimum of  $\frac{1}{8}$ " clearance between the lower edge of the tone arm and the top of the rest-post hook. Adjust the ear on the swivel post until a compromise is reached between the correct rest-post clearance and base-plate clearance.

### Tone-Arm Vertical and Horizontal Timing

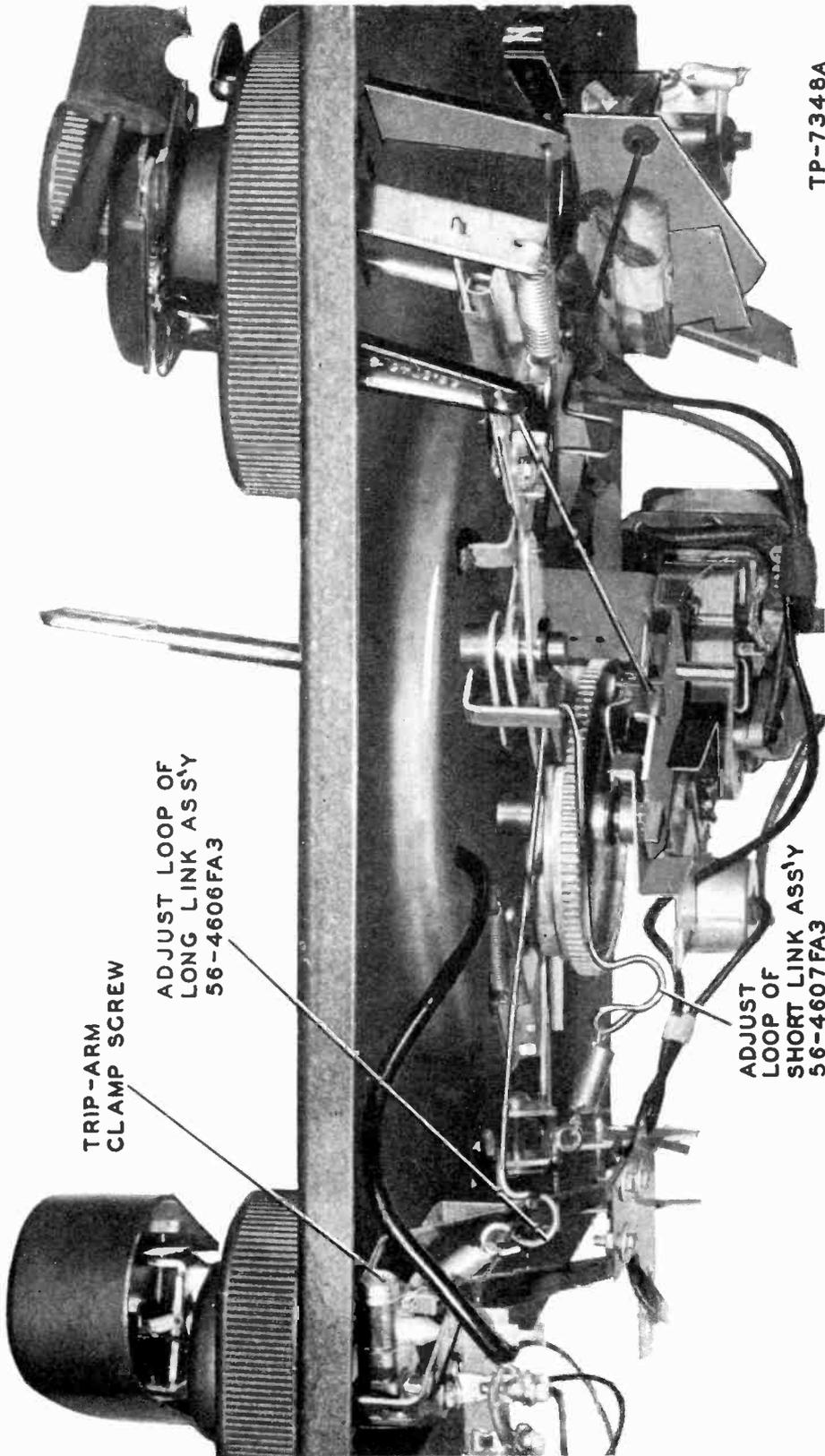
Before making these adjustments, make the tone-arm height and lift adjustments described above.

For the vertical adjustment, start with the changer out of cycle, push the OFF-MAN-AUT-REJ control to REJ, and rotate the turntable  $\frac{3}{4}$  of a revolution by hand. At this point, the leading edge of the cam is approximately  $\frac{1}{4}$ " from the end of the link actuator, 76-4193 (this is the lower actuator lever shown in figure 10). Adjust the wire loop of the *short* link (56-4607FA3 in figure 12) until the ear of the tone-arm swivel post makes contact with the lower end of the cutout on the tone-arm pivot assembly.

For the horizontal adjustment, start with the changer out of cycle, and rotate the turntable  $1\frac{1}{2}$  revolutions by hand. At this point, the upper leading edge of the cam gear is approximately  $\frac{1}{4}$ " from the upper actuator lever, 76-2987 (shown in figure 11). Adjust the wire loop of the *long* link (56-4606FA3 in figure 12) by squeezing or spreading it until the tone arm is up against the rubber bumper on the rest post.

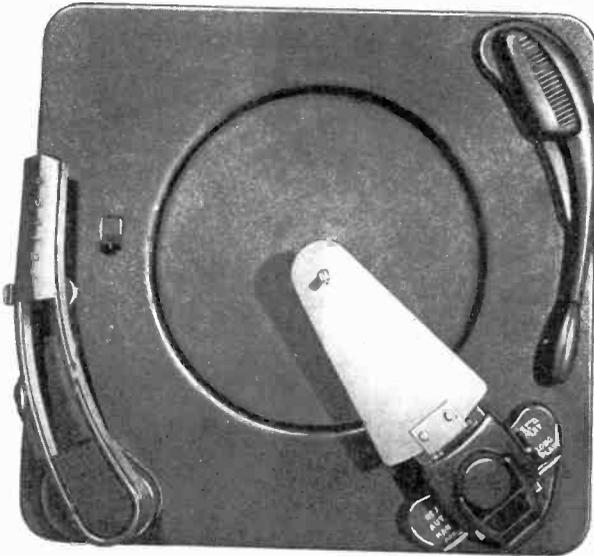
### Record Shelf

Set the record shelf to the 10" position, with the changer out of cycle. Place the Philco record-shelf gauge, 45-1470, over the spindle and onto the record shelf, as shown in figure 13. Loosen the two hex-head screws that hold the record-shelf assembly to the changer base plate. Move the record-



TP-7348A

FIGURE 12 LOOP ADJUSTMENTS FOR TONE-ARM  
VERTICAL AND HORIZONTAL TIMING



TP 7335

FIGURE 13 SPECIAL PHILCO RECORD-SHELF GAUGE, SHOWN IN CORRECT POSITION

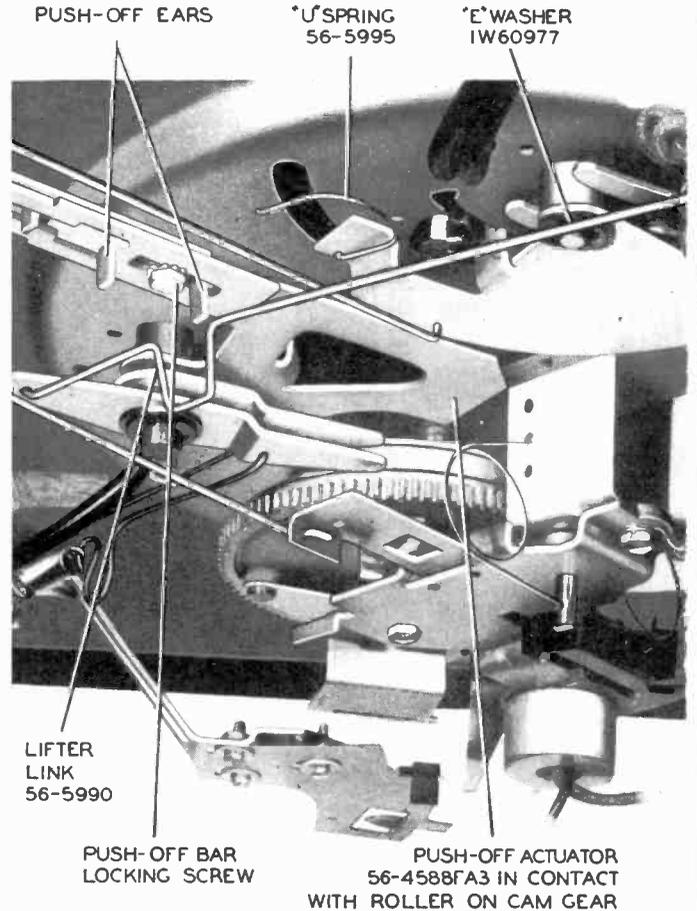
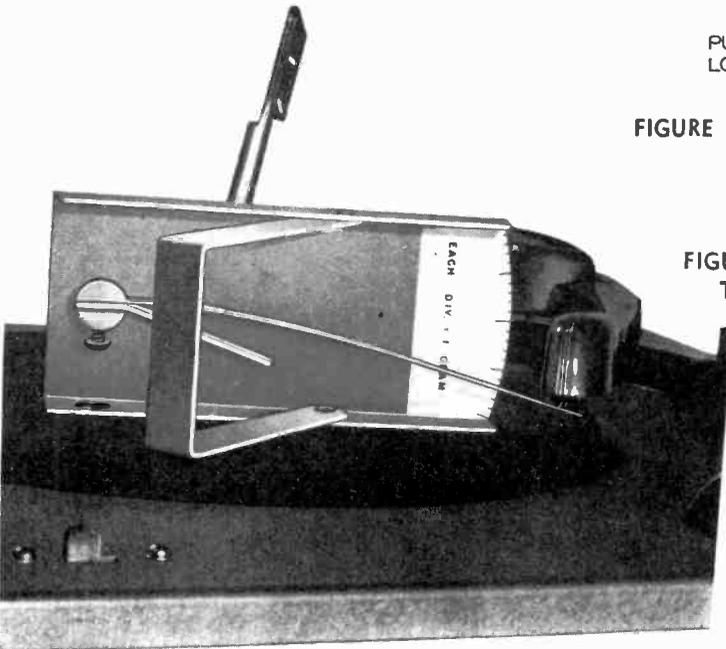


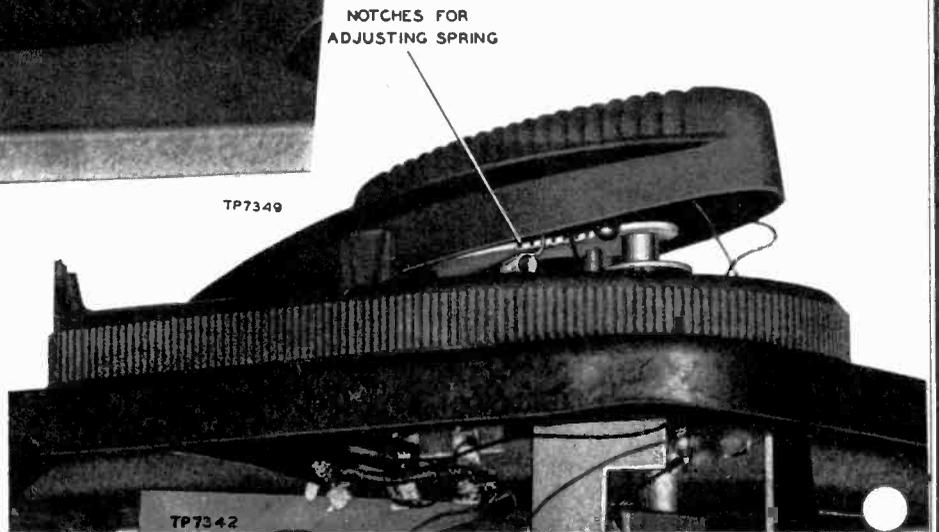
FIGURE 14 PUSH-OFF ADJUSTMENT

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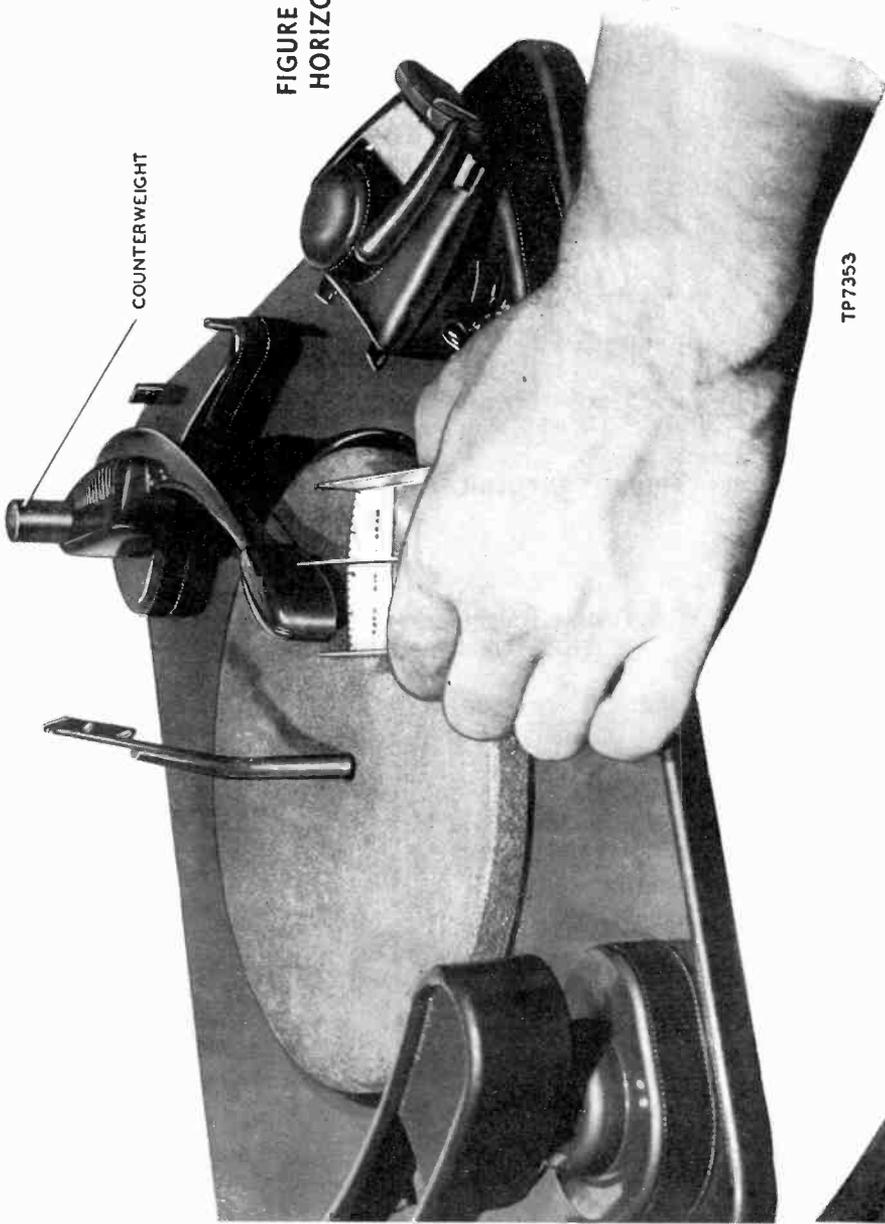
FIGURE 15 PHILCO GRAM SCALE, SHOWN IN POSITION FOR MEASURING NEEDLE PRESSURE AND VERTICAL FRICTION



TP7342

FIGURE 16 NEEDLE-PRESSURE ADJUSTMENT

FIGURE 17 MEASURING HORIZONTAL FRICTION



MAINTAIN 1/32" CLEARANCE BETWEEN TIPS OF HOLDER AND INSIDE WALL OF PICKUP

PICKUP HOLDER MTG. SCREW

CENTER HOLDER

FIGURE 18 PICKUP-HOLDER ADJUSTMENT

TP6596-1

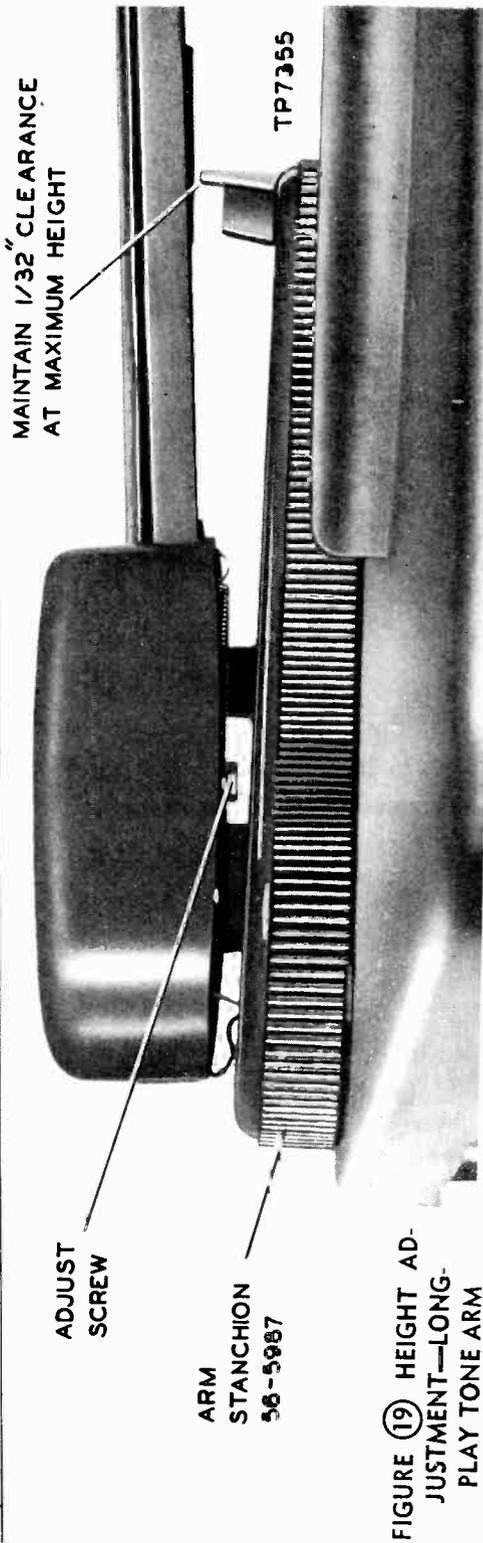


FIGURE 19 HEIGHT ADJUSTMENT—LONG PLAY TONE ARM

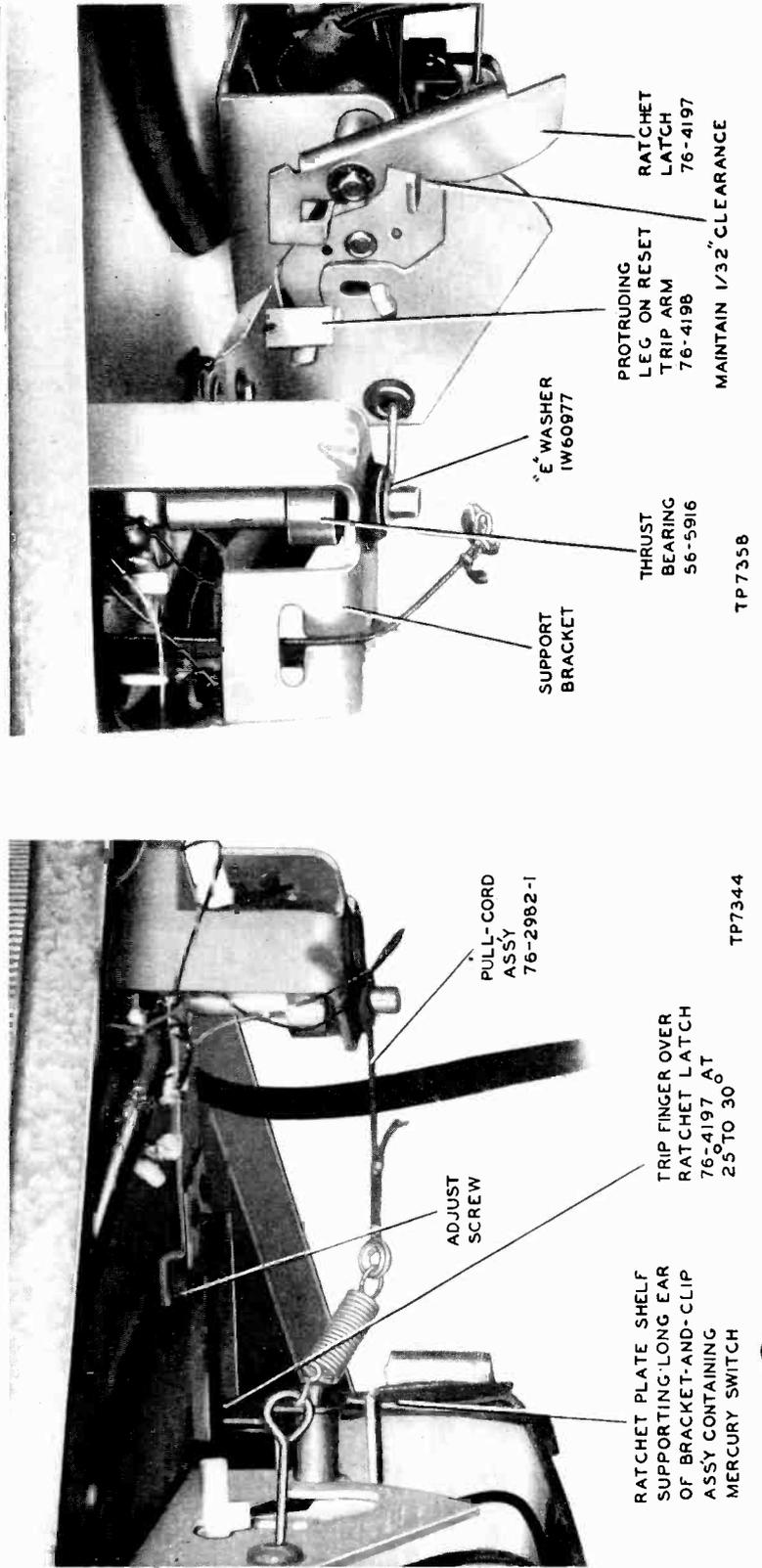


FIGURE 20 TRIP-FINGER ADJUSTMENT

FIGURE 21 TRIP-SWITCH ADJUSTMENT

MODEL M-12C

PHILCO CORP.

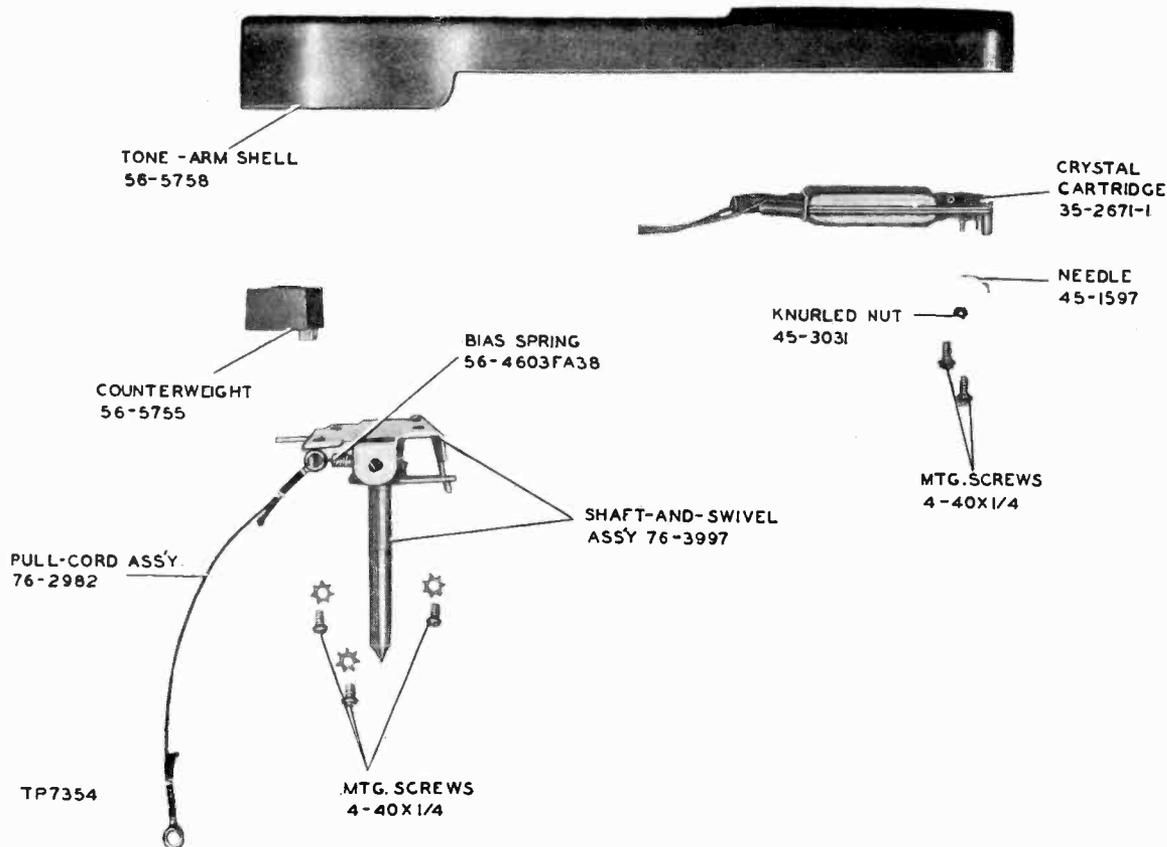


FIGURE (22) CHANGER TONE-ARM ASSEMBLY (35-2675)

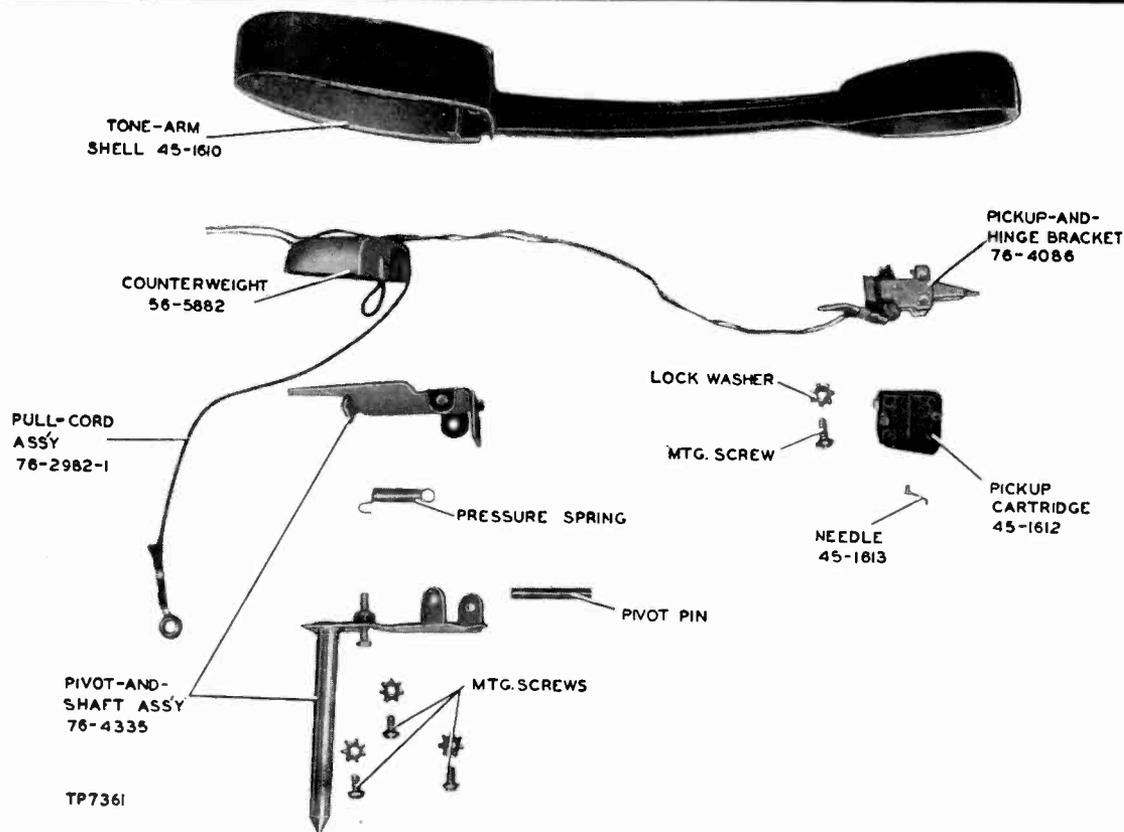


FIGURE (23) LONG-PLAY TONE-ARM ASSEMBLY (35-2686)

**ADJUSTMENTS FOR THE RECORD CHANGER (Continued)**

shelf assembly away from the spindle until the large curved part of the gauge drops even with the record-shelf lips. Now push the record shelf and gauge lightly against the spindle, taking out all play toward the spindle; keep the lips of the record shelf in even contact with the edge of the gauge. Tighten the two hex-head screws.

**Push-Off**

With the changer out of cycle, push the OFF-MAN-AUT-REJ control to REJ, and rotate the turntable 2½ revolutions by hand; at this point, the push-off actuator, 56-4588EA3, is in its most forward position, in contact with the roller on the cam gear, as shown in figure 14. Loosen the push-off-bar locking screw and squeeze the push-off ears toward each other until the slide plate on the record shelf extends 1/32" beyond the lips of the shelf. Tighten the hex-head push-off-bar screw.

**LONG-PLAY TONE ARM ADJUSTMENTS**

**Vertical Friction**

Use the Philco gram scale, 45-9531. Calibrate the scale to zero by holding it on its side and setting the pointer to the center line of the scale. The center is the "0" point, and each small division on either side of "0" is equal to one gram.

After the scale has been calibrated to zero, place the scale on the changer base, with the guard on the scale in an open position, at right angles to the scale, as shown in figure 15. Set the needle of the long-play tone arm into the hole at the end of the pointer. Press down on the head of the pickup, and let it spring back; then note the reading on the scale. Raise the pickup, let it return slowly, and note the reading on the scale. The average of the two readings taken is the needle pressure; the difference between the two readings is the vertical friction. The correct needle pressure is between 6 and 7½ grams. The vertical friction should not exceed 2 grams.

**Needle Pressure**

To adjust the needle pressure, move the tone arm toward the center of the turntable; unhook the spring from the notch on the pivot assembly (below the rear end of the tone arm), and place the spring into a different notch. Each notch represents a change of one gram in needle pressure. After changing the spring into a different notch, measure the needle pressure again with the gram scale. Figure 16 shows the notches on the pivot assembly.

**Horizontal Friction**

Calibrate the gram scale by laying it flat, face-up. Set the pointer to zero with the scale in this position.

Place a counterweight on top of the rear end of the tone arm; move the counterweight until the tone arm is balanced horizontally, and the needle point clears the turntable. Hold the gram scale face-up, place its pointer against the side of the pick-up, and push the tone arm horizontally, as shown in figure 17. Note the reading on the gram scale while moving the tone arm throughout its entire travel (outside of the trip range). At no time should it require more than 2 grams of pressure to move the tone arm.

**Pickup Holder**

The pickup cartridge holder should be centrally spaced between the walls of the tone arm, so that there is no binding or rubbing against the inside of the tone arm when the cartridge is moved vertically.

To obtain the proper spacing, first remove the tone arm, as directed on page 24; loosen the screw which holds the pickup-bracket mounting. Move the mounting until it is centrally spaced between the walls of the tone arm; maintain a 1/82" clearance between the tip of the ears on the holder and the inside surface at the front end of the tone arm, as shown in figure 18.

**Tone-Arm Base-Plate Clearance**

With the tone arm off the rest post and over the base plate, the needle should be at least 1/16", and not more than 3/16", above the base plate. To adjust, grasp the tone arm and raise or lower it (whichever is required) with a little pressure, to obtain the correct clearance. To lower the tone arm, it may be necessary to remove the turntable and bring the pickup toward the center; this position affords sufficient leverage to permit bending the tone arm downward. (See page 23 for removal of the spindle; remove the turntable by pulling it straight up.)

**Tone-Arm Height Clearance**

The tone arm should clear the rest-post hook at its highest point by a maximum of 1/32". This clearance can be obtained by adjusting the hex-head screw on the pivot assembly, shown in figure 19.

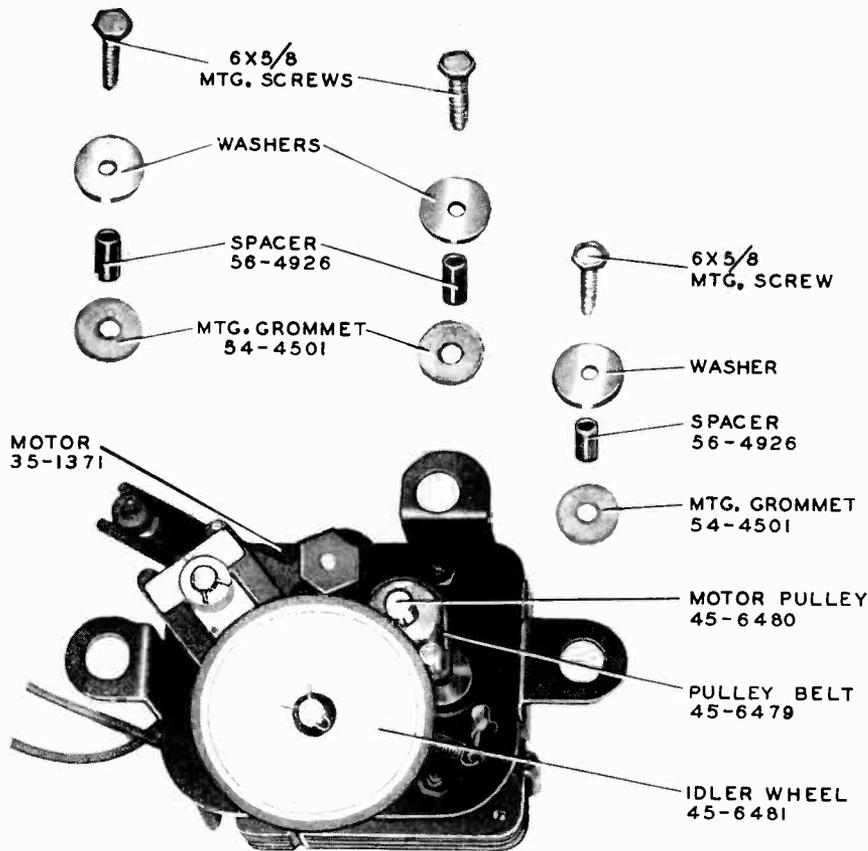
**Tone-Arm Raise**

Should the record changer be put through a change cycle with the long-play tone arm set on a record, the tone arm should lift from the record automatically, and set down on the rest post; during any further changer cycling, this tone arm should merely raise and lower on its rest post. To obtain the correct action, adjust the square loop of the lifter link, 56-5990, shown in figure 14, so that the tone arm is lifted firmly against the height-adjustment screw when the pickup is at its maximum height over the rest post.

When the changer is out of cycle, the pull-cord assembly, 76-2982-1 (figure 20), should be slack, allowing the tone arm to be freely moved, manually, anywhere on the record.

MODEL M-12C

PHILCO CORP.



TP-7014

FIGURE (24) MOTOR ASSEMBLY (35-1371)

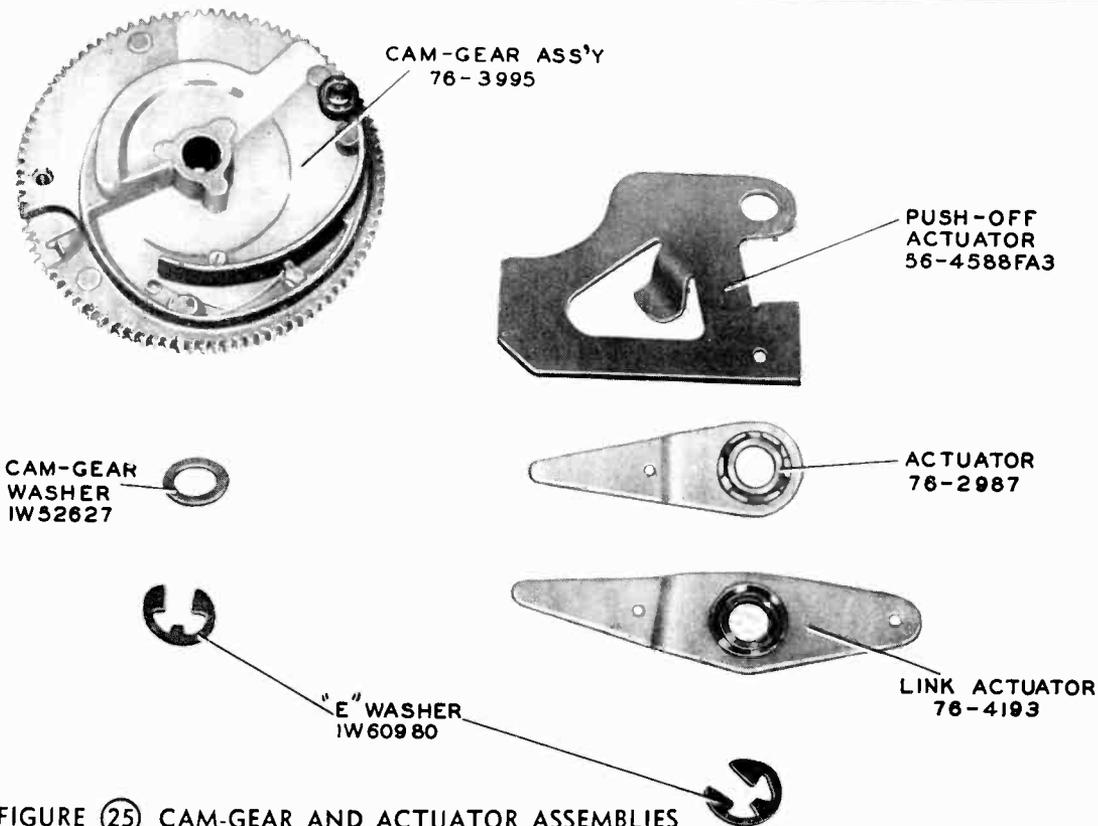


FIGURE (25) CAM-GEAR AND ACTUATOR ASSEMBLIES

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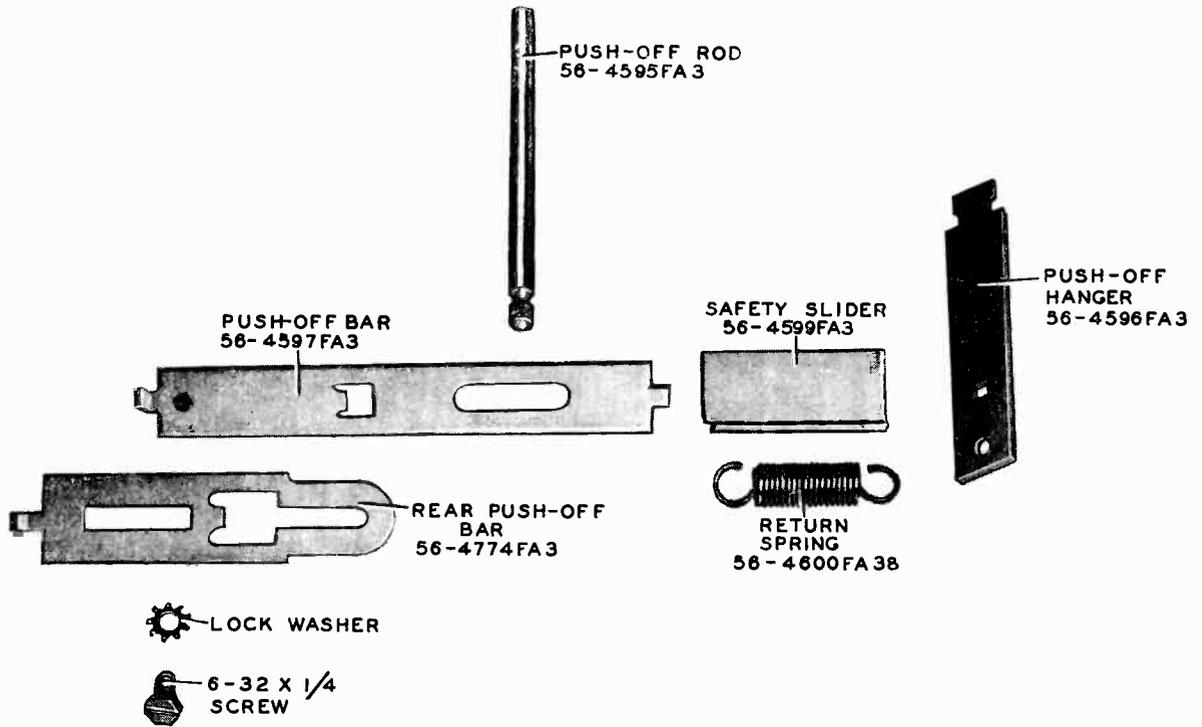


FIGURE 26 PUSH-OFF ASSEMBLY

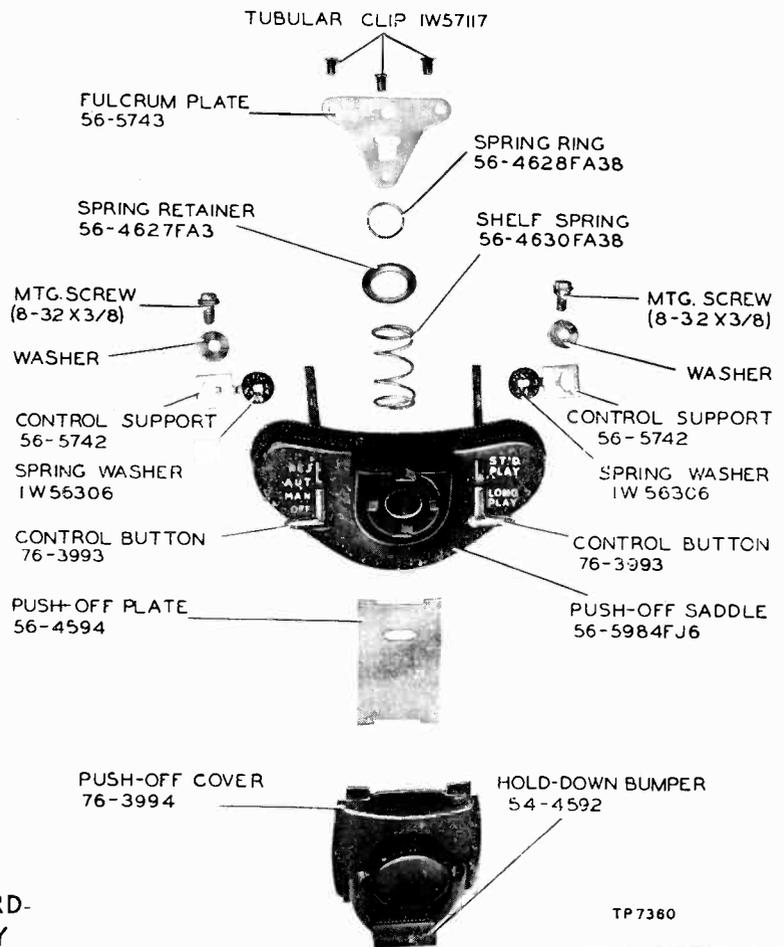


FIGURE 27 RECORD-SHELF ASSEMBLY

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## TRIP ADJUSTMENTS

### Trip Finger

When the pickup needle is in the eccentric groove of a long-playing record, the trip finger should be riding over the ratchet latch, 76-4197, at an angle of 25° to 30°. To obtain the correct angle, adjust the screw shown in figure 20.

### Trip Switch

When the pickup is set on the rest post, the mercury switch should be latched in the "on" position. To adjust the switch, loosen the clamp screw on the reset trip arm, 76-4198, hold the pickup on the rest post, and move the reset trip arm outward until its protruding leg contacts the short ear on the bracket-and-clip assembly, 76-4195; there should be a maximum of 1/32" clearance between the long ear on the bracket-and-clip assembly and the cutout shelf on the ratchet latch, 76-4197. See figure 21.

When tightening the clamp screw, maintain 1/32" vertical end play in the tone-arm shaft.

### Selector-Lever Throw

The lock plate, 56-5986 (figure 3), is adjusted by loosening the hex-head screw under the base plate and moving the lock plate so that, when the play control is set to either position, the selector-lever throw does not cause the shift-speed lever on the motor to bind against the mechanical stop on the motor.

## UNEVEN TURNTABLE SPEED (WOWS)

Uneven turntable speed can be caused by the following conditions:

- Dirt under and around the idler-wheel assembly.
- Idler-wheel spring loose or missing.
- Flat spot on idler-wheel tire.  
(For the 33 1/3 r.p.m. speed, a loose or worn pulley belt can result in a slow speed. To replace the pulley belt, push the idler-wheel assembly aside.)

## REPLACEMENT OF PARTS AND ASSEMBLIES

The following procedures are recommended for the correct removal of parts and assemblies. The parts should be replaced by reversing the order of removal. Adjustments should be made according to the directions given in the Adjustment section of the manual.

### 1. Needles

To remove the needle from the standard crystal on the changer tone arm, loosen the knurled nut under the crystal and pull the needle out.

To remove the needle from the special cartridge of the long-play tone arm, grasp the sides of the cartridge with the fingernails and pull it out; then pry out the needle with the fingernail or knife point. When replacing this needle, align the keyway on the needle shaft with the slot in the chuck on the cartridge, then push the needle into the cartridge. Replace the cartridge by pushing it until it is firmly seated.

### 2. Crystal Cartridge, 35-2671-1

- Bring changer tone arm toward center of turntable
- Remove the two screws and lock washers that hold cartridge to tone arm.
- Drop cartridge below tone arm sufficiently to allow the removal of the two clips from cartridge. Figure 22 shows the cartridge assembly.

### 3. Spindle, 76-3926

- Unhook both ends of spindle spring, 56-5644, from the "U"-shaped bracket mounted under changer base. See figure 11.
- Uncoil spring through spindle and remove spring.
- Pull out spindle.

### 4. Changer-Tone-Arm Assembly, 35-2675

- Unsolder tone-arm wires from terminal panel on under side of changer base plate.
- Remove pull cord from link spring.
- Loosen clamp screw that holds trip arm to tone-arm shaft (figure 12).
- Lift out tone arm. Figure 22 shows the tone-arm assembly.

**Note:** When the tone arm is replaced on the changer, be sure to maintain 1/32" vertical end play between the trip arm and the changer base plate.

