



Model 715

SPECIFICATIONS

Model 715 is a Radio-Phonograph combination consisting of a nine (9) tube super-heterodyne radio and an automatic phonograph record changer.

RADIO SECTION

The radio incorporates the Philco Built-in Domestic and Overseas Aerial system; six electric push-buttons for automatically tuning stations in addition to manual tuning; two tuning ranges, covering 540 to 1720 K.C. and 9 to 12 M.C.; variable tone control; automatic volume control; automatic bass compensation; push-pull pentode output tubes with screen phase inversion; loktal tubes; the new noise reducing XXL converter tube and a twelve (12) inch concert grand dynamic speaker.

INTERMEDIATE FREQUENCY: 460 K.C.

POWER SUPPLY: 115 volts; 25 or 60 cycles A.C. current.
Power consumption 75 watts.

PHILCO TUBES USED: 7B5E Oscillator; XXL, Converter; two 7B7E I.F. Amplifiers; 7C7 Phonograph Amplifier; 7C6, 2nd Detector, 1st Audio, A.V.C., two 41E Audio Output and a 7Y4, Rectifier.

ADJUSTING ELECTRIC PUSH BUTTON TUNING: Five push-buttons are used for automatically tuning stations including television sound and one push-button for the power switch.

The procedure for setting and operating electric push-button tuning for reception of stations is the same as that given for Model 41 in Radio Service Bulletin No. 345.

PHONOGRAPH SECTION

The Phonograph of this model includes an automatic record changer which plays twelve 10-inch records or ten 12-inch records at one loading. The new Philco Photo-Electric Reproducer with floating jewel which reproduces sound on a light beam and a special phonograph amplifier stage for operation through the push-pull output tubes of the radio.

LIGHT-BEAM REPRODUCER ADJUSTMENTS

To reproduce the sound from a record, the light beam of the reproducer must be carefully positioned on the light sensitive cell. If the light beam is not carefully set, the sound reproduction will be distorted, weak or, if the light beam is completely on or off the cell, the phonograph will be silent.

If any of these conditions exist, the following adjustment procedure should be made:—

NOTE—These adjustments should be made with the power line voltage at 118 volts A.C.

A. ADJUSTING WIDTH OF LIGHT BEAM

To make this adjustment push the lamp socket assembly into its holder until a clear image of the lamp filament appears on the light cell. The socket should then be slightly pushed in beyond this point until the rectangular spot of light is 5/32" in width. The socket assembly is now rotated so that the spot of light is vertical.

B. POSITIONING THE LIGHT BEAM

To position the light beam on the light cell, turn the adjusting screw at the lower left side of the reproducer until the spot is half on the cell and half on the metal frame surrounding the cell

C. ADJUSTING INTENSITY OF LAMP

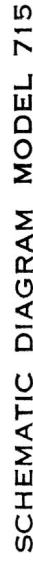
When shipped from the factory, the lamp of the reproducer is adjusted for best operating efficiency. The intensity of the light from the lamp is adjusted by Compensator No. 11B located on the radio chassis. Under ordinary circumstances, an adjustment will not be necessary. When replacing the reproducer or lamp, however, there may be a tendency towards microphonic feedback. In this case the compensator is adjusted as follows:

1. Turn volume control on full and play a record.

2. While the record is playing, turn compensator 11B in the direction necessary to eliminate microphonic feedback. By turning the compensator the strength of the pick-up output is increased or decreased.

D. INSTALLING NEW LAMP

When installing a new lamp in the socket, there are two positions in which the lamp can be inserted. Ordinarily, either of these positions can be used. In some cases, however, due to the lamp filament being off center, the lamp must be inserted in the position that gives the best centering of the spot of light on the vibrating mirror.



REPLACEMENT PARTS — MODEL 715

Schem. No.	Description	Part No.	Schem. No.	Description	Part No.	Schem. No.	Description	Part No.
1	Loop Aerial	76-1124	54	Input Trans. (Light Beam Reprod.)	32-8148	Cable Ass. (reproduces Trans. to chassis)	41-3554	
2	Aerial Transformer	32-3531	55	Philco Light-Beam Reprod. Complete		Cable (Pickup Light)	41-3559	
3	Mica Cond. (250 mmfd.)	60-125157		with Tone Arm	35-2175	Cable (Speaker)	41-3552	
4	Silver Mica Cond. (104 mmfd.)	30-1192		Cover Reproducer Head	76-1104	Cable and Plug Assembly (changer)	41-3549	
5	Tuning Condenser	31-2481		Jewel, Armature and Frame Assem.	318-2168	Clip (Coil Mounting)	28-5002	
6	Compensator (Aerial 12 M.C.)	31-6384		Lamp	34-2408	Clip (Coil Mounting)	28-5003	
7	Compensator (Aerial 1500 K.C.)	31-6401		Lamp Shield	27-9182	Connector (Input Transformer)	57-0591	
7A	