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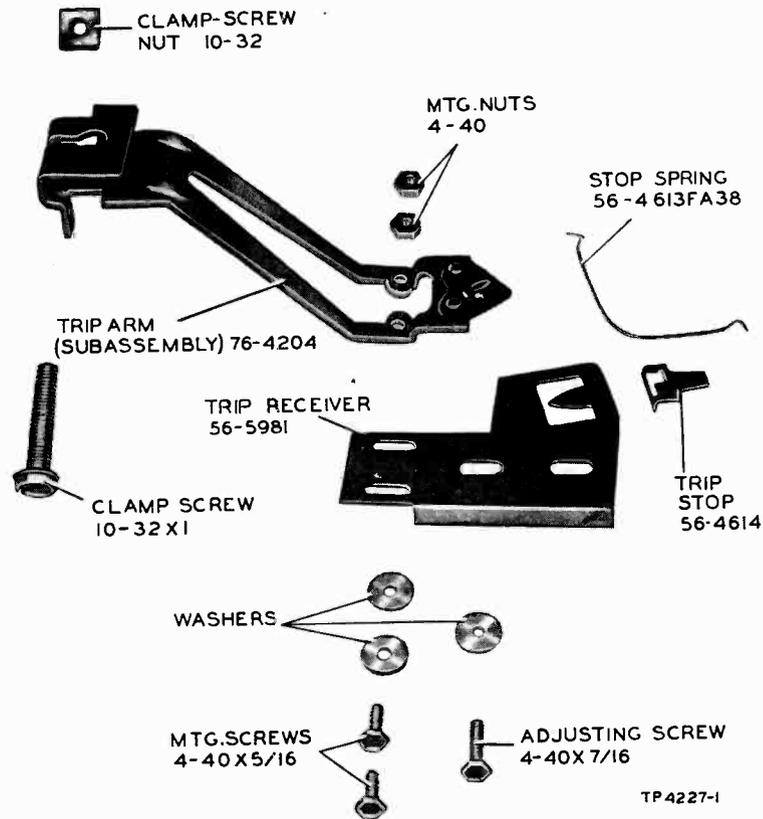


FIGURE (28) TRIP-ARM AND TRIP-RECEIVER ASSEMBLIES

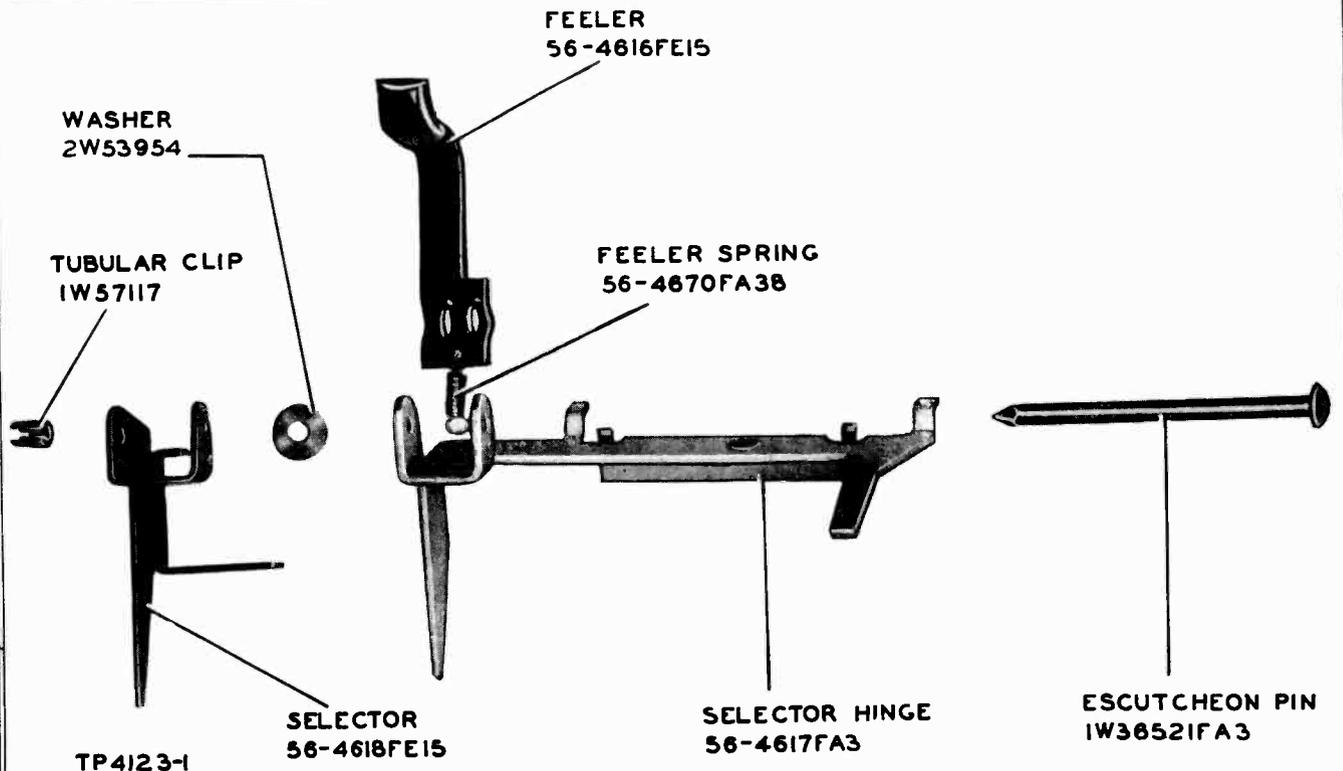


FIGURE (29) SELECTOR ASSEMBLY

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PHILCO CORP.

be inserted in the record-shelf assembly with the elongated hole toward the 12-inch position of the record shelf. The push-off assembly is shown in figure 26.

### 11. Control Button (OFF-MAN-AUT-REJ), 76-3993

- Remove bridge assembly, 76-3998, as directed in paragraph 7.
- Disengage control link rod, 56-4589FA3, from control button.
- Remove hex-head screw that holds record shelf to changer base plate.
- Remove control-button support, 56-5742, from control button.
- Lift control button out through record-shelf saddle.

### 12. Control Button (Play), 76-3993

- Remove selector lever, 56-5985, as directed in paragraph 19.
- Disengage selector link, 56-5991, from control button.
- Remove the hex-head screw that holds the record-shelf assembly to the changer base plate.
- Remove control-button support, 56-5742, from control button.
- Lift control button out through record-shelf saddle.

### 13. Record-Shelf Assembly

- Remove both control buttons as directed in paragraphs 11 and 12.
- Lift out entire record-shelf assembly through top of changer base plate. Figure 27 shows the assembly of the record shelf

### 14. Trip-Arm Assembly, 76-4204

- Loosen clamp screw on trip arm, 76-4204. See figure 12.
- Raise tone arm and shaft sufficiently to clear trip arm.
- Remove trip arm and disengage link spring. Figure 28 shows the trip-arm and trip-receiver assembly.

Note: When assembling the trip-arm assembly, maintain  $\frac{1}{32}$ " vertical end play between the trip arm and the changer base plate.

### 15. Selector Assembly

- Remove cam gear as directed in paragraph 8.
- Remove feeler spring, 56-4670FA38, from bracket on changer base plate.
- Tilt selector assembly and remove it from changer base plate. Figure 29 shows the assembly.

### 16. Long-Play-Tone-Arm Thrust Bearing, 56-5916

- Remove long-play-tone-arm assembly, 35-2686, as directed in paragraph 5.
- Remove "E" washer, 1W60977, from thrust-bearing shaft.
- Lift thrust bearing out of the rubber grommet mounted on the long-play-tone-arm-shaft-support bracket. See figure 21.

### 17. Long-Play-Tone-Arm Stanchion, 56-5987

- Remove long-play-tone-arm assembly, 35-2686, as directed in paragraph 5.
- Remove the hex-head screws that hold stanchion to changer base plate.
- Lift stanchion off base plate. See figure 19.

## REPLACEMENT OF PARTS AND ASSEMBLIES (Continued)

### 5. Long-Play-Tone-Arm Assembly, 35-2686

- Unsolder tone-arm leads from terminal panel on underside of changer base plate.
- Remove pull cord from lifter-link spring.
- Loosen the clamp screw that holds the reset trip arm to the tone-arm pivot shaft.
- Lift out tone arm. Figure 23 shows the tone-arm assembly.

### 6. Motor Assembly, 35-1371

- Remove spindle as directed in paragraph 3
- Unsolder motor lead from mercury switch.
- Unsolder motor lead from switch mounted on bridge assembly.
- Remove ground lead from one side of bridge assembly.
- Remove the three screws, washers, and spacers from motor frame. Figure 24 shows the correct assembly.
- Lift motor out.

### 7. Bridge Assembly, 76-3998

- Remove the two hex-head screws from bridge plate.
- Disengage the link control rod, 56-4589FA3, from the slider control bar.

### 8. Cam-Gear Assembly, 76-3995

- Remove bridge assembly as directed in paragraph 7.
- Slide trip plate off cam-gear spindle.
- Remove turntable lower bearing, 76-2991, from "U"-shaped mounting bracket by pulling it off.
- Remove large "E" washer, 1W60980, from cam-gear spindle.
- Slide cam washer, 1W52627, off cam spindle.
- Slide cam gear off spindle.

### 9. Tone-Arm Actuator Levers

- Remove short link, 56-4607FA3, from link spring.
- Remove "E" washer, 1W60980, from actuator stud.
- Slide link actuator, 76-4193, from stud.
- Disengage lifter link, 56-5990, from link actuator.
- Remove long link, 56-4606FA3, from link spring.
- Slide actuator lever, 76-2987, from stud. Figure 25 shows the actuator levers.

### 10. Push-Off Actuator, 56-4588FA3

- Remove actuator levers as directed in paragraph 9.
- Remove selector lever, 56-5985, as directed in paragraph 19.
- Press push-off rod, 56-4595FA3, and push-off hanger bar, 56-4596FA3, together and pull downward to release the entire assembly.
- Slide push-off actuator over to align upturned ears with cutout in base plate.
- Slide actuator off stud.

Note: When removing the push-off assembly, the slide plate, 56-4594, on the record shelf may slide out of the assembly. When reassembling, this blade should

## REPLACEMENT OF PARTS AND ASSEMBLIES (Concluded)

### 18. Long-Play-Tone-Arm Upper Bearing, 56-5903

- Remove long-play-tone-arm stanchion, 56-5987, as directed in paragraph 17.
- Remove "E" washer, 1W60981, from upper-bearing shaft mounted on long-play-tone-arm stanchion (figure 19).
- Remove upper bearing from rubber grommet mounted on long-play-tone-arm stanchion.

### 19. Selector Lever, 56-5985

- Remove "E" washer, 1W60977, from stud which mounts selector lever on changer base plate. See figure 14.
- Remove spring washer, 1W56306, from stud.
- Remove "U"-shaped detent spring, 56-5995, between selector lever and changer base plate.
- Loosen lock-plate screw.
- Align ears of selector lever with cutout slots on changer base plate.
- Remove selector lever from stud.
- Disengage selector link, 56-5991, from selector lever

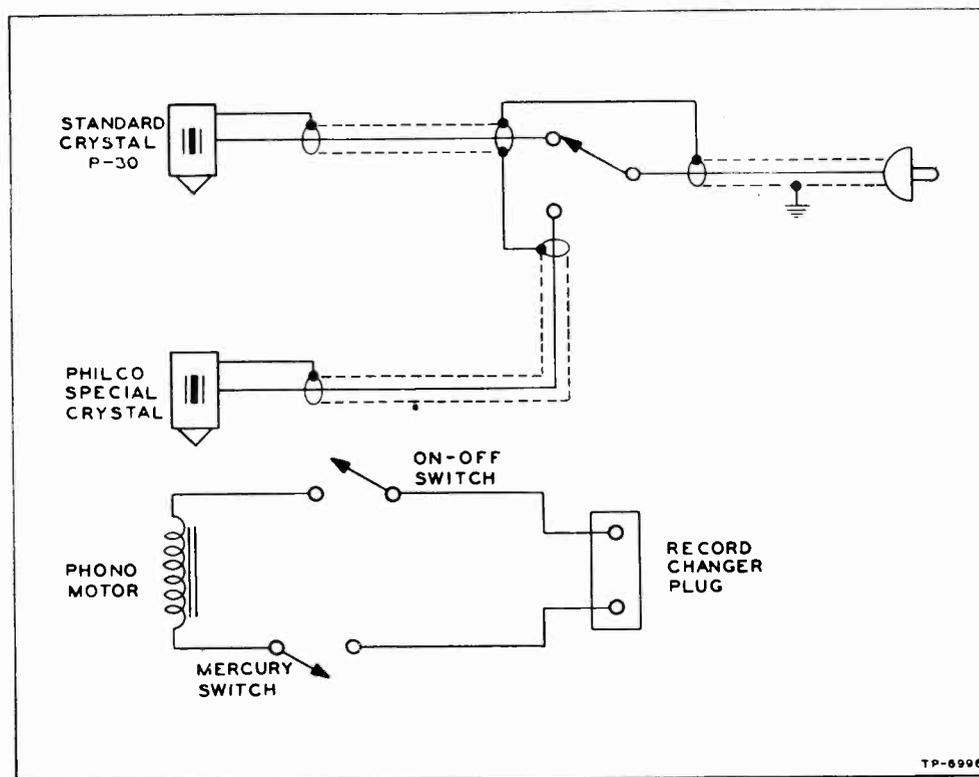


FIGURE 30 WIRING DIAGRAM OF MODEL M-12C

MODEL M-12C

PHILCO CORP.

## REPLACEMENT PARTS LIST

SERVICE PART NO.	DESCRIPTION	SERVICE PART NO.	DESCRIPTION
35-1371	Motor	56-5754	Pivot pin (changer tone arm)
35-2671-1	Crystal pickup (changer)	56-5755	Counterweight (changer tone arm)
35-2675	Tone-arm assembly (changer)	56-5758	Tone-arm shell (changer)
35-2686	Tone-arm assembly (long play)	56-5882	Counterweight (long-play tone arm)
35-3066-1	Turntable	56-5903	Bearing (long-play tone arm)
41-3869-2	Cable and plug	56-5912	Stop (long-play tone arm)
42-1873	Switch	56-5916	Bearing, thrust
45-1597	Needle (changer)	56-5981	Trip receiver (trip arm)
45-1609	Pickup-and-needle assembly (long play)	56-5984FJ6	Saddle, push-off
45-1610	Tone-arm shell (long play)	56-5985	Lever, selector
45-1612	Pickup cartridge	56-5986	Plate, lock
45-1613	Needle (long play)	56-5987	Stanchion (long-play tone arm)
45-3031	Knurled thumb nut	56-5990	Link, lifter
45-6479	Pulley belt	56-5991	Link, selector
45-6480	Motor pulley	56-5995	Spring, detent ("U" shaped)
45-6481	Idler wheel	56-6404	Trip receiver (reset trip)
54-4501	Grommet, motor mtg.	76-2140-2	Switch, mercury
54-4592	Bumper (record-shelf hold-down)	76-2982	Pull-cord assembly (changer tone arm)
54-7613	Trip finger	76-2982-1	Pull-cord assembly (long-play tone arm)
56-2832FA3	Cable clamp	76-2987	Actuator assembly (changer tone arm)
56-4585FA3	Lever, index	76-2990	Trip plate
56-4588FA3	Actuator, push-off	76-2991	Bearing assembly
56-4589FA3	Link, control	76-3926	Spindle
56-4594	Plate (push-off slide)	76-3993	Control button
56-4595FA3	Rod, push-off	76-3994	Push-off cover (record shelf)
56-4596FA3	Hanger, push-off	76-3995	Cam gear
56-4597FA3	Bar, push-off	76-3997	Shaft and swivel (changer tone arm)
56-4599FA3	Slider, safety	76-3998	Bridge assembly
56-4600FA38	Spring, return	76-4008	Base-plate assembly
56-4603FA38	Spring, index	76-4010	Cover assembly (switch)
56-4606FA3	Link, long	76-4086	Bracket (pickup and hinge)
56-4607FA3	Link, short	76-4193	Link, actuator
56-4608FA38	Spring	76-4194	Trip switch
56-4613FA38	Spring, stop	76-4195	Bracket-and-clip assembly
56-4614	Trip-arm stop	76-4196	Switch bracket
56-4616FE15	Feeler (selector assembly)	76-4197	Latch assembly
56-4617FA3	Hinge, selector	76-4198	Reset and trip
56-4618FE15	Selector	76-4201	Base-plate assembly
56-4627FA3	Retainer, spring	76-4204	Trip arm (subassembly)
56-4628FA38	Spring ring	76-4204	Pivot assembly
56-4630FA38	Spring (record shelf)	76-4335	Screw, 4-40 x 1/4, crystal mtg.
56-4647	Retainer, spring	1W14460	Pin (escutcheon)
56-4670FA38	Spring (feeler)	1W36521FA3	Cam-gear washer
56-4774FA3	Bar, push-off (rear)	1W52627	Spring washer
56-4926	Spacer, motor mtg.	1W56306	Tubular clip
56-5644	Spring, spindle	1W57117	"E" washer, small
56-5742	Support (control button)	1W60977	"E" washer, medium
56-5743	Plate, fulcrum	1W60980	"E" washer, large
56-5744	Tone-arm rest (changer)	1W60981	Washer, selector assembly
56-5753	Push-off saddle	2W53954	

## DESCRIPTION OF OPERATION

Power for the motor circuit is controlled by two mercury switches. These switches are inserted into clips; one of these clips is a part of a latch-plate-and-clip assembly, Part No. 76-4237, and the other is a part of a reset-plate-and-clip assembly, Part No. 76-4238. These two plate-and-clip assemblies are mounted on a switch-bracket assembly, Part No. 76-4235, which is located underneath the base plate, as shown in figure 1.

The tipping of the mercury switches to the OFF and ON position is accomplished by the trip arm, which is attached to the tone-arm shaft, and therefore is controlled by the tone arm.

When the tone arm is pulled back and set on its rest post, a protruding leg on the trip arm contacts the reset-plate-and-clip assembly, Part No. 76-4238, and raises it upward and tips the mercury switch mounted on it to the OFF position, as shown in figure 1. By the same action, the reset plate contacts an ear on the latch-plate-and-clip assembly, Part No. 76-4237, and holds it in an up, or horizontal, position. This tips the mercury switch mounted on it to the ON position, as shown in figure 1.

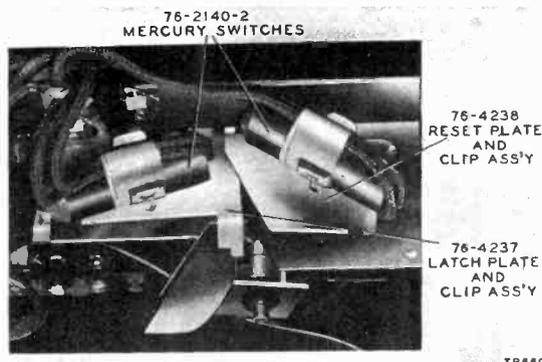


Figure 1

The two mercury switches are electrically connected in series. Since one of them is in the OFF position when the tone arm is on the rest post, the motor circuit is open and no power is supplied to the motor. When the tone arm is taken off the rest post and placed on a record, the reset-plate-and-clip assembly is permitted to drop down, tipping its mercury switch to the ON position. See figure 2. The motor circuit is now closed, and the record player is turned on.

During the playing of a record, a trip finger mounted on the trip arm rides over a ratchet on the latch-and-bushing assembly, Part No. 76-4197; see figure 3. When the pick-up needle enters the eccen-

tric finish groove at the end of the record, the trip arm, which is connected to the tone arm through the tone-arm shaft, will oscillate in a forward and backward motion, causing the trip finger to trip the latch-and-bushing assembly, Part No. 76-4197. This permits the latch-plate-and-clip assembly to drop down, and tip its mercury switch to the OFF position. The motor circuit is now open, and the record player is turned off.

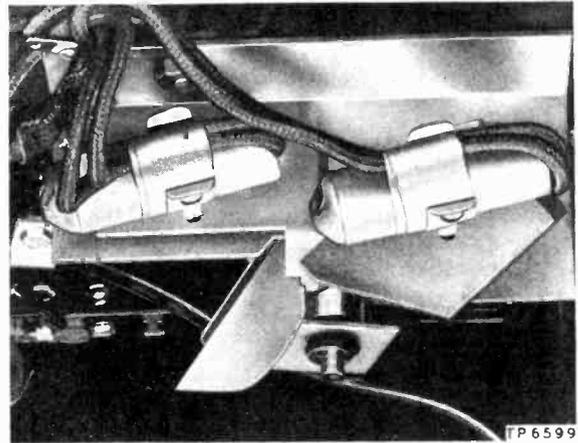


Figure 2

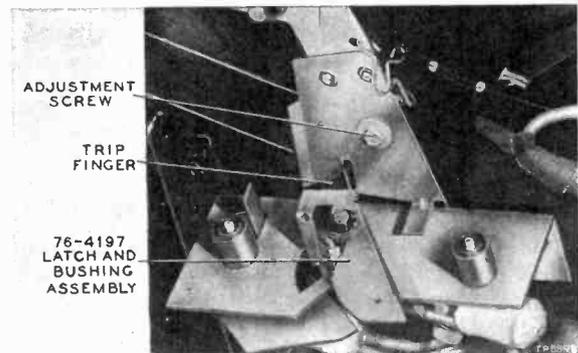


Figure 3

## TESTS

### STARTING

With the tone arm on the rest post, place a 12-inch Columbia Long Playing Record on the turntable, lift the tone arm from the rest post, and place it on the starting groove of the record. The turntable should start immediately after the tone arm is off the rest post. If not, refer to page for the adjustment of the switches.

### PICKUP AND NEEDLE

After the tone arm has been placed on the record, listen to its tone. If distortion is noted, replace the crystal cartridge as directed on page . If the trouble continues, check for loose wiring leads, bad contacts, etc.

### SHUTOFF

Place the tone arm in the finish groove of the record, and observe the shutoff action. The record player should shut off within three revolutions of the turntable, after the pickup needle has entered the finish groove of the record. Refer to page for trip-finger adjustments.

### BASE-PLATE CLEARANCE

Remove the record from the turntable, and place the tone arm over the base plate. Note whether there is a minimum of  $\frac{1}{8}$ -inch clearance between the needle point and the base plate. Refer to page for the base-plate-clearance adjustment.

### TURNTABLE AND MOTOR

Allow the motor to run for at least 10 minutes, then place a stroboscope disc such as Philco Part No. 45-9531 on the turntable, and illuminate the disc with a lamp operating on 60-cycle a.c. The dots in the row calibrated for  $33\frac{1}{3}$  r.p.m. should appear to remain stationary or drift very slowly, but smoothly, forward or backward. If the dots are moving in either direction very fast or in a jerky motion, refer to "Uneven Turntable Speed and Rumble,"

## ADJUSTMENTS

### NEEDLE PRESSURE AND VERTICAL FRICTION

Needle pressure and vertical friction can be measured by means of the Philco Gram Scale, Part No. 45-9532. The scale consists of a long, flat pointer spring set in a movable pivot. The end of the scale has a number of divisions, with each division equal to one gram. The center line is zero.

Hold the scale on its edge, with the setscrew up, and set the pointer spring to the midpoint, or zero, position. Lift the tone arm slightly off the rest post and place the needle point in the dimple in the pointer spring. Lift the tone arm approximately  $\frac{1}{2}$  inch with the scale, as shown in figure 4, and note the reading. Then lower the scale  $\frac{1}{2}$  inch again and note the reading; see figure 4A. The midpoint between the two readings is the needle pressure, and the difference between the two readings is the vertical friction. The needle pressure should be not less than 5 grams and not more than 7 grams, and the vertical friction should be not more than 2 grams.



Figure 4

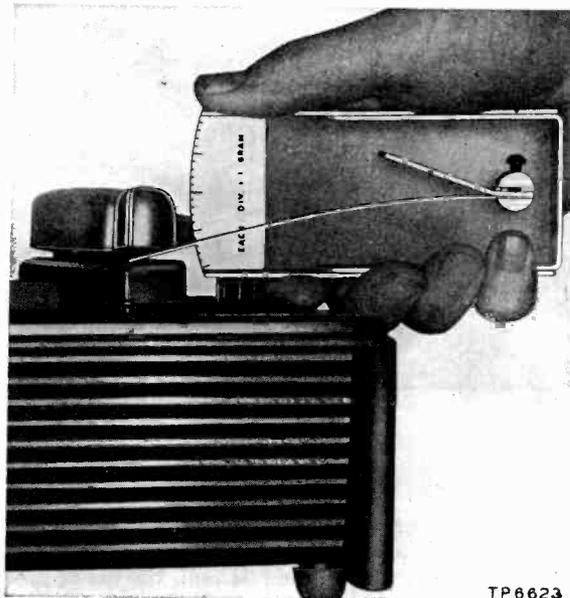


Figure 4A

Example:

With the scale attached and the tone arm raised  $\frac{1}{2}$  inch, the reading is 7 grams. With the tone arm lowered, the reading is  $6\frac{1}{4}$  grams. The midpoint between the two readings, or the needle pressure, is approximately  $6\frac{3}{8}$  grams. The differ-

ence between the two readings, or the vertical friction, is  $\frac{3}{4}$  gram.

To obtain the correct needle pressure, bring the tone arm to the center of the turntable and unhook the spring, shown in figure 6, from the notch of the pivot-and-shaft assembly, Part No. 76-4092. Place the spring in different notches until the correct needle pressure is obtained.

#### HORIZONTAL FRICTION

Lay the Philco Gram Scale, Part No. 45-9532, flat with the scale divisions up, and set the pointer spring to the midpoint, or zero, position.

Take the tone arm off the rest post and place a weight on top of the back section of the tone arm. Move the weight until the tone arm is balanced in a horizontal position.

Hold the scale so that the pointer spring bears against the side of the tone-arm head as shown in

figure 5; move the tone arm with the spring toward the center of the turntable, and note the reading while the tone arm is being moved horizontally.

At no time should the reading be more than 3 grams.

#### PICKUP HOLDER

The pickup holder should be centrally spaced between the walls of the tone arm so that the pickup cartridge does not bind or rub against the inside of the tone-arm wall when the cartridge is move vertically.

To obtain the proper spacing, first remove the tone arm (see page ); loosen the screw which holds the pickup-bracket mounting. Move the mounting until it is centrally spaced between the walls of the tone arm; maintain a  $\frac{1}{32}$ -inch clearance between the tip of the ears on the holder and the inside surface at the front end of the tone arm, as shown in figure 7.

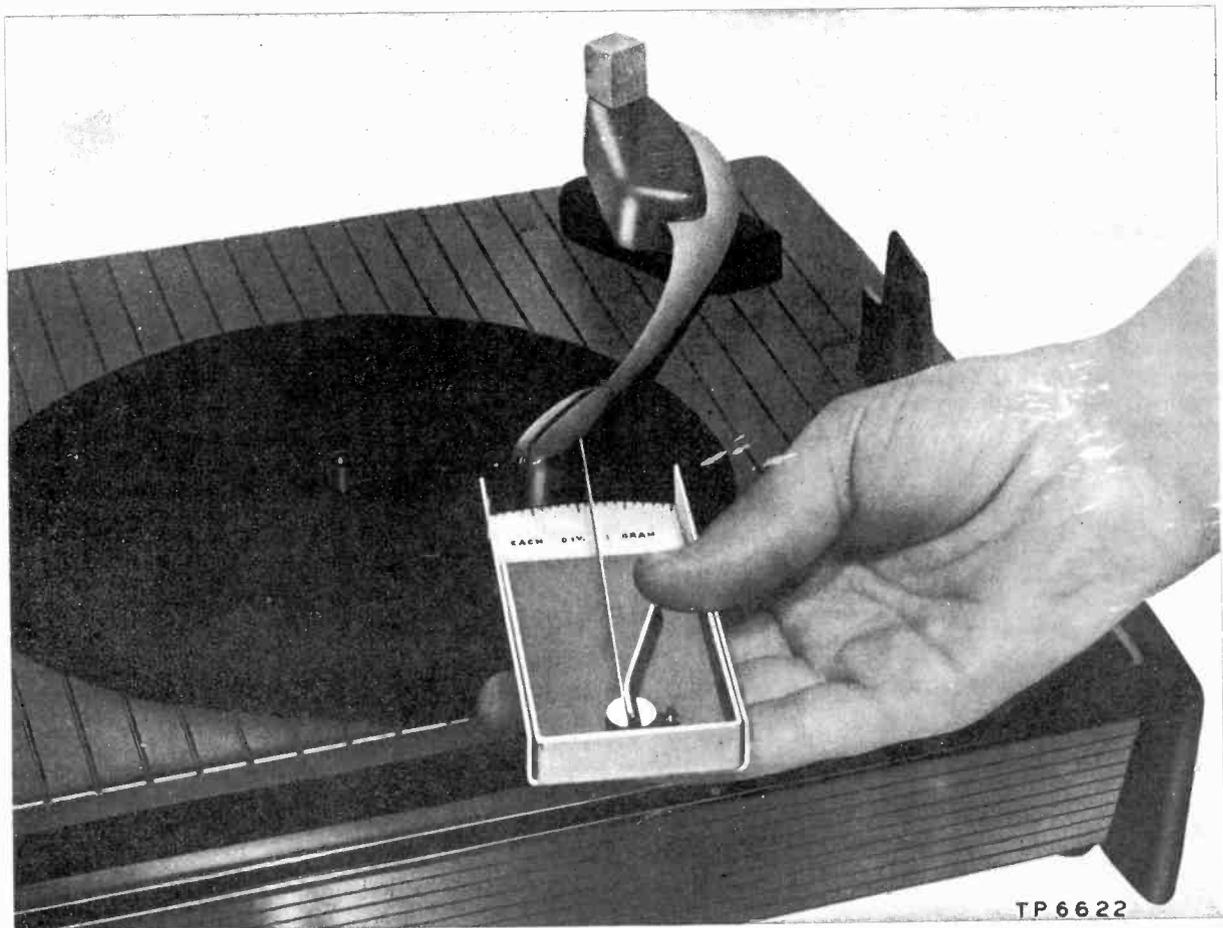


Figure 5

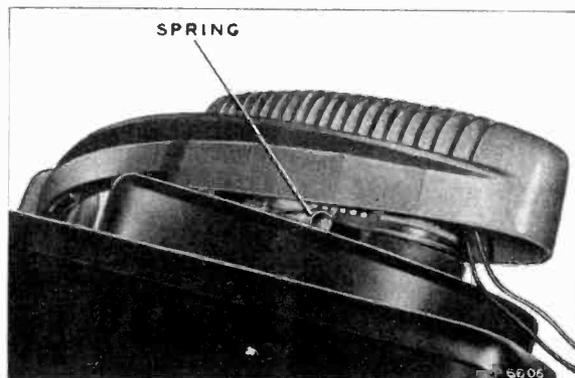


Figure 6

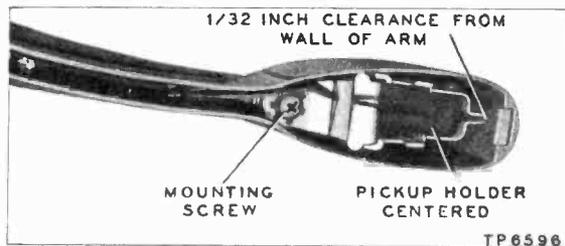


Figure 7

### TONE-ARM BASE-PLATE CLEARANCE

With the tone arm off the rest post and lying over the base plate, as shown in figure 8, the needle should be at least  $\frac{1}{8}$ -inch, and not more than  $\frac{3}{16}$ -inch, above the base plate. If the clearance is incorrect, grasp the tone arm and raise or lower it, whichever is required) with a little pressure to obtain the correct clearance.

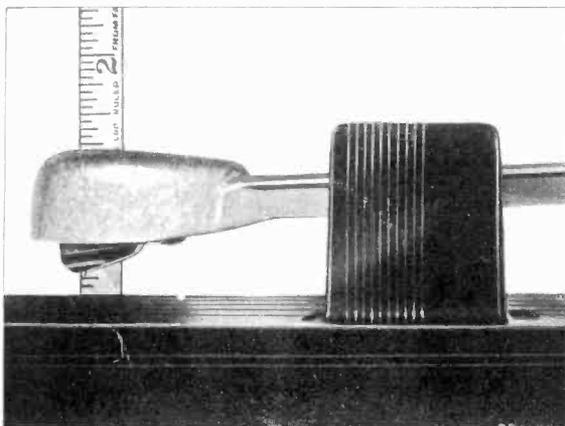


Figure 8

### TRIP SWITCH

With the tone arm on the rest post, both the reset-plate switch, Part No. 76-4238, and the latch-plate switch, Part No. 76-4237, should be in a horizontal position, as shown in figure 1. To adjust, turn the record player around and, from the rear, loosen the trip-arm clamp screw. Hold the tone arm on the rest post, and move the trip arm until the trip-arm leg engages the reset-latch ear. At the same time, the latch-plate ear should be approximately  $\frac{1}{32}$  inch above the cut-out on the ratchet-plate-latch assembly, Part No. 76-4197. Refer to figure 9 for the correct position of the latch ears. After the adjustments are made, tighten the clamp screw on the trip arm.

Note: Before tightening the clamp screw, be sure to leave .010-inch vertical clearance between the spacer in the trip arm and the tone-arm-shaft support.

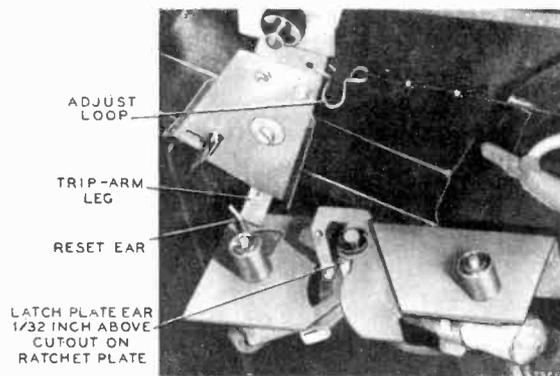


Figure 9

### TRIP FINGER

Place the tone-arm needle in the finish groove of a record, and from underneath the rear of the record player observe the trip finger riding over the ratchet on the latch-bushing assembly. The trip finger should assume an angle of  $25^\circ$  to  $30^\circ$  while riding over the ratchet, as shown in figure 3. Adjust the screw on the trip arm to obtain the proper angle.

### TRIP-FINGER CENTERING

The trip-finger center line should be directly over the ratchet on the latch-and-bushing assembly when the tone-arm needle is in the finish groove of the record. To adjust, remove the mercury switches from their clips by pulling them out. Loosen the two nuts which hold the switch-assembly bracket, Part No. 76-4235, to the base plate. Move the switch bracket until the trip-finger center is directly over the ratchet. Tighten the switch-bracket nuts and insert the mercury switches, in the clips, in the correct positions.

Note: Be sure that sufficient clearance between the mercury switches is maintained, or they may bind against each other when tripped.

### IDLER PULL CORD

The idler wheel should be disengaged from the motor shaft when the tone arm is on the rest post. It should re-engage when the needle is approximately  $\frac{1}{16}$ -inch from the edge of a 12-inch record. To adjust, tighten or spread the loop of the pull cord attached to the trip arm. See figure 7.

### UNEVEN TURNTABLE SPEED AND RUMBLE

Remove the turntable by removing the E washer from the spindle and pulling the turntable up. Clean all dirt from the idler-wheel assembly and the inside rim of the turntable. Examine the idler wheel and the rim of the turntable for bumps. Replace the idler wheel or turntable if any bumps are found. Some rumble can be caused by looseness of one or more of

the motor mounting screws, or by hardening of the rubber grommets on the motor frame.

### REPLACEMENT OF PARTS AND ASSEMBLIES

The following procedures are recommended for the correct replacement of parts and assemblies. The part should be replaced by reversing the order of removal, and should be adjusted as directed in the "Adjustments" section of this manual.

#### CRYSTAL-CARTRIDGE ASSEMBLY, PART No. 45-1609

To remove the crystal cartridge, grasp the crystal by its sides and pull it down and out. When replacing the cartridge, push it up into the head of the tone arm until it is completely seated.

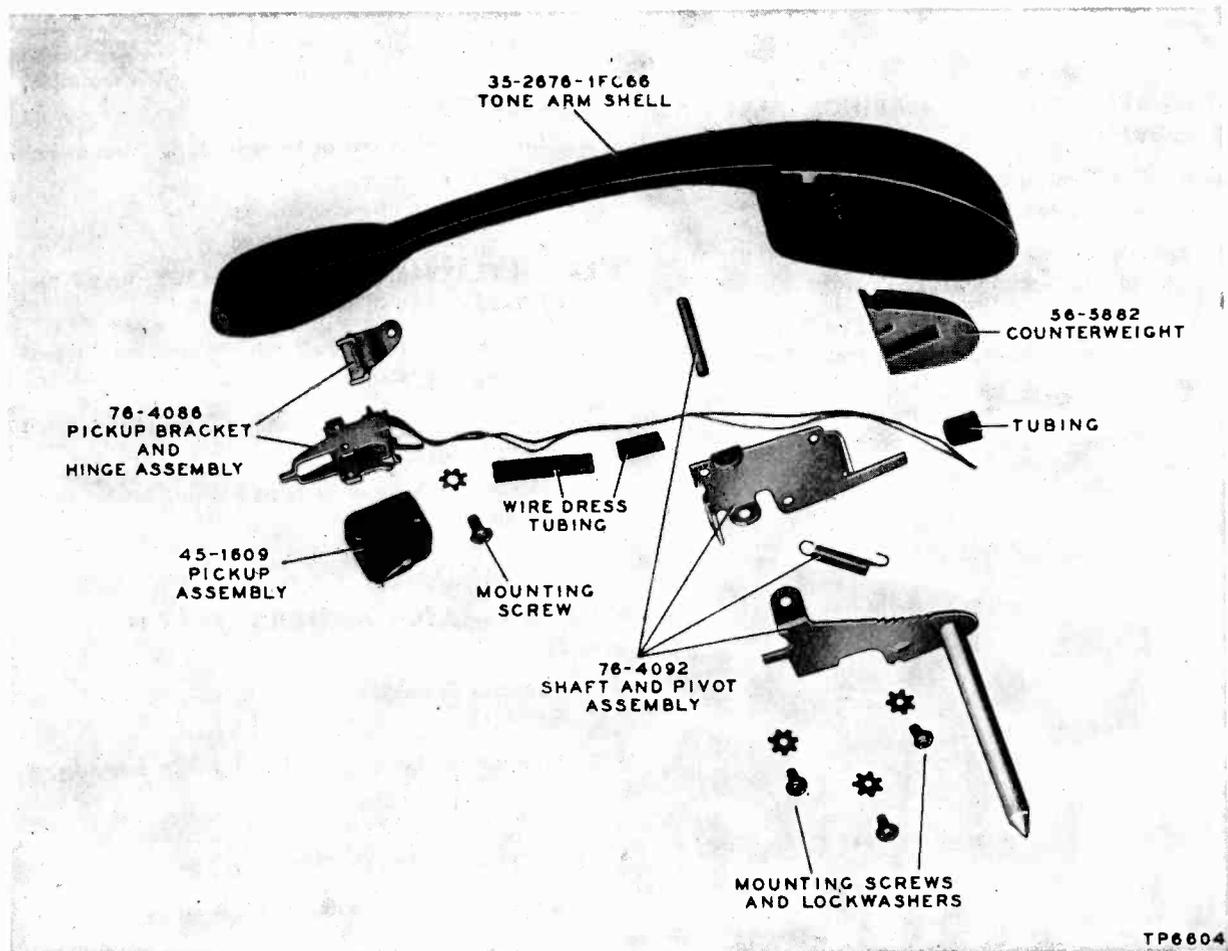


Figure 10

**MOTOR, PART No. 35-1359 OR 35-1361**

1. Remove E washer from spindle.
2. Lift out turntable.
3. Remove idler pull cord from idler bracket.
4. Unsolder motor leads.
5. Remove the three mounting screws.
6. Lift out motor.

**TONE-ARM ASSEMBLY, PART No. 35-2681**

1. Unsolder tone-arm lead wires from terminal panel on underside of record-player base plate.
2. Loosen clamp screw which holds trip arm to tone-arm shaft.
3. Lift out tone arm. Be careful not to lose fiber spacer on tone-arm shaft. Refer to figure 10 for correct assembly of tone arm.

**TONE-ARM THRUST BEARING, PART No. 56-5916**

1. Remove tone-arm assembly as directed under "Tone-Arm Assembly, Part No. 35-2681."
2. Remove E washer, Part No. 1W60977FE7, from bearing shaft; see figure 11.
3. Lift bearing out of grommet, Part No. 27-4099-3, mounted on tone-arm-shaft support, Part No. 56-5827.

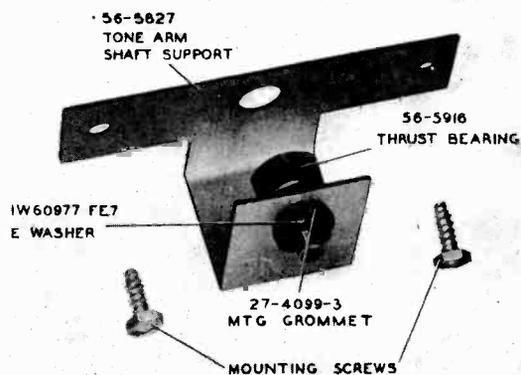


Figure 11

**TONE-ARM UPPER BEARING, PART No. 56-5903**

1. Remove tone-arm assembly as directed under "Tone-Arm Assembly, Part No. 35-2681."
2. Remove E washer, Part No. 1W60981FE7, from upper bearing at top of tone-arm housing.
3. Lift out bearing from underneath base plate.

**TONE-ARM-SHAFT SUPPORT, PART No. 56-5827**

1. Remove tone-arm assembly as directed under "Tone-Arm Assembly, Part No. 35-2681."
2. Remove the two mounting screws from underneath base plate.

**RESET-PLATE-AND-CLIP ASSEMBLY, PART No. 76-4238**

1. Remove mercury switch from clip.
2. Remove E washer, Part No. 1W60971FE7, from shaft of reset plate mounted on switch assembly; see figure 12.
3. Slide reset plate out of brass bushing from switch assembly.

**LATCH-PLATE-AND-CLIP ASSEMBLY, PART No. 76-4237**

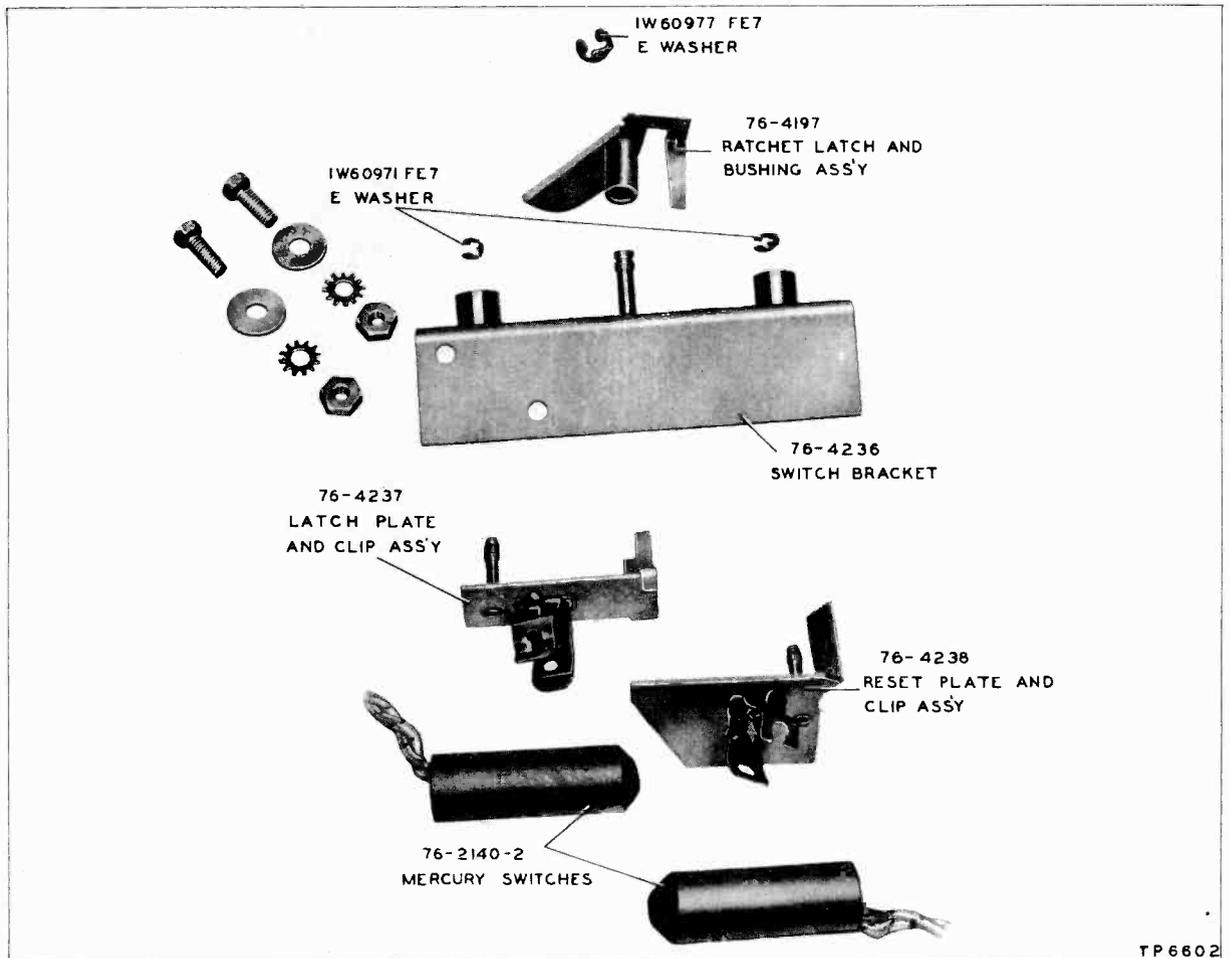
1. Remove reset plate, Part No. 76-4238, as directed in paragraph above.
2. Remove E washer, Part No. 1W60971FE7, from latch-plate shaft.
3. Slide latch plate out of brass bushing from switch assembly.

**RATCHET-LATCH ASSEMBLY, PART No. 76-4197**

1. Remove E washer, Part No. 1W60977FE7; see figure 12.
2. Slide ratchet-latch assembly off switch assembly.

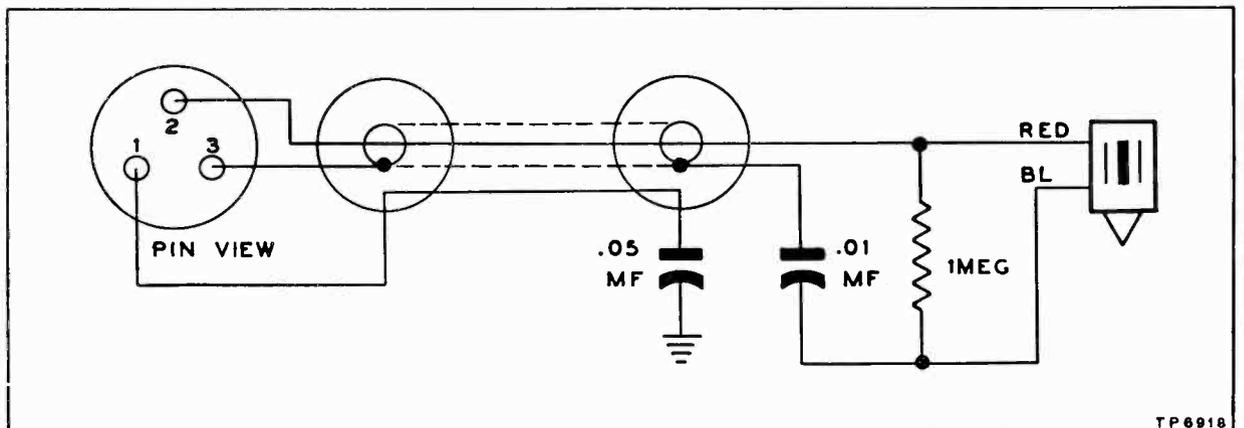
**SWITCH ASSEMBLY, PART No. 76-4235**

1. Remove mercury switch from latch-plate clip.
2. Remove the two hex-head nuts which hold switch assembly to base plate.



TP6602

Figure 12



TP6918

Model M-15, Schematic Diagram

MODEL M-15

PHILCO CORP.

**REPLACEMENT PARTS LIST**

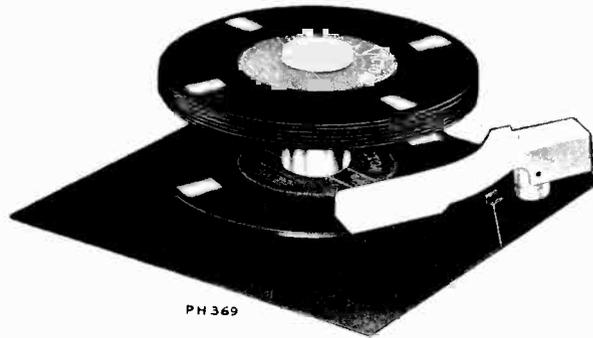


<i>Part No.</i>	<i>Description</i>
10720	Cabinet, less scale
10720A	Cabinet, less scale
27-4099-3	Grommet
28-2345	Cable clamp
28-2669FA43	Plug (for FM Adaption)
35-1359	Motor (Alliance)
35-1361	Motor (G.I.)
35-2676-1FC66	Tone-arm shell
35-2681	Tone arm
35-2683	Turntable (Alliance)
35-2685	Turntable (G.I.)
41-3821-6	Line cord
41-3869	Cable
45-1609	Pickup-and-needle assembly

54-4604	Cabinet base
54-4605	Cabinet top
54-4624	Grommet
54-4638	Tone-arm rest
54-4645	Rubber foot
54-7665	Bottom cover
55-0890	Bumper
56-2832FA3	Cable clamp, pickup
56-4584FA3	Loop, cord
56-5827FA3	Support, shaft
56-5882	Counterweight
56-5903	Bearing, upper
56-2912FA3	Stop
56-5916	Thrust bearing
56-6295	Lid support
56-6296	Binder post
56-6305	Hinge

<i>Part No.</i>	<i>Description</i>
76-2140-2	Mercury switch
76-4086	Bracket assembly, pickup and hinge
76-4092	Pivot, tone arm
76-4189	Reset and trip
76-4197	Latch assembly
76-4235	Switch assembly
76-4236	Switch bracket
76-4237	Latch plate
76-4238	Reset plate
W2537-3	Screw, hinge
1W10796FA9	Screw, binder post
1W56920FE7	Speed clip, tone-arm rest
1W60971FE7	E washer, switch assembly
1W60977FE7	E washer, thrust bearing
1W60981FE7	E washer, upper bearing
11W52604	Fiber washer

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MODEL RP-168,  
Series

PH 369

The basic RP168 mechanism includes the metal sub-panel and all necessary operating parts except the tone arm and trip lever assemblies. Instruments using the cabinet as the motor board will have additional items (other than the tone arm and trip lever assemblies) listed in the Service Data issued for the individual models.

RP-168-1: Record changer mechanism plus tone arm assembly RMP-129-1; instrument cabinet is used as record changer motor board. Used in Models 9JY and 9EY3.

RP-168A-1: Record changer mechanism plus tone arm assembly RMP-129-1 and metal motor board. Used in Models 9W101, 9W103, 9W105, 9TW333, 9TW390 and 9Y7.

Complete record changer parts listing (except output cable), included in this Service Data. Different types and lengths of output cables are used—listed in Service Data of Individual Instruments.

RP-168A-2: Record changer mechanism plus tone arm assembly RMP-130-1 and metal motor board. Used in Berkshire Models.

### AUTOMATIC OPERATION

1. Place a stack of records over the center post, with the desired selections upward the last record to be played on top.
2. Apply power to drive motor.
3. Push the "start-reject" knob to "start" and let go. The mechanism will automatically play in sequence one side of each record stacked on the separator shelves.
4. To reject a record being played push the "start-reject" knob to "reject."
5. At conclusion of playing and as the last record is being repeated, lift tone arm and place on rest. Push "on-off" knob to the "off" position.

### SPECIFICATIONS

This mechanism is designed to play automatically a series of eight new RCA seven-inch fine groove records.

RPM .....	45
Pickup .....	Crystal
Sapphire dia. ....	.0009 inches
Pickup voltage output .....	Medium
Pickup force .....	5 grams

### CAUTION

1. Avoid handling the tone arm when the mechanism is in cycle.
2. Do not use force to release a jam.
3. Do not try to remove the records on the turntable if the turntable is stopped in cycle.
4. Do not try to operate the mechanism if the separator knives protrude from the center post when the mechanism is out of cycle.

Turn Power control on. The turntable revolves. Press finger gently against protruding discs until they disappear inside the holder. Do not do this during a change cycle.

### LUBRICATION

A light machine oil (SAE No. 10) should be used to oil the bearings of the drive motor.

On all bearing surfaces, excepting the motor bearings, Houghton STA-PUT No. 320, or equivalent, should be used. On all other sliding surfaces, STA-PUT No. 512, or equivalent, is recommended. STA-PUT can be purchased from E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

(Do not oil or grease record separator shelves.)

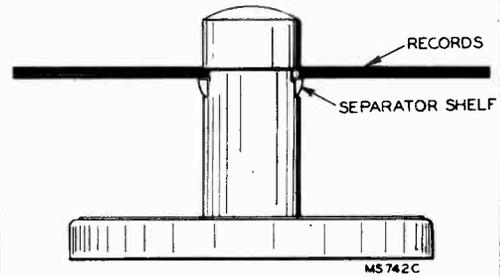
It is important that the drive motor spindle and the rubber tire on the idler wheel be kept clean and free from oil or grease, dirt, or any foreign material at all times. Carbon tetrachloride or naphtha is satisfactory for cleaning these parts.

MODEL RP-168,  
Series

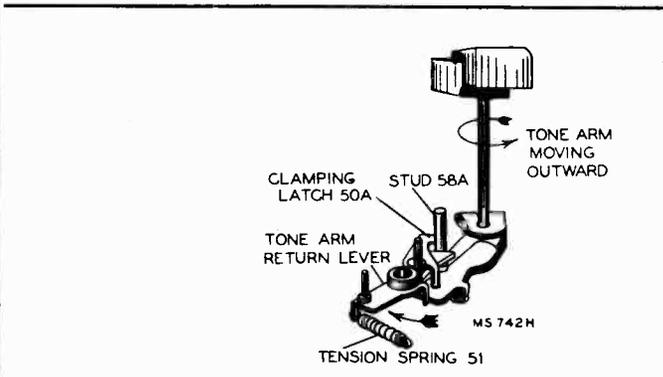
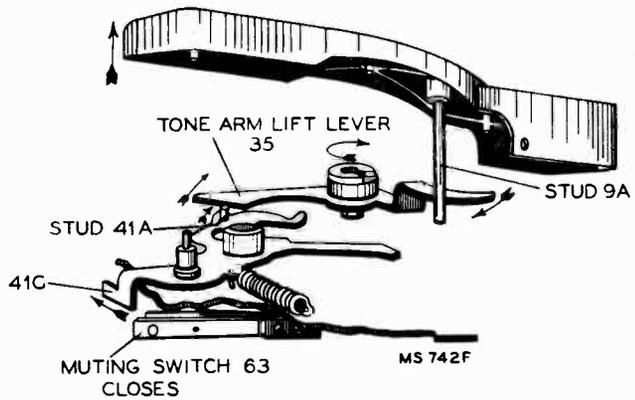
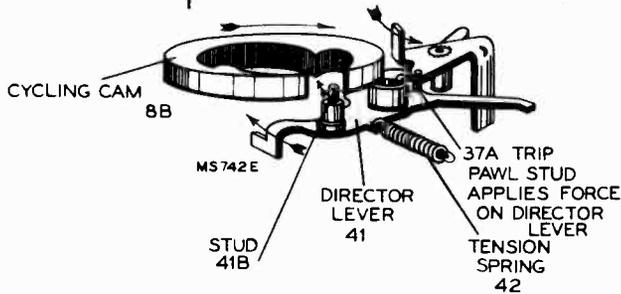
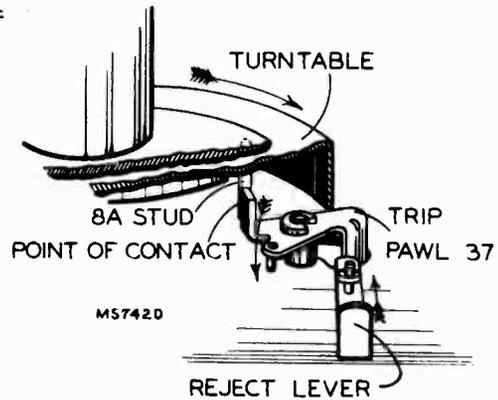
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CYCLE OF OPERATION RP-168

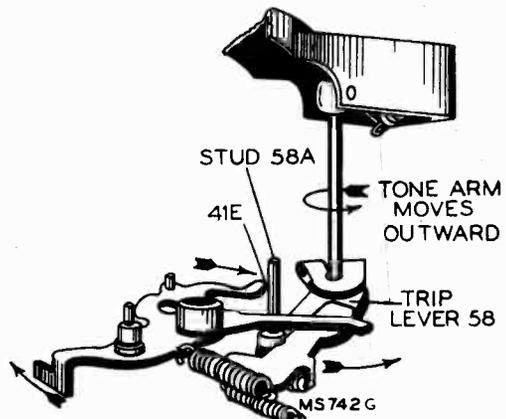
Function	Explanation
Place records over the center post and turn the power on	1. Records rest on separator shelves protruding from either side of the center post.
Operator Push start-reject knob	1. Start-reject knob which is linked to start-reject slide (45A) moves trip pawl (37) into tripping position.
	2. As the turntable rotates the small projection (8A) extending from the underside of the turntable contacts end of trip pawl.



Automatic Cycle Tone arm rises	1. As the turntable continues to rotate it carries the trip pawl (37) along for a short distance.
	2. The stud (37A) on trip pawl applies force against director lever (41) in opposition to tension spring (42). This force continues to be applied until the stud (41B) on the director lever has been forced through the slot and into the cycling cam (8B).
	3. The end (41C) of the director lever extending below the motor board moves away allowing the muting switch (63) to close.
	4. At the same time the stud (41A) pushes the tone arm lift lever (35) which in turn raises the tone arm.

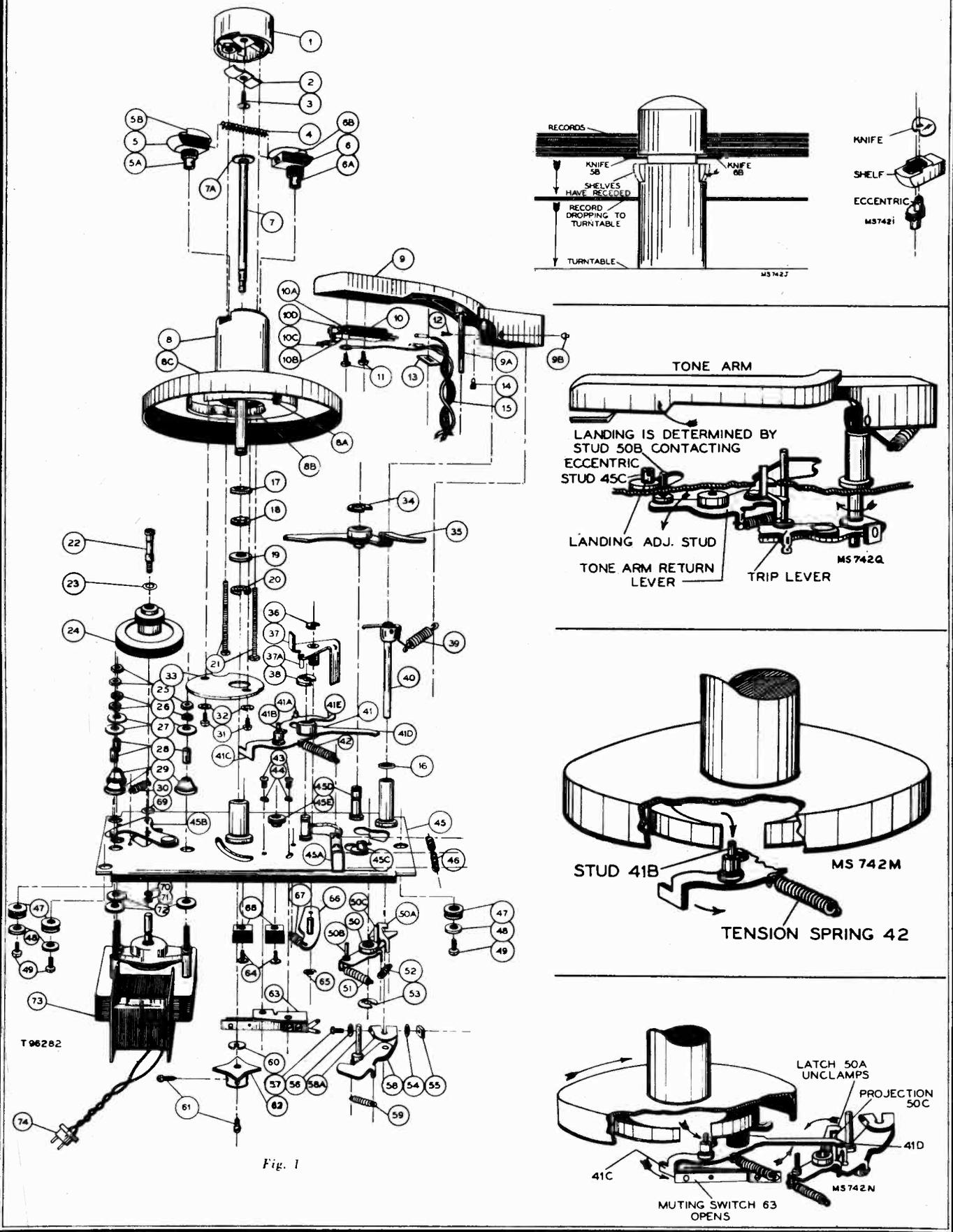


Tone arm moves out	1. The end (41E) of the director lever (41) contacts stud (58A) on trip lever (58), starting the tone arm on its outward movement.
	2. The stud (58A) on trip lever contacts tone arm return lever (50), pushing it outward against the tension spring (51).
	3. As the tone arm reaches its outermost position, it is locked in position by the latch (50A) clamping the stud (58A) on the end of the tone arm return lever.



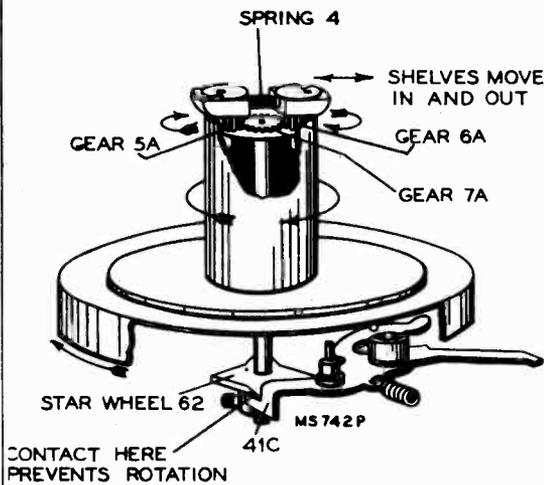
RADIO CORP. OF AMERICA

MODEL RP-168,  
Series



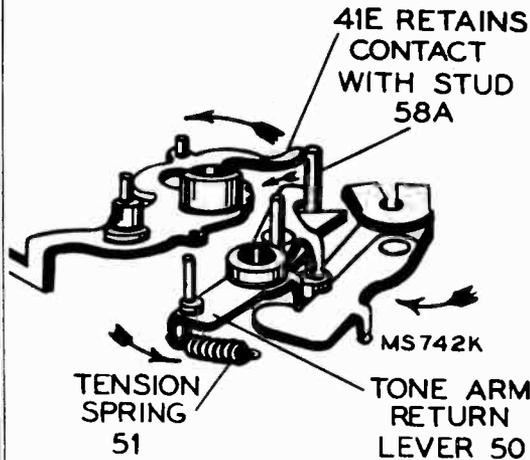
MODEL RP-168,  
Series

RADIO CORP. OF AMERICA



Separator knives separate the lower record from the stack and allows the record to drop to the turntable

1. While the tone arm is moving outward the end (41C) of the director lever (41) extending below the motor board, contacts and prevents the star wheel (62) from rotating.
2. Since the turntable continues to rotate and the star wheel and shaft remain stationary. The two small gears (5A and 6A) embedded in the upper section of the center post rotate around the gear (7A) on the upper end of the star wheel shaft (7).
3. The eccentric extending from the upper end of the two embedded gears runs in a slot in the separator shelves (5 and 6). This produces the necessary action which causes the shelves to move in against the tension of spring (4).
4. As the shelves recede the separator knives (5B and 6B) mounted above each separator shelf, separate the lower record of the stack and support the remaining stack while the lower record drops to the turntable.



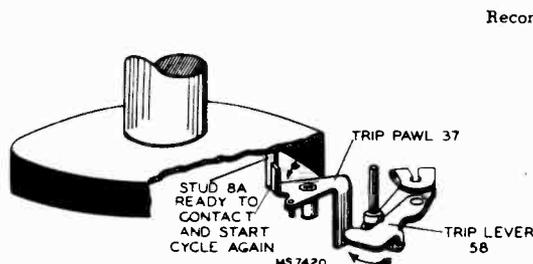
Tone arm moves in for landing

1. As the locator lever (41) continues to move toward the out of cycle position the end of the locator lever (41E) retains contact with the stud (58A) on the trip lever (58). This contact stabilizes the inward movement of the tone arm which is being pushed in by the tone arm return lever (50).
2. The inward movement of the tone arm is stopped directly above the landing position due to the stud (50B) on tone arm return lever coming in contact with the eccentric stud (45C).



Tone arm lowers sapphire to the record

1. The stud (41A) on director lever (41) continues to contact tone arm elevating lever (35) and lowers the sapphire on the start of the record.
2. As the turntable completes on revolution the stud (41B) on director lever is pulled through the slot in the cycling cam by the force produced by tension spring (42).
3. While the stud (41B) on director lever slides through the slot in the cam and assumes the out of cycle position, the end of the director lever (41D) contacts projection (50C) and unlatches the tone arm return lever (50).
4. The end (41C) of the director lever below the motor board moves away from the star wheel and opens muting switch.



Record plays

1. After the selection has been completed the sapphire moves into the tripping groove. At this time the trip lever (58) pushes the trip pawl (37) into position for engagement with the stud (8A) on the under side of the turntable.
2. This contact between stud (8A) and the trip pawl (37) starts another change cycle and the next record is moved into position for playing.

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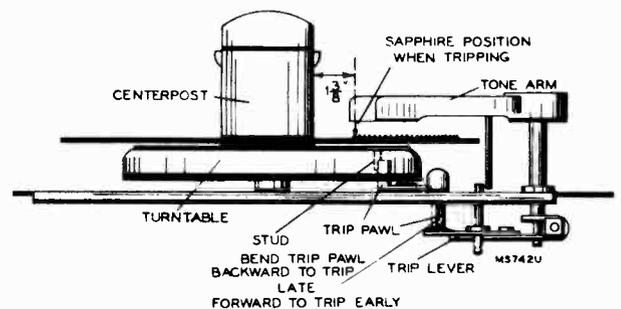
MODEL RP-168,  
Series

REPLACEMENT PARTS

STOCK No.	ILL. No.	DESCRIPTION	STOCK No.	ILL. No.	DESCRIPTION
<b>MODEL RP-168</b>					
*74090	1	Nose—Spindle nose	*74088	63	Switch—Muting switch
*74091	2	Spring—Spindle nose spring (formed)	33726	65	Washer—"C" washer for trip pawl lever
	3	Screw—No. 6-32 round head machine screw for spindle nose spring	*74245	66	Lever—Trip pawl lever
*74095	4	Spring—Separator shelf return spring (.180" O.D. x 1-1/16"—10 turns)	*74100	67	Spring—Trip pawl take-up spring (.195" O.D. x 5/8"—20 1/2 turns)
*74096	5	Separator—Separator knife, shelf and gear assembly	*74102	69	Washer—Dampening washer for idler wheel (bottom)
*74096	6	Separator—Separator knife, shelf and gear assembly	70		Lockwasher—No. 4 lockwasher for idler wheel mounting stud
*74092	7	Gear—Star wheel shaft and gear assembly	71		Nut—No. 4-40 hex nut for idler wheel mounting stud
*74042	8	Turntable—Turntable and shaft complete with mat	*74071	73	Motor—105/125 volts, 60 cycles
*74094	8A	Mat—Turntable mat	<b>MODEL RP-168A-1</b>		
*74080	17	Washer—Washer for turntable assembly	NOTE: Parts listed for mechanism RP-168 plus the following are those parts for the above Record Changer. (For Pickup and Arm Assembly RMP-129-1, see separate listing.)		
72349	18	Bearing—Turntable thrust bearing	*74256	16	Washer—Vellutex washer
72688	20	Washer—"C" washer for turntable assembly	*74099	58	Lever—Trip lever (includes spring No. 59)
	21	Screw—No. 6-32 x 1 3/4" fillister head machine screw for turntable assembly (2 required)	74060	59	Spring—Trip lever spring (.171" O.D. x .695"—43 turns)
*74079	22	Stud—Idler wheel mounting stud	73549		Emblem—"RCA-Victor" emblem
*74078	23	Washer—Dampening washer for idler wheel (top)	*74210		Knob—Reject control knob
*74077	24	Wheel—Idler wheel	*74211		Lever—Reject lever actuating lever
*74132		Hardware—Motor mounting hardware consisting of Three (3) hex nuts	*74184		Motorboard—Motorboard complete with welded brackets and stud—less rest and operating parts
	25	Three (3) lockwashers	*74212		Nut—Speed nut for reject control knob
	26	Six (6) flat washers	*74185		Rest—Pickup arm rest
	27-72	Three (3) spacers	33726		Washer—"C" washer for mounting reject lever actuating lever
*74087	29	Grommet—Rubber grommet to mount motor (3 required)	<b>MODEL RMP-129-1</b>		
*74089	30	Spring—Idler wheel spring (.195" O.D. x .593"—14 turns)	Pickup and Arm Assembly (Used with 9EY3, 9JY and RP-168A)		
*74231	33	Cam—Follower cam	*74041	9	Arm—Pickup arm shell and stud less crystal, cable and rear pivot arm
35969	34	Washer—"C" washer for tone arm lift lever	*74061	9B	Pivot—Tone arm pivot
*74073	35	Lever—Tone arm lift lever	*74067	10	Crystal—Crystal cartridge complete including sapphire and guard
33726	36	Washer—"C" washer for trip pawl	*74065	10A	Screw—No. 2-56 x 3/16" fillister head screw to mount crystal (2 required) or needle guard (2 required)
*74072	37	Pawl—Trip pawl	*74069	10B	Guard—Needle guard
35969	38	Washer—"C" washer for director lever	*74068	10C	Sapphire—Sapphire and holder
*74076	41	Lever—Director lever	*74230	10D	Washer—Washer and nut to mount sapphire and holder
*74084	42	Spring—Director lever spring (.195" O.D. x .732"—23 3/4 turns)	74065	11	Screw—No. 2-56 x 3/16" fillister head screw to mount crystal (2 required) or needle guard (2 required)
	43	Screw—No. 6-32 screw to mount muting switch	*74062	12	Screw—No. 8-32 x 13/32" cone point pivot adjusting screw
	44	Lockwasher—No. 6 lockwasher (external) to mount muting switch	38458	13	Nut—Speed nut to hold pickup cable
*74070	45	Base—Sub-base assembly complete with all staked and riveted parts including idler lever and reject lever	74410	14	Screw—No. 4-40 x 3/16" fillister head set screw to lock pivot screw 74062
*74082	45E	Washer—Felt washer (1/2" O.D. x 1/4" I.D. x 3/16" thick)	*74066	15	Cable—Twisted pickup cable (12") complete with connectors
*74086	46	Spring—Reject lever spring (.203" O.D. x 13/16"—34 3/4 turns)	*74060	39	Spring—Pivot arm spring (.171" O.D. x .695"—43 turns)
*74074	50	Lever—Return lever (includes spring No. 61)	*74059	40	Arm—Pivot arm and shaft
*74085	51	Spring—Return lever actuating spring (.195" O.D. x 29/32"—37 1/2 turns)			
*74075	52	Spring—Return lever latch spring (.180" O.D. x .535"—21 1/2 turns)			
35969	53	Washer—"C" washer for tone arm return lever			
33726	60	Washer—"C" washer for star wheel shaft			
*74083	61	Screw—No. 6-32 x .291" cone point set screw for star wheel (2 required)			
*74081	62	Wheel—Star wheel			

TRIPPING ADJUSTMENT

The tripping should occur after the sapphire leaves the last playing groove. This point of tripping should be when the sapphire is 1 3/8 inches from the side of the centerpost. Bend end of trip pawl as required.



### TIMING OF SEPARATOR KNIVES

1. Make certain the two embedded gears (5 and 6) are meshed with gear (7A) on the upper end of the star wheel shaft so the action of the separator knives are synchronized.
2. Loosen the two set screws (61) sufficiently to permit the star wheel to rotate without disturbing the shaft (7).
3. Position the separator knives as indicated in figure (3).
4. Push reject lever and rotate the turntable slowly by hand until the end (41C) of the director lever moves in far enough, so when the star wheel is rotated it contacts by the amount as indicated in figure (2).
5. Tighten the two set screws (61) and rotate the mechanism through a complete cycle. The separator knives must rotate 360° and return to the starting position as indicated in figure (3).

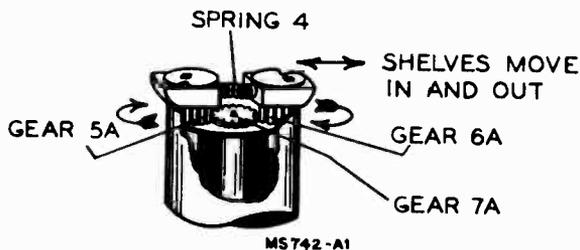


Fig. 3

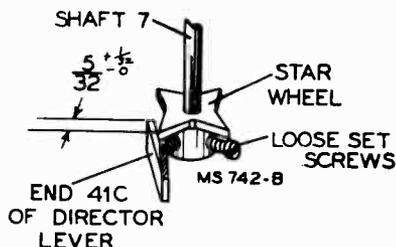


Fig. 2

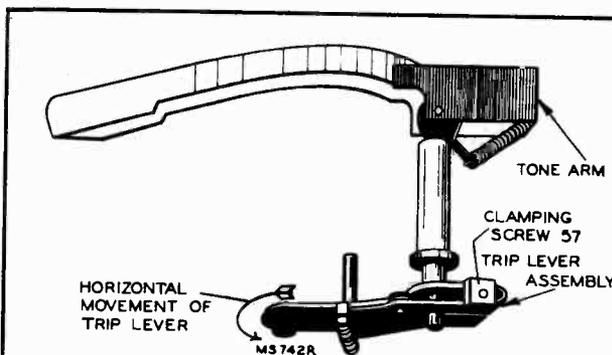


Fig. 4

### PICKUP LANDING ADJUSTMENT

1. Assemble the tone arm and trip lever assemblies as shown in figure (4). Leave the clamping screw (57) loose enough to permit horizontal movement of the trip lever on the shaft. (Allow approx. .010 inch vertical end play.)
2. Turn the eccentric landing adjustment stud (45C) to determine the inward and outward limit of adjustment, then turn it to a setting half way between the limits. Fig. 6. (Screwdriver slot approx. 30° from parallel with front edge of subpanel, in a counter-clockwise direction.)
3. Place a record on the turntable, push the reject lever and slowly rotate the turntable until the sapphire is just ready to set on the start of the record.
4. Hold the trip lever and move the tone arm by hand until sapphire is in position halfway between the music grooves and the edge of the record.
5. Tighten clamp screw (57), apply power and run the mechanism through cycle. (Note the sapphire landing position.)
6. The exact landing position of the sapphire can be adjusted by turning the eccentric landing adjustment screw (45C). (Do not attempt to correct a landing error of more than ± 1/32", with the eccentric screw driver adjustment stud.)

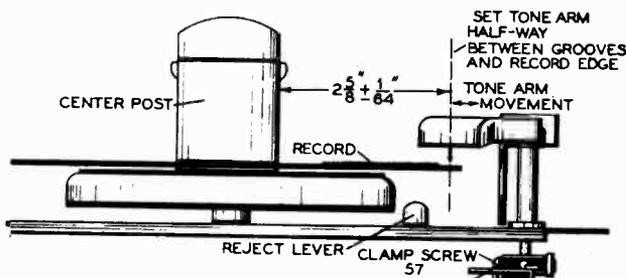


Fig. 5



Fig. 6

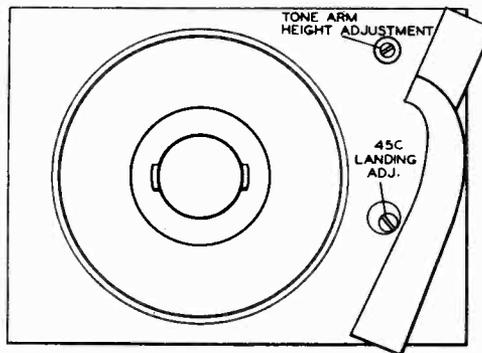


Fig. 7

Sapphire landing position should be  $(2\frac{5}{8}) \pm \frac{1}{64}$ " from the side of the center post as shown in figure (5).

### OUT OF CYCLE HEIGHT OF TONE ARM

Bend tone arm lug so the sapphire point is approximately  $\frac{1}{16}$ " above the motor board as shown in the sketch.

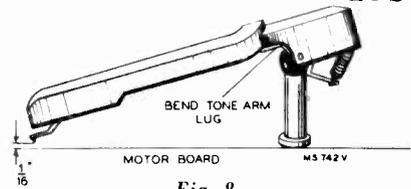


Fig. 8

### TONE ARM IN CYCLE HEIGHT ADJUSTMENT

Set the mechanism in cycle. Turn the turntable by hand, until the tone arm has reached its maximum height. By means of a screwdriver turn the height adjustment stud until the distance between the top of the turntable and the sapphire point is  $\frac{3}{4}$ ". Turning the stud clockwise will raise the arm and counter-clockwise will lower the arm.

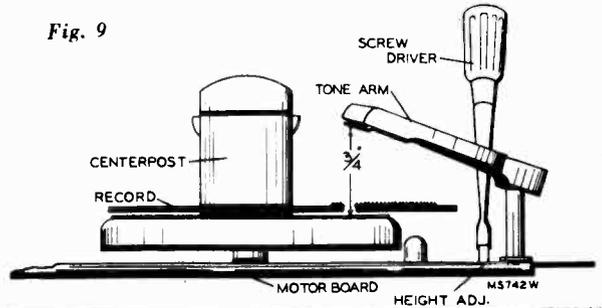
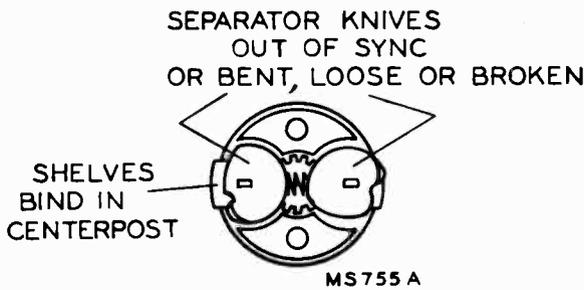


Fig. 9

### IMPROPER RECORD SEPARATION

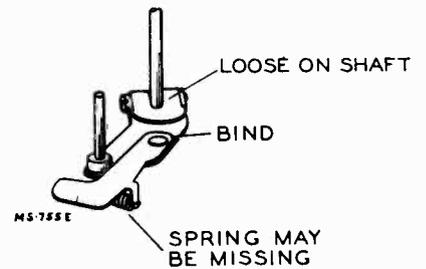
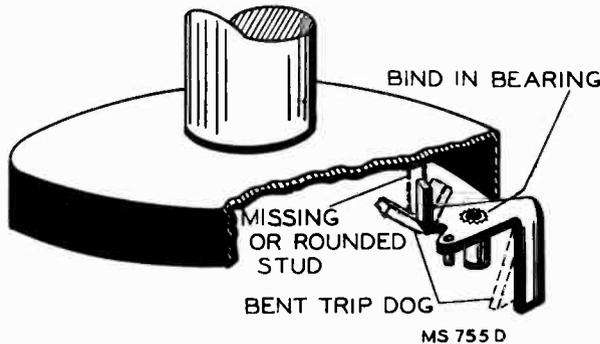


### STAR WHEEL OUT OF SYNC

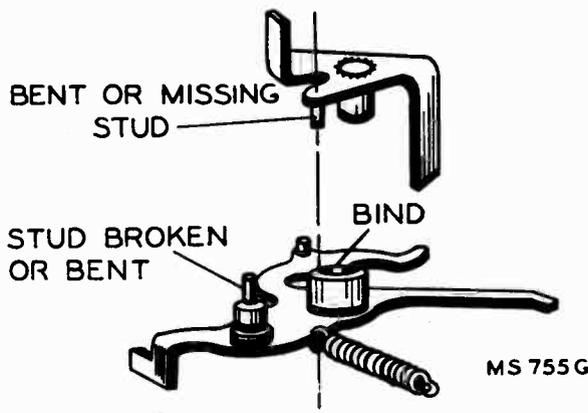


To insure proper dropping of records and avoid tilting of stack. It is important that the separator shelves move in and out freely. It is therefore essential that the shelves be free from burrs, grease, grit or dirt in general.

### FAILS TO TRIP

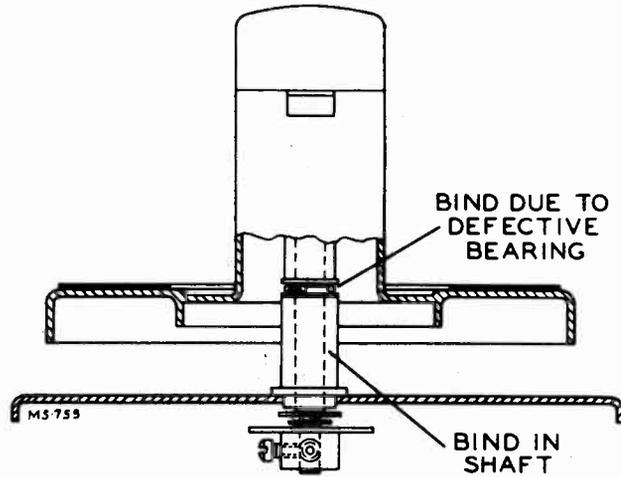
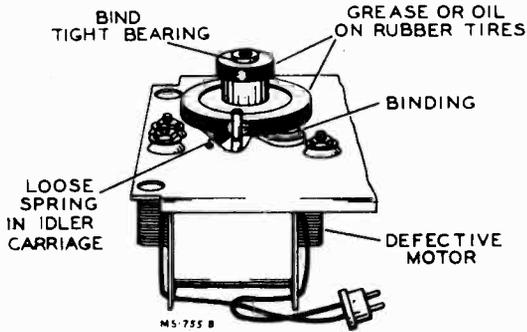


### FAILS TO GO INTO CYCLE

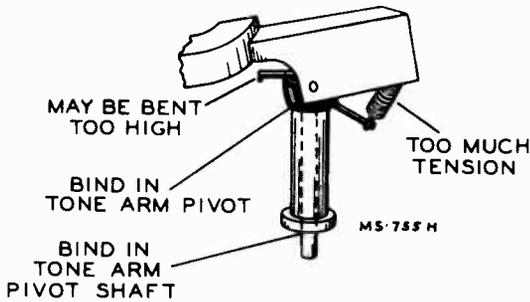


MODEL RP-168,  
Series

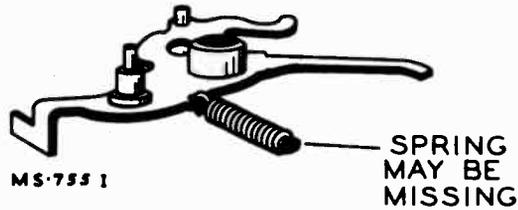
**WOW (Speed Variation)**



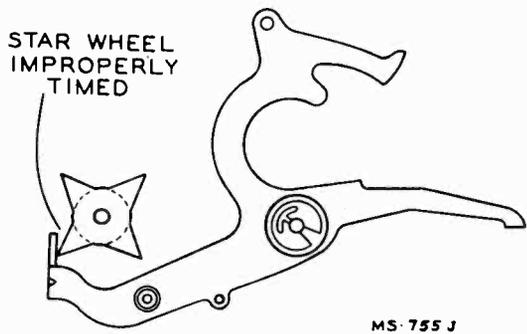
**REPEATS GROOVES**



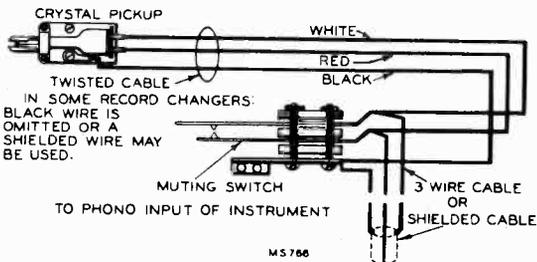
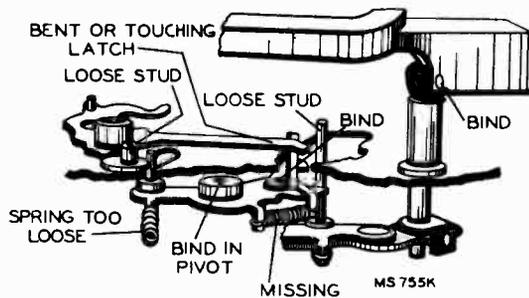
**CONTINUOUS TRIPPING**



**RECORD DROP ON OR HIT TONE ARM**



**ERRATIC PICKUP LANDING**



- A BENT SAPPHIRE SUPPORT
  - CHIPPED SAPPHIRE
  - SAPPHIRE TOUCHING TONE GUARD
  - LINT OR FOREIGN MATERIAL IN GUARD
  - A CHIPPED SAPPHIRE MAY CAUSE SKIPPING OF GROOVES
  - A CHIPPED SAPPHIRE MAY CAUSE FAILURE TO TRIP
- MS-767

Fig. 10

RADIO CORP. OF AMERICA

MODEL 9EY3,  
CHASSIS RS-132



Specifications

Tube Complement

- 1. RCA 12AV6 ..... Amplifier
- 2. RCA 50C5 ..... Output
- 3. RCA 35W4 ..... Rectifier

Loudspeaker (92577-6W)

Size and type ..... 4 in. P.M.  
Voice coil impedance ..... 3.2 ohms at 400 cycles

Dimensions (overall)

Height, 7 $\frac{5}{8}$ "      Width, 9 $\frac{1}{16}$ "      Depth, 9 $\frac{3}{8}$ "

Power Supply Rating

115 volts, 60 cycles A.C. .... 45 watts

Power Output

Undistorted ..... 1.0 watt      Maximum ..... 1.25 watts

Record Changer (RP-168-1)

Turntable speed ..... 45 r.p.m.  
Records used ..... Long playing—7 in.  
Record capacity ..... 8 records  
Pickup ..... Crystal (medium output)

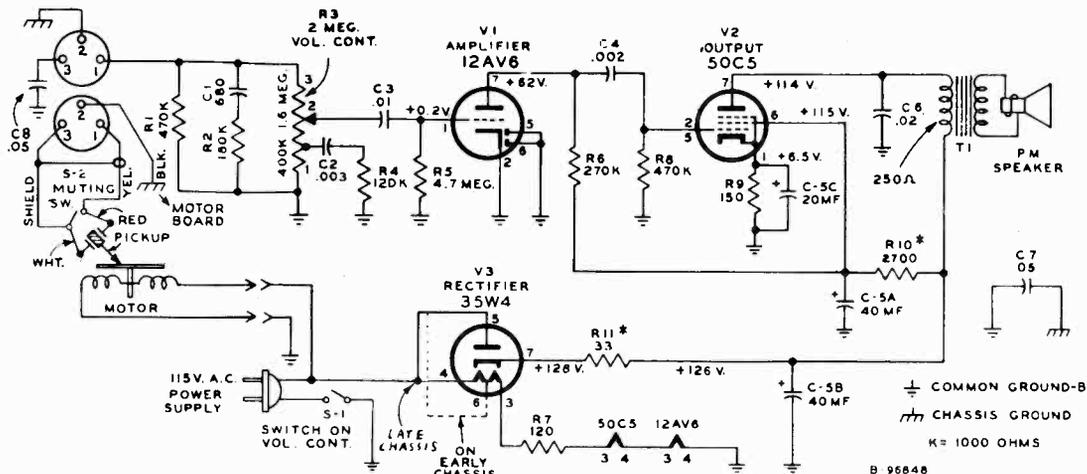
REPLACEMENT PARTS

STOCK No.	DESCRIPTION	STOCK No.	DESCRIPTION
	<b>AMPLIFIER ASSEMBLIES</b> RS-132		
39648	Capacitor—Mica, 680 mmf. (C1)	73117	Resistor—Fixed, composition, 4.7 megohms $\pm 20\%$ , $\frac{1}{2}$ watt (R5)
72839	Capacitor—Moulded paper, .002 mfd., 400 volts (C4)	36422	Socket—Tube socket
73961	Capacitor—Tubular, .003 mfd., 200 volts (C2)	72535	Socket—3 contact socket for phono input cable
71923	Capacitor—Tubular, .01 mfd., 200 volts (C3)		Transformer—Output transformer (T1)
56871	Capacitor—Moulded paper, .02 mfd., 400 volts (C6)		<b>SPEAKER ASSEMBLIES</b> 92577-6W—RL 108B4
71702	Capacitor—Moulded paper, .05 mfd., 400 volts (C7, C8)	*74165	Speaker—4" P.M. speaker complete with cone and voice coil
72281	Capacitor—Electrolytic, comprising 1 section of 80 mfd., 150 volts; 1 section of 40 mfd., 150 volts; and 1 section of 20 mfd., 25 volts (C5A, C5B, C5C)		<b>MISCELLANEOUS</b>
*74133	Control—Volume control and power switch (R3, S1)	*74135	Baffle—Speaker baffle
28451	Cover—Insulating cover for electrolytic capacitor	*74134	Bottom—Cabinet bottom cover
*73693	Grommet—Strain relief grommet (1 set) for power cord	*74137	Bracket—Mounting bracket for reject button and shaft
70391	Insulator—Phono input socket insulator	*74136	Bracket—Speaker mounting bracket
30868	Plug—2 contact female plug for motor cable	*74138	Button—Reject button and shaft
73237	Resistor—Wire wound, 33 ohms, 150 ma. (R11)	Y2071	Cabinet—Plastic cabinet—maroon—less bottom cover
72314	Resistor—Wire wound, 120 ohms, 5 watts (R7)	*74190	Cable—Shielded pickup cable complete with 3 prong male plug
	Resistor—Fixed, composition, 150 ohms $\pm 10\%$ , $\frac{1}{2}$ watt (R9)	*74193	Clamp—Spring clamp for reject button and shaft
	Resistor—Fixed, composition, 2700 ohms $\pm 10\%$ , $\frac{1}{2}$ watt (R10)	73549	Emblem—"RCA-Victor" emblem
	Resistor—Fixed, composition, 120,000 ohms $\pm 10\%$ , $\frac{1}{2}$ watt (R4)	74087	Grommet—Rubber grommet to mount record changer (3 required)
	Resistor—Fixed, composition, 180,000 ohms $\pm 10\%$ , $\frac{1}{2}$ watt (R2)	73490	Knob—Volume control and power switch knob—maroon
	Resistor—Fixed, composition, 270,000 ohms $\pm 10\%$ , $\frac{1}{2}$ watt (R6)	*74192	Plug—3 prong male plug for pickup cable
	Resistor—Fixed, composition, 470,000 ohms $\pm 20\%$ , $\frac{1}{2}$ watt (R8)	*74191	Spacer—Metal spacer (eyelet) to mount record changer (3 required)
	Resistor—Fixed, composition, 470,000 ohms $\pm 10\%$ , $\frac{1}{2}$ watt (R1)	14270	Spring—Retaining spring for knob
		*74139	Spring—Reject button and shaft return spring (.203" dia. x 1 $\frac{1}{2}$ "—21" turns)
		2917	Washer—"C" washer for reject button and shaft

\* This is the first time that this Stock No. has appeared in Service Data.

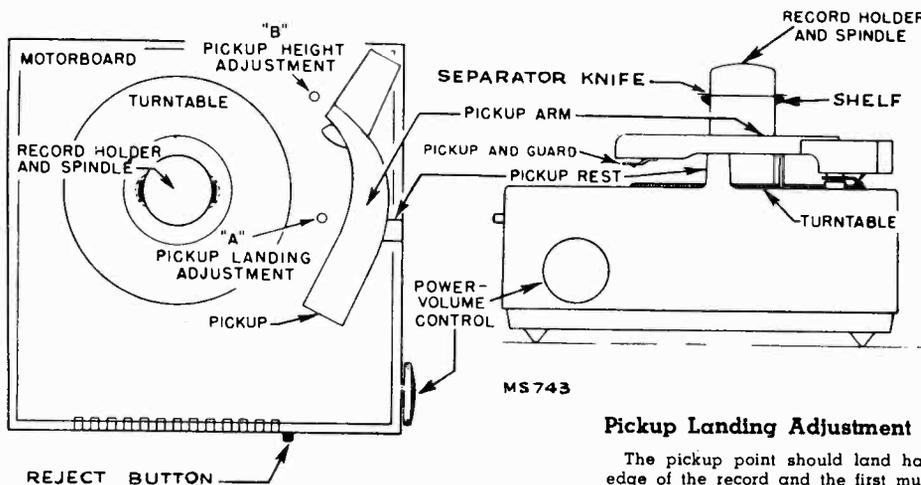
MODEL 9EY3,  
CHASSIS RS-132

RADIO CORP. OF AMERICA



VOLTAGES MEASURED TO COMMON WIRING WITH "VOLTOHMYST" — SHOULD HOLD WITHIN  $\pm 20\%$   
 \* IN SOME CHASSIS R10 IS 5600 OHMS, R11 IS NOT USED, RECTIFIER CIRCUIT AS SHOWN BY DOTTED LINE.

Schematic Diagram



Top and Side Views

Record Separators

In the out of cycle position the record separator knives or discs are normally concealed inside the center post. During service the position of the star wheel on the underside of the record changer may be accidentally shifted; this may cause the separator knives to be extended when they should be concealed.

If the separator knives are thus extended—turn the power on so that the turntable is revolving, gently press fingers against the extended knives until they disappear inside the center post—DO THIS ONLY WHILE MECHANISM IS OUT OF CYCLE.

Record Changer Mounting

The cabinet is used as the motor board of the record changer. The record changer is attached to the cabinet with three screws, grommets and spacers. THE PICKUP ARM MUST BE REMOVED BEFORE THE RECORD CHANGER CAN BE REMOVED—REFER TO RP-168 SERIES SERVICE DATA.

To Remove Chassis

Remove the four screws at the corners of the bottom cover, separate the motor power plug and socket and remove the pickup cable from its socket on the amplifier chassis.

Elongated holes permit the speaker position to be adjusted. If the speaker should be replaced or its mounting bracket loosened, the speaker mounting bracket screws should not be tightened until after the bottom cover is assembled to the cabinet.

Pickup Landing Adjustment "A"

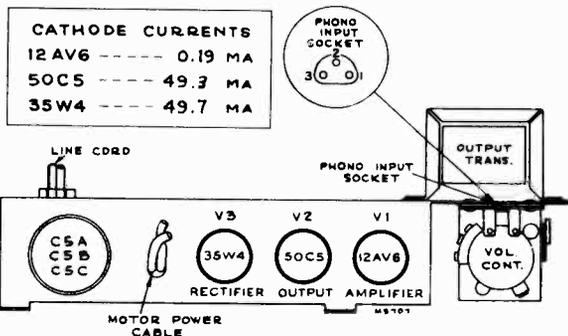
The pickup point should land half-way between the outer edge of the record and the first music groove.

If the pickup lands inside the starting grooves—turn screw "A" slightly clockwise. If pickup lands outside the starting grooves—turn screw "A" slightly counterclockwise.

Pickup Height Adjustment "B"

During cycle the pickup arm must rise high enough to clear a stack of eight records on the turntable, but not high enough to cause the top of the arm to touch records resting on the record supports.

If pickup does not clear a stack of eight records—turn screw "B" slightly clockwise. If pickup arm touches records on record supports—turn screw "B" slightly counterclockwise.



Amplifier Top View

**Specifications**

**Record Changer (RP-168-1)**

Turntable speed ..... 45 r.p.m.  
 Records used ..... Long playing—7 in.  
 Record capacity ..... 8 records  
 Pickup ..... Crystal (medium output)

**Power Supply Rating**

115 volts, 60 cycles A.C. .... 15 watts

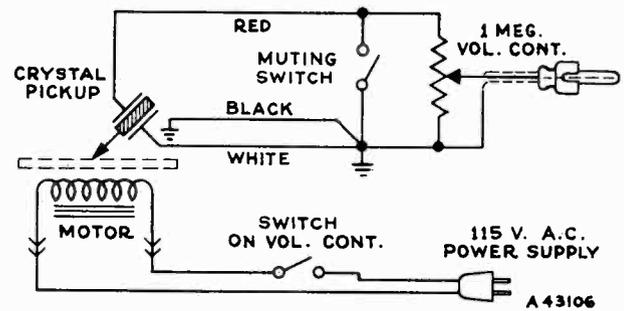
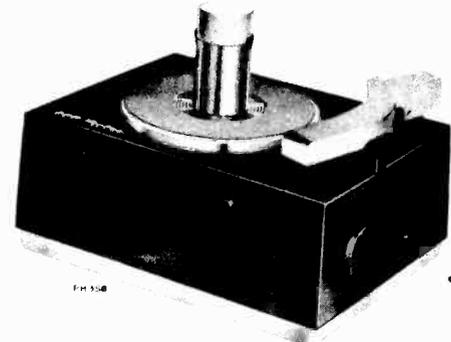
**Dimensions (overall)**

Height 6 3/8"                      Width 9 1/8"                      Depth 6 3/8"

**Record Separator**

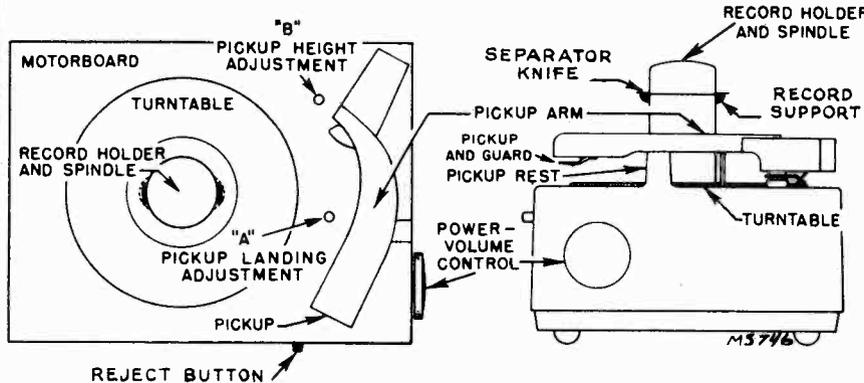
In the out of cycle position the record separator knives or discs are normally concealed inside the center post. During service, the position of the star wheel on the underside of the record changer may be accidentally shifted; this may cause the separator knives to be extended when they should be concealed.

If the separator knives are thus extended—turn the power on so that the turntable is revolving, gently press fingers against the extended knives until they disappear inside the center post—**DO THIS ONLY WHILE MECHANISM IS OUT OF CYCLE.**



In some instruments: Black wire is omitted or a shielded wire is used in place of the red-black-white cable.

*Schematic Diagram*



*Top and Side Views*

**Record Changer Mounting**

The cabinet is used as the motorboard of the record changer. The record changer is attached with three screws and bushings. **THE PICKUP ARM MUST BE REMOVED BEFORE THE RECORD CHANGER CAN BE REMOVED—REFER TO RP-168 SERIES SERVICE DATA.**

**FOR RECORD CHANGER SERVICE INFORMATION—REFER TO RP-168 SERIES SERVICE DATA.**

**Pickup Landing Adjustment "A"**

The pickup point should land half-way between the outer edge of the record and the first music groove.

If the pickup lands inside the starting grooves—turn screw "A" slightly clockwise. If pickup lands outside the starting grooves—turn screw "A" slightly counterclockwise.

**Pickup Height Adjustment "B"**

During cycle the pickup arm must rise high enough to clear a stack of eight records on the turntable, but not high enough to cause the top of the arm to touch records resting on the record supports.

If pickup does not clear a stack of eight records—turn screw "B" slightly clockwise. If pickup arm touches records on record supports—turn screw "B" slightly counterclockwise.

**REPLACEMENT PARTS**

STOCK No.	DESCRIPTION
*74097	Bottom—Cabinet bottom cover
*74189	Bushing—Shoulder bushing to mount record changer in cabinet (3 required)
*74098	Button—Reject button
Y2062	Cabinet—Moulded cabinet less bottom cover
39386	Cable—Shielded pickup cable complete with pin plug
*74101	Control—Volume control and power switch
73549	Emblem—"RCA-Victor" emblem
31051	Foot—Rubber foot (4 required)
*73490	Knob—Volume control and power switch knob—maroon
14270	Spring—Retaining spring for knob

\* This is the first time that this Stock No. has appeared in Service Data.

Connecting Record Changer Attachment to Radio Receivers

RCA Radios with Phono Jack

Plug male connector on the end of the "Phono" lead into the female connector on the receiver chassis. If set is provided with a phono switch, push or turn the "Phono" switch to "Phono" position, and operate the Record Changer Attachment according to instructions. If no switch is provided, use maximum setting of volume control on attachment, and minimum setting of radio volume control which will give acceptable volume, and tune receiver off frequency from any very strong station. In some instances the radio volume control will have the effect of a tone control.

RCA Type No. 202W1 Record Player Selector

This selector switch may be used for combined operation of two record players through one phono input jack. A choice of two types of input jacks and output cable plugs are provided.

Radio-Phonograph Combinations

Most radio-phonograph combinations use resistors and/or capacitors for tone compensation in the phono input circuit.

Where unsatisfactory reproduction is obtained with Model 9JY connected into the phono jack of such instruments, we suggest that Model 9JY be connected as indicated for radios which do not have a phono jack.

Radios Without Phono Jack

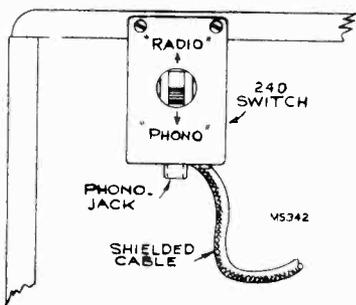
Methods of connecting the Record Changer Attachment to various types of audio systems are given in the accompanying text and illustrations. The data given requires that an RCA Type No. 240X1 (Formerly Stock No. 240) Radio-Phono switch be used for switching from radio to phonograph, as desired. For ease in connecting the "phono" lead to the switch, the male plug on the end of the lead matches the phono jack on the switch.

In general, the Record Changer Attachment must be used with radio receivers having at least two stages of high-gain audio amplification. The output of the Record Changer Attachment should be connected to the input of the first audio tube, and at the same time the output of the radio receiver portion of the chassis should be shorted or opened, to prevent radio signals being heard while the Record Changer Attachment is in operation.

Installation of Switch

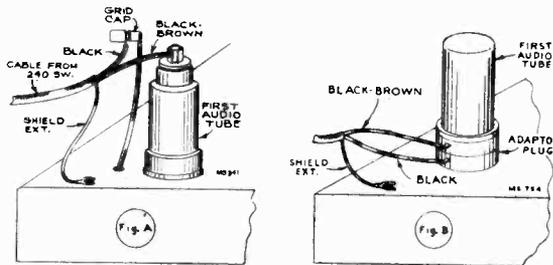
Fasten the bracket to the cabinet in such a position that the switch may be easily reached. For wooden cabinets, a suggested place is the upper rear edge of the cabinet. If the radio has a plastic cabinet, the bracket may be fastened to the chassis by self-tapping screws or soldering. In the case of a.c.-d.c. sets, the bracket should not be fastened to the chassis. In such cases, a wooden block may be fastened to the chassis and the bracket screwed to the wooden block, care being exercised that there is no metallic path from the bracket to the chassis.

Connect the braided shield extension to the radio chassis by either soldering or placing the spade lug under a mounting screw.



On a.c.-d.c. sets it is necessary to isolate the cable shield from the chassis. This is best done by connecting the shield to the chassis through a .25 mfd 300-volt condenser. Care should be taken that the shield braiding and switch bracket do not come in contact with the chassis.

If the common-negative wiring in the a.c.-d.c. set is isolated from the set chassis, connect the cable shield, through a .25 mfd. capacitor, to the common-negative wiring, and not to the chassis.

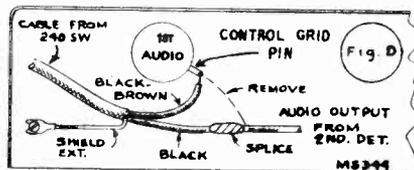
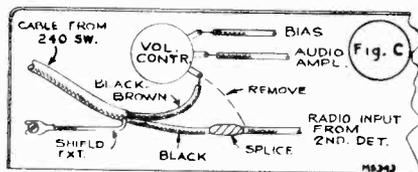


For radio receivers in which the 1st-audio tube has a top grid cap—see Fig. A:

1. Disconnect the grid lead from the first audio tube.
2. Connect the cap on the black lead to the clip on the grid lead, as shown above.
3. Connect the clip on the black-brown lead to the grid cap at the top of the first audio tube, bending the terminal if necessary to proper size for a metal tube cap.
4. Insert the plug on the end of the record player lead into the jack on the bracket.
5. Secure or position the connection cable assembly so that the cap and clip terminals are well separated from each other and other metal parts.

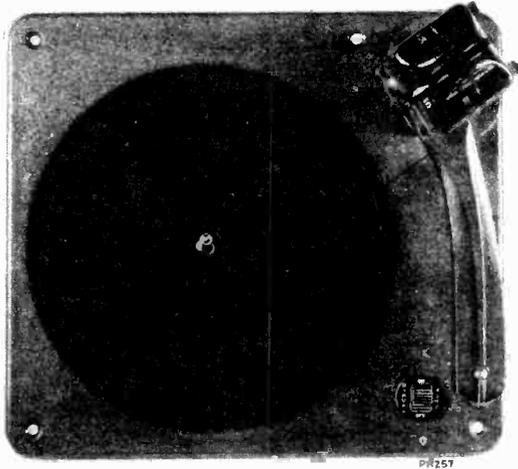
For radio receivers in which the 1st-audio tube is type 6SQ7, 6SR7, 12SQ7 or 12SR7—see Fig. B:

1. Use adaptor plug RCA Stock No. 37798.
2. Remove the 1st audio tube.
3. Solder the switch leads to the adaptor plug terminals—black to bottom lug—black-brown to top lug.
4. Tape terminals to prevent short circuits when installed in set.
5. Insert the adaptor into the 1st audio tube socket.
6. Insert the 1st audio tube into the adaptor.
7. Insert the plug on the end of the record player lead into the jack on the bracket.



For other radio receivers in which the 1st-audio tube does not have a grid cap: connection to volume control input—see Fig. C. connection to 1st-audio tube control grid—see Fig. D:

1. Unsolder the lead from the volume control lug indicated in Fig. C or from the control grid pin indicated in Fig. D. It is usually necessary to remove the chassis from the cabinet to do this.
2. Solder the black-brown lead (remove clip) to the lug or pin disconnected in Step 1.
3. Solder the black lead (remove plug) to the lead disconnected in Step 1. Tape the joint to prevent short circuits.
4. Insert the plug on the end of the record player lead into the jack on the bracket.



### Manual Operation

1. Rotate the record separator shelf clockwise for 10-inch or counterclockwise for 12-inch position (numerals 10 or 12 pointing towards center post).
2. Place the record to be played on the turntable and turn the power switch on.
3. Move the control knob to manual and to the on position.
4. Press down firmly but momentarily on the end of the tone arm and let go. The pickup will land automatically on the start of the record. When the selection is completed the pickup will ride the eccentric groove until the pickup is placed on the rest manually.
5. Turn power switch off manually.
6. Remove the record by raising straight up without tilting.

### Automatic Operation

1. With the power switch in the off position rotate the record support shelf as required for 10- or 12-inch records until the record size indicated on the support cover is pointing toward the center post. (Rotate clockwise for 10-inch and counterclockwise for 12-inch records).
2. Place the records to be played in a stack with desired selections upward and in proper sequence with the last record on top. Load them on the changer by placing them over the center post and resting on the record support shelf. Place record stabilizing clip on top of the record stack.
3. Push the control knob to automatic and to the on position.
4. Press down firmly but momentarily on the end of the tone arm and let go. The changer will continue to play one side of each record of the entire stack automatically.  
The tone arm can be moved to the rest position any time the mechanism is not in cycle.
5. Turn the power switch off and remove the stack from the turntable by placing fingers of both hands directly opposite and under the stack. Then lift straight up—"don't tilt" or squeeze stack. Turning the support shelf one-fourth turn facilitates removal of records.

### Cautions

1. Avoid handling the tone arm or rotating record support assembly while mechanism is in cycle.
2. Never turn the power switch off, leaving the mechanism in cycle for an extended period of time.
3. Do not allow the records to remain on supports when not in use.
4. Do not allow oil or grease to come in contact with any rubber parts.
5. Do not install instrument near source of heat. Excessive heat may damage the pickup cartridge.

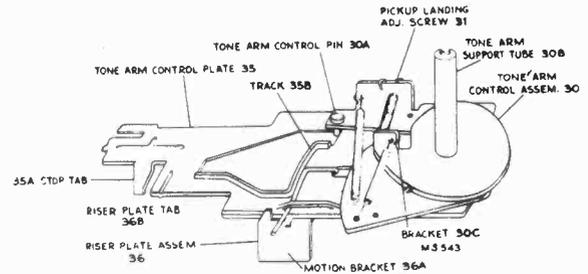


FIG. 2

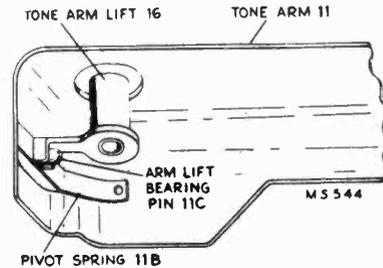


FIG. 3

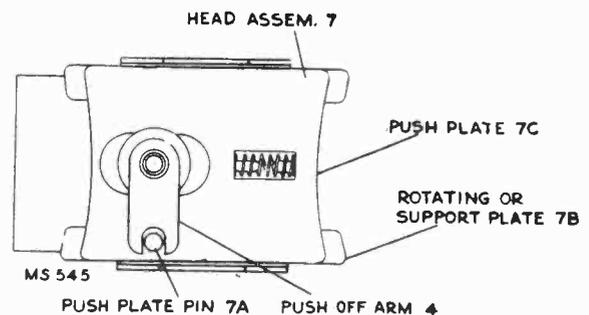


FIG. 4

### FUNCTIONS OF PRINCIPAL PARTS

#### Head Assembly—7, 7A, 7B, 7C

Supports outer edge of record stack and pushes the record off notch in center post and allows it to drop to the turntable while the mechanism is going through cycle.

#### Center Post—53

Supports the entire stack of records, and together with the offset notch and latch in the center post, provides a means for separating records.

#### Tone Arm Lift Assembly—16

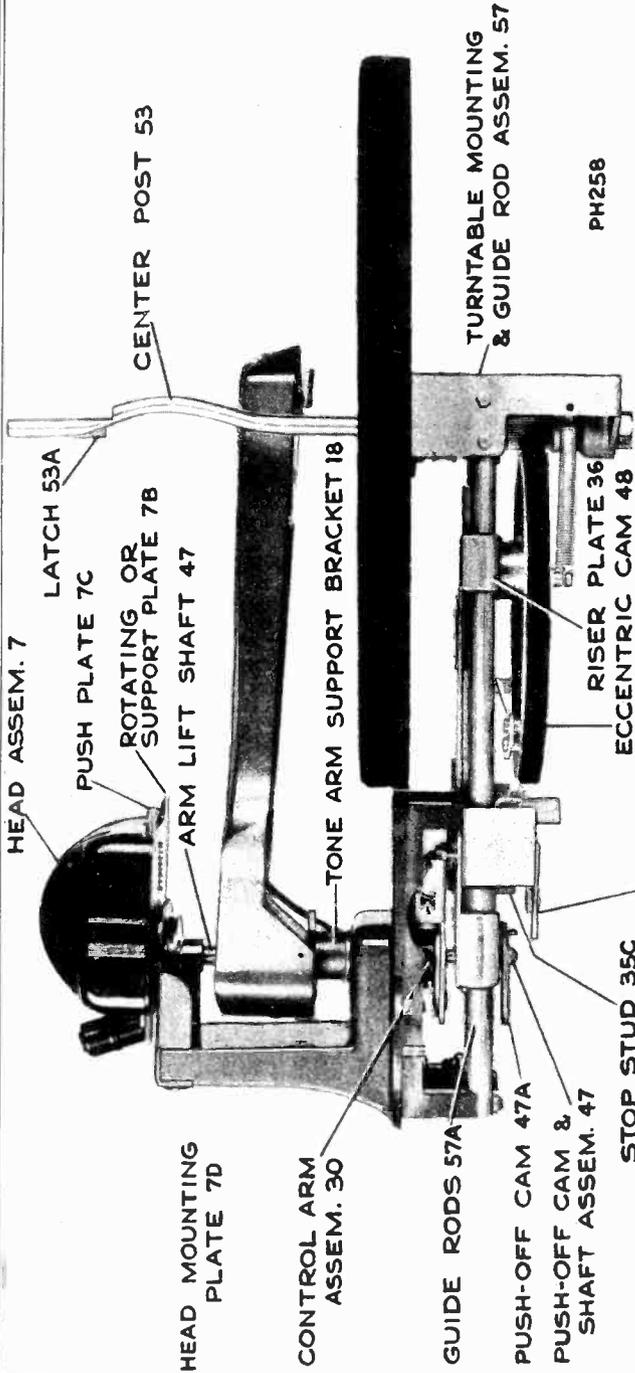
Couples tone arm to riser plate 36 through arm lift shaft 47, thereby transferring the action for the vertical motion of the tone arm during change cycle.

#### Arm Control Assembly—30

Provides a tie between tube 30B, bracket 30C and tone arm support bracket 18, thereby directing the horizontal movement of the tone arm during change cycle. Arm control pin 30A slides along track in arm control plate 35, and in so doing, determines the point of landing of the pickup and the point of trip of the mechanism. It also incorporates landing adjusting screw 31.

#### Arm Control Plate Assembly 35, 35A, 35B, 35C

Incorporates a track 35B which controls the pickup landing and the tripping of the mechanism. Stop tab 35A functions as portion of the tripping device, stud 35C, contacting push-off cam 47A controls the point of landing for both 10- and 12-inch records.



**MANUAL LOCKOUT**

**Riser Plate Assembly—36, 36A, 36B, 36C** LEVER 59  
Provides mounting for eccentric cam 48, and incorporates an inclined track 36C, which controls the vertical movement of the tone arm.  
**Riser plate tab 36B** pushes against curved portion of cam on arm control assembly 30, providing a control for the horizontal movement of tone arm during change cycle.  
**Riser plate bracket 36A** contacting push-off cam 47A provides the necessary motion for push plate 7C.

**Eccentric Cam—48**  
Transfers motion from turntable to riser plate 36 while cycling.

**Push-Off Cam and Shaft Assembly—47, 47A**  
Provides a means of mechanically coupling tone arm lift 16 and push plate 7 assemblies to main cycling mechanism.  
**Cam 47A** contacting stud 35C controls the position of arm control plate while in cycle, which determines the landing point of the pickup on 10- or 12-inch records.

**Turntable Mounting and Guide Rod Assembly—57, 57A**  
Incorporates the main bearings for the turntable and provides a mounting for guide rods 57A.

**Manual Lockout Lever—59**  
Consists of a small lever which forms a stop for stud 35C. This prevents arm control plate 35 from moving forward and disengaging stop catch 45 when the mechanism is operated in the manual position.

**ADJUSTMENTS**

**Tone Arm Adjustment**

The tone arm height should be so adjusted as to permit the sapphire to engage and ride in the grooves of one record placed on the turntable, but at the same time prevent the tone arm from touching the records on the supports while the mechanism is going through cycle, fig. 5.

1. With the mechanism out of cycle, lift tone arm and check, and make certain tone arm lift 16 engages pin 11C as shown in fig. 6.
2. With the pickup near the edge of the record, loosen the set screw, holding collar 47, fig. 9, and moving it up or down on shaft 47, so as to have the conditions indicated in sketch, fig. 5.

**Preliminary Landing Adjustments**

An accessible landing adjustment screw 31 is provided, but if for any reason the tone arm support bracket has become loose or removed, proceed as follows:

1. With the mechanism out of cycle turn adjustment screw 31, fig. 8, clockwise as far as it will go, then turn counterclockwise two or three full turns.
2. Set head assembly for 12-inch position; place a 12-inch record on turntable.
3. Press down on the reject button and rotate the turntable by hand, causing the mechanism to cycle until the pickup is about to land on the record. In this position, the arm control pin 30A is in a position on track 35B as indicated by "s" and adjustment screw 31 remains against bracket 30C as indicated in fig. 8.

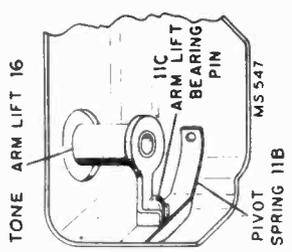


FIG. 6

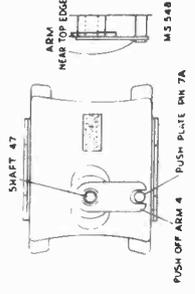


FIG. 7

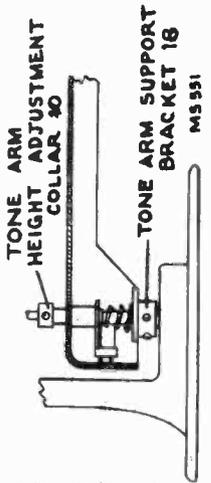


FIG. 9

RADIO CORP. OF AMERICA

MODEL 960276

Replacement Parts

STOCK No.	ILL. No.	DESCRIPTION	STOCK No.	ILL. No.	DESCRIPTION
*73337	1	Cover—	*73347	36	Riser—Riser plate including Motion bracket
71232	2	Pad—Hold down pad and arm	36A	36A	Motion bracket
72458	3	Spring—Hold down spring	36B	36B	Riser plate tab
37458	4	Arm—Push off arm	36C	36C	Inclined track
*73339	5	Screw—#6-32 x 3/8" set screw	71191	37	Spring—Recoil spring
*73340	6	Plate—Hold down plate	*73353	38	Lever—Reject lever
*73341	6A	Spring—Hairpin spring	71228	39	Spring—Reject lever spring
*73342	7	Head—Head assembly including Push pin	*73354	40	Screw—self tapping screws for mounting item 39
	7A	Rotating plate	71228	41	Terminal—Terminal strip
	7B	Push plate	*73355	42	Terminal—Terminal strip
	7C	Spring—Push plate spring	71177	44	Spring—Reject catch
71209	8	Screw—#6-32 x 3/16" Bristo head set screw	*73352	45	Spring—Reject catch support spring
71201	9	Collar—Lift adjusting collar	72486	46	Cam—Push off cam, including Shaft (part of 47)
72461	10	Arm—Pickup arm shell complete with Arm mounting rivets	72478	47	Cam—Eccentric cam and tire
*73342	11	Pivot mounting spring	72479	48	Tire—Rubber tire for eccentric cam
	11A	Lift stud	71198	48A	Spring—Eccentric cam spring
	11B	Plastic button	72480	49	Washer—Washer used to mount eccentric cam (#8 washer approx. 9/16" O.D.)
	11C	Button—Plastic button for pickup arm	*73355	50	Washer—Lock washer (#8)
73190	11D	Clip—Pickup arm spring clip		51	Screw—Eccentric cam mounting screw (#8 x 32 x 1/4" binder head)
70338	13	Crystal—Crystal cartridge complete with guard and sapphire		52	Centerpost—
72345	13A	Sapphire—Sapphire and holder assembly	71235	53	Turntable—
38462	13B	Guard—Sapphire guard	*73348	54	Washer—One set of cork washers for turntable
70341	13C	Nut—Mounting nut and washer for sapphire	71239	55	Bearing—Turntable thrust bearing (including 2 steel washers)
37763	13D	Screw—#2-56 x 1/8" screw for sapphire guard (2 required)	71238	56	Support—Turntable mounting support including guide rods
70912	14	Screw—#4-40 screw to mount crystal	*73349	57	Screw—#6 x 3/8" fillister head set screw to mount turntable support (4 required)
	15	Cable—Shielded pickup cable complete with pin plug		58	Control—Reject manual control including Arm (Part of 59)
	15A	Plug—Pin plug for shielded cable	71228	60	Spring—Reject arm spring
72462	16	Lift—Pickup arm lift	72926	61	Roller—Turntable shaft knurled roller
72463	17	Spring—Brake spring	71200	62	Screw—#8-32 x 1/2" Bristo head set screw to fasten knurled roller (2 required)
72466	18	Support—Pickup arm support		63	Washer—lock washer for mounting centerpost
	19	Screw—To mount pickup arm support (two required)	71236	64	Nut—Hex nut for centerpost
		one Allen or Bristo #6-32 x 1/8" cone point set screw		65	Screw—#8 R.H. 1/4" screw to mount turntable support
		one Allen or Bristo #6-32 x 3/16" blunt set screw	71183	66	Motor—Motor (117 volt, 60 cycle) complete with drive idler, tension spring, mounting grommets, shaft bushing and mounting bracket—less power cord
*73341	21	Z screw		66A	Wheel—Drive idler wheel for motor stamped 407B9
*73343	22	Base—Operating mechanism mounting base less all removable parts	71413	66B	Pin—Cotter pin (hairpin spring) for drive idler wheel
*73362	22A	Washer—Faston washer to mount mechanism base to motorboard		66C	Spring—Drive idler wheel tension spring for motor stamped 407B9
*73356	23	Knob—Control knob	*71244	66D	Grommets—Motor mounting grommets
72466	24	Washer—Spring washer	*73359	67	Fastener—Snap fastener to mount motor (3 required)
72469	25	Spring—Safety spring	*73360	68	Grommet—Rubber grommet to mount record changer (4 required)
72470	26	Spring—Set down spring	*73361	69	Stud—Record changer mounting stud (4 required)
32119	27	Switch—"On-Off" switch	72472	70	Washer—#10 Flat washer (OD 1/2")
	27A	Cover—Switch cover	*73345	71	Screw—Phillips #10 x 32 x 1/2" flat head counter sunk screw used to connect shock mounts to motor board
*73358	28	Trigger—Manual control trigger (wire)		72	Plug—2 prong male AC plug
71225	29	Washer—Spring washer			
*73344	30	Control—Arm control pin			
	30A	Control—Arm control assembly including Arm control pin			
	30B	Bracket			
	30C	Bracket			
72472	31	Screw—Landing adjustment screw			
*73345	32	Spring—Set down adjustment lock spring			
72474	33	Spring—Cushion spring			
72475	34	Spring—Trip spring			
*73346	35	Control—Arm control plate including Stop tab			
	35A	Control—Arm control plate including Track			
	35B	Control—Arm control plate including Size change stop			
	35C	Control—Arm control plate including Size change stop			

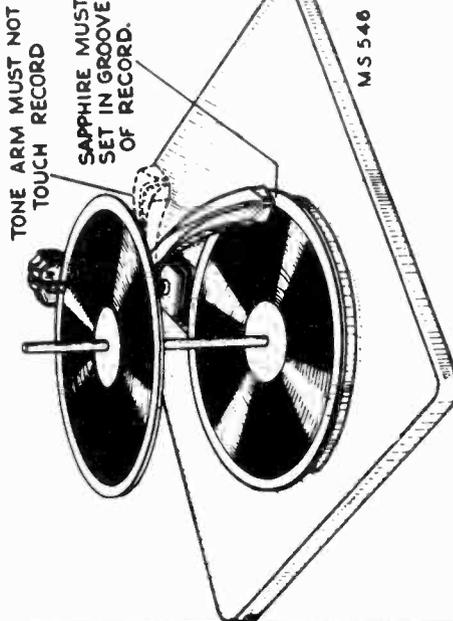
- Loosen the two set screws holding the tone arm support bracket.
- While holding this position, indicated in step 2, place the sapphire in the starting groove of the record and tighten the two set screws in the tone arm support bracket.

**Final Landing Adjustment**

The exact landing adjustment can be made by pressing the reject button and rotating the turntable by hand until the pickup is about to land. Then turn adjustment screw 31, fig. 8, until the sapphire is directly above the starting groove of the record. If the mechanism continues to land incorrectly after this adjustment has been made, compensate the difference by turning the screw 31 slightly. Turning screw counter-clockwise will move the landing towards the center post.

**Positioning Push-Off Arm**

- With the mechanism out of cycle, turn the push-off cam 47A so that its arm makes a 90° angle with the slide bars as shown in fig. 10. Make certain the large radius side of cam is toward the stud 35C when the support post is in the 12-inch position.
- Place push-off arm 4 over push-off cam shaft 47, and engage push-off plate pin 7A near the top edge, fig. 7. Tighten set screws.
- Press down on reject button and rotate the turntable slowly by hand, making certain push plate does not reach its limit before riser plate motion bracket has reached the end of its outward travel. If the push plate should reach its limit, deviate slightly from the 90° angle but make certain that the mechanism operates satisfactorily on both 10" and 12" records.
- Check this for 10- and 12-inch setting.



\* This is the first time this Stock Number has appeared in Service Data.  
 † These parts are not stocked.

FIG. 5

MODEL 960276

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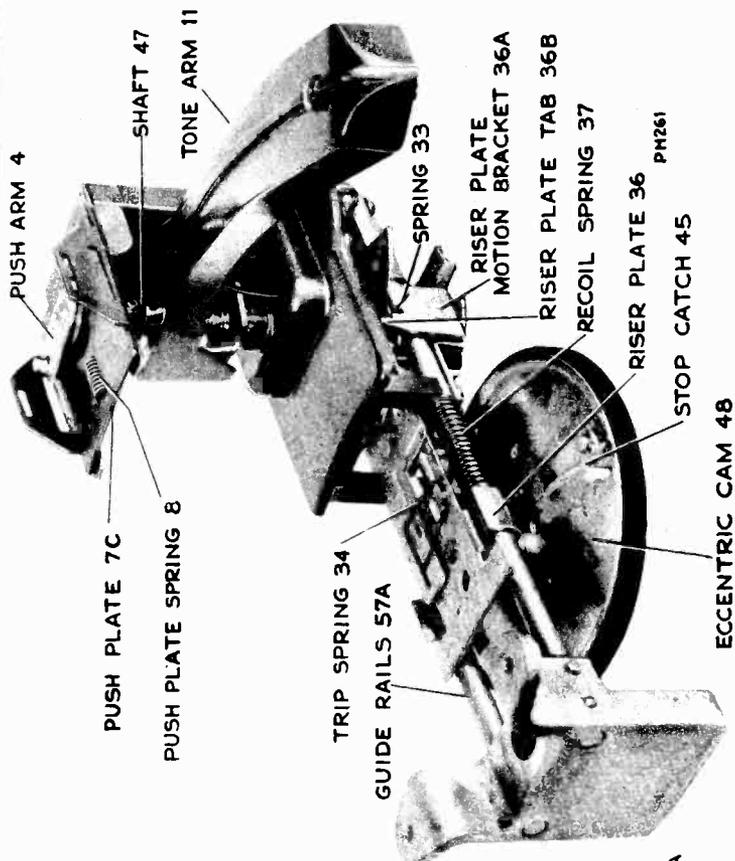


FIG. 12

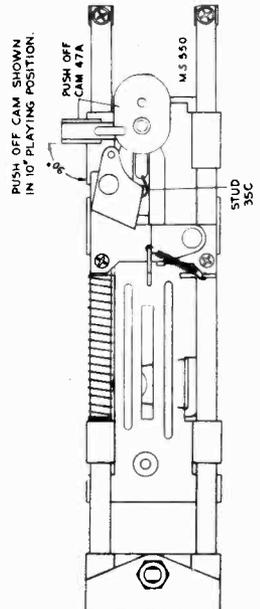


FIG. 10

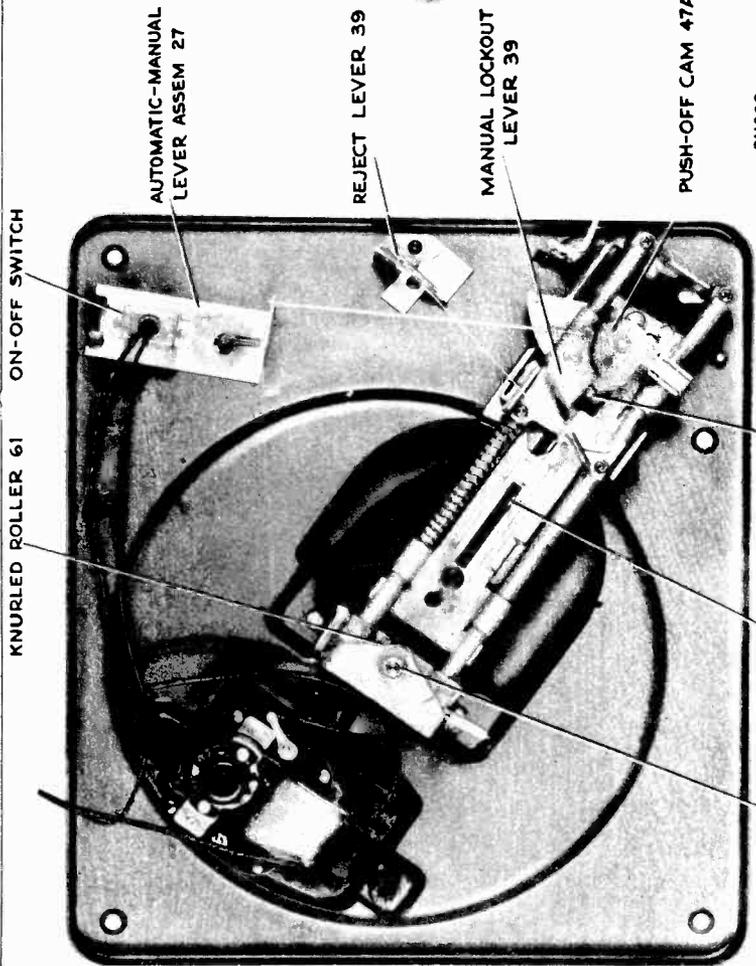


FIG. 11

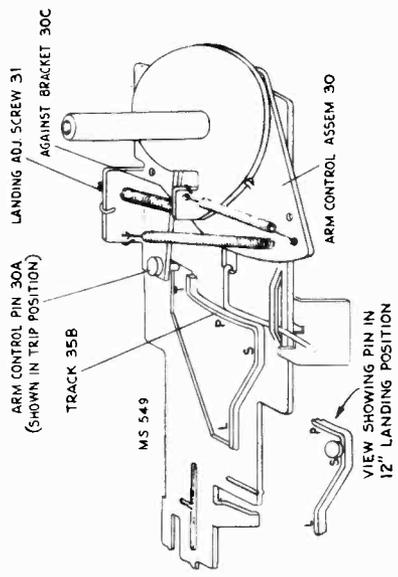


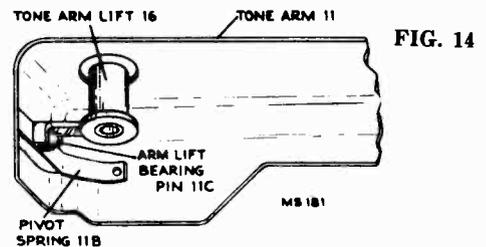
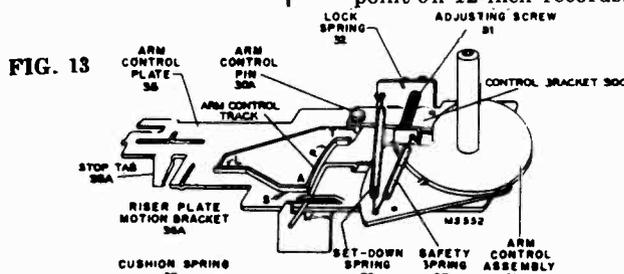
FIG. 8

RADIO CORP. OF AMERICA

MODEL 960276

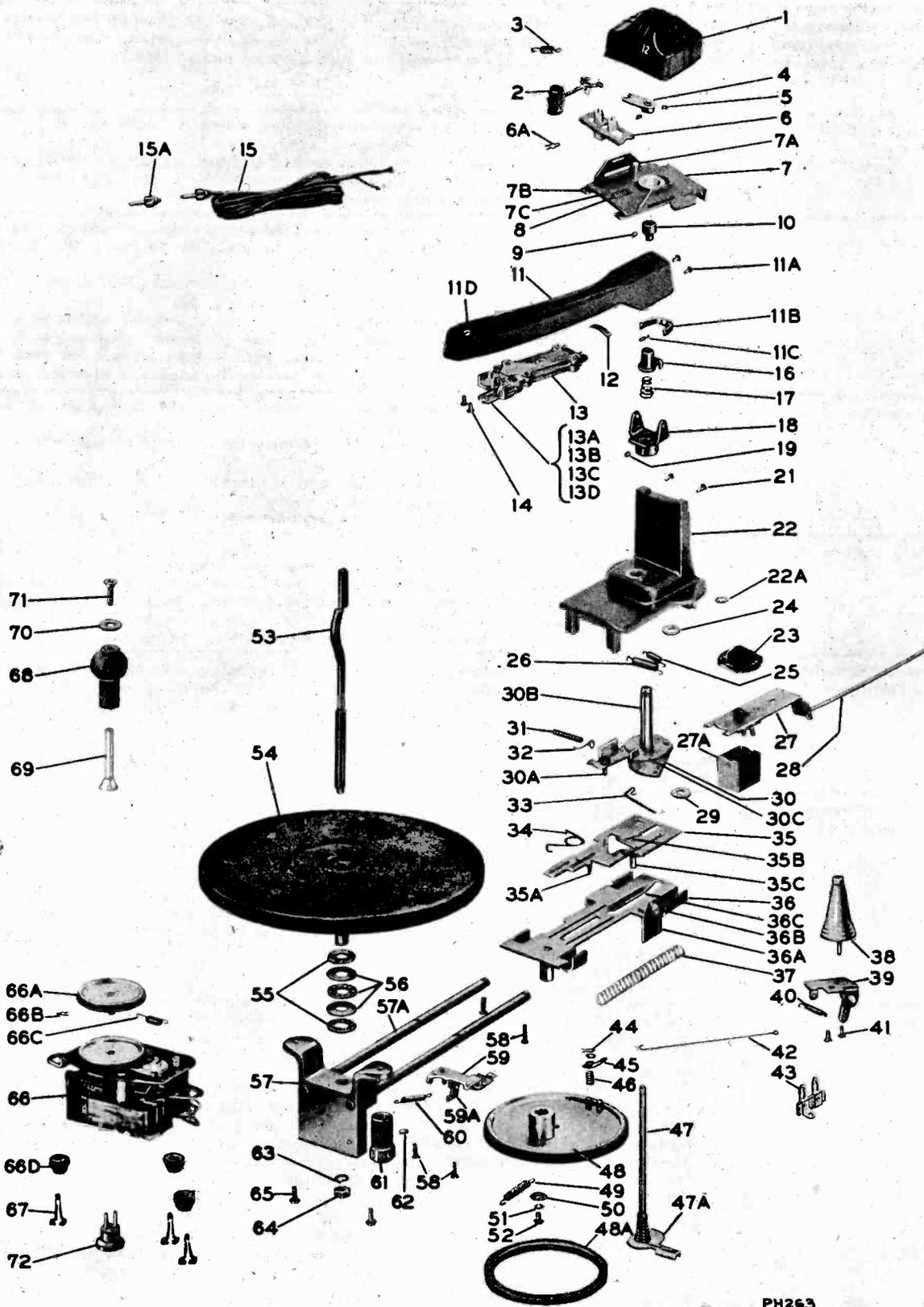
CYCLE OF OPERATION

<p>Turn record support to 10- or 12-inch position as desired and place a stack of records on supports.</p>	<ol style="list-style-type: none"> <li>1. Turning the record support positions the push-off cam 47A through the linkage of push-off arm 4 and push-off shaft 47. In so doing it determines the amount of movement of control plate 35 which in turn governs pickup landing.</li> </ol>
<p>Start-reject button.</p>	<ol style="list-style-type: none"> <li>1. Press down on tone arm; this actuates button on which it is resting.</li> <li>2. Start-reject button actuates reject lever.</li> <li>3. Reject lever transfers action to reject latch 59A through coupling wire 42.</li> <li>4. The unlatching of reject latch allows eccentric cam 48 to be pulled against rotating knurled roller 61 which starts cycle.</li> </ol>
<p>Record plays.</p>	<ol style="list-style-type: none"> <li>1. While the record is being played and the tone arm moves towards the center of the record, the arm control pin 30A on arm control assembly 30 moves along track 35B as designated by "P," fig. 13.</li> <li>2. As pickup moves into trip groove on record, tone arm control pin 30A moves into recess in control plate 35 at point indicated by "T," fig. 13.</li> <li>3. Trip spring 34 pulls arm control plate 35 towards center post 53, and in so doing allows stop tab 35A on arm control plate 35 to disengage stop catch 45 on eccentric arm 48. (In manual operation the manual lockout lever holds stud 35C thereby preventing arm control plate from moving forward and starting cycle.)</li> </ol>
<p>Cycling starts.</p>	<ol style="list-style-type: none"> <li>1. Spring 49 pulls eccentric cam 48, causing rubber tire 48A to engage rotating knurled roller 61.</li> <li>2. Eccentric cam 48 mounted on riser plate forces the riser plate assembly back along the guide rails 57A away from center post 53.</li> <li>3. As riser plate moves, the push-off cam and shaft assembly 47 rides along the inclined track 36C of the riser plate 36.</li> <li>4. This action results in the push-off cam and shaft assembly 47 being pulled down.</li> </ol>
<p>Tone arm raises and moves out.</p>	<ol style="list-style-type: none"> <li>1. The tone arm lift 16 sliding on shaft 47 is pulled downward, contacting lift bearing pin 11C, and causing tone arm to raise and clear record.</li> <li>2. The riser plate tab 36B contacting curved portion of arm control assembly 30, which is coupled to tone arm support bracket assembly, causes the tone arm to be moved outward away from, and clear of the edge of the records. Arm control plate is also being carried along by tab 36B contacting spring 33.</li> </ol>
<p>Record is separated and drops to turntable.</p>	<ol style="list-style-type: none"> <li>1. As riser plate 36 continues to travel further along guide rods 57A, the riser plate motion bracket 36A contacts and rotates the push-off cam and shaft assembly 47.</li> <li>2. Push-off arm 3, being coupled to push-off cam and shaft assembly 47, is rotated, causing push plate 7C to push record off of projection on center-post and dropping it to the turntable.</li> </ol> <p>Note: The small separator latch in the end of the center post functions as a thickness gauge, allowing only one record to be pushed off the projection at one time.</p>
<p>Tone arm is returned and is positioned for landing.</p>	<ol style="list-style-type: none"> <li>1. As eccentric cam 48 is returning to minimum diameter (out of cycle position), riser plate is being pushed back to normal position by recoil spring 37. At the same time, the push plate spring 8 is pushing the push plate 7C and push-off arm 4 back to normal position.</li> <li>2. The portion of arm control assembly mounting the control pin, and the control bracket 30C, are hinged on the plate forming part of assembly 30. Since the pin 30A has followed the track 35B and the curved portion of bracket 30C was forced out by motion of tab 36B, the tension of spring 26 is tending to pull them together as the riser plate is returning to normal position. The governing factor in determining how far the bracket will be pulled in, is the setting of the landing adjustment screw 31.</li> </ol>
<p>Pickup lands.</p>	<ol style="list-style-type: none"> <li>1. During part of the change cycle when riser plate is in the outermost position, and carrying arm control plate along by tab 36B contacting spring 33, the stud 35C is stopped by cam 47A. This acts as a gauge to determine the point of contact of pin 30A on arm control track 35B. This cam having two different radii will govern the distance arm control plate can travel since this is set when the record size change is made. If the smaller radius side of cam 47A is toward stud 35C, the arm control pin 30A will ride portion of track 35B designated by "L," causing the pickup to land on 10-inch records. On the other hand, if the larger radius portion of cam is toward the stud, the pin will ride along track designated by "S," which determines landing point on 12-inch records.</li> </ol>



MODEL 960276

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PH263

PHOTOGRAPH OF PARTS

FIG. 15

CHANGER WILL NOT COMPLETE CYCLE

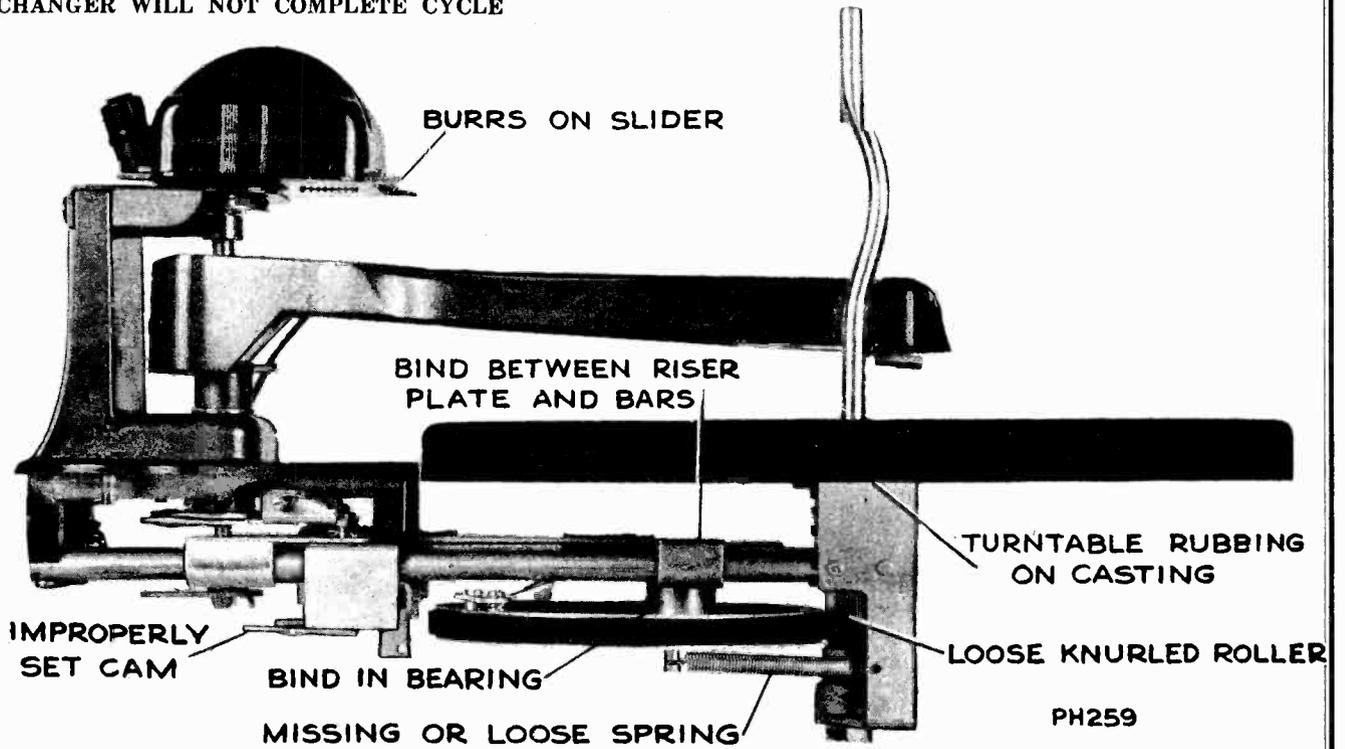


FIG. 16

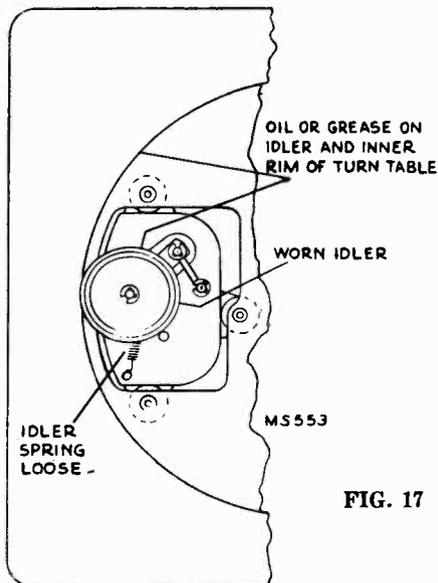


FIG. 17

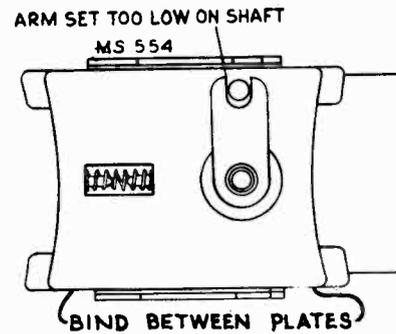


FIG. 18

RECORDS DO NOT SEPARATE OR DROP PROPERLY

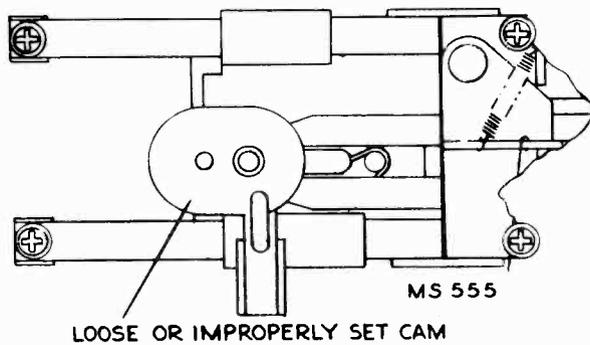


FIG. 19

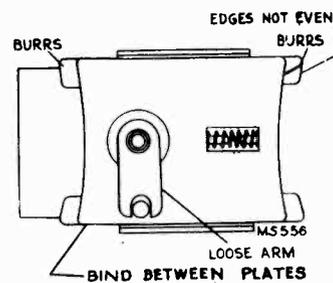


FIG. 20

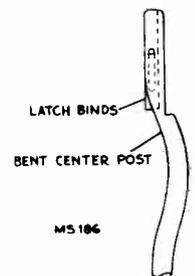


FIG. 21

PICKUP REPEATS GROOVES

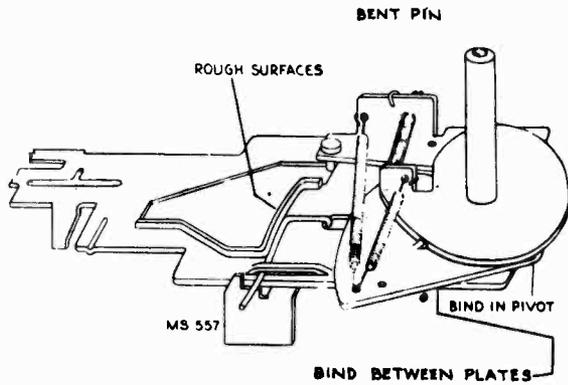


FIG. 22

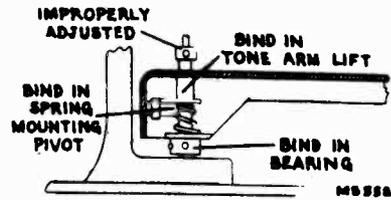


FIG. 23

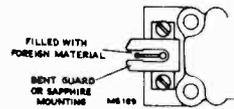


FIG. 24

"WOW" OR SLOW TURNTABLE SPEED

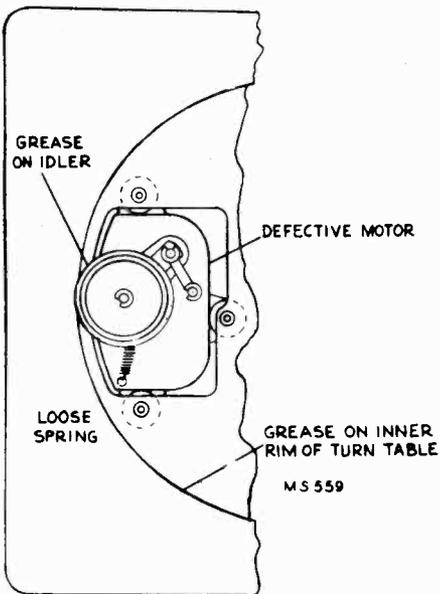


FIG. 25

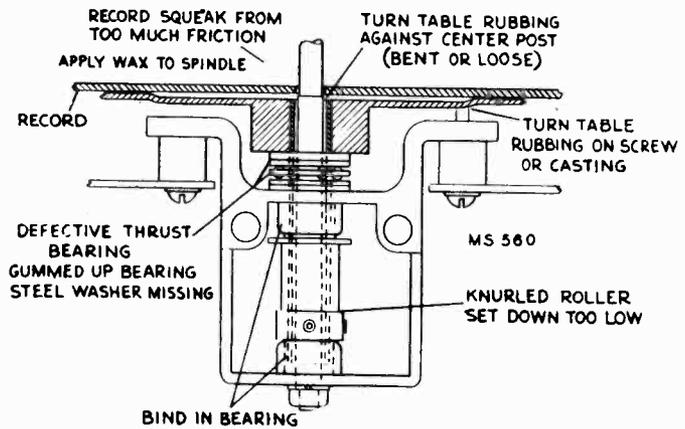


FIG. 26

CONTINUOUS TRIPPING

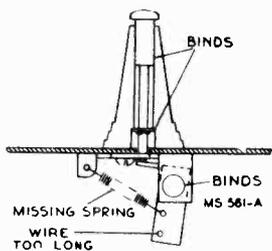


FIG. 27

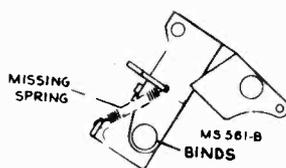


FIG. 28

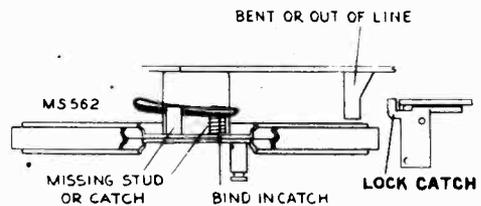


FIG. 29

IMPROPER PICKUP LANDING

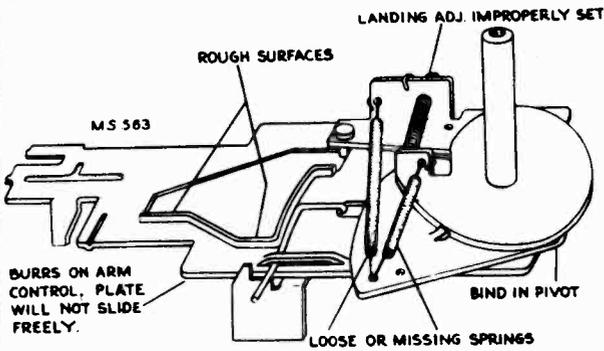


FIG. 30

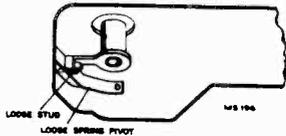


FIG. 32

FAILURE TO TRIP OR GO INTO CYCLE

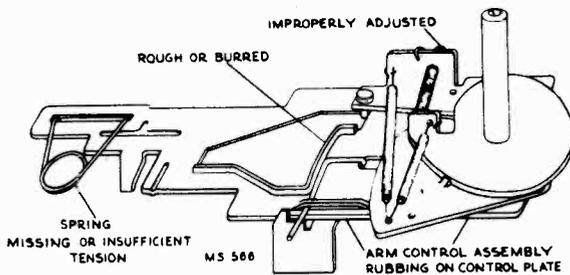


FIG. 34

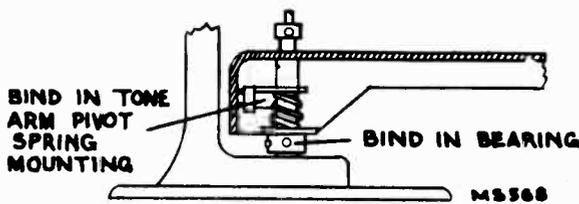


FIG. 36

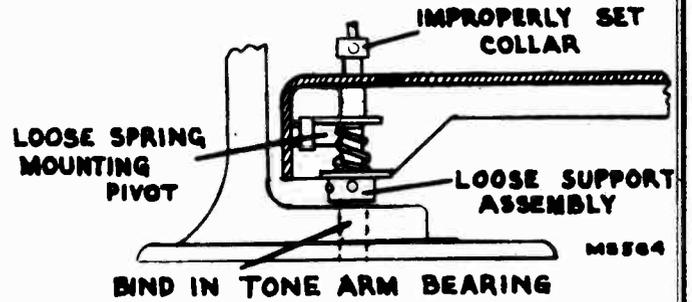


FIG. 31

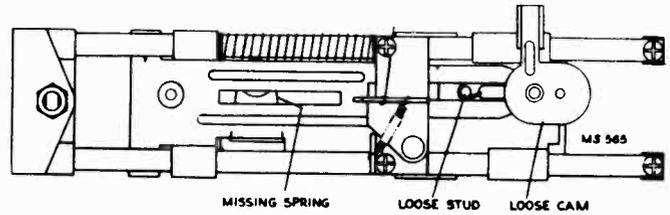


FIG. 33

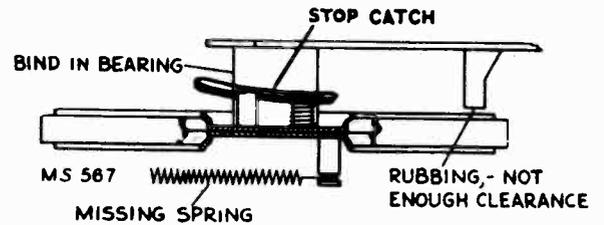


FIG. 35

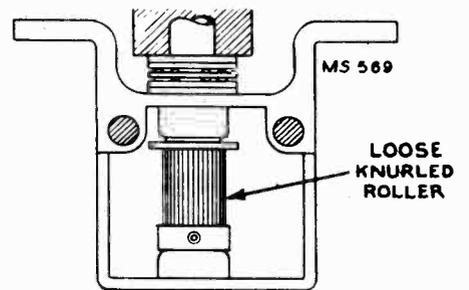


FIG. 37

PREMATURE TRIPPING

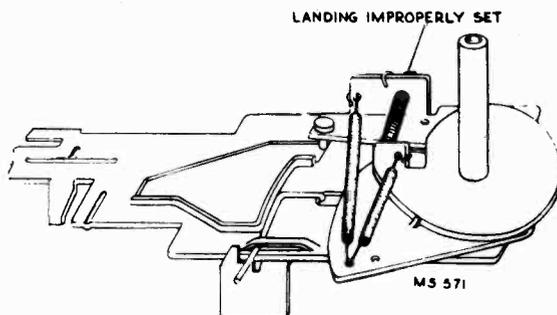


FIG. 40

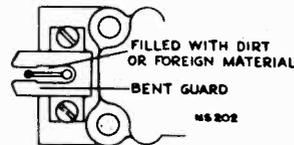


FIG. 38

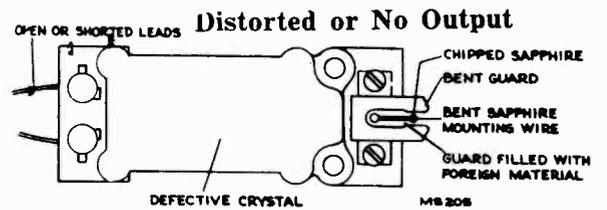
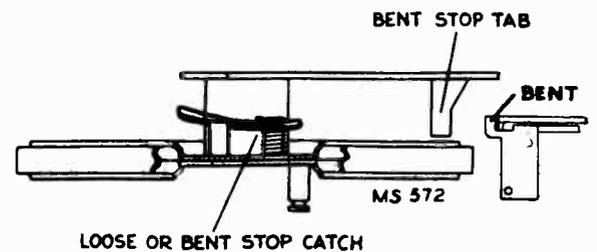


FIG. 41



MODEL 960276

RADIO CORP. OF AMERICA

**RUMBLE OR HOWL**

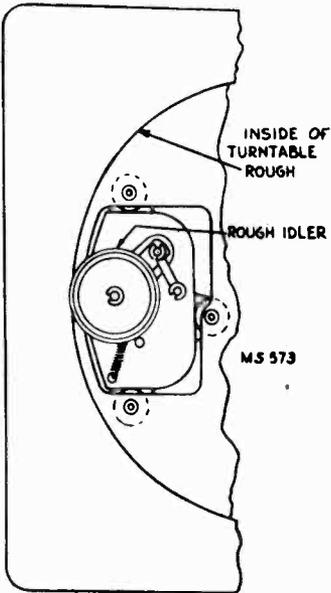


FIG. 42

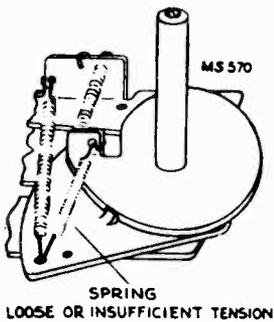


FIG. 45

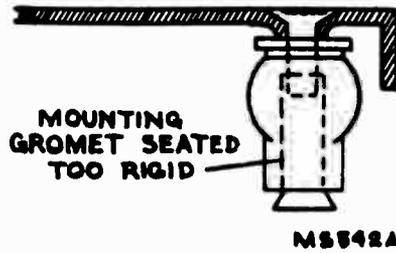


FIG. 43

**VOLUME CONTROL  
ADVANCED TOO FAR**



FIG. 44

**TO NE ARM  
FAILS TO LEAVE REST  
AUTOMATICALLY**

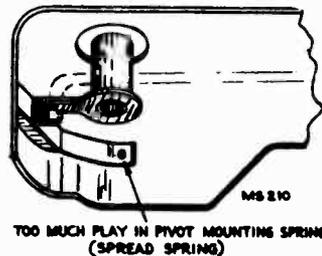


FIG. 46

**TOO POSITIVE A  
CONTACT**

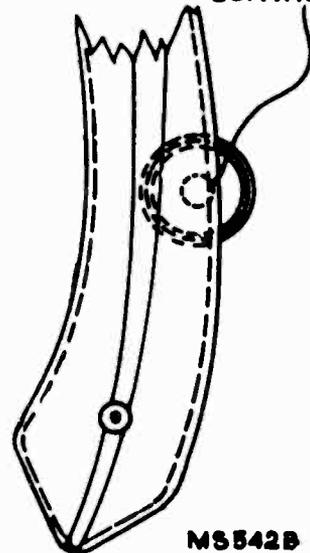


FIG. 47

**RECORD DAMAGE**

The spindle shelf and the top of spindle shaft should be free from burrs or rough edges to avoid scratching records or damaging record center holes. The record shelf edge should be smooth and be rounded only to a minute radius. Never round the bottom edge of the record separator latch.

A slight application of wax on the spindle shaft will prevent "squeal" of a stack of records.

**LUBRICATION**

**Motor**

Motor is lubricated at factory to provide normal operation for a long period of time.

If it becomes necessary to lubricate, use SAE #10 motor oil to saturate the felt wicks on the motor bearings.

**Main Bearing**

Use STA-PUT #512 or SAE #30 motor oil.

**Slides and Levers**

Use STA-PUT #512.

STA-PUT can be purchased from E. F. Houghton & Co., 303 W. Lehigh Ave., Phila., Pa.

**REPLACEMENT OF SAPPHIRE**

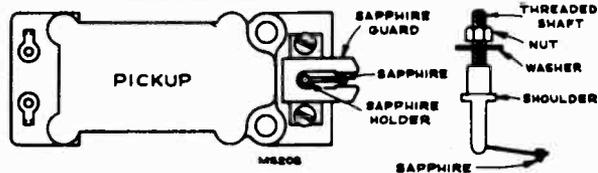


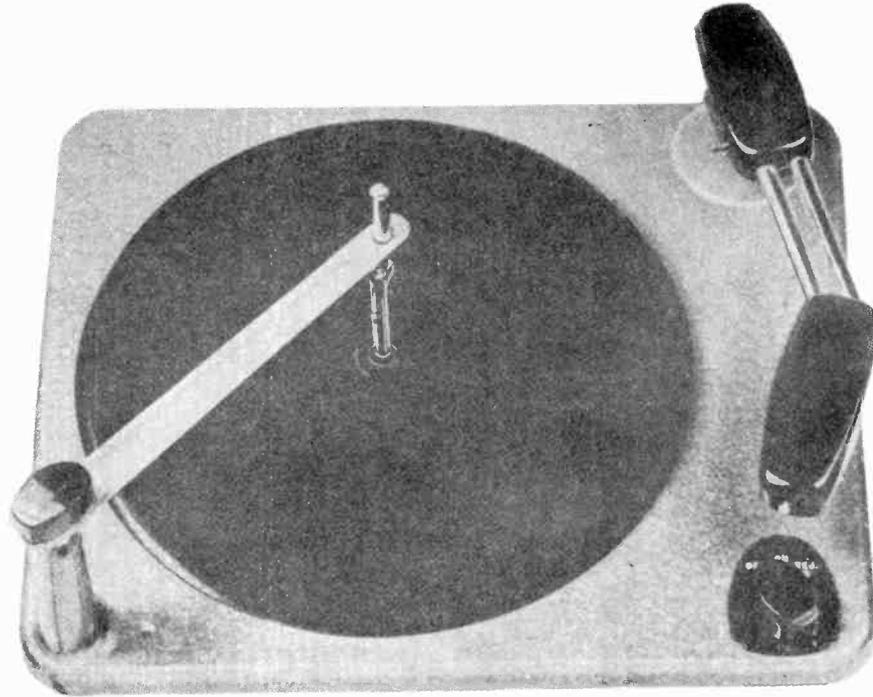
FIG. 48

**Caution:** Never bend the sapphire support wire. Extreme care should be used when loosening the nut so that the twisting motion does not break the crystal. Remove the two screws holding the sapphire guard in place and remove guard. Remove the small nut and washer on the threaded shaft of the sapphire holder and gently push the shaft through the hole in the armature shaft until the sapphire holder assembly comes free. Do not use force or the crystal may be broken.

Insert threaded shaft of replacement sapphire holder through armature shaft and replace the washer and nut. Make sure that the sapphire is in the correct position. Take hold at the lower end of the shaft with a pair of pliers while tightening the nut, being very careful so as not to strip the threads or break the crystal. Replace the sapphire guard, positioning it by means of the oversize screw slots. Make certain that the sapphire and its supporting wire are centered in the guard. Tighten the guard screws. Before using, check to see that the sapphire projects far enough (approx. .020) beyond the guard so that the guard will not strike the record. If necessary, bend the guard a little.

SEARS, ROEBUCK & CO.

MODELS 101.211,  
101.211-1, 101.211-2,  
101.211-3,  
101.211-4



The Models 101.211-1 and 101.211-1 are designed to automatically change as many as ten 12-inch, twelve 10-inch or ten intermixed records of standard commercial dimension with a minimum of record wear and to manually play any standard record up to twelve inches in diameter and to automatically shut off after last record has been played.

**Model Differences:**

Both Record Changers are similar, however, plastic parts on the 101.211-1 are finished in dark brown.

Chassis 101.211-2 same as 101.211-1 except uses ungrounded Syntronic pickup cartridge in pick-up arm with adapter plate.

101.211-3 - Chassis same as 101.211-1 except uses new style pickup arm with ungrounded Syntronic pickup cartridge.

101.211-4 - Chassis same as 101.211-3 except uses grounded Syntronic pickup cartridge.

**Power Requirements**

These changers have been designed to operate on 110 Volt 60 Cycle A. C. current unless otherwise indicated.

<u>LOCATION NUMBER</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
1	R57700	Knob - (101.211)
1	R57786	Knob - (101.211-1)
2	R49655	Russell Drive Wheel Assembly
3	R57701	Record Support Assembly
4	R57702	Speed Nut
5	R57703	Turntable Assembly
	R57704	Turntable Washer
	R57705	Turntable Bearing
	R57706	Retainer Spring - Turntable
6	R57707	Shipping Bolt
7	Part of Item 14	Trip Lever
8	R57708	Adjusting Ring Spring
9	R57709	Set Screw
10	R57710	Adjusting Screw
11	R57711	Adjusting Ring
12	R57712	Hinge Pin
13	R57713	Lift Bed Screw
14	R57714	Hinge Body Assembly
15	Part of Item 11	Adjusting Screw
16	Part of Item 14	Catch
17	R57715	Catch Spring
18	Part of Item 14	Hinge Cam
19	R57716	Cable & Clip Assembly

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LOCATION NUMBER	PART NUMBER	DESCRIPTION	LOCATION NUMBER	PART NUMBER	DESCRIPTION
20	R52826	Crystal Cartridge	62	R133	Trip Spring
21	R57718	Pickup Arm - (101.211)	63	Item 51	Clutch Pawl
22	R57719	Pickup Arm - (101.211-1)	64	R57751	"C" Washer
23	R57720	Screw - #4 Type "2"	65	R57752	Screw - #6 x 5/8 Type "Z"
24	R57787	Escutcheon - (101.211)	66	R57753	Grommet Spacer (Russell)
25	R57721	Escutcheon - (101.211-1)	67	R57754	Grommet (Russell)
26	R57722	"C" Washer	68	R57755	Motor Assembly - 110 Volt - 60 Cycle (Russell)
27	R57700	Knob - (101.211)	68	R62360	Motor Assembly - 110 Volt - 50 Cycle (Russell)
28	R57786	Knob - (101.211-1)	69	R57756	"C" Washer
29	R57722	Ratchet Arm Assembly	70	R57757	Spindle Assembly
30	R57723	Pawl Spring	71	R57758	Spindle Shaft & Base Assembly
31	Part of Item 26	Drive Pin	72	R57759	Record Pusher
32	Part of Item 26	Ratchet Pawl	73	R57760	Pusher Pin
33	R57725	Trip Rod Bearing	74	R57761	Pusher Spring
34	R57726	Screw - #6 x 1/4 Type "2"	75	Part of Item 5	Pusher Shaft
35	R57727	"C" Washer	76	R57705	Turntable Hub
36	R57728	Fiber Washer	77	R57763	Turntable Bearing
37	R57728	Ratchet Assembly	78	R57764	Spindle Set Screw
38	R57731	Control Shaft	79	Part of Item 78	Pusher and Roller Assembly
39	R57732	Fiber Washer	80	Do Not Stock	Spindle Roller
40	R57733	Control Link	81	Part of Item 78	Roller Plunger
41	R57734	Cutoff Lever	82	R57765	Turntable Bearing Washer
42	R57735	Set Down Locator	83	R57766	Fiber Washer
43	R57737	Control Lever	84	R57767	Pinion Gear
44	R57744	Tubular Rivet	85	R57768	Pusher Shaft Spring
45	R57719	Screw - #4 x 1/4 Type "Z"	86	R57769	Guide
46	R57738	Lever - Spring	87	R57770	Spindle Guide Spring
47	Do Not Stock	Screw - #8-32 x 3/8"	88	R57771	Spindle Pin
48	R57739	Lift Arm Assembly	89	R57772	Bearing Cone
49	Part of Item 51	Pawl Spring	90	R57773	Bearing Ball
50	Do Not Stock	Cam Bearing	91	R57774	Fiber Washer
51	R57740	Cam Assembly	92	R57775	"C" Washer
52	R57741	"C" Washer	93	R57776	Safety Spring
53	R57742	Fiber Washer	94	R57777	Left Rod
54	Do Not Stock	Roller	95	R57778	Left Rod Spring
55	R57743	Cam Stud Sleeve	96	R57779	Lock Spring
56	R419	Cam Locator Spring	97	R57780	Hinge Bearing Assembly
57	R57744	Tubular Rivet	98	R57781	Pickup Arm Locator Assembly
58	R57745	Control Crank	99	R57782	Bearing Spacer
59	R57746	Speed Nut	100	R57783	Return Spring
60	R57747	Lift Arm Washer	101	R57736	Set Down Locator
61	R57748	Fiber Washer - 1/64" Thick	102	R57722	Ratchet Arm Assembly
	R57749	Fiber Washer - 3/64" Thick	103	R57784	Pinion Spring
	R57728	Ratchet Assembly	104	R57706	Retainer Spring
	R57750	Trip Rod Bearing			
			Chassis 101.211-2		
			20	R65100	Cartridge - Syntronic Pickup (grounded)
				R57881	Plate - Adaptor - Syntronic Pickup Attaching
				R57888	Screw - Syntronic Pickup Attaching

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The mechanism will operate automatically on all standard records. In case of records not having the standard "trip groove" (a spiral groove near the center of record) when tone arm reaches end of record, turn control knob to "REJ" to bring next record to playing position.

Warped, worn, disheveled or dirty records will cause poor reproduction. Records should be stored away from heat in a record album or laid flat. Clean records periodically with a soft, lint-free cloth.

AUTOMATIC OPERATIONLoading:

- (1) Pull straight up on record support knob (1) until record support (3) clears spindle.
- (2) Swing record support in either direction until pin in shaft drops into locating groove. As many as ten 12-inch, twelve 10-inch or ten intermixed records may be loaded at one time.
- (3) Carefully place records on spindle and lower to offset shoulder.
- (4) Steady records with one hand and replace record support over spindle. Gently press down on record support knob until records are held parallel with turntable.

Starting:

To start operation of record changer, turn control knob (25) clockwise to "REJ" and release. Changer will operate automatically until last record has been played. Control knob then turns to "OFF" position, pickup arm (21) returns to rest and machine automatically stops.

Reject:

To reject a record at any time while it is playing, turn control knob to "REJ" and release.

Manual Stopping:

To turn off changer before last record has been played, turn control knob to "OFF", lift pickup arm from record and replace on rest.

Unloading:

To remove records from turntable, lift up on record support knob and swing record support in either direction until pin in shaft drops in locating groove. Carefully lift entire stack of records straight up.

**CAUTION:** When loading or unloading changer, use care to prevent bending spindle. Records should never be left on the offset portion of the spindle as they may warp. If changer is turned off before all records have been played, remove unplayed records from spindle or operate "Reject" until all records have dropped to turntable.

MANUAL OPERATIONStarting:

- (1) To play single records or home recordings, pull straight up on record support knob until record support clears spindle. Swing record support in either direction until pin in shaft drops into locating groove.
- (2) Lower record to offset shoulder of spindle and tilt toward back of tone arm. Carefully work record past offset shoulder.
- (3) Turn control knob to "ON" and push down on trip lever (51) located near back of tone arm. Machine will then operate independently of cycling mechanism - PROVIDED - tone arm is moved all the way in to the spindle before it is returned to the rest after the record is played. When playing "inside out" records, move tone arm all the way in to spindle before setting it down on first playing grooves of the record.

Repeating:

- (1) To repeat a 10-inch record, remove any records remaining above offset shoulder of spindle.
- (2) Pull straight up on record support knob until record support clears spindle.
- (3) Swing record support in either direction until pin in shaft drops into locating groove.
- (4) Carefully lift records from spindle. Do not replace record support over spindle. Changer will repeat the record on the turntable until control knob is turned to "OFF".

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LUBRICATION

No lubrication should be necessary for the life of the changer, but in cases of unusual use or high operating temperature, the changer should be lubricated as follows:

- (1) Hinge bearing (97).
- (2) Ratchet arm (102) and set down locator plate (101).
- (3) Cam faces on lift arm (48), lift arm bearing, and lift arm cutoff rod bearings.
- (4) Between lever spring (46) and cutoff rod (42).
- (5) Heart shaped cam track on cam (51) and cam bearing (50).
- (6) Spindle, between roller plunger (80) and roller spring housing (78) and between the roller spring housing and the spindle body.
- (7) Turntable ball bearing (76).

Apply a small quantity of light machine oil to:

- (1) Pickup arm locator assembly bearing (98) and ball bearing in pickup arm post (90).
- (2) Ratchet pawl bearing (28).
- (3) Trip rod bearings (30) and (61).
- (4) Control lever bearing (35).

ADJUSTMENTS

**NEEDLE SET DOWN:** The set down position of the needle is adjusted by means of the two adjusting screws (10) & (15). If the needle is setting down too far out on the record, loosen the back screw (10) about 1/4 turn and tighten the front screw (15) to lock the adjustment in place. If the needle is setting down too far in on the record, loosen the front screw and tighten the back screw.

**PICKUP ARM HEIGHT:** The pickup arm height is adjusted by the screw (13) located on top of the tone arm lift rod. Turn the screw out or in until the underneath side of the tone arm clears the rest by 1/8" to 3/16".

SERVICE INFORMATIONCONTROL KNOB CANNOT BE TURNED TO "ON" POSITION

Machine stalled in cycle. Turn turntable carefully by hand until the control knob is free.

TURNTABLE DOES NOT REVOLVE WHEN CONTROL KNOB IS TURNED TO "ON" POSITION:

1. Machine stalled in cycle. Turn turntable carefully by hand until it starts rotating under its own power.
2. No current at motor:
  - (a) Check to determine if current is reaching A. C. leads of changer.
  - (b) Check switch to determine if it is closing.
  - (c) Check wiring and soldered terminals in changer.
3. Motor defective:  
Remove turntable to allow motor to operate without load. If current is reaching the motor and pulley does not rotate, the motor is defective. Repair or replace.
4. Motor idler wheel not engaging turntable rim.  
If motor pulley is turning but turntable is not:
  - (a) Check motor idler assembly to determine if it is free to contact the motor pulley and the turntable.
  - (b) Wipe off the inside rim of the turntable to remove flock or if oily, clean turntable rim and rubber tire of idler wheel with carbon tetrachloride.
5. Turntable bearing tight:  
Hold idler away from turntable or remove idler wheel and rotate turntable by hand to see if it is free. If binding occurs, remove turntable, clean out foreign matter and lubricate with light oil.

CHANGER DOES NOT CYCLE WHEN CONTROL KNOB IS TURNED TO "REJ" POSITION:

1. Changer stalled or motor not driving turntable. See "TURNTABLE DOES NOT REVOLVE WHEN CONTROL KNOB IS TURNED TO "ON" POSITION".
2. Manual reject not actuating trip:  
Turn control knob to "REJ" position, hold and see if leg on control lever (44) is contacting the stud on the bottom of the ratchet casting (34) and turning the trip rod (60) sufficiently to allow the trip rod to disengage the trip.

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3. Trip not actuating clutch:  
When the trip rod (60) is turned, if the clutch pawl (63) does not move forward, engaging the pinion teeth, check for a loose pawl spring (49) or binding between the clutch pawl and the cam. If binding occurs, clean out foreign matter and check for freedom but do not oil.

RECORD DOES NOT DROP WHEN CHANGER CYCLES:

1. Spindle pusher shaft broken:  
If the pusher shaft (74) is broken, the roller assembly (78) will drop out of the spindle (70). To replace the roller assembly, loosen the spindle screw (77) and remove the spindle. Slip the pusher shaft return spring (85) over the pusher shaft and insert the roller assembly in the spindle. Turn the milled flat section at the top of the pusher shaft until it faces out of the milled opening in the spindle. Press up on the roller until it raises about 1/8". Hook the pusher (71) around the pusher pin (72) and press the pusher back until it touches the spindle body. Push down and back on the pusher and slightly up on the bottom of the roller assembly until the pusher snaps into place.
2. Pusher in spindle not moving far enough forward to eject a record:  
The pusher (71) should move up inside the spindle body, then move forward until it has reached a point flush with, or a maximum of .010" beyond the spindle body. To assure the pusher is all the way forward, the spindle roller should be raised high enough by the lift arm (48) at the top of the cam face to slightly compress the roller spring (81). See "TURNTABLE STALLS DURING CYCLE" - 7. If the roller spring is compressed and the pusher does not move far enough forward to eject a record, the spindle should be replaced. If a record is not pushed completely off the ledge, it may hang up on the spindle momentarily, then drop on the pickup arm when it moves in over the turntable.
3. Lift arm screw loose:  
Check screw (47) to determine if it is turned all the way in.
4. Pusher raises outside spindle body:  
When the changer cycles, the pusher (71) should first rise up inside the spindle body, then move forward inside the center hole in the record. If the pusher rises outside the spindle body, it will raise the record instead of pushing it off the spindle ledge. Check the pusher shaft (74) to see if it is straight. If the shaft is bent, it will force the pusher forward prematurely.
5. Lift arm roller broken off:  
If the lift arm roller (53) is broken off, the lift arm (48) will not turn when the cam (51) revolves.

TWO RECORDS DROP AT ONCE:

1. Hole in record too large:  
Check the diameter of the hole in the record. An oversize hole will cause two records to drop at once.
2. Spindle slide not fully down:  
If the spindle slide is not all the way down, more than one record may be dropped at a time.
  - (a) Check the slide to be sure it is free and does not bind at any point. Clean out foreign matter or straighten if necessary. Do not oil.
  - (b) When records are placed on the spindle, be sure the slide is all the way down. The slide will normally raise slightly as a record is being dropped but it should return to place immediately.
3. Record support binding on spindle or bent out of square with the shaft.  
The record support must be able to slide freely by gravity down the spindle. If the support does not follow the records down as they are being ejected, two or more records may be ejected at once.  
If binding occurs:
  - (a) Check the spindle to determine if it is straight. Bend carefully with the fingers if necessary.
  - (b) Straighten the record support (3) if it is not square with the record support shaft.
  - (c) If the hole in the record support is not centered over the spindle after checking (a) and (b), bend the support shaft post on the base plate until the hole in the record support is centered over the spindle.
  - (d) When the pin in the record support shaft has just entered the slot in the record support shaft post on the base plate, the play in the record support as it is swung from one side to the other should be equal on both sides of the spindle. To correct bent position, hold the support shaft and carefully force the record support into the proper position. If the support is loose on the shaft, remove the knob and re-stake with hammer and punch.
4. Record pusher defective:  
The record pusher (71) may be deformed, etc. This may cause two records to drop at once. Replace the pusher.

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**RECORD HITS PICKUP ARM:**

1. Pusher in spindle not moving far enough forward to eject record. See "RECORD DOES NOT DROP WHEN CHANGER CYCLES" - 2.
2. Lift arm screw loose:  
Tighten lift arm screw (47).
3. Pusher extending beyond outside diameter of spindle:  
Cycle changer by hand until roller assembly (78) is at the top of its travel. Using new record as a gauge pass it over spindle to see if it binds at any point. File off high points on pusher (71) with a fine file until record will pass freely over spindle.
4. Pickup arm not adjusted properly:  
The adjustment procedure for the needle set down point is given under "ADJUSTMENTS" If the hinge bearing (97) has been removed or the hinge bearing set screw (9) has been loosened, the relationship between the hinge bearing and the pickup arm locator assembly (98) must be reset. The procedure is as follows:  
Loosen the set screw (9) sufficiently to allow the hinge bearing to slide on the pickup arm locator assembly shaft. The set screw may be adjusted with an Allen wrench through the hole in the adjusting ring (11) located between the two adjusting screws (10) and (15). Place a 1/32" shim between the set down locator (101) and the ratchet arm (102). Turn the control knob to the "OFF" position. Place the pickup arm on the rest. In this position the arm extending from the set down locator should be engaged by the turned up leg on the control lever (44). Take up all the play between the parts by pressing up on the bottom of the ratchet arm and down on the top of the hinge bearing. Tighten the hinge body set screw (9) and remove the shim.

**NEEDLE DOES NOT SET DOWN ON 10" RECORD IN PROPER POSITION:**

1. Pickup arm not adjusted properly. See "RECORD HITS PICKUP ARM" - 4.
2. Hinge catch does not return to 10" record position when changer cycles.
  - (a) Stop the machine in mid cycle when the lift arm (48) has moved as far out as it will go and is about to move back to its starting position. Lift the pickup arm and see if there is a gap of at least 1/64" between the end of the leg of the catch (16) and outside step on the adjusting ring (11). The catch should be free to allow it to be pulled forward against the stop at the end of the leg on the adjusting ring. If there is not enough gap, check the setting of the hinge body and the pickup arm locator, see "RECORD HITS PICKUP ARM" - 4. If the setting is correct, the cam face on the lift arm (48) which contacts the round stud on the bottom of the ratchet arm (26) may be bent. The ratchet arm should be forced around far enough to bring the pickup arm out until the stop on the bottom of the hinge casting meets the stop in the base plate; then, to assure that the pickup arm is out as far as it will go, the lift arm should move the ratchet arm a few degrees further around, which will slightly compress the safety spring (93) and hold the pickup arm out firmly against the stop.
  - (b) Lubricate the hinge bearing with lubriplate. Do not use heavy grease. If the bearing between the hinge bearing and hinge body binds, the safety spring will compress instead of bringing the hinge body around firmly against the stop.
3. Binding between safety spring and ratchet arm:  
If the safety spring (93) binds against the ratchet arm and does not hold the casting on the bottom of the pickup arm locator assembly (98) against the stop inside the ratchet arm, irregular needle set down will result. Disassemble the pickup arm locator assembly (98) by removing the lift arm (48), loosening the hinge bearing set screw (9) and pulling the ratchet arm and pickup arm locator assemblies down from the bottom of the changer. Hold the pickup arm locator shaft in one hand, turn the ratchet arm assembly to slightly compress the safety spring, release, and see if the safety spring returns the pickup locator casting firmly against the stop surface in the ratchet arm assembly. If binding occurs, remove the safety spring, see if the pickup arm locator casting turns freely in the ratchet arm casting. Remove burrs or sharp edge on end of safety spring, stretch safety spring a little to increase tension and replace.
4. Hinge catch does not disengage from the hinge cam:  
When the trip lever (7) has been depressed, it is held in the position until the catch (16) is disengaged, see "NEEDLE DOES NOT SET DOWN ON 12" RECORD IN PROPER POSITION" - 6. When the cycle is completed, if the catch does not disengage from the hinge cam (18):
  - (a) Check to determine if the leg on the catch (16) is sliding down the incline on the leg on the adjusting ring (11), see "NEEDLE DOES NOT SET DOWN ON 12" RECORD IN PROPER POSITION" - 7.
  - (b) The catch (16) and the hinge cam (18) are not disengaging when the catch leg is resting on the inside step on the adjusting ring. If this occurs, file the edge of the catch which contacts the hinge cam until the two parts have a clearance between them of about 1/64" when the leg on the catch is on the inside step on the adjusting ring.

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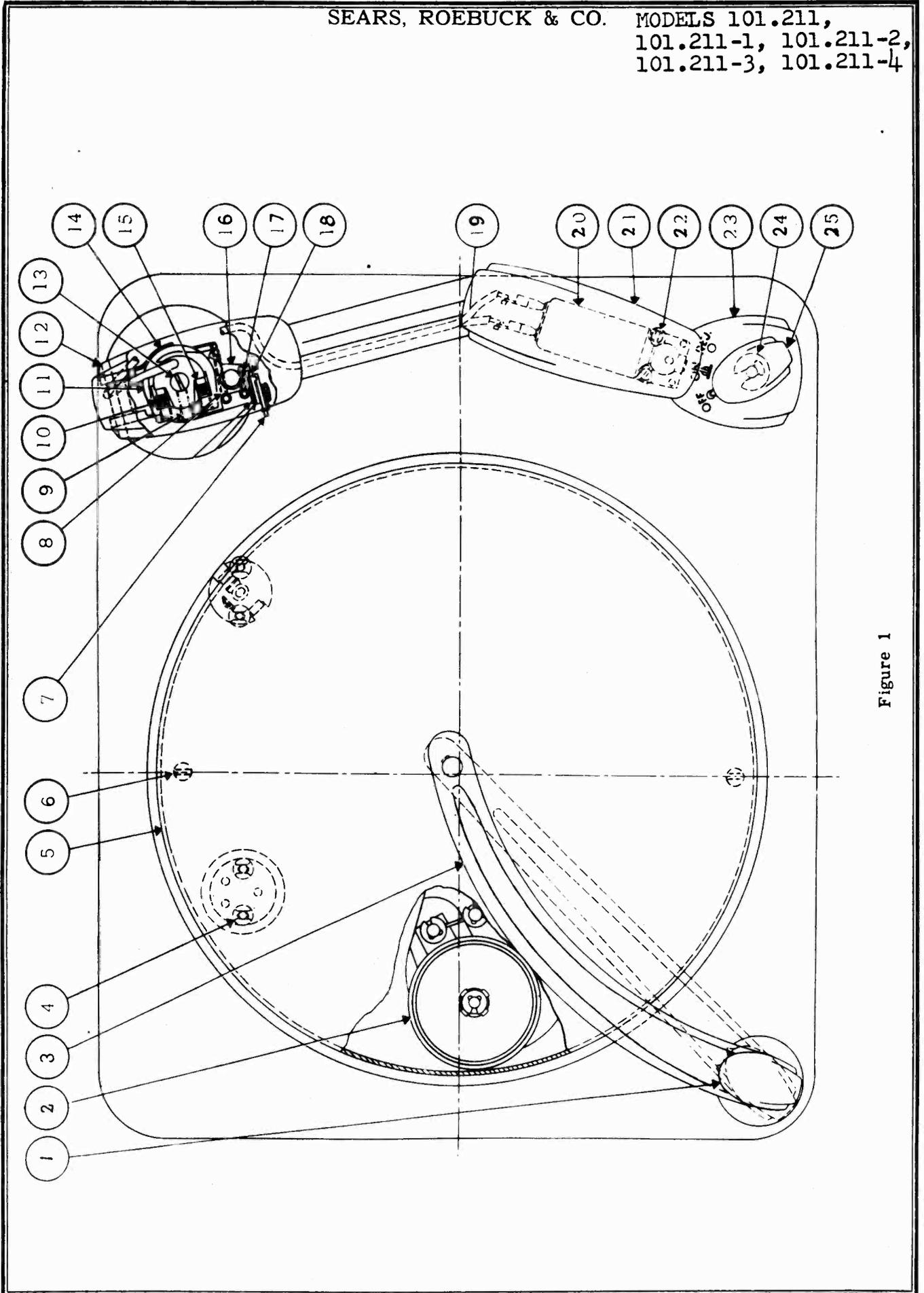


Figure 1

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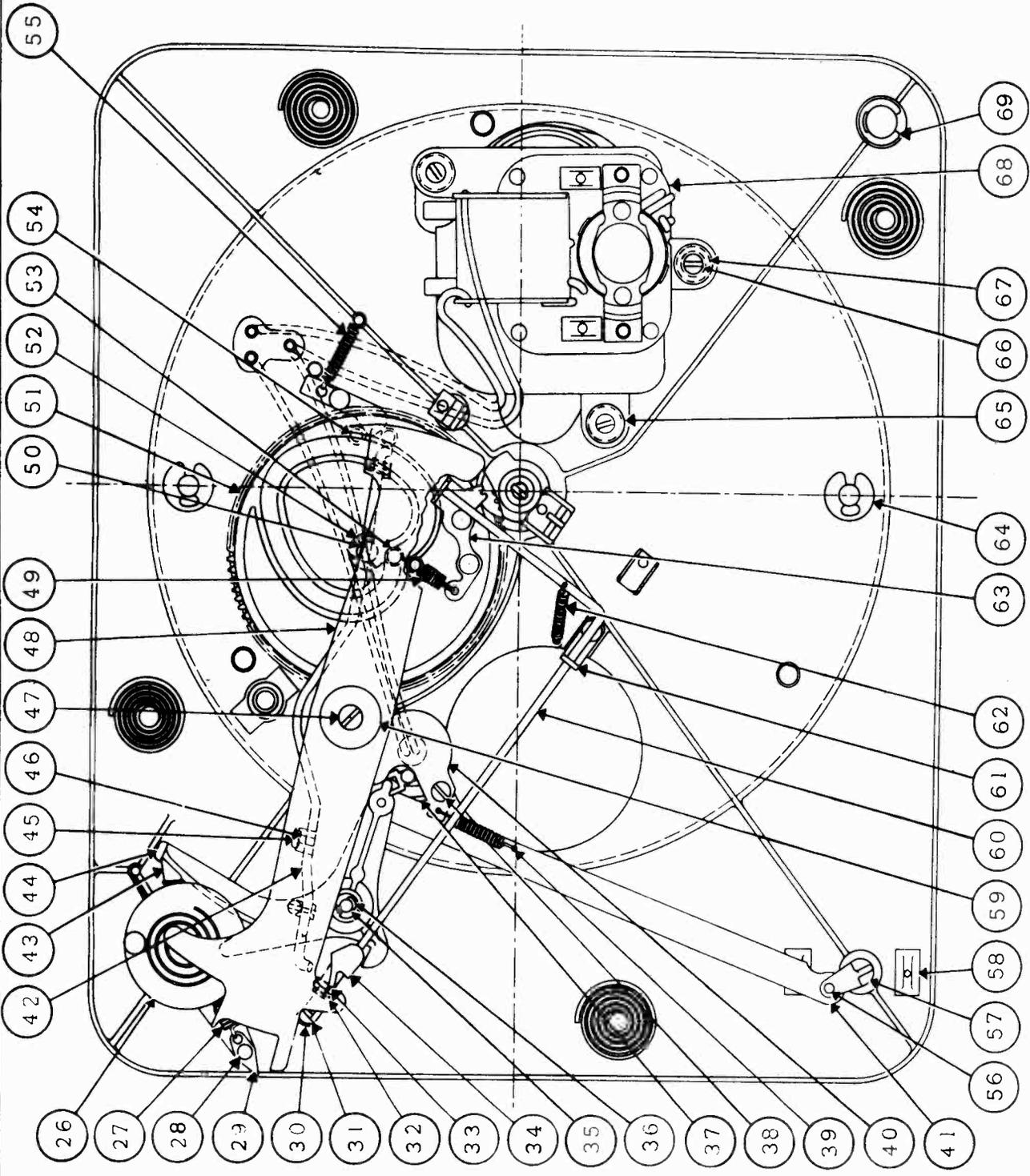


Figure 2

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**NEEDLE DOES NOT SET DOWN ON 12" RECORD IN PROPER POSITION:**

1. Diameter of 12" record undersize:  
 The set down position of the needle for 12" records is determined by the edge of the record striking the trip lever (7). If a 12" record has a diameter of less than the standard size of 11 7/8" plus or minus 1/32", it may fail to depress the trip lever far enough.
2. Enlarged center hole in record:  
 An enlarged center hole might fail to set the trip lever because it could produce the same effect as a small record.
3. Pickup arm not adjusted properly:  
 See "RECORD HITS PICKUP ARM" - 4.
4. Binding between safety spring and ratchet arm:  
 See "NEEDLE DOES NOT SET DOWN ON 10" RECORD IN PROPER POSITION" - 3.
5. Trip lever does not cock when 12" record drops:  
 Allow a 12" record to drop to the turntable and shut off the changer just after it falls, before the pickup arm has a chance to move in over the record. The trip lever (7) should be forced down until the step on the hinge cam (18) passes the edge of the catch (16), preventing the hinge cam and the trip lever from returning to their original position. If the trip lever does not stay down in a depressed position:
  - (a) Check the catch (16) to see if it is free to move forward and engage the hinge cam.
  - (b) If the stop on the hinge body (14) is defective, it might allow the pickup arm to move too far out, thus moving the trip lever away from the spindle. This will produce the same effect as an undersized record.
6. Hinge catch does not go into inside step on adjusting ring when trip lever is depressed:  
 When the trip lever (7) is tripped by a falling 12" record, the leg on the catch (16) should be moved out over the incline between the inside and outside steps on the adjusting ring leg and held in that position by the shoulder on the hinge cam (18) until the pickup arm starts to move in over the record. When this occurs, the leg on the catch should contact the incline and be moved out as it slides down the incline until the catch is disengaged and the trip lever can snap back up to a horizontal position. If the leg on the catch is not moved out far enough to enable it to slide down the incline, file about the 1/64" chamfer on the edge of the catch leg which contacts the incline.  
 Check for binding between hinge body (14) and hinge bearing (97). Burrs on the bearing surfaces or lack of lubrication may prevent the hinge bearing from turning freely.

**NEEDLE DOES NOT TRACK ACROSS RECORD PROPERLY:**

1. Ratchet arm does not disengage from the set down locator when a cycle is completed.
  - (a) There should be a 1/32" gap between the ratchet arm and the set down locator when the machine is not in cycle. If the gap is small enough to allow the parts to touch and bind as the needle moves across the record, the hinge bearing must be reset. See "RECORD HITS PICKUP ARM" - 4.
2. Hinge bearing binds.  
 Place a block under the back end of the tone arm to prevent the needle from touching the turntable. With sensitive gram scale, check the amount of force required to move the pickup arm across the turntable. The force required should not exceed 2 grams. If the pressure required is excessive:
  - (a) Check the ratchet arm and set down locator for binding. See 1, above.
  - (b) Check the bearing in the pickup arm post for binding. The bearing is located below the hinge bearing (97). To inspect it, loosen the set screw (9) in the hinge bearing. Un-solder the pickup leads and pull them out through the hole in the hinge bearing. Pull up on the hinge and pickup assemblies. Clean foreign matter or corrosion from the bearings; Lubricate with light oil. To reset position, see "RECORD HITS PICKUP ARM" - 4.

**CHANGER TRIPS BEFORE NEEDLE REACHES END OF RECORD:**

1. Hole in record too large:  
 If hole in record is too large, the grooves may turn eccentric with the spindle and cause premature tripping.
2. Binding in trip rod bearings:  
 With the trip released, check the trip rod for play in the bearings. It should be free to turn without binding.

**CHANGER DOES NOT CYCLE WHEN RECORD HAS BEEN PLAYED:**

1. Binding in trip rod bearings. See "CHANGER TRIPS BEFORE NEEDLE REACHES END OF RECORD" - 4.
2. No eccentric trip groove on record:  
 All standard records made today have an eccentric trip groove, but some records made in the past did not have this groove. When records of this type are being played the control knob must be turned to "REJ" at the end of the record.

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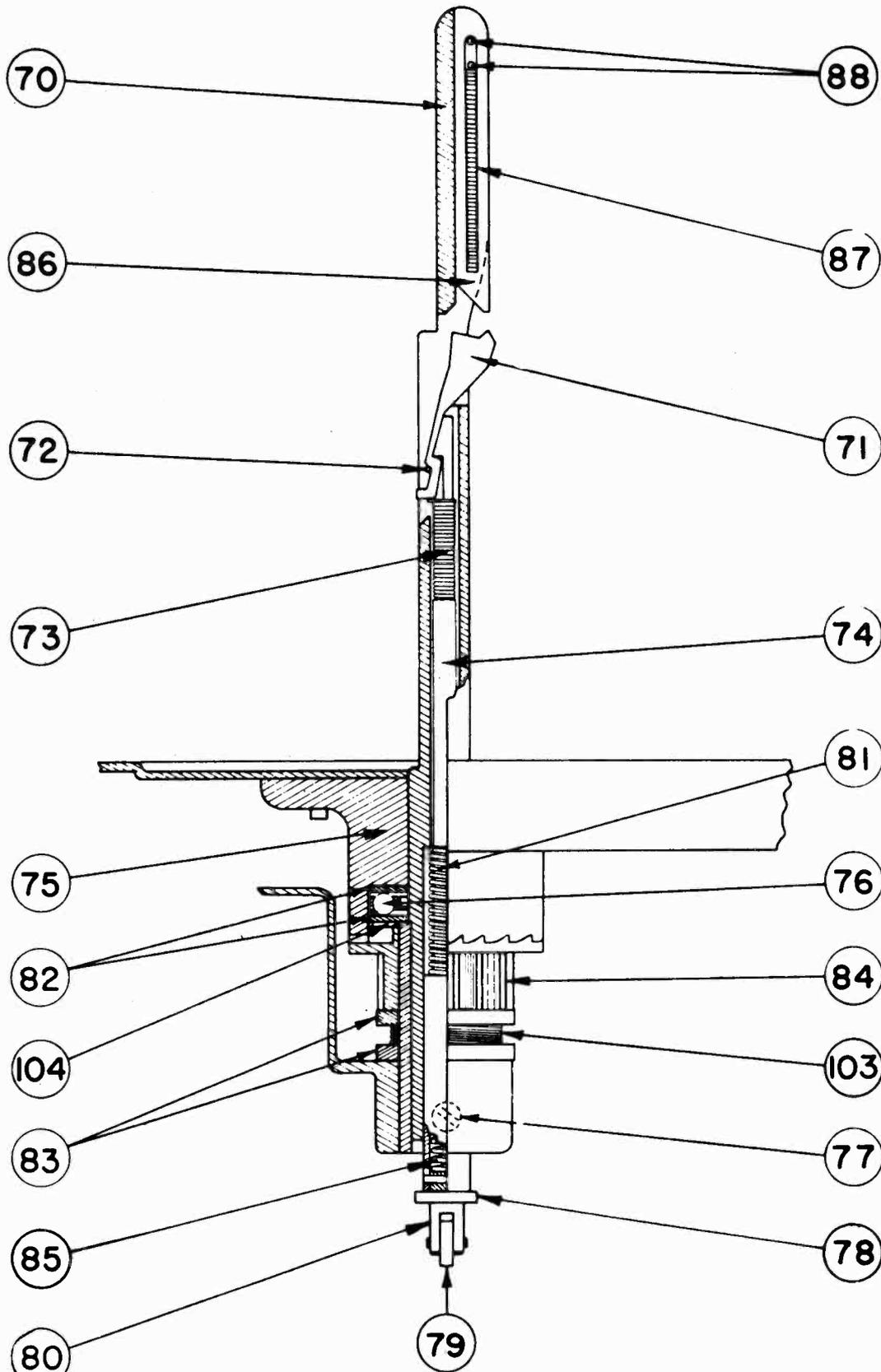


Figure 3

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3. Ratchet pawl not engaging the ratchet sector:  
The ratchet pawl (29) must press against the ratchet sector forcing it back when the motion of the pickup arm is reversed. If the pawl does not contact the ratchet sector or slides over it:
  - (a) Check the pawl (29) for burrs around the hole.
  - (b) Be sure the pawl is free to turn on the bearing. If the drive pin (28) is driven down too far causing binding, the pin may be relieved by tapping up on the shank.
  - (c) Check the pawl spring (27) for insufficient tension.
  - (d) Check the point on the pawl. It should be sharp to enable it to dig into the ratchet teeth. Sharpen with stone if necessary.
4. Ratchet sector too far away from ratchet pawl:  
If the ratchet sector (34) is too far away from the pawl (29), the eccentric motion required to operate the trip will be excessive. If necessary, bend the trip bracket slightly to reduce this distance. If the sector is too close to the pawl, excessive trip pressure will result.
5. Needle jumps out of eccentric groove in record:
  - (a) Check trip pressure, it should not exceed 8 grams for the trip shown in Fig. 2. If the pressure is excessive, see "CHANGER TRIPS BEFORE NEEDLE REACHES END OF RECORD" - 4 above.
  - (b) The record may be defective. The trip groove is often too shallow. Check with a record which is known to be good.
  - (c) The point on the needle may be bad. Check for a worn point.
  - (d) There may be binding in the pickup bearing or ratchet arm. See 1 and 2, "NEEDLE DOES NOT TRACK ACROSS RECORD PROPERLY".
6. Clutch pawl binding on cam face:  
On the trip mechanism shown in Fig. 2 the clutch pawl (63) must be free to move forward and engage the pinion gear teeth when the trip rod releases it. Check for burrs or foreign matter lodged between the pawl and the cam. Do not oil as this might collect dirt and gum up the pawl.

PICKUP ARM STRIKES RECORDS ON SPINDLE WHEN IT RAISES OR PICKUP ARM REST WHEN IT MOVES OUT:

Pickup arm height not adjusted properly. See instructions for adjusting the pickup arm height under "ADJUSTMENTS".

TURNTABLE SPEED TOO SLOW:

1. Binding in turntable bearing: Check the turntable bearing for freedom. Hold the motor idler wheel (2) out of engagement with the turntable and spin the turntable by hand to see if it turns readily and coasts for a long time. Clean out the bearings to remove foreign matter and lubricate with light oil.
2. Motor pulley too small in diameter: Replace the motor pulley with one having a greater diameter.
3. Line voltage too low: The line voltage should not be less than 100 volts or the turntable may be too slow.
4. Operating temperature too low. If the machine has been stored in a cold place or operated in surroundings at a temperature of less than 60° F., the turntable speed may be too slow.

TURNTABLE SPEED TOO FAST:

Motor pulley too large in diameter. Replace the pulley with one having a smaller diameter or grind one or two thousandths off the pulley.

TURNTABLE STALLS DURING CYCLE:

1. Motor idler not engaging turntable. See "TURNTABLE DOES NOT REVOLVE WHEN CONTROL KNOB IS TURNED TO "ON" POSITION" - 4.
2. Turntable bearing tight. See "TURNTABLE DOES NOT REVOLVE WHEN CONTROL KNOB IS TURNED TO "ON" POSITION" - 5.
3. Operating temperature too low. See "TURNTABLE SPEED TOO SLOW" - 4.
4. Line voltage too low: The line voltage should not be less than 100 volts.
5. Binding in drive mechanism:
  - (a) Remove lift arm (48) and hold idler (2) away from turntable or remove idler wheel. Cycle machine, turning turntable slowly by hand. The cam should turn freely for the complete revolution without binding at any point. If binding occurs check for foreign matter in the gear teeth, a bent cam bearing or bent spindle bushing.
  - (b) Replace lift arm, loosen spindle screw (77) and raise spindle high enough to clear the lift arm cam when the machine cycles. Hold the pickup arm lift rod (94) up so the end of the lift rod does not contact the lift arm cam. Cycle the machine by hand. The entire cycle should be free, without binding at any point. If binding occurs, check the lift arm bearing for freedom and the lift arm roller to be sure it is not bent causing binding in the cam track.

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6. Binding between pickup arm lift rod and lift arm cam face: Cycle machine stopping it halfway through the cycle just as the lift arm is about to return. Lift pickup arm and raise lift rod (94) by pulling up on the adjusting screw (13) as high as it will go. Feel the lift arm (48) (94) by pulling up on the adjusting screw (13) as high as it will go. Feel the lift arm (48) for play. The lift rod may still touch the lift arm cam face, but it should not bind. If binding occurs, the lift arm bearing may be bent or the fiber washer (59) under the lift arm should be removed to lower the lift arm.
7. Spindle roller spring compressed too far. Cycle the changer and watch the relationship between the bottom of the roller spring housing (78) and the roller (79). Just before the top of the lift arm cam raise is reached, the roller spring housing should stop its upward motion and the roller should continue up .005" to .047" more, slightly compressing the roller spring (81). If the spring compresses too much, the changer may stall on the shut off cycle. Check the lift arm bearing to determine if it is square with the base plate. It should be 90° to the base plate within 1/4°. If it is bent, carefully pound into place with a soft mallet. If it is straight and the roller spring is being compressed too much, remove the fiber washer (59) between the lift arm and the steel washer under it. The dimension on the spindle between the shoulder on which it rests and the bottom of the roller should be 1 7/8" plus or minus .010". An oversize spindle could also cause a binding condition.
8. Motor weak. In cases where everything checks all right but the changer still stalls in cycle, the motor may be weak.

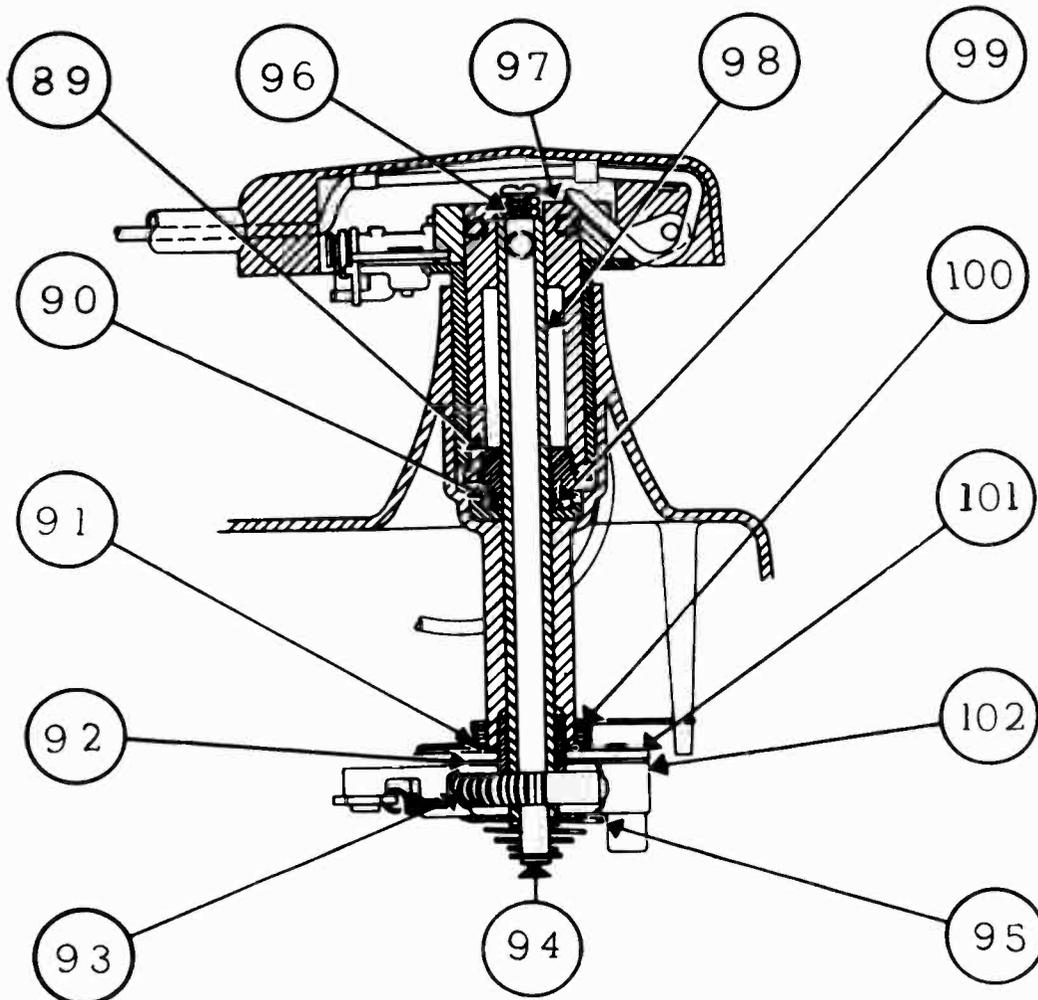


Figure 4

SEARS, ROEBUCK & CO. MODELS 101.211,  
101.211-1, 101.211-2,  
101.211-3, 101.211-4

#### CHANGER CONTINUES TO CYCLE:

1. Trip catch not engaging properly. See 2, "CHANGER TRIPS BEFORE NEEDLE REACHES END OF RECORD".
2. Insufficient tension on trip spring. See 3, same as above.
3. Binding in trip rod bearings. See 4, same as above.
4. Defective trip catch. See 5, "CHANGER DOES NOT CYCLE WHEN RECORD HAS BEEN PLAYED".
5. Reject control holding trip open. Check the control knob (25), control link (41), and control lever (44) for binding to determine if the control assembly is holding the trip in a disengaged position.
6. Trip rod not holding clutch pawl out of engagement with pinion teeth. On changers having the trip shown in Fig. 2, the end of the trip rod (60) should contact the bent up section of the clutch pawl (63) and push the pawl out of engagement with the pinion teeth. If the trip rod is not free to meet the clutch pawl, continuous cycling will result.
  - (a) See if the trip spring (62) is in place.
  - (b) Check the trip rod (60) for freedom in its bearings.

#### NOISE DURING PLAYING OF RECORD:

1. Rumble:
  - (a) From motor: If a low pitched rumbling sound comes from the loud speaker while a record is being played, check the motor grommets (67) to be sure the motor is freely suspended on them. The motor lead wires should have slack to allow the motor to float. Motor rumble may also come from an out of balance motor rotor. In this case, the motor should be replaced.
  - (b) From bearings: Defective turntable bearings can cause rumble. Check for foreign matter in the bearings, defective balls, binding between balls and ball retainer. Rough surface on washers. Clean ball bearing, sleeve bearing and washers, lubricate with lubriplate or light oil.
2. Defective motor idler wheel:  
A rapid thumping sound while the motor is running may indicate a flat spot on the motor idler wheel (2). Remove the turntable and check the rubber tire on the idler. If the surface of the rubber tire is not smooth and even, replace the idler.
3. Defective needle:  
A bad needle will cause loud needle scratch or hiss through both the speaker and the air directly from the needle. For reduced needle scratch and "needle talk" use a needle with high vertical compliance such as an offset "dog leg" type needle.
4. Defective record:  
Worn or defective records cause needle scratch and distortion of the recorded sound. If the record is warped, it may slip on the other records causing "wow", a waver in the recorded sound. An enlarged hole in the record can also cause "wow".
5. Turntable scrapes:  
If a scraping sound occurs as the turntable revolves, check:
  - (a) Turntable warped, causing outer rim to rise and fall.
  - (b) Motor idler (2) bent.
  - (c) Wires beneath turntable rubbing.
6. Squeaks:  
Squeaking sound, as changer operates indicates lack of oil. Lubricate points indicated under "LUBRICATION".

#### NOISE DURING CYCLING:

1. Squeaks: See "LUBRICATION".
2. Grinding sound indicates lack of lubrication or worn parts:  
Lubricate spindle roller assembly in bearing between it and spindle body.

#### DISTORTION OF RECORDED SOUND:

1. Defective needle. See 3, "NOISE DURING PLAYING OF RECORD".
2. Defective record. See 4, "NOISE DURING PLAYING OF RECORD".
3. Defective pickup cartridge:  
When the cartridge is defective, the recorded sound may be distorted, weak or stop entirely.
4. Defective amplifier:  
Check phonograph, amplifier and speaker.

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101.211-3, 101.211-4

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NO SOUND DURING PLAYING:

1. Defective cartridge. See 3, "DISTORTION OF RECORDED SOUND" - 4.
2. Defective wiring:  
Check pickup leads for a shorted or open lead.
3. Defective amplifier. See "DISTORTION OF RECORDED SOUND" - 4.

EXCESSIVE RECORD WEAR:

1. Binding in pickup arm. See 1 and 2, "NEEDLE DOES NOT TRACK ACROSS RECORD PROPERLY".
2. Defective needle. See 3, "NOISE DURING PLAYING OF RECORD".
3. Excessive needle pressure:  
The pickup arm is designed to give the proper needle pressure when an aluminum cased cartridge is used. If a cartridge with a die-cast housing is used, a compensating spring must be used to bring the needle pressure down to the usual standard of 1 oz. to 1½ oz. If the needle pressure is too great on a compensating spring, bend the long end of the spring.

CHANGER DOES NOT SHUT OFF AFTER LAST RECORD HAS BEEN PLAYED:

1. Record support binding on spindle:  
The record support (3) must rest on the offset shoulder of the spindle or the changer will not shut off.  
See 3, "TWO RECORDS DROP AT ONCE".
2. Changer stalls during shut off cycle.  
See "TURNTABLE SECTIONS; under "SERVICE INFORMATION.
3. Cutoff rod not engaging shoulder on spindle roller spring housing.  
On the shut off cycle, the end of the cutoff rod (42) should contact the shoulder on the bottom of the spindle roller spring housing (78) and turn the cutoff rod over 90°. If the end of the cutoff rod passes under the roller spring housing as the machine cycles, on the shut off cycle, check:
  - (a) The record support to be sure it is resting on the spindle shoulder, see 1, above.
  - (b) The spindle to see if it is being held down in place by the spindle screw (77).
  - (c) The lift arm screw (47) to be sure it is tight.
  - (d) The bent up end of the cutoff rod (42) may be short. Replace if necessary.

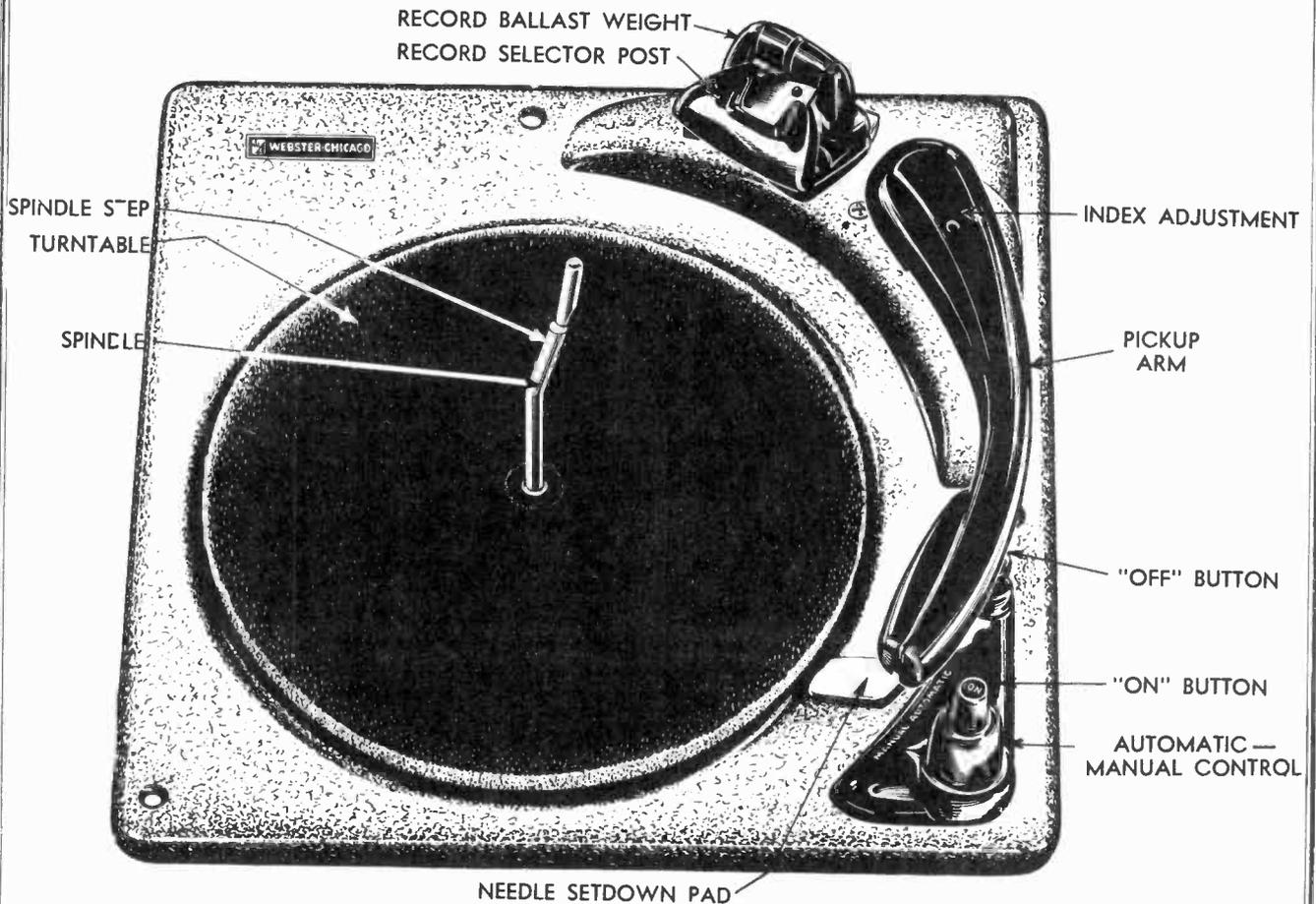
PICKUP ARM DOES NOT SET DOWN ON REST AFTER LAST RECORD HAS BEEN PLAYED:

Control lever does not engage set down locater.

On the shut off cycle, one leg of the control lever (44) should catch the set down locater (43) holding it to prevent the return spring (100) from pulling the pickup arm in. The pickup arm should be held against the stop in the base plate. In this position, the nest in the pickup arm should be directly above the pickup rest.

CHANGER SHUTS OFF PREMATURELY:

1. Spindle roller spring compressed too far. See 7, "TURNTABLE STALLS DURING CYCLE".
2. Roller spring in spindle too weak:  
When the bottom record of a stack of ten 12" records is being ejected from the spindle ledge, the roller spring (81) should not compress until just before the roller reaches the top of the cam incline on the lift arm. If the roller spring is compressed under the load of a full stack of records it may cause premature shut off. Replace the roller assembly (78) if necessary.
3. Record too thick:  
The changer is designed to play standard records. If an old style 1/8" thick record is used, the changer will shut off instead of dropping the record.
4. Cutoff rod not being reset:  
After the shut off cycle, when the cutoff rod (42) has been turned to throw the switch to the "OFF" position, it should be returned to its original position the next time the machine cycles by the bent up end of the cutoff rod, contacting the round stud on one leg of the control lever (44). The flat spring (46) acting against the cutoff rod should throw the rod against its stop on the lift arm (48) and hold it there. If the cutoff rod is not fully turned, the bent up end next to the spindle may stick up high enough to prematurely contact the shoulder on the roller spring housing (78).
  - (a) Check the lever spring (46) for tension. Remove and bend slightly to increase tension if necessary.
  - (b) Lubricate the cutoff rod bearings and around the lever spring with lubriplate or oil.
  - (c) Check the clearance between the end of the cutoff rod (42) which passes under the control lever (44) and the bottom of the round stud on the control lever. When the cutoff rod is in its normal operating position, it should not clear the bottom of the round stud by more than enough to completely turn the end of the cutoff rod from a vertical position back to a horizontal position.



## OPERATION

### MOTOR

Connect the motor cord to a source of 105-115 volt 60 cycle current only. If it is desired to operate the changer on 50 cycle current, a special motor pulley (Part No. 17X412-11) must be used in place of the one supplied with the changer in order to drive the turntable at the required speed of 78 R.P.M.

Do not under any circumstances connect the motor to a source of direct current or alternating current of any other frequencies.

### PICKUP

The high impedance crystal cartridge supplied may be of the fixed permanent point or removable needle type. If it is the latter, use a needle which is not more than  $1\frac{1}{16}$  inches long for most satisfactory results.

Some desirable qualities of a good needle are faithful reproduction, low surface scratch or hiss, long wearing qualities, minimum record wear and rugged construction.

The Webster-Chicago Nylon Needles are particularly adaptable for use with your Webster "156". The "Knee-action" of the nylon knee permits the needle to ride the record groove in a gentle, floating motion, protects valuable records

from unnecessary wear . . . virtually eliminates breakage of the sapphire tip if accidentally dropped . . . greatly lengthens needle life . . . produces a pleasing harmonious tonal balance and delivers remarkably authentic reproduction. **DO NOT USE SINGLE PLAY OR CACTUS NEEDLES FOR AUTOMATIC OPERATION.**

### OPERATION — AUTOMATIC

1. Turn the Record Selector Post to "10" or "12" for ten or twelve inch records.
2. Turn the Selector Control (sleeve of ON button) to AUTOMATIC.
3. With the Record Ballast Weight turned back, place up to ten 12" records, or twelve 10" records on the spindle so that the bottom record rests on the step of the spindle and the shelf of the Record Selector Post.
4. Turn the Record Ballast Weight forward to rest on the top record.
5. Press the ON button.

To "reject" any record while playing in the AUTOMATIC position, press the ON button.

**NOTE:** The OFF button may be pressed during any portion of the change cycle. The Pickup Arm may be moved manually at any time without damage to the mechanism. However, after

the last record has been played, the Pickup Arm is automatically locked in position and should not be handled until it has come to rest on the OFF button.

6. After the last record has been played, the entire stack may be removed from the turntable at one time. The simplest procedure is as follows:
  - a. Turn the Record Ballast Weight out of position.
  - b. Place the fingers of both hands under opposite edges of the bottom record.
  - c. Do not apply pressure to the top record. (Keep your thumbs free.)
  - d. Lift the stack of records straight up, following the contours of the spindle. This permits the stack of records to follow the curve of the spindle without binding and greatly facilitates the removal of the stack.

### OPERATION — MANUAL

1. Turn the Record Selector Post to the 12" posi-

tion. (This is not essential but permits more clearance in loading and unloading records.)

2. Turn the Selector Switch (sleeve of ON button) to **MANUAL**.
3. Place a record on the Turntable. It may facilitate this operation if the record is placed over the spindle at an angle, with the edge of the record held below the level of the Record Selector Post Shelf. Records may be removed in this same manner.
4. Press the ON button.
5. Place the needle gently on the edge of the record. Do not lift the Pickup Arm too high as this will cause it to catch in the Automatic Stop Lock position. Particular care should be exercised if your pickup has a sapphire point needle. Although the sapphire is very hard and long wearing, it is extremely brittle and may be fractured or chipped if dropped on the record.
6. To stop the mechanism at any time, press the OFF button.

## SERVICE INFORMATION AND ADJUSTMENTS

All units are accurately adjusted, lubricated and tested at the factory. However service repairs and adjustments sometimes become necessary. This bulletin should be studied carefully before making any adjustments or replacing parts.

Service parts are available from your Webster-Chicago distributor. All parts must be ordered by piece part number and also record changer model and production number, stamped on the under side of the main plate.

The functions and most probably misadjustments of the main assemblies are as follows (reference numbers refer to the exploded view)

### THE AUTOMATIC TRIP FAILS TO FUNCTION

The Main Cam Assembly (38) and Actuating Gear (36) are the heart of the record changer. The Main Cam Assembly drives the mechanisms as-

sociated with the action of the Pickup Arm (5) and the Record Selector assemblies. It, in turn, is driven by the gear train (29, 30, 31) and the Turntable which is rim driven by the phonograph motor.

The Main Cam Assembly and Actuating Gear is put in motion or "tripped" by means of the "automatic" trip or by the manually operated "reject" trip. When the movement of the Pickup Arm toward the spindle is greater than  $\frac{1}{8}$ " in  $\frac{1}{2}$  revolution of the Turntable, the Automatic Trip Arm (33) trips the Velocity Trip and Roller Assembly (37). This releases the Actuating Pawl on the Main Cam Assembly (38), allowing it to engage the Main Cam Actuating Gear (36) and driving it through the change cycle. The pressure from the Automatic Trip Arm required to actuate the trip mechanism is negligible.

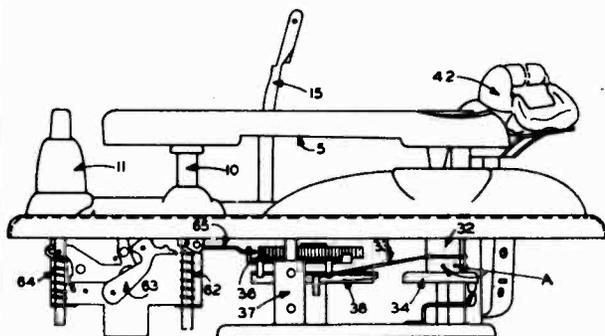


Fig. 1

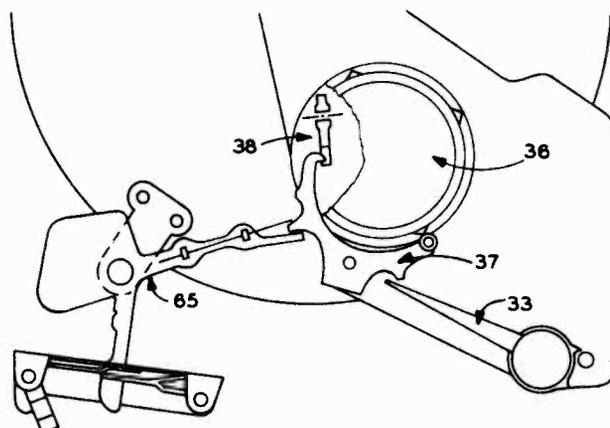


Fig. 2

The Automatic Trip Arm (33) follows the movement of the Pickup Arm through a weighted friction clutch (32). This clutch must be kept free of oil and grease. Should it become necessary, clean the clutch parts with carbon tetrachloride. This clutch should operate the trip mechanism without placing undue drag on the movement of the pickup arm.

Also check for:

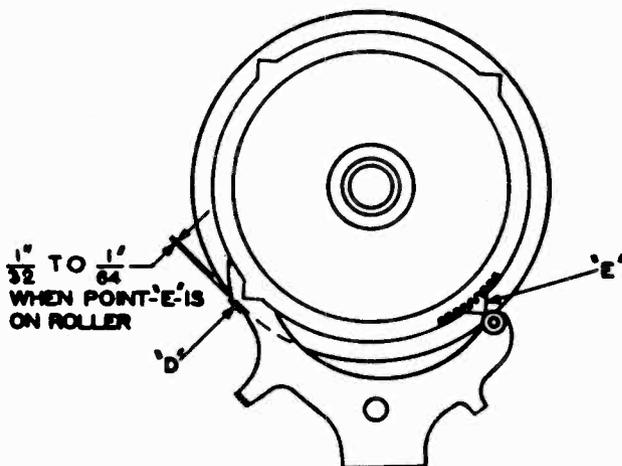
1. Velocity Trip and Roller Assembly binding.
2. Slight burr on end of the actuating pawl or on the underside of the Velocity Trip hook.
3. Actuating Pawl stuck (part of Main Cam Assembly (38) engaged by the hook end of the Velocity Trip and Roller Assembly (37).
4. Automatic Trip Arm (33) bent and not hitting the Velocity Trip and Roller Assembly (37).
5. Automatic Trip Arm (33) fails to touch the Velocity Trip and Roller Assembly.
6. Velocity Trip and Roller Assembly (37) rubbing on the underside of the Main Cam Actuating Gear (36).
7. No velocity lead-in groove or eccentric groove in the center of record.
8. Foreign matter in record groove.
9. Badly worn record.
10. Badly bent or worn needle.

**IF THE "REJECT" TRIP FAILS TO FUNCTION**

When the "On" button is pressed, the hair spring of the "reject" trip lever arm (65), actuates the Velocity Trip and Arm Assembly, putting the change mechanism in cycle.

Check for:

1. "Reject" trip hair spring of Lever (65) bent or broken.
2. Velocity Trip and Roller Assembly (37) binding.



ADJUST IF NECESSARY BY BENDING AT POINT "D".

Fig. 3

3. Actuating Pawl (part of Main Cam Assembly 38) stuck.

**IF THE MECHANISM CONTINUES TO CYCLE**

At the completion of the change cycle, the Actuating Pawl is disengaged from the Main Cam Assembly Actuating Gear (36) by the hook end of the Velocity Trip and Roller Assembly (37) which has been returned to its normal position by the reset points on the Main Cam Drive Gear (Fig. 3). This hook should be adjusted for about  $\frac{1}{64}$ " clearance from the bottom of the Main Cam Drive Gear (36), Fig. 1. Greater clearance may permit the pawl to bounce past the hook and re-engage, causing the mechanism to continue to cycle.

If the clearance between the lip on the Velocity Trip Lever and the edge of the Main Cam is too small, it will prevent the hook end of the Velocity Trip Lever from engaging the trigger. Adjust the clearance between the lip (D, Figs. 3 and 5) on the Velocity Trip Lever of the Main Cam to be within  $\frac{1}{64}$ " when the roller is contacting the point of one of the protrusions on the Actuating Gear.

Also check for:

1. Velocity Trip and Roller Assembly (37) rubbing on Main Cam Actuating Gear (36).
2. Manual Trip Lever (65) binding.
3. "Disengage Roller" broken on Velocity Trip and Roller Assembly (37).

**PICKUP ARM LIFT TOO HIGH OR TOO LOW**

The vertical movement of the pickup arm is controlled by the angle of the Pickup Arm Raising Lever (40), Fig. 4. The needle should approach the top record of a full stack of 10" records on the turntable with approximately  $\frac{1}{8}$ " clearance.

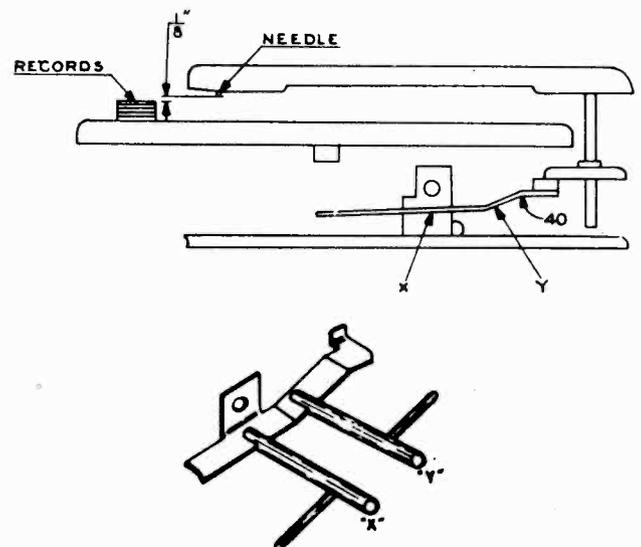


Fig. 4

To adjust:

1. Put a full stack of 10" records ON THE TURN-TABLE.
2. Press the "On" button and rotate the Turntable clockwise until the needle clears the top record of the stack by about  $\frac{1}{8}$ ".
3. Be sure the notch in the Pickup Arm raising disc (34) engages the pickup arm raising lever (40).
4. If the needle does not clear the top record or if it raises too high, adjust by bending the pickup arm raising lever at the point indicated in Fig. 4.

**CAUTION:** All adjusting bends should be made slowly, using slight but firm, easy pressure.

Be sure the set screws of (A of Fig. 1) of the pickup arm raising disc are not loose and are properly positioned in the alignment holes as explained in the paragraph on Needle Setdown Indexing.

### NEEDLE SET DOWN INDEXING INCORRECT

The horizontal movement of the pickup arm (5) is controlled by the eccentric excursion of the Pickup Arm Raising Lever (40) moving the Pickup Arm Raising Disc (34) when actuated by the Main Cam Assembly (38). The eccentric screw (part of 6), accessible through the top of the pickup arm (5), should take care of any normal position adjustment. Turn this screw clockwise to index the needle in toward the spindle and counter-clockwise to index the needle out away from the spindle.

Should further adjustment be necessary, proceed as follows:

1. Set the eccentric screw, just mentioned, to a middle position.
2. Set the Record Selector Post (42) to the 10" position.
3. Operate the mechanism by revolving the Turntable manually until the needle drops to within  $\frac{1}{8}$ " of a 10" record on the turntable.
4. Be sure the notch in the Pickup Arm Raising Disc (34) engages the Pickup Arm Raising Lever (40).
5. With a No. 8 Bristol wrench in each of the set screws of the Pickup Arm Raising Disc (35) as indicated in A, Fig. 1, alternately loosen one screw and tighten the other until the needle rests above the record lead-in groove at the desired point.
6. Complete the change cycle of the mechanism and position the Pickup Arm on the "off" button (10). If necessary, bend the tongue of the Pickup Arm Raising Disc closer to or away from the Base Plate Post until the Pickup Arm is correctly seated on the "off" button when the tongue is touching the Base Plate Post.

**NOTE:** All adjusting bends should be slight but firm, easy bends.

7. Be sure that both set screws are tight when this adjustment is completed.
8. Turn the Record Selector Post to 12" and check the needle drop on a 12" record. Make any additional adjustments with the eccentric screw mentioned previously.

### PICKUP ARM DROPS OFF THE "OFF" BUTTON

The upturned end of the pickup arm pivot shaft bracket (35) prevents the pickup arm from falling off the "off" button. There should be approximately  $\frac{1}{64}$ " clearance between the tongue of the Pickup Arm Raising Disc (34) and the bottom of the groove formed by the bracket and the Base Plate Post. Bend the Bracket end up or down to secure proper positioning of the disc tongue and the Pivot bracket. Be careful to bend the end only or the Bracket will bind on the Pickup Arm Pivot Shaft (7).

The Bracket should not be too high or the disc tongue will rub on it when the needle approaches the edge of a 12" record, causing "glide in" on the first few grooves of the record.

### CHANGE CYCLE STARTS BEFORE END OF RECORD

If the trip assembly chatters while the changer is running, or if the changer cycles before the entire record is played, there is probably insufficient clearance between the hook end of the Velocity Trip and Roller Assembly (37) and the Actuating Gear (36). This clearance should be adjusted to be within  $\frac{1}{32}$ " to  $\frac{1}{64}$ " by bending the lever at point "C" shown in Fig. 5.

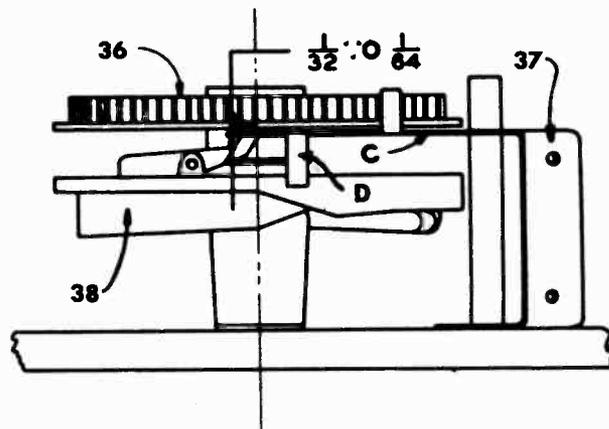


Fig. 5

### MORE THAN ONE RECORD IS DROPPED DURING A CHANGE CYCLE

The floating latch at the top of the Record Spindle is so spaced that only one record at a time can slide between the heel of the latch and the step of the spindle. The hole in the latch is elongated

so that the latch can slip into the spindle recess when records are being removed. If more than one record is dropped at a time, it will be found to be due to:

1. Foreign matter in spindle recess causing the latch to stick.
2. Exceptionally thin records. Standard records are .075" - .090" thick.

### RECORD DROPS ON PICKUP ARM

As the change cycle is started, the first motion of the inclined outer bottom surface of the Main Cam (38) causes the Record Selector Post (42) to move toward the Spindle about  $\frac{3}{32}$  inch. This position is maintained until the Pickup Arm has made its full outward lateral excursion at which time the Record Selector Post again moves toward the spindle, causing the bottom record to drop into playing position.

If the Record Selector Post (42) has been bent back, away from the Record Spindle, it is possible for a standard record to rest on the spindle step with its edge just over the edge of the Record Selector Post shelf. Then as the change cycle is started, the record is pushed off the spindle by the initial movement of the Record Selector Post, so that it drops on the Pickup Arm.

To correct this condition, the Rocker Arm Assembly must be adjusted so that the Record Selector Post is brought nearer to the spindle. This adjustment is made in the following manner:

1. With the mechanism at rest, remove the Turntable and replace the Record Spindle. Set the Record Selector Post to the position for playing 12-inch records and place a 12-inch record on the Record Spindle.
2. Insert a short screwdriver through the motor-

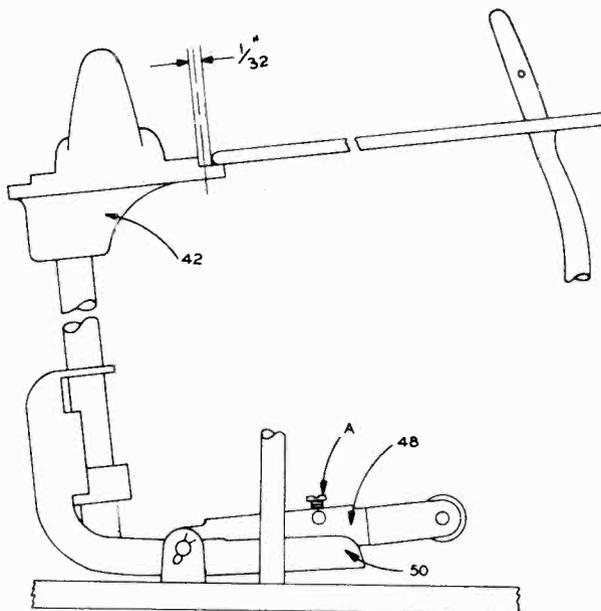


Fig. 6

board opening into the screw slot as shown at "A" in Fig. 6. Clockwise rotation of the screw will increase the distance between the Record Spindle and the Record Selector Post; counter-clockwise rotation will decrease it.

It is recommended that the distance between the edge of the record and the step of the Record Selector Post be held to just over  $\frac{1}{32}$  of an inch so that records with rough or sharply beveled edges will not catch on the outer edge of the Record Selector Post.

**CAUTION:** Be certain that a standard size record is used in making this adjustment. A standard 10" record measures  $9\frac{7}{8} \pm \frac{1}{32}$ " diameter. A standard 12" record measures  $11\frac{7}{8} \pm \frac{1}{32}$ " diameter.

### PUSH OFF POST ANGLE INCORRECT

The Record Selector Post should be adjusted so that the curve of the shelf matches the curve of the record. See Fig. 7.

To adjust this angle:

1. Turn the Record Selector Post to the "10" position.
2. Place a ten-inch record on the Spindle in the normal position for automatic playing.
3. With a No. 8 Bristol wrench in each of the set screws (point A, Fig. 7), alternately loosen one and tighten the other until the Record Selector post angle is correct. Be sure that both set screws are tight at the completion of this adjustment.

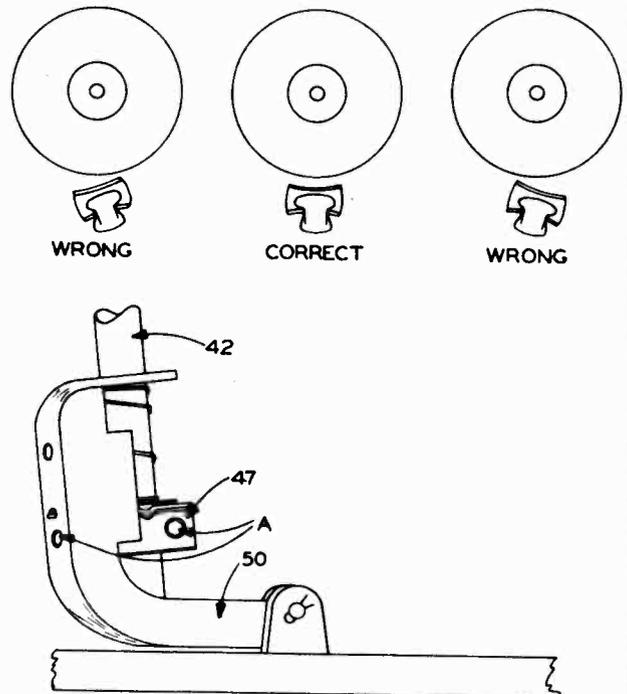


Fig. 7

## ERRATIC INDEXING

Indexing in the 10" or the 12" position is controlled through the presence or absence of pressure from the Compression Spring (47A) on the Pickup Arm Raising Lever (40). The compression on this spring is changed as the Record Selector Post (42) is changed to the 10" or 12" position. Improper adjustment of the spring tension will result in erratic indexing. In the 12" position, the spring should be just free. In the 10" position, the compression of the spring holds the stud of the Pickup Arm Raising Lever (40) against the outside edge of the groove, forcing the stud to travel the inside edge or the outside edge of the groove in the bottom of the Main Cam (38).

To adjust:

Bend the slotted arm (part of 40) for proper tension and smooth clearance of the spring guide arm (47).

## GLIDE IN ON 12" RECORDS

1. Check tension of compression spring (47A) as explained above. Spring should be free in 12" position.
2. Remove any cause of friction in Index Lever (47).
3. Tongue of Pickup Arm Raising Disc (34) should not touch beveled edge of pickup arm pivot shaft bracket (35) when the needle is on the edge of a 12" record. Bend the end of the bracket if necessary.

## "WOW"

If the speed of the Turntable varies during each revolution, check:

1. Defective Idler wheel (24).
2. Dirt or foreign matter inside the rim of the Turntable.

## LAST RECORD CONTINUES TO PLAY

1. Check the record spindle to be sure that it moves up and down freely.
2. With no records on the spindle, check the Automatic Shut Off Lock Lever (44). The lower hook end of this arm ("C") should catch the Pickup Arm Raising Disc (34) at the beginning of the cycle to prevent travel of the Pickup Arm, causing it to drop on the OFF button. With no records on the Spindle and with the mechanism at rest, this hook should clear the top of the Pickup Arm Raising Disc by  $\frac{1}{32}$ ". Adjust, if necessary, by inserting a screw driver in the hole in the bottom base plate and bending

lip "D". Never attempt to move the Pickup Arm Raising Disc up or down.

3. The elevated hook "A" on the Automatic Shut Off Lock Lever will sometimes lock with the bracket "B" on the Record Selector Post (50) if the drop of the record is delayed. More clearance can be obtained by bending the elevated hook "A" away from the bracket.

## LAST RECORD DOES NOT PLAY

The weight of the records on the Spindle keeps the Automatic Shut Off Lock Lever (44) from dropping and engaging the Pickup Arm Raising Disc (38), thus permitting the mechanism to continue to cycle.

The Push Off Post (50) moves forward slightly at the beginning of each change cycle. The bracket "B" on this post is then underneath the elevated hook "A" on the Automatic Shut Off Lock Lever (44). This forward movement takes place before the last record drops so the change cycle should continue. However the dropping of the last record releases the Automatic Shut Off Lock Lever, permitting it to drop and shut off the mechanism when the change cycle starts after the last record.

If the last record does not play:

1. Bend the elevated hook "A", Fig. 8 forward so that it will overlap the Push Off Post bracket "H" about  $\frac{1}{32}$ " with a record on the spindle.

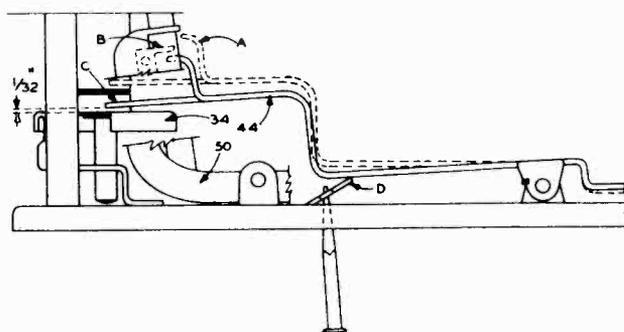


Fig. 8

## MOTOR DOES NOT SHUT OFF

1. OFF button stuck.
2. Defective switch.
3. OFF button Shaft Spring (62) has too much tension.
4. Roller on Switch Lever binding.
5. Switch Lever binding on switch frame.
6. Excessive counterbalancing on Pickup Arm.

## REPLACEMENT OF PARTS

### REPLACE PICKUP CARTRIDGE

1. Press upward on the clip fastener at the forward end of the Pickup Mounting Bracket and

raise the Pickup Arm to a vertical position.

2. Remove the screws holding the cartridge in place and replace the cartridge.

**REPLACE PICKUP ARM**

1. Press upward on the clip fastener at the forward end of the Pickup Arm Mounting Bracket.
2. Raise arm to vertical position.
3. Remove screws holding arm and bracket.
4. After the new Pickup Arm has been installed, press the arm and the Mounting Bracket together until the clip latches.

**REMOVE THE SUB-PLATE ASSEMBLY**

In the event that it becomes necessary to replace any of the major parts in the sub-plate assembly, the entire assembly should first be removed from the motorboard.

1. Remove the Record Spindle which is held in by a clip under the sub-plate.
2. Remove the Turntable.
3. Remove the Pickup Arm in the manner outlined previously.
4. Unhook the Rocker Arm Return spring.
5. Remove the Rocker Arm Pivot Pin.
6. Remove the five No. 8-32 x  $\frac{3}{4}$  R.H. screws holding the sub-plate studs and the No. 8-32 x  $\frac{3}{8}$  R.H. screw holding the center post to the motorboard. Note that one of the 8-32 x  $\frac{1}{4}$  R.H. screws is accessible through the Pickup Arm hole in the Crescent Assembly.

It should not be necessary to remove the Crescent Assembly except for replacement or to remove the complete Rocker Arm Assembly.

**REPLACING THE SUB-PLATE ASSEMBLY**

1. Reverse the above procedure making certain that all parts fall into their proper positions.
2. Particularly note the Selector Lever and Selector Lever Compression Spring to see that they are in position with the lever through the slot in the Pickup Arm Raising Lever Bracket.

**REPLACE PICKUP ARM BRACKET AND SHAFT ASSEMBLY**

1. Loosen Bristol screws in Pickup Arm Raising Disc.
2. Remove Disc and Clutch parts by sliding them off the bottom of the Pickup Arm Shaft and pull shaft out of changer from above.

To replace, reverse the procedure and adjust the Pickup Arm Raising Disc for proper operation.

**REPLACE RECORD POST AND ROCKER ARM ASSEMBLY**

1. Remove the Pickup Arm Assembly.
2. Remove the four nuts under the main plate which hold the Crescent Assembly.
3. Unhook the Rocker Arm Return Spring.
4. Remove the Rocker Arm Pivot Pin.
5. Lift out the Record Selector Post, Rocker Arm and Crescent Assembly as a unit.
6. In replacing the Rocker Arm Assembly, note paragraph "Replacing the Sub-Plate Assembly."

**LUBRICATION**

Model 156 Record Changers leave the factory completely oiled and lubricated. Under normal conditions this should be sufficient for approximately one year or 1,000 hours of operation. When operated under extreme conditions of dust or heat, this operation should be performed more frequently as required.

**NOTE: AVOID EXCESSIVE LUBRICATION.**

Do not permit any oil or grease to get on the rubber idler drive wheel or the Motor Sleeve (Illus. 11 and 21, Fig. 4), on turntable drive rim or on the automatic trip arm clutch. Any oil or grease on these points should be removed using carbon tetrachloride.

The recommended lubricants and points of lubrication are as follows:

**A — No. 10 OIL (Apply With Small Oil Can Or Medicine Dropper)**

1. Motor Bearings. Saturate top and bottom felts.
2. Pickup Arm Shaft (Illus. 22, Fig. 6). Apply one drop each to bottom bearing point, bracket hole and hole through Main Base Plate.

3. Ball Bearing Assembly (Illus. 7, Fig. 4).

4. Idler Wheel Felt (Illus. 13, Fig. 4).

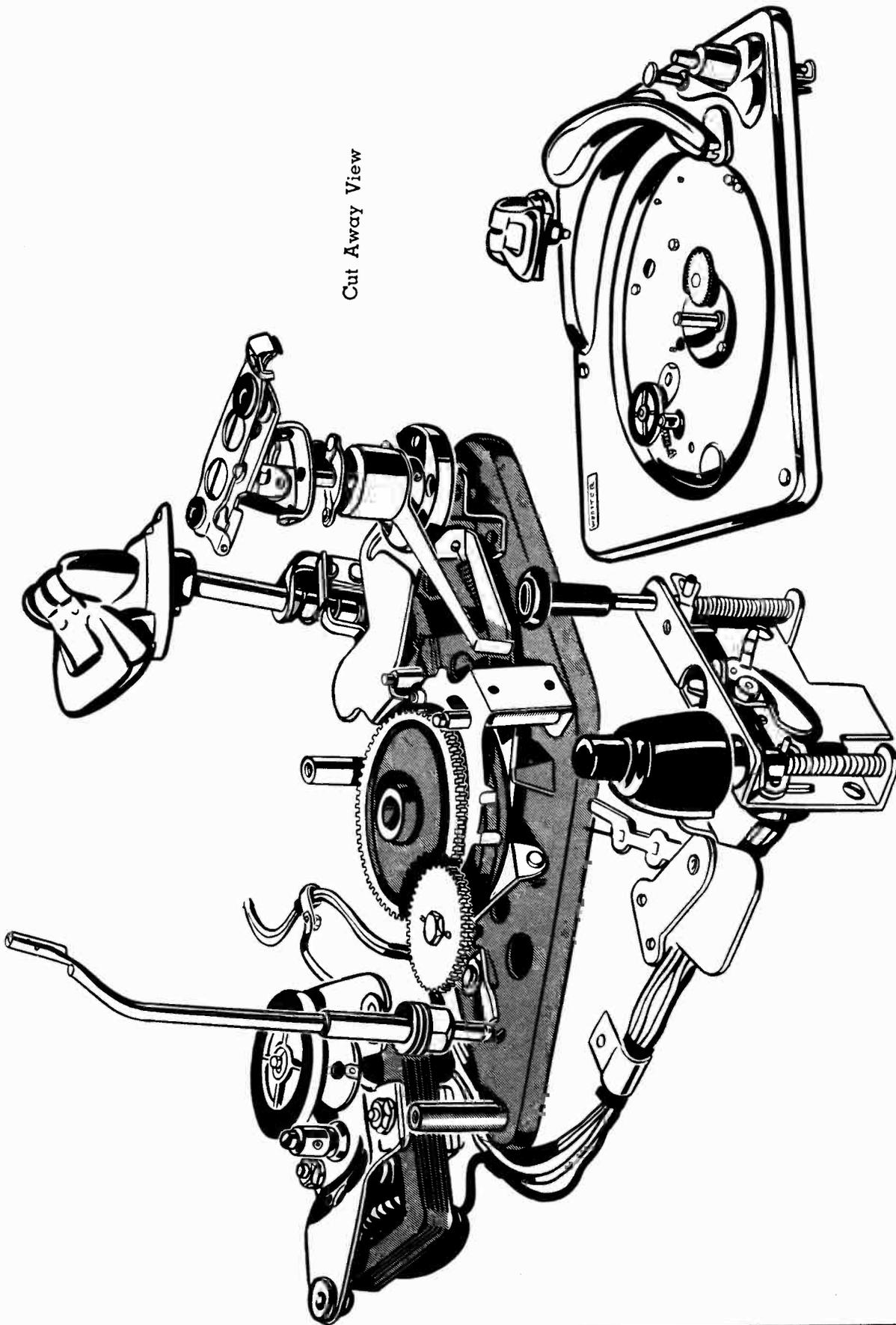
**B — LUBRIPLATE (Apply With Small Brush)**

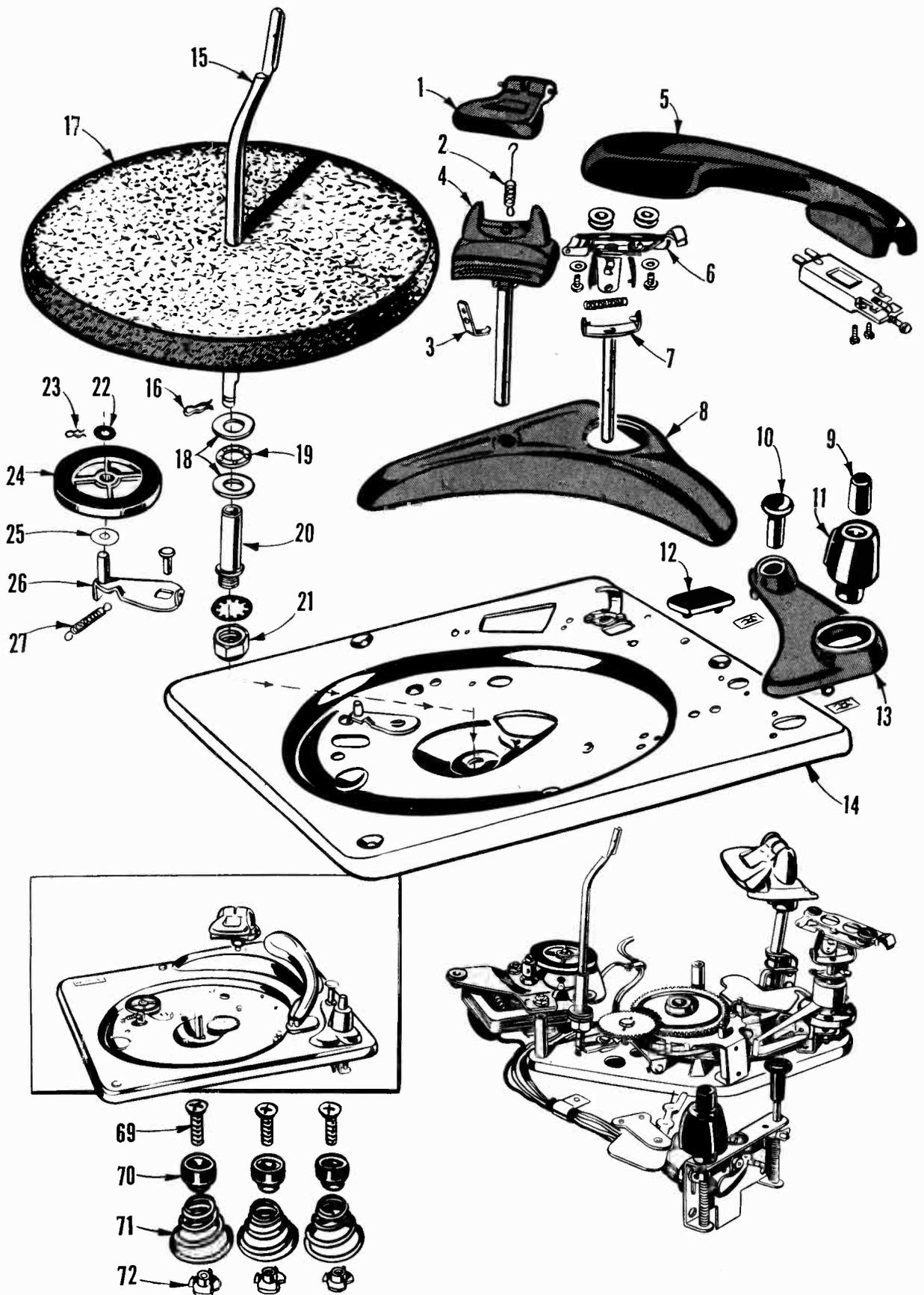
1. Idler Wheel Link (Illus. 16, Fig. 4).
2. Turntable Shaft Stud.
3. Pickup Arm Hinge Pins.
4. Knife edge of Raising Lever (Illus. 33, Fig. 7).
5. Main Cam Bearing. (It is necessary to remove the sub-plate Assembly to lubriplate this bearing. See paragraph Mechanical Repairs "C" To Remove the Sub-Plate Assembly.)

**C — STA-PUT (Apply With Small Brush)**

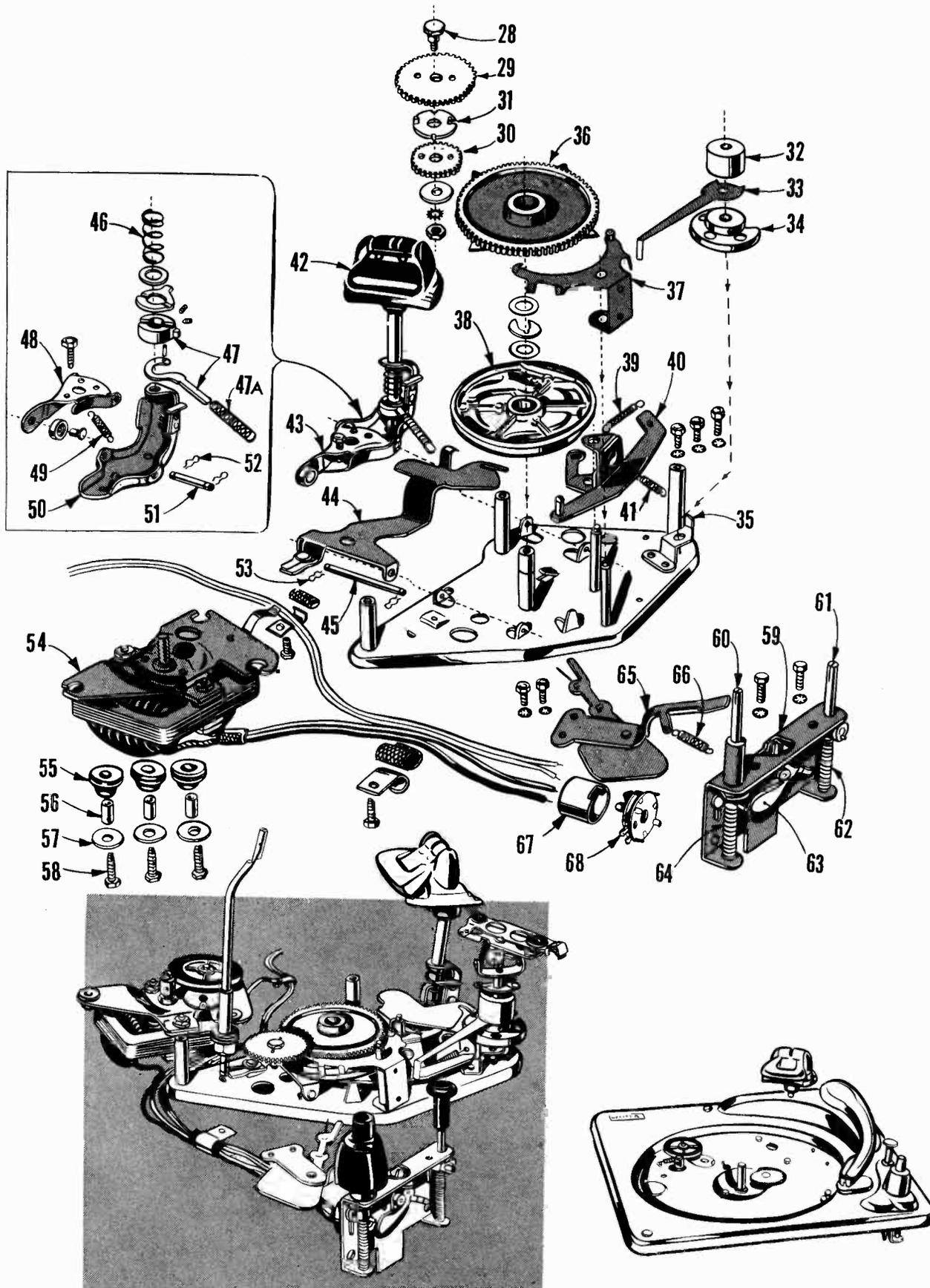
1. Teeth of Main Cam Actuating Gear (Illus. 43, Fig. 7).
2. Track of Main Cam Gear (Illus. 42, Fig. 7).
3. Teeth of Large and Small idler gears (Illus. 9, Fig. 4).
4. Raising lever Bracket bearing surfaces (Illus. 33, Fig. 7).

Cut Away View





Exploded View



Exploded View

WEBSTER CHICAGO CORP.

MODEL 156

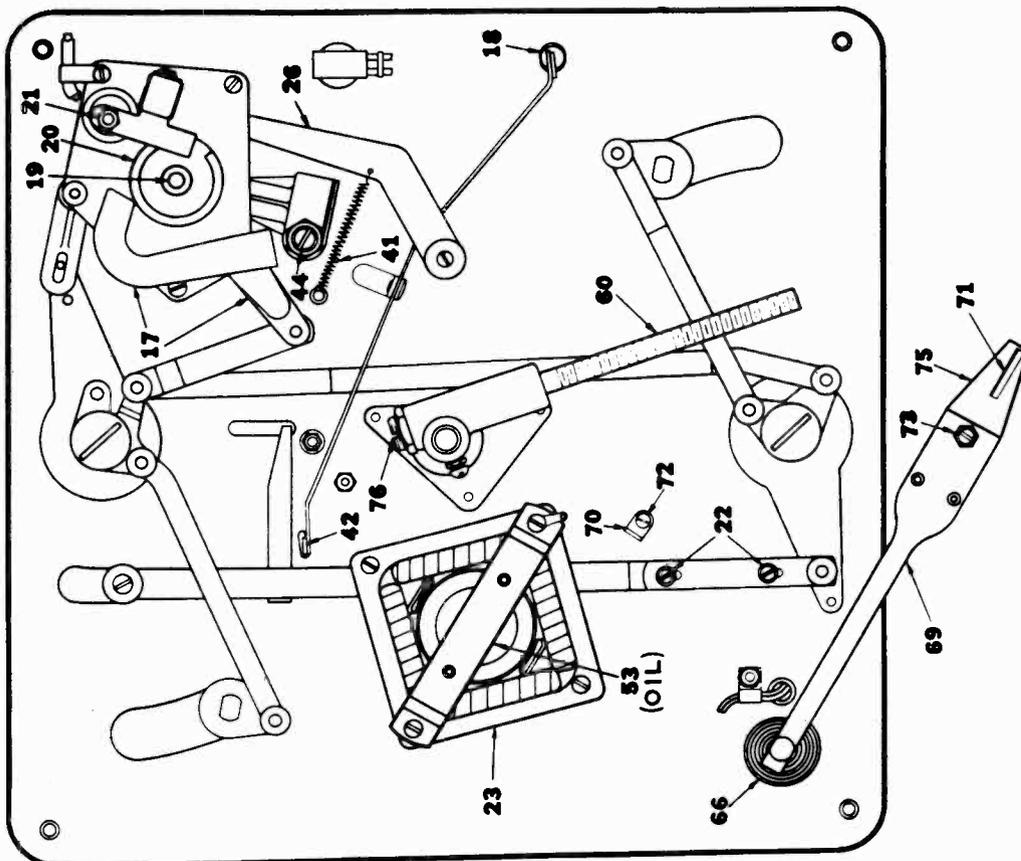
REPLACEMENT PARTS LIST

REPLACEMENT PARTS LIST

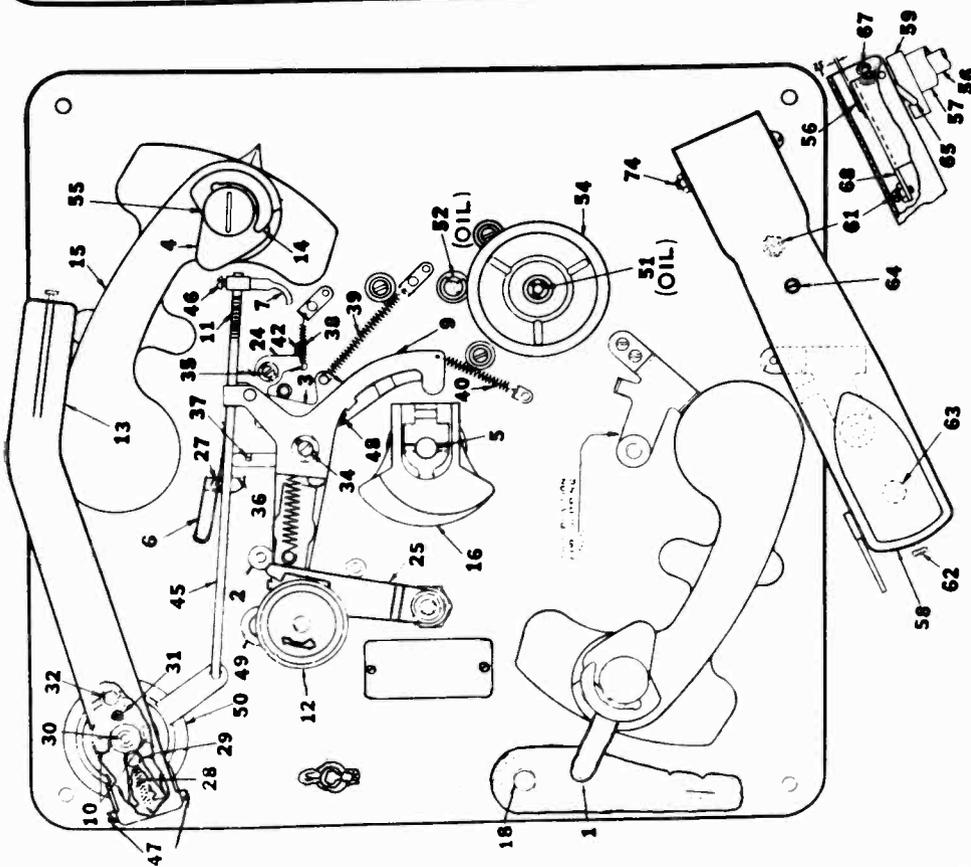
Illustration No.	Part No.	Part Name and Description	Illustration No.	Part No.	Part Name and Description
1	49P074	Record Stabilizer Weight	28	41P333	Shoulder Screw
2	46P126	Stabilizer Weight Tension Spring	29	47P024	Large Fibre Gear
3	45P464	Stabilizer Spring Retaining Bracket	30	47P023	Small Fibre Gear
4	49X029	Record Selector (Pushoff) Post	31	45P342	Idle Gear Coupler
5	49X068	Pickup Arm Lens Hardware and Cartridge	32	41P576	Clutch Tension Weight
6	21X280	Pickup Arm Mounting Hinge	33	46P568	Automatic Trip Arm
7	11X136	Pickup Arm Base Shaft Assembly	34	11X227	Pickup Arm Raising Disc and Hub Assembly
8	.	Pickup Arm — Record Post Base Crescent Assembly	35	45P347	Tone Arm Lift Stop Bracket
9	49P026	"ON" Button	36	11X032	Main Cam Actuating Gear
10	49P050	"OFF" Button	37	11X047	Velocity Trip and Roller Assembly
11	11X139	"Automatic - Manual" Knob	38	11X033	Main Cam Assembly
12	24P014	Rubber Needle Set Down Pad	39	46P044	Raising Lever Tension Spring
13	49P027	Control Escutcheon	40	11X046	Pickup Arm Raising Lever
14	.	Main Base Plate	41	46P139	Pickup Arm Raising Lever Tension Spring
15	11X133	Spindle Assembly Including Pawl	43	45P583	Rocker Arm Lever Assembly
16	50P160	Spindle Retaining Clip	44	11X079	Automatic Shut-Off Lock Lever
17	11X138	Turntable Including Gear	45	41P443	Automatic Shut-Off Lock Lever Pin
18	25P269	Bearing Race Washer	46	46P012	Automatic Shut-Off Lock Compression Spring
19	11X058	Bearing Race Assembly	47	11X049	Selector Lever and Collar Assembly
20	41P414	Steel Turntable Bearing	48	11X141	Rocker Arm Lever Assembly
21	26P687	Turntable Bearing Nut	49	46P017	Rocker Arm Lever Assembly Compression Spring
22	25P030	Idle Wheel Felt Washer	50	11X142	Rocker Arm Lever Assembly
23	50P125	Idle Retaining Clip	51	41P421	Rocker Arm Lever Assembly Pin
24	11X003	Idle Drive Wheel	52	50P125	Rocker Arm Lever Assembly Clip
25	25P046	Fibre Idle Washer	53	50P125	Rocker Arm Lever Assembly Clip
26	11X068	Idle Link Assembly	54	50X090	Motor Assembly 60 Cycle, 105 - 120 Volt
27	46P112	Idle Tension Spring	54A	17X412-11	Motor Shaft Sleeve — 50 Cycle
			55	25P363	Rubber Shock Motor Mounts
			56	41P592	Motor Mounting Sleeve
			57	25P367	Motor Mounting Washer
			58	26P312	Motor Mounting Bolt
			59	11X145	Switch Assembly Complete Less Buttons
			60	41P444	Switch Assembly "ON" Post
			61	41P588	Switch Assembly "OFF" Post
			62	46P138	Switch Assembly "OFF" Spring
			63	45P570	Switch Assembly Release Lever
			64	46P123	Switch Assembly "ON" Spring
			65	11X158	Trip Lever and Wire Assembly
			66	46P117	Trip Lever Tension Spring
			67	32X039	A. C. Switch Cover
			68	32X044	A. C. Switch

\*Not stocked for service.





Bottom View



Top View — Table Removed

MODELS 7E40, 7E44

WILCOX-GAY CORP.

DRAWING NO.	PART NO.	NAME	
1	11419	10" and 12" link pin handle assembly	39
2	11562	Sleeve for pulley control lever stop post.	40
3	11475	Cam lift lever assembly	41
4	11407	Record shelf	42
5	11144	Turntable shaft.	44
6	12969	Trip rod tension spring	45
7	11523	Spiral trip dog	46
8	Not used		47
9	11677	Pulley control lever assembly	48
10	11616	Adjusting screw for tone arm and mounting bracket.	49
11	11430	Trip rod	50
12	12870	Change mechanism drive pulley	51
13	13612	Tone arm complete (Less cartridge)	
14	11406	Record divide support	
*15	12811	Rear record support bracket complete	52
16	11529	Trip cam assembly complete	
17	11632	Record shelf turning lever assembly	53
18	13896	Reject button	54
19	11499	Gear shaft	55
20	11685	Tone arm lift cam assembly	
21	21184	Lift pin platform lock nut	56
22	11611	Connecting link adjustment screw	57
23	5017	Screw for assembly #12812 and #12814	58
24	1194	Lock washer for mtg. screw	59
25	22105	Motor 115 volt A C 60 cycles	60
26	12974	Latch and trip lever assembly	61
27	11533	Latch lever	62
28	11413	Cam follower lever	63
29	12143	Screw for attaching #12144 clip, also for #11523	64
30	18603	Tone arm lift spring	65
31	18236	Tone arm spring pin	66
32	11098	Tone arm lift pin	
33	Not separate part		
34	11616	Adjusting screw for tone arm and mounting bracket and Nut for #11616 screw	67
35	11573	Pulley control lever stud	68
36	11657	Clip for shift cam stud and for holding drive disc and Washer for #11657	69
37	11663	Washer for #11559 screw	70
38	11588	Screw for cam lift lever and latch lever	71
39	11559	and	72
40	21841	Clip for cam lift lever and latch lever	73
41	Part of #12969		74
42	Not separate part		
43	12963	Latch lever spring	75
44	*The other record support bracket is part #12809 and is described as the front bracket. It is not numbered on the drawing but part #1 on the drawing is part of it.		76

ZENITH RADIO CORP. MODELS S-13675, S-14002,  
S-14006, S-14008**GENERAL**

Service notes for models S-13675, S-14002, S-14006, and S-14008 have been combined in this manual. Except for slight mechanical, electrical and color variations, these models are alike. The adjustments that the serviceman will be called to make will be the same for all models.

Models S-13675 (maroon) and S-14006 (black) have the automatic shut-off feature and are identical mechanically. Models S-14002 (maroon) and S-14008 (black) have slight electrical differences.

For convenience, the Operating Instructions supplied with each Record Changer are summarized as follows: The Record Changer will automatically play up to fourteen 10 inch or twelve 12 inch records at one loading, or up to twelve 10 and 12 inch records intermixed. The Record

Stack rests on the Spindle and the Record Shelf. The Selector Sprocket drives the Ejector Cam which pushes the records off the Shelf and Spindle allowing them to drop on the Turntable. To load for automatic operation, swing the Pressure Bar to the right, place the stack of records on the Spindle, swing the Pressure Bar to the left until it rests on the record stack, set the OFF-MAN-AUTO switch to AUTO and press the Record Change button. Models S-14002 and S-14008 will play the entire selection of records and repeat the last record until turned off. Models S-13675 and S-14006 will automatically shut off after the last record is played.

For manual operation set the OFF-MAN-AUTO switch to MAN and play the records singly as on a non-automatic record player.

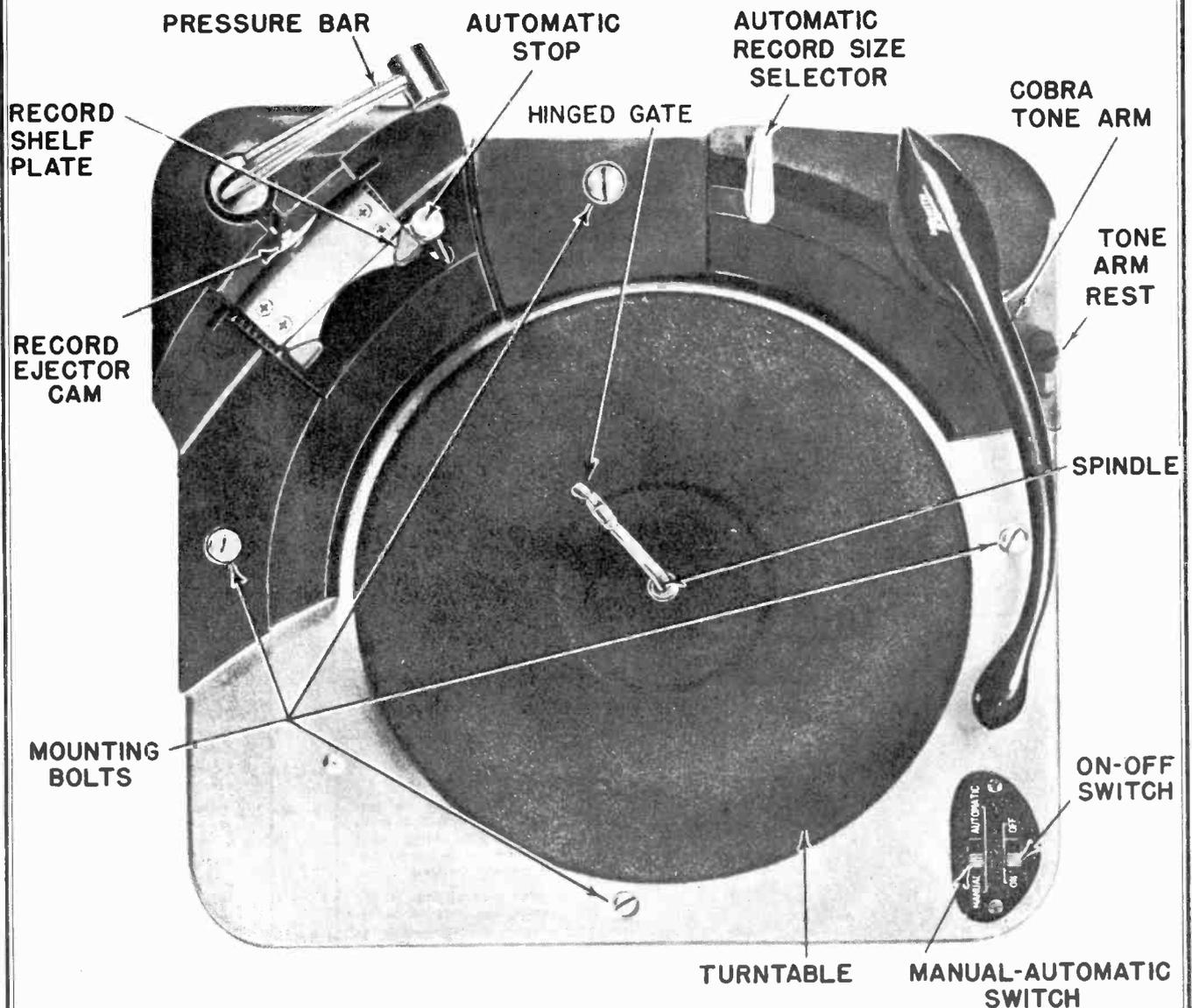


Fig. 1. Top View S-13675 and S-14006 Record Changers.

MODELS S-13675, S-14002,  
S-14006, S-14008

ZENITH RADIO CORP.

### DESCRIPTION OF CYCLING

The phono motor friction drives the idler wheel. The idler wheel rim drives the turntable, and the turntable shaft. To the turntable shaft is attached the segmented clutch drive plate. The pawl on the clutch drive sprocket assembly engages the drive plate, causing the sprocket to rotate. The pawl pusher lever on the clutch release arm assembly causes the clutch to engage or disengage.

Closing either the trip switch or the record change switch energizes the solenoid. The magnetic flux of the solenoid attracts the clutch release lever causing the mechanism to trip and move the pawl pusher lever away from the clutch pawl. This action allows the clutch pawl spring to pull the pawl into position for the drive plate segment to engage and start the clutch sprocket rotating. The clutch sprocket is meshed with the chain drive sprocket and the chain drives the selector and timing sprockets.

The timing sprocket completes 7 functions through 360° rotation. These functions are as follows: 1. Applies the tone arm brake. The brake lever is actuated by the brake stud on the timing sprocket. The brake prevents coasting and erratic landing of the needle. 2. The inclined groove pushes the lift pin upward. The lift pin raises and lowers the tone arm. 3. The locating pin laterally swings the tone arm off the record stack. 4. The locating pin or bushing swings the tone arm over the starting groove of the record. With 12" records, the locating pin swings the tone arm in while the locating bushing swings the tone arm with 10" records. The

locating bushing is pushed upward by the discriminator trip plate. 5. The reset stud resets the clutch trip mechanism and moves the pawl pusher lever in the path of the clutch pawl. 6. The lift pin lowers the tone arm over the starting groove of the record. 7. The brake stud releases the brake. When the clutch pawl hits the pawl pusher lever, the clutch is disengaged.

The selector sprocket actuates the record ejector cam, and must be timed with the timing sprocket to drop the records on the turntable when the tone arm is at its greatest outward swing. This occurs immediately after the No. 3 function of the timing sprocket.

As the record is played, the tone arm gradually moves toward the center. The ratchet on the tone arm control lever moves toward the pawl on the trip switch lever. As the ratchet comes in contact with the pawl, the oscillating action produced by the eccentric groove on the record causes the trip switch to close, complete the solenoid circuit and repeat the cycle. If the record does not have an eccentric groove, the position trip will close the trip switch and start the next cycle.

Noise and microphonics are eliminated by muting the phono pre-amplifier during the record change cycle. The tone arm brake lever actuates the muting switch. When the contacts are closed, a low reactance capacitor is connected across the audio output making the amplifier inoperative during the change cycle.

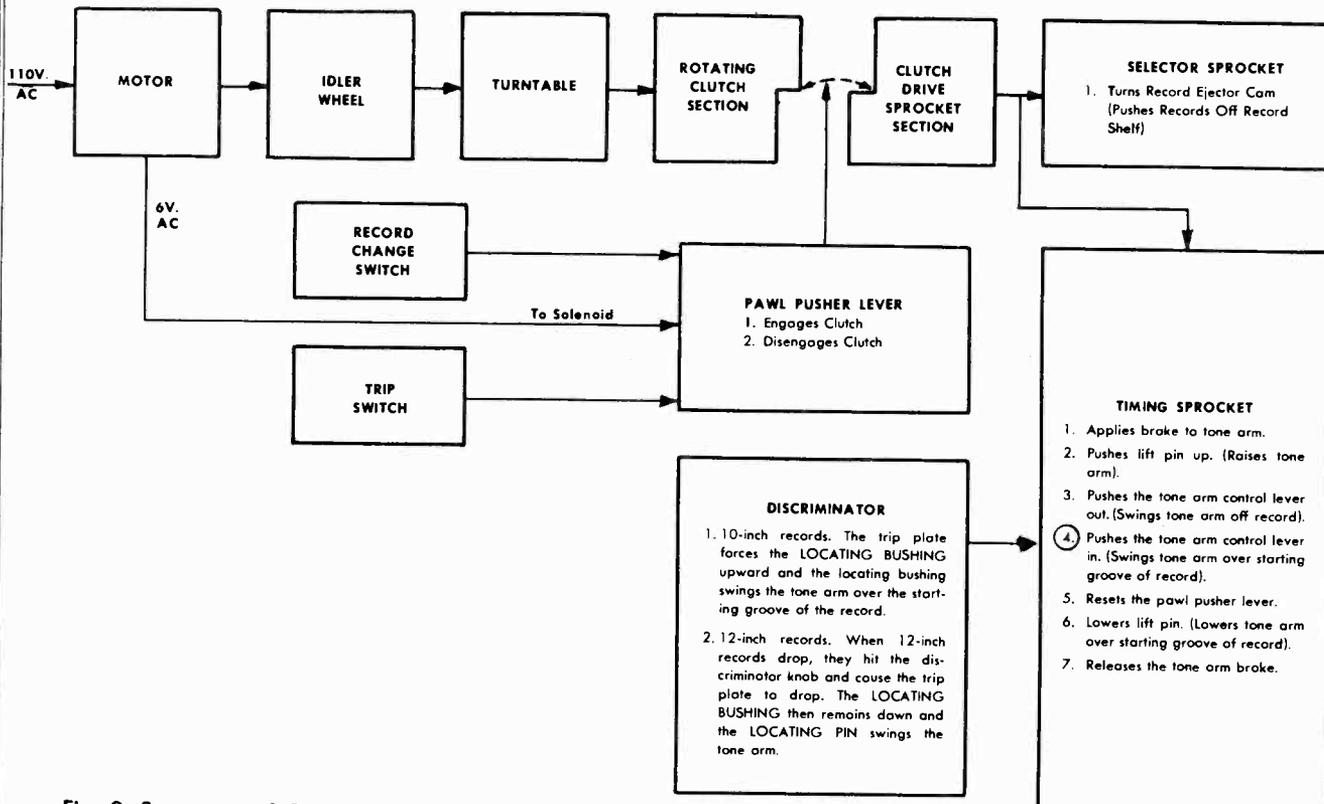


Fig. 2. Sequence of Operation—Zenith Record Changers.





ZENITH RADIO CORP.

MODELS S-13675, S-14002,  
S-14006, S-14008

## THEORY OF THE COBRA RADIONIC PICKUP

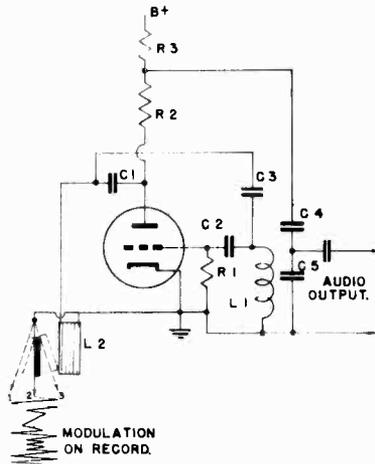


Fig. 8. Simplified Circuit of Oscillator.

The operation of the Cobra pickup is considerably different from Crystal and Dynamic pickups. These pickups generate audio power, while the Cobra controls power generated by a radio frequency oscillator. The triode tube is a modulated oscillator, detector and audio amplifier. The oscillator operates at a frequency of 2.5 Mc. Modulation is accomplished by changing the energy losses in a tuned circuit. These losses may be represented by an equivalent resistance in series with the reactance of the coil. The ratio of the resistance to the reactance determines the efficiency or  $Q$  of the coil. The amplitude of the RF voltage developed across this coil by the oscillator will vary with changes in  $Q$ .

The grid coil  $L_1$  and other components of the oscillator are mounted in the receiver chassis, while the plate coil  $L_2$  is in the Needle Cartridge with the vane and needle assembly. The coil is fixed and has 40 turns of No. 40

wire (approximate DC resistance  $2\frac{1}{2}$  ohms). The stainless steel vane, which is in the field of the coil, is spot welded to the osmium-iridium tipped stylus. Any movement of the stylus will cause a corresponding movement of the vane. As the stylus and vane follow the modulations in the record, changes in the mutual inductance between the vane and coil occur (see Fig. 8). In position 2 the vane is at rest, and a constant RF voltage appears across the plate coil. As the vane is set in motion and reaches position 1, it is at its greatest outward swing from the coil, resulting in low mutual inductance, low reflected resistance, higher  $Q$ , and a higher RF voltage across the coil. In position 3 it is at its greatest inward swing; resulting in a high mutual inductance, high reflected resistance, lower  $Q$  and a lower RF voltage. It can be seen that the amplitude of the RF voltage which appears across the coil will vary with changes in  $Q$ , satisfying the condition for amplitude modulation. The position of the vane changes both the  $Q$  and  $L$  of the coil. Changes in  $L$  shift the frequency slightly, and a certain amount of frequency modulation is present, but since there is no frequency discrimination it remains undetected.

Since the grid and plate coils are part of a single tuned circuit any variations of amplitude of the RF voltage brought about by the changes in  $Q$  across the plate coil will also appear across the grid Coil  $L_1$  causing a shift in the average plate current through the plate load resistor across which the audio output voltage is developed. Plate bend detection takes place since only the positive half of the grid swing causes an increase in the average plate current. These changes in the average plate current appear as audio voltage across the plate load resistor.

The 2.5 Mc. RF voltage and the audio voltage both appear at the plate of the oscillator triode.  $R_2$ ,  $C_4$  and  $C_5$  filter out the RF voltage allowing only the audio component to the grid of the pre-amplifier where it is amplified and reproduced by the loud-speaker.

## ADJUSTMENTS

## 1. Tone Arm Set Down Adjustment.

The Tone Arm Set Down Adjustment determines the landing position of the needle on the starting groove of the record. The adjustment screw can be reached with a screwdriver (Fig. 10). The tone arm must be held in the rest position while the adjustment is made. Clockwise rotation of the screw moves the tone arm in, while counter-clockwise rotation moves it out.

## 2. Tone Arm Height Adjustment.

The Tone Arm vertical rise is governed by the Lift Pin. The Lift Pin is adjustable (see Fig. 9). Too long a Lift Pin will cause the Tone Arm to hit the underside of the records on the Spindle. If the Lift Pin is short, the needle will not clear fourteen records on the Turntable. To make the proper adjustment, trip the Clutch by hand and rotate the Turntable clockwise until the Tone Arm starts to swing toward the Spindle. Gently push the Tone Arm as close to the Spindle as it will go, place a record on the Spindle and observe the spacing between it and the Tone Arm. The spacing "A" (Fig. 11), should be approximately the thickness of a record.



Fig. 9. Lift Pin.

If the spacing is incorrect, lift the Tone Arm, remove the Lift Pin, and adjust the Lift Pin to the proper length.

## 3. Trip Switch Adjustment.

As the record is played, the ratchet on the tone arm pivot shaft engages the trip pawl. The oscillating action developed by the eccentric groove on the record closes the trip switch contacts and allows the solenoid to become energized. The magnetic flux attracts the trip lever which moves the pawl pusher lever from the path of the clutch pawl. This allows the clutch to engage and start the next cycle.

The gap between the trip switch contacts should be approximately  $\frac{1}{16}$ ". If the spacing is incorrect, bend the contact spring. If the contact spring tension is too great, the needle may not follow the oscillating groove on the record. To adjust the spring tension, insert a screwdriver between the contact and guide springs and bend the contact spring (Fig. 10) until an approximate pressure of one ounce is necessary to move the contact spring from the guide spring. Be certain that the contact spring exerts some pressure on the guide spring after adjustment.

The spacing between the trip magnet and trip lever should be approximately  $\frac{3}{32}$ ".

MODELS S-13675, S-14002,  
S-14006, S-14008

ZENITH RADIO CORP.

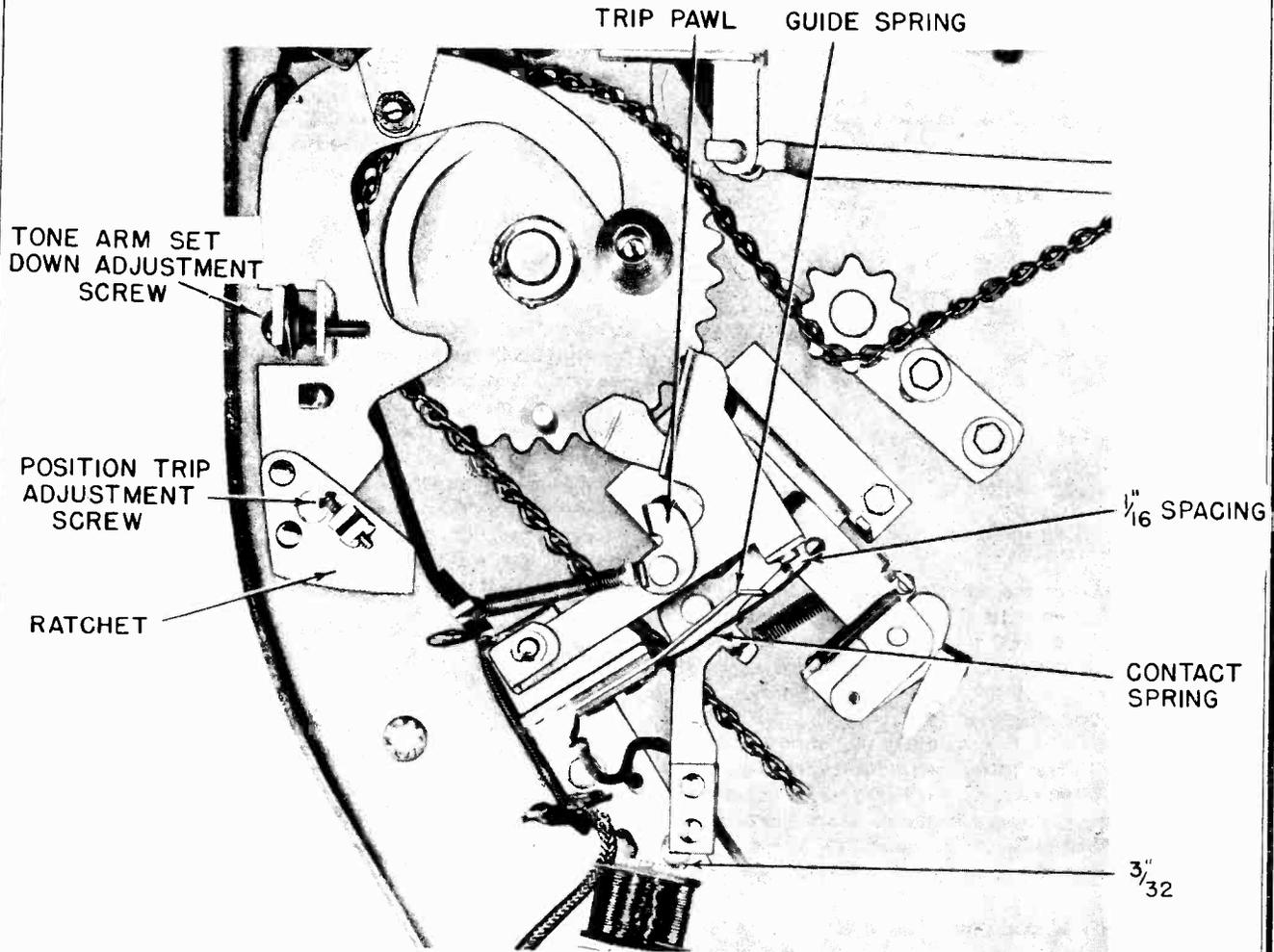


Fig. 10. Tone Arm Set Down, Position Trip and Trip Switch Adjustments.

**4. Position Trip Adjustment.**

The Position Trip does not depend on an eccentric groove in the record to start the record change cycle, but will trip the mechanism whenever the needle comes within a pre-determined distance from the Spindle. Older type records that do not have an eccentric groove can in most cases be played automatically by the proper adjustment of the Position Trip. Under normal conditions with the needle approximately  $1\frac{7}{8}$ " from the center of the Spindle, adjust the Position Trip Adjustment Screw (Fig. 10) until the Trip

Switch contacts close. This distance is generally satisfactory since no modern record will be cut off before it has completed its play, and none will fail to trip the mechanism at the end. In special cases, screw the Position Trip Adjustment Screw clockwise for earlier tripping and counter-clockwise for later tripping as the individual case may be.

It may be impossible to find an adjustment that will always trip the mechanism and never cut off on all type records, and in these special cases the record must be played manually.

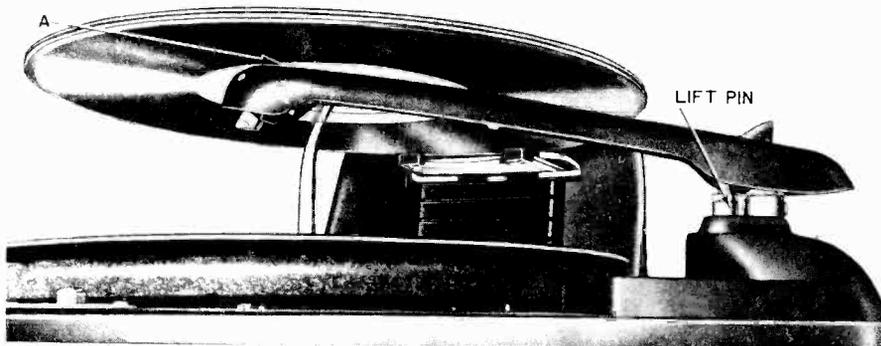
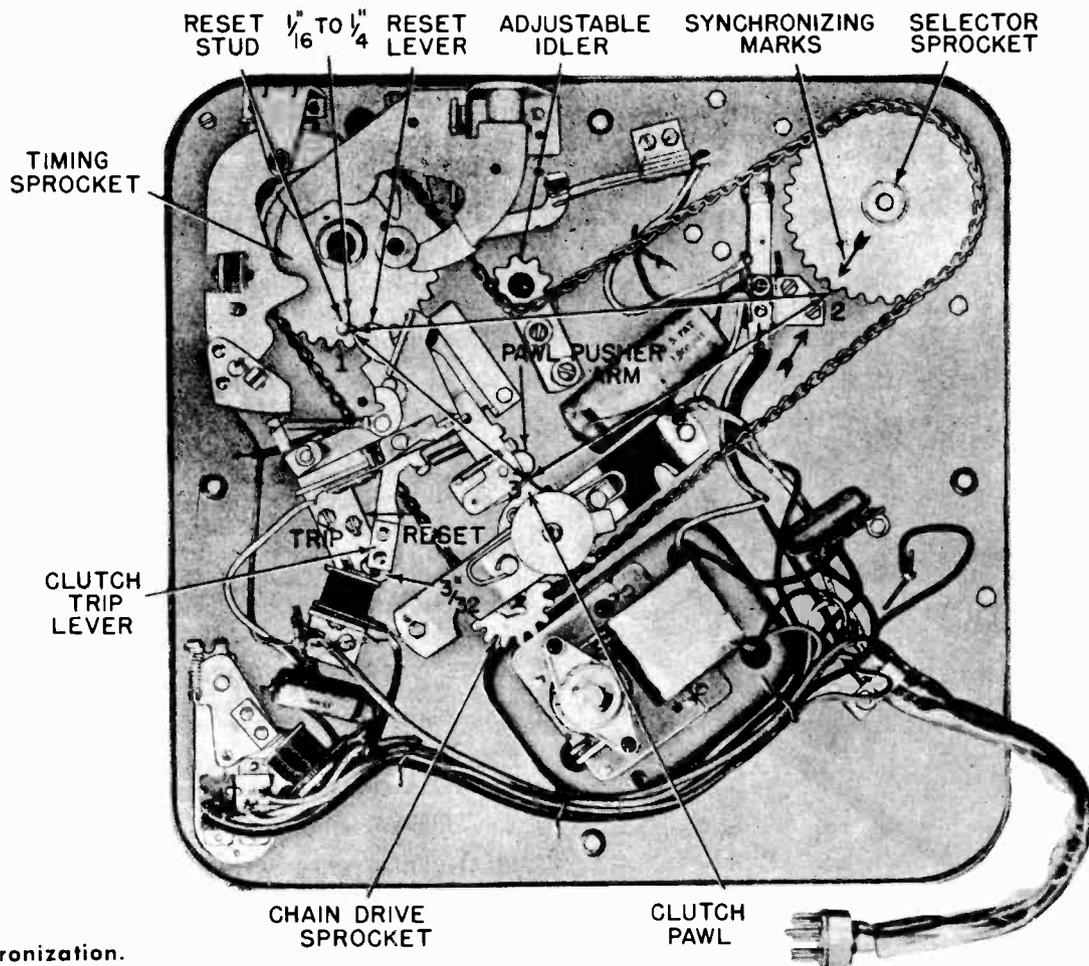


Fig. 11. Tone Arm Height Adjustment.

ZENITH RADIO CORP.

MODELS S-13675, S-14002,  
S-14006, S-14008

### 5. Synchronization.

A properly timed changer drops records on the turntable when the tone arm is at its greatest outward swing. Improper timing results in the records hitting the tone arm. The record changer is kept in time by the drive chain. If the chain is removed, the changer must be synchronized.

Fig. 12 indicates the correct position of the timing sprocket and the clutch. To synchronize, study Fig. 12 and proceed as follows:

1. Reset the clutch trip lever.
2. Turn the timing sprocket until the reset stud is approximately  $\frac{1}{16}$ " from the reset lever (1). Turn the selector sprocket until the synchronizing mark lines up with the mark on the base plate (2). THESE POSITIONS MUST BE MAINTAINED DURING THE NEXT OPERATION.
3. Thread the chain over the timing sprocket, chain drive sprocket, adjustable idler, selector sprocket and set the adjustable idler for medium tension of the chain. Check the position of the synchronizing marks and the reset stud.
4. Remove the retaining washer and lift the chain drive sprocket until the gears disengage.
5. Turn the clutch until the clutch pawl touches the pawl pusher lever (3).
6. Lower the chain drive sprocket until it engages the clutch gears and reinsert the retaining washer.

### REMOVING THE TURNTABLE

Hold the clutch by inserting a wide blade screwdriver against the spindle bracket and a segment of the drive plate. Apply a twisting, pulling force to the turntable.

Before seating the turntable, be certain that the idler wheel is pushed inside the turntable rim.

Fig. 12. Synchronization.



Fig. 13. Removing the Turntable.

MODELS S-13675, S-14002,  
S-14006, S-14008

ZENITH RADIO CORP.

### REPLACING THE MOTOR

When a replacement Motor is ordered, include the line voltage and frequency of the receiver.

To replace the Motor, unsolder the connecting leads, remove the Turntable, the three retaining washers and allow the Motor to drop out. When the Motor is installed do not draw the connecting leads tight as this will prevent the Motor from "floating" on its mounts. Be certain that the retaining washers are crimped and the leads securely soldered and taped.

### REPLACING THE CHAIN

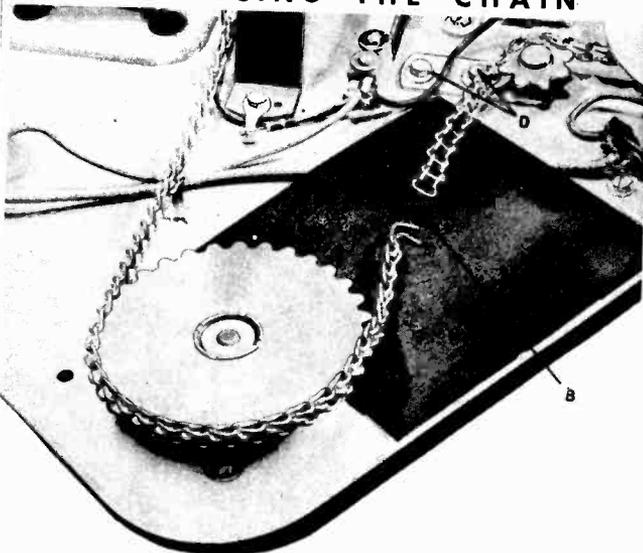


Fig. 14. Replacing the Chain.

The chain may be removed by loosening the adjustable idler (Screws "D," Fig. 14), and opening one of the links (B). It will be noted that on some models the open ends of the links face inward while on others outward as in Fig. 14. The reason for this is to get the quietest operation. Normally the open ends of the links will face outward with all replacement chains.

After the chain is threaded in place, carefully close the open link and be certain that there is no stiffness in its action. Read the paragraph on Synchronization before the chain is permanently installed.

### TROUBLE SHOOTING

#### SQUEAKS OR NOISES DURING PLAYING OF RECORDS.

- Friction between the records on the turntable and the spindle will occasionally cause squeaks. A thin coat of wax applied to the spindle will remedy this condition.
- Check lubrication.

#### MECHANISM STARTS SLOWLY AND MOTOR GETS HOT.

- Check line voltage and frequency.
- Check lubrication.
- Motor windings damaged.
- Room temperature abnormally low.

#### PRESSING RECORD CHANGE BUTTON ON RECEIVER PANEL DOES NOT START THE RECORD CHANGE CYCLE.

- See that the OFF-MAN-AUTO switch is set to AUTO.
- Check Record Change Switch.
- Check electrical continuity of solenoid circuit.
- Check the solenoid energizing voltage.

#### MOTOR FAILS TO RUN EVEN WHEN IT IS DISCONNECTED FROM CHANGER AND PROPER VOLTAGE AND FREQUENCY APPLIED DIRECTLY TO THE TWO INPUT LEADS OF THE WINDING.

- Open windings.
- Damaged or frozen bearings.
- Lower Bearing Support Bracket bent. Remove and straighten bracket—Re-center armature.

#### RUMBLE AND MICROPHONICS DURING REPRODUCTION.

- Changer not "floated" properly. Loosen mounting bolts.
- Motor retaining rings rubbing on the idler wheel.
- Motor leads pulled too tight preventing motor from "floating" freely.
- Noisy Phono Oscillator tube.
- Impression on Idler Wheel.

#### NEEDLE SETS DOWN PROPERLY ON RECORD BUT SLIDES OVER THE RECORD GROOVES.

- Cabinet tilted.
- Badly worn or broken needle cartridge.

#### NEEDLE FAILS TO CLEAR MAXIMUM LOAD OF RECORDS ON THE TURNTABLE.

- Check Tone Arm height adjustment. (Adjustment 2.)

#### CHANGER CYCLES WITH OFF-MAN-AUTO SWITCH ON MAN.

- Check OFF-MAN-AUTO switch.
- Reset stud does not engage clutch reset lever.

#### TOUR ARM FALLS OFF RECORD.

- Check Tone Arm set down adjustment. (Adjustment 1.)
- Check Tone Arm Pivot Bracket.
- Changer not level.

#### TOUR ARM SET-DOWN POSITION VARIES.

- Check Tone Arm Brake and Spring.
- Tight Tone Arm Connecting Leads.

#### RECORD IS NOT HEARD ALTHOUGH CHANGER OPERATES.

- See that the Phono Radio switch is on Phono.
- Check receiver audio by listening to radio.
- Check the phono oscillator tube.
- Check Needle Cartridge.
- Check Tone Arm Housing for broken leads.

#### TOUR ARM SETS DOWN TOO FAR IN OR OUT ON RECORD.

- Check Tone Arm set down adjustment. (Adjustment 1.)

#### CHANGER CONTINUES TO CYCLE.

- Check Trip switch adjustment. (Adjustment 3.)
- Check Record Change switch.
- Clutch release mechanism sticks.
- Pawl pusher lever not reset by reset stud.

#### CHANGER WILL NOT CYCLE UPON COMPLETION OF RECORD.

- See that the OFF-MAN-AUTO switch is set to AUTO.
- Be certain the record has an eccentric center groove.
- Check Trip switch.

ZENITH RADIO CORP. MODELS S-13675, S-14002, S-14000, S-14008

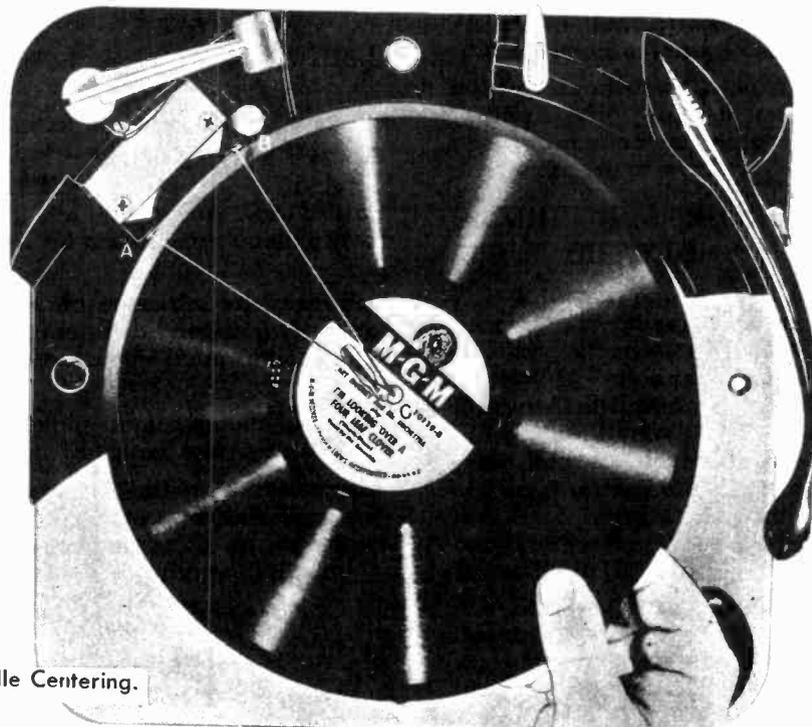


Fig. 15. Checking Spindle Centering.

**RECORD CENTER HOLE WEAR.**

- a. Record centers oversize.
- b. A bent spindle will cause center hole wear due to impeded record injection. To check the spindle position, place a 10" record as shown in Fig. 15. If the spindle is properly centered, a triangle will be formed with the metal ends of the record shelf plate.

**SQUEAKS WHEN CHANGER IS IN CYCLE.**

- a. Friction between Lift Pin and Timing Sprocket. Apply a thin coat of Sta-Put.

**MOTOR RUNS BUT TURNTABLE SLIPS OR STOPS.**

- a. Turntable not fully seated. Tap gently.

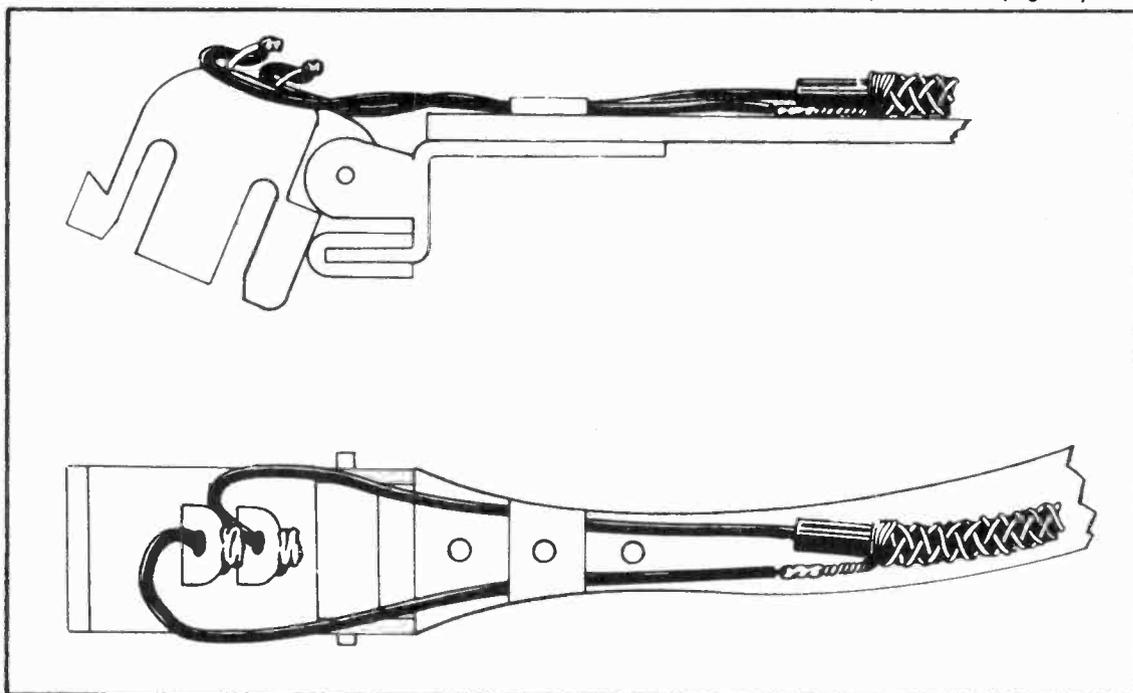


Fig. 16. Needle Cartridge Socket Connection.

Fig. 16 shows how the leads are connected to the Needle Cartridge Socket. The lead and insulation are run through the hole in the contact and the lead is soldered with a light soldering iron. Great care must be exercised, and very little heat applied as the socket is made of lucite and will burn easily. The complete lead and socket are supplied as S-12633.



PIN END VIEW OF PLUG

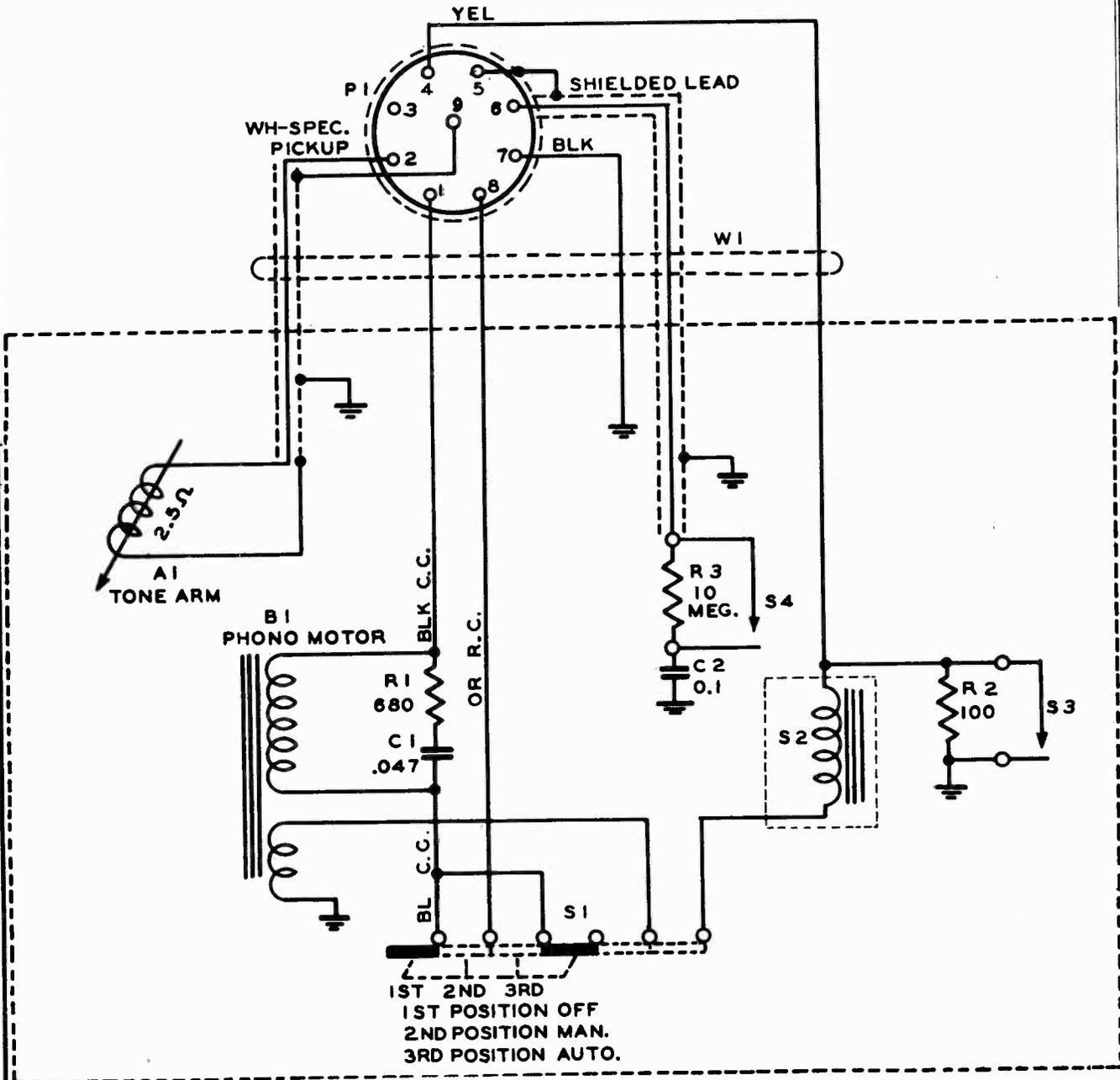


Fig. 18. S-14008 Schematic Diagram.

MODELS S-13675,  
S-14006

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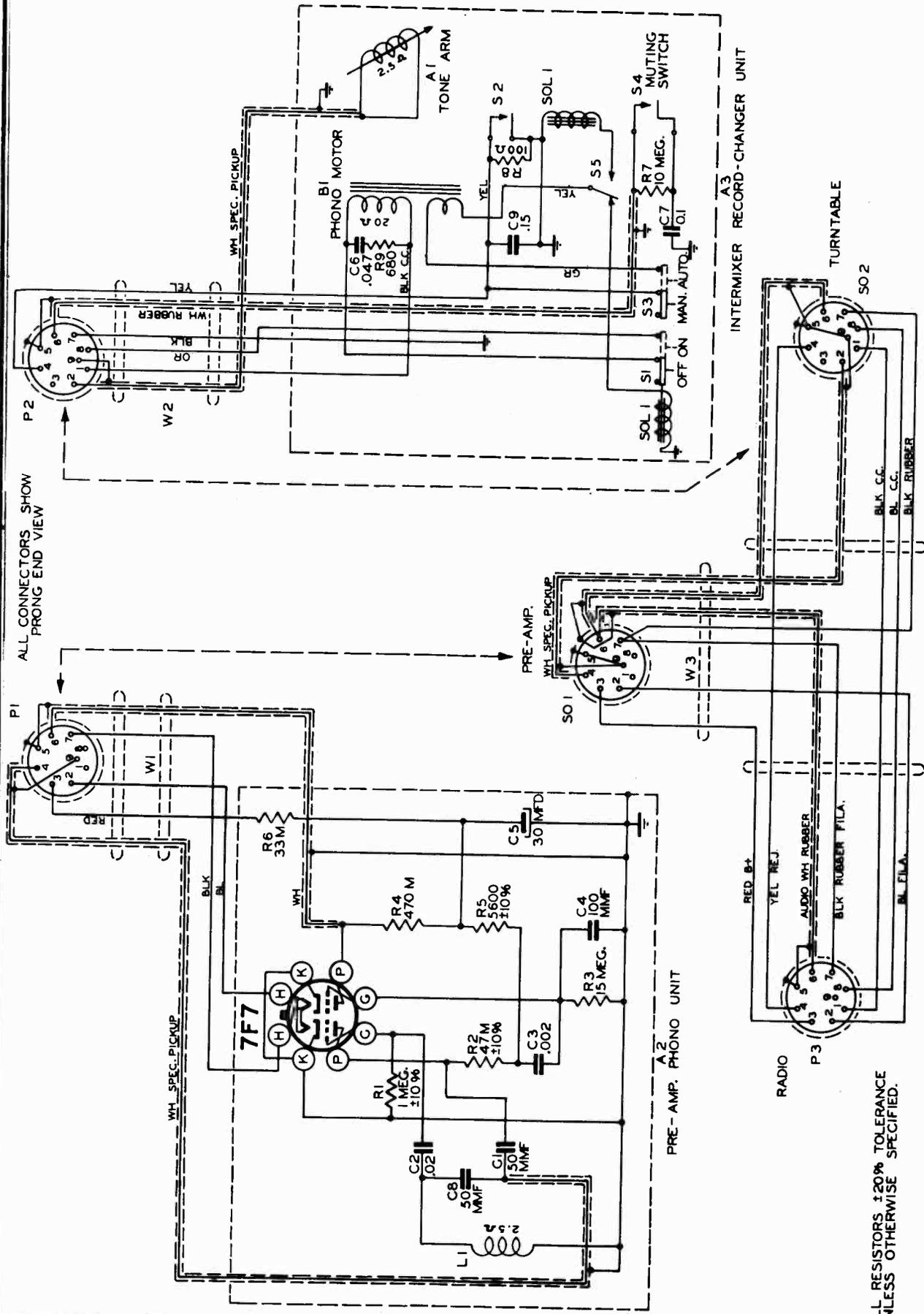


Fig. 19. S-13675 and S-14006 Schematic Diagram.

ALL RESISTORS ±20% TOLERANCE  
UNLESS OTHERWISE SPECIFIED.

## ZENITH RADIO CORP.

MODELS S-13675, S-14002,  
S-14006, S-14008

## NUMERICAL PARTS LIST

12-1124	Record Ejector Plate Mounting Bracket (S-13675, S-14006)	80-462	Cam Spring
12-1216	Tone Arm Pivot Bracket	80-479	Spring (Spindle Dog)
12-1340	Record Ejector Plate Mounting Bracket (S-11674)	80-531	Brake Spring
12-1390	Solenoid Mounting Bracket	80-538	Landing Adjustment Spring (S-13902)
15-64	Plug Cap and Insulator	80-544	Contact Spring
19-88	Cable Clip	80-545	Contact Spring
19-150	Housing Cover Clip	80-572	Clutch Spring (S-13894)
22-417	.1 Mfd. Paper Dielectric Capacitor 600 V.	80-574	Pawl Pusher Bracket Spring (S-13903)
22-1570	.05 Mfd. Paper Dielectric Capacitor 400 V.	80-582	Pawl Spring (S-13901)
24-354	Record Ejector Housing Cover (S-14006, S-14008)	80-584	Tone Arm Lift Pin Spring
24-432	Record Ejector Housing Cover (S-13675, S-14002)	80-605	Cobra Cartridge Socket Tension Spring (S-13675, S-14006)
43-103	Tone Arm Housing (S-14006, S-14008)	80-649	Shut-Off Lever Spring (S-13675, S-14006)
43-147	Record Ejector Housing (S-13675, S-14002)	80-650	Shut-Off Pawl Spring
43-148	Tone Arm Housing (S-13675, S-14002)	80-653	Trip Arm Spring (S-13903)
43-156	Tone Arm Support Housing (S-14006, S-14008)	83-343	Three Lug Terminal Strip
43-157	Tone Arm Support Housing (S-13675, S-14002)	83-1106	Two Lug Terminal Strip
43-164	Record Ejector Housing (S-14006, S-14008)	83-1301	Two Lug Terminal Strip
54-30	No. 8-32 x $\frac{5}{16}$ " x $\frac{7}{64}$ " Hex Nut—Steel N.P.	83-1349	Tone Arm Shipping Strip
54-66	No. 10-32 x $\frac{5}{16}$ " Hex Nut—Steel N.P.	83-1423	Cobra Needle Guard Strip
54-246	No. 4-40 x $\frac{3}{16}$ " x $\frac{3}{32}$ " Hex Nut (S-13675, S-14006)	84-65	Tone Arm Rest (S-14006, S-14008)
56-146	Spring Retaining Pin (Pressure Arm)	84-68	Tone Arm Rest (S-13675, S-14002)
56-226	Tone Arm Lift Pin—Lower	85-372	Three Position Slide Switch (S-14002, S-14008)
56-227	Tone Arm Lift Pin—Upper	85-405	On-Off Switch (S-13675, S-14006)
57-1290	Switch Escutcheon (S-13675)	85-406	Auto-Man Switch (S-13675, S-14006)
57-1323	Turntable Shaft Plate	86-81	Shakeproof Terminal No. 2101-8
57-1324	Clutch Drive Plate	86-190	Terminal—Cinch No. 1483
57-1355	Switch Plate (S-14002, S-14008)	93-125	No. 6 Int. Shakeproof Lockwasher No. 1206
57-1397	Switch Escutcheon (S-14006)	93-126	No. 8 Int. Shakeproof Lockwasher No. 1208
58-133	Phono Plug (S-13675, S-14006, S-14008)	93-216	.015 x .255 x $\frac{7}{16}$ " Steel Washer—Cad.
58-169	Phono Plug (S-14002)	93-415	No. 6 Ext. Shakeproof Lockwasher No. 1106
63-1744	100 Ohm Carbon Resistor $\frac{1}{2}$ W. $\pm 20\%$ — Insulated	93-536	$\frac{5}{8}$ " x $\frac{5}{16}$ " x .031 Steel Washer—Cad. Pl.
63-1779	680 Ohm Carbon Resistor $\frac{1}{2}$ W. $\pm 20\%$ — Insulated	93-617	Sprocket Shaft Retaining Washer
63-1954	10 Megohm Carbon Resistor $\frac{1}{2}$ W. $\pm 20\%$ — Insulated (S-13675, S-14006, S-14008)	93-655	.012 x .098 x $\frac{9}{32}$ " Steel Washer—N.P.
69-38	No. 8-32 x $\frac{3}{4}$ " R.H.M.S.—Steel N.P.	93-672	Idler Wheel Stud Washer—Large
69-43	No. 8-32 x $\frac{3}{8}$ " R.H.M.S.—Steel N.P.	93-673	Idler Wheel Stud Washer—Small
69-217	No. 4-40 x $\frac{3}{16}$ " R.H.M.S. (S-13675, S-14006)	93-677	Idler Wheel Stud Fishpaper Washer—Large
69-238	No. 4-40 x $\frac{5}{8}$ " R.H.M.S.—Steel Cad.	93-678	Idler Wheel Stud Fishpaper Washer—Small
71-70	No. 6-32 x $\frac{3}{16}$ " Phillips Flat Hd. M.S.—Steel— Bright N.P.	93-679	Idler Wheel Stud Felt Washer
71-71	No. 6-32 x $\frac{1}{4}$ " Phillips Flat Hd. M.S.—Steel N.P.	93-719	$\frac{7}{16}$ " x $\frac{3}{16}$ " x .031 Flat Washer—Cad.
71-81	No. 8-32 x $2\frac{3}{4}$ " Flat Hd. M.S.—Steel N.P.	93-764	Spring Washer—Shakeproof No. 3759-14
73-99	No. 8-32 x $\frac{1}{4}$ " Slab Hd. Set Screw—Steel— Conopoint	93-767	Cam Spacer Washer (.020 x .385 x $\frac{5}{8}$ " Steel —Cad. Pl.)
73-100	No. 8-32 x $\frac{1}{2}$ " Slab Hd. Set Screw—Steel— Conopoint	93-769	Steel Washer—Cad. Pl.
80-368	Idler Wheel Tension Spring	93-844	No. 5 External Shakeproof Lockwasher
80-418	Tension Spring (Pressure Arm)	93-876	Fibre Washer
		93-900	Fibre Washer
		93-903	Steel Washer
		94-415	Tone Arm Locating Bushing
		94-416	Timing Sprocket Bushing
		112-56	No. 6 x $\frac{1}{4}$ " Hex. Hd. Self Tapping Screw— Type Z—Cadmium
		112-483	No. 6-32 x $\frac{3}{8}$ " B.H.M.S.—Steel N.P.
		112-576	No. 5-40 x $\frac{1}{4}$ " Oval B.H.M.S.—Steel N.P.

MODELS S-13675, S-14002;  
S-14006, S-14008

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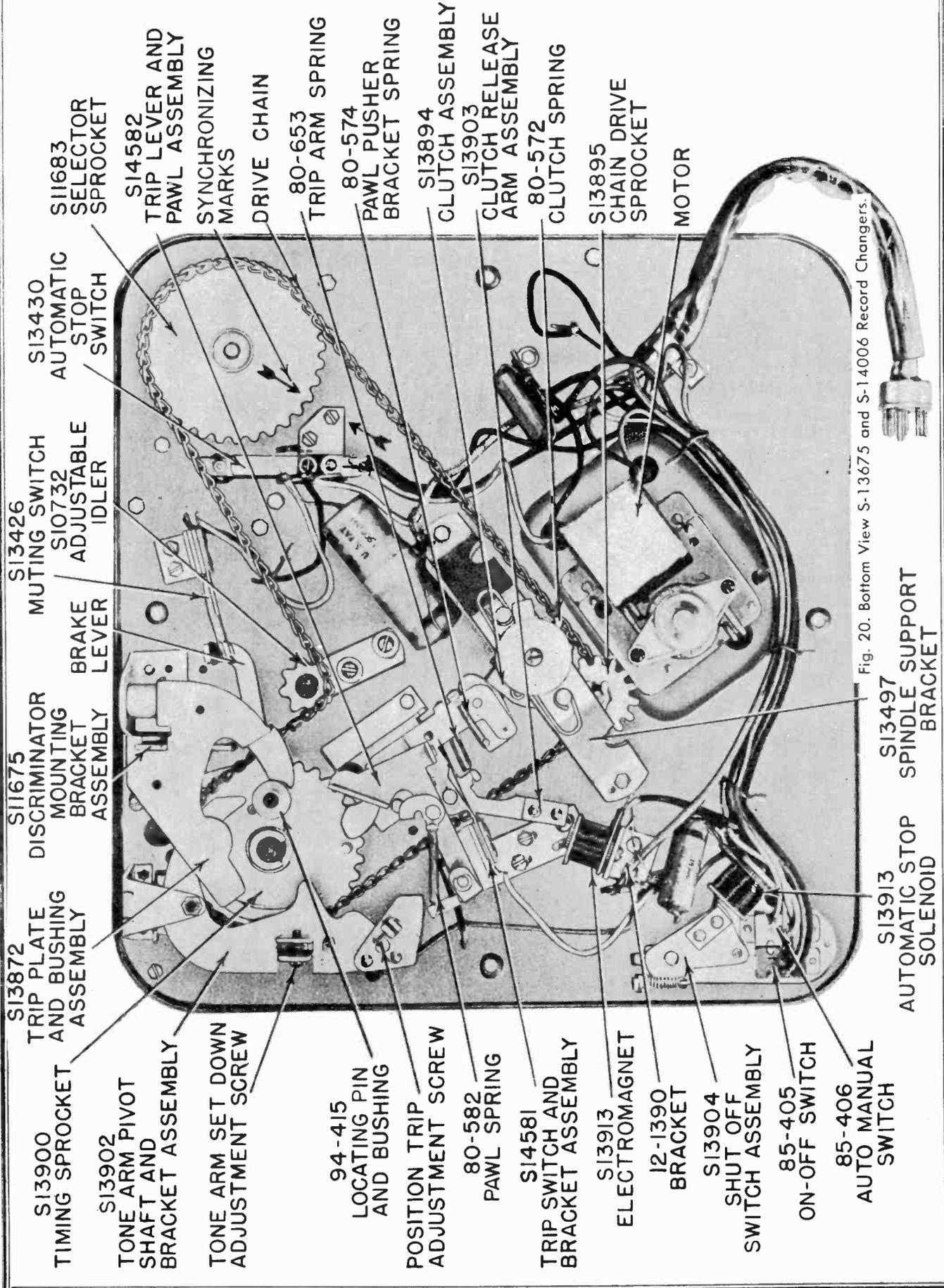
## NUMERICAL PARTS LIST—Continued

112-581	No. 6 x $\frac{3}{8}$ " R.H. Self Tapping Screw—Shakeproof Type 25—Cadmium	S-12038	Record Ejector Housing Cover Assembly (S-14006, S-14008)
112-585	No. 6 x $\frac{3}{8}$ " R.H. Self Tapping Screw—Type FZ—Cadmium	S-12507	Record Spindle Assembly
112-619	Cobra Tone Arm Housing Mounting Screws	S-12633	Needle Cartridge Socket and Cable Assembly
112-637	No. 4-40 x $\frac{1}{4}$ " B.H.M.S.—Steel N.P.	S-12686	Cam and Washer Assembly
112-706	No. 4-40 x $\frac{3}{16}$ " R.H.M.S.—Steel N.P. (SEMS)	S-12859	Discriminator Knob and Plate Assembly
112-719	No. 6 x $\frac{3}{8}$ " Flat Hd. Self Tapping Screw—Shakeproof Type 25—Steel Cad. Pl.	S-13060	Cobra Tone Arm Hinge Plate and Swivel Bracket Assembly
114-88	No. 8-32 x $\frac{1}{2}$ " Hex. Acorn Hd. M.S.—Steel N.P.	S-13062	Cobra Tone Arm Hinge Plate, Swivel Bracket, Needle Cartridge Socket and Cable Assembly
114-89	No. 8-32 x $\frac{5}{16}$ " Hex. Acorn Hd. M.S.—Steel N.P.	S-13063	Cobra Tone Arm Assembly (S-14006, S-14008)
114-201	No. 8 x $\frac{5}{16}$ " Hex. Hd. Slotted Self Tapping Screw—STAN-TAP—Cad. Pl.	S-13423	Record Support Plate and Bracket Assembly (S-13675)
114-248	No. 6-20 x $\frac{5}{16}$ " Hex. Hd. Slotted Self Tapping Screw—Shakeproof Type 25—Steel Cad. Pl.	S-13426	Muting Switch Assembly (S-13675, S-14006, S-14008)
114-262	No. 8 x $\frac{7}{16}$ " Hex. Hd. Slotted Self Tapping Screw—STAN-TAP—Cadmium	S-13430	Automatic Stop Switch Assembly (S-13675, S-14006)
117-132	Shut-Off Switch Lever (S-13675, S-14006)	S-13461	Record Ejector Housing Cover Assembly (S-13675, S-14002)
125-61	Rubber Grommet—Motor Mtg.	S-13466	Cobra Tone Arm Assembly (S-13675, S-14002)
128-21	Record Ejector Cam (S-11668)	S-13494	Record Support Plate Mounting Bracket Assembly (S-13675)
141-108	A.C. Phono Motor—60 Cycles	S-13496	Discriminator Mounting Bracket Assembly (S-13675)
141-109	A.C. Phono Motor—60 Cycles (S-14002)	S-13497	Bracket and Spring Assembly
148-83	Cobra Tone Arm Housing (S-13675, S-14006)	S-13872	Trip Plate and Bushing Assembly
148-51	Bakelite Housing	S-13894	Clutch Pawl Assembly
166-30	Rubber Bumper	S-13895	Drive Sprocket and Bushing Assembly
166-41	Rubber Bumper	S-13896	Turntable Drive Shaft Bearing Assembly
187-9	Push Rod (Automatic Stop S-13675, S-14006)	S-13900	Timing Sprocket Assembly
188-27	Retaining Ring	S-13901	Trip Switch Assembly
188-32	Retaining Ring	S-13902	Tone Arm Pivot Shaft and Bracket Assembly
188-52	Retaining Ring	S-13903	Clutch Release Arm Assembly
214-4	Sprocket Drive Chain	S-13904	Shut-Off Switch Assembly (S-13675, S-14006)
S-10732	Idler Assembly	S-13913	Magnet Assembly
S-11111	Turntable Shaft and Bearing Assembly	S-13915	Cable Assembly (S-13675, S-14006, S-14008)
S-11118	Idler Wheel Assembly	S-13929	Main Base Plate Assembly (S-13675)
S-11473	Cobra Needle Cartridge	S-13931	Turntable Assembly
S-11657	Idler Wheel Stud and Washer Assembly	S-14229	Cable Assembly (S-14002)
S-11668	Record Ejector Cam and Shaft Assembly	S-14312	Main Base Plate Assembly
S-11671	Pressure Arm and Bracket Assembly	S-14313	Muting Switch Assembly (S-14002)
S-11672	Record Support Plate Assembly	S-14314	Main Base Plate Assembly (S-14008)
S-11674	Record Support Plate Mounting Bracket Assembly	S-14581	Trip Lever Mounting Bracket Assembly
S-11675	Discriminator Mtg. Bkt. Assembly (S-14002, S-14006 and S-14008)	S-14582	Trip Lever and Pawl Assembly
S-11683	Selector Sprocket and Bushing Assembly	S-14665	Main Base Plate Assembly (S-14006)
S-11983	Idler Wheel and Rubber Drive Ring Assembly	S-14666	Record Support Plate Mounting Bracket Assembly (S-14006)

Unless Specified, Parts Apply to All Models.

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MODELS S-13675,  
S-14006



- SI13900 TIMING SPROCKET
- SI13902 TONE ARM PIVOT SHAFT AND BRACKET ASSEMBLY
- SI13872 TRIP PLATE AND BUSHING ASSEMBLY
- SI11675 DISCRIMINATOR MOUNTING BRACKET ASSEMBLY
- SI13426 MUTING SWITCH
- SI10732 ADJUSTABLE IDLER
- SI13430 AUTOMATIC STOP SWITCH
- SI11683 SELECTOR SPROCKET
- SI14582 TRIP LEVER AND PAWL ASSEMBLY
- SYNCHRONIZING MARKS
- DRIVE CHAIN
- 80-653 TRIP ARM SPRING
- 80-574 PAWL PUSHER BRACKET SPRING
- SI3894 CLUTCH ASSEMBLY
- SI3903 CLUTCH RELEASE ARM ASSEMBLY
- 80-572 CLUTCH SPRING
- SI3895 CHAIN DRIVE SPROCKET
- MOTOR
- SI13913 AUTOMATIC STOP SOLENOID
- SI13497 SPINDLE SUPPORT BRACKET
- SI13913 ELECTROMAGNET
- 12-1390 BRACKET
- SI13904 SHUT OFF SWITCH ASSEMBLY
- 85-405 ON-OFF SWITCH
- 85-406 AUTO MANUAL SWITCH
- 94-415 LOCATING PIN AND BUSHING
- POSITION TRIP ADJUSTMENT SCREW
- 80-582 PAWL SPRING
- SI14581 TRIP SWITCH AND BRACKET ASSEMBLY
- SI13913 ELECTROMAGNET
- 12-1390 BRACKET
- SI13904 SHUT OFF SWITCH ASSEMBLY
- 85-405 ON-OFF SWITCH
- 85-406 AUTO MANUAL SWITCH

Fig. 20. Bottom View S-13675 and S-14006 Record Changers.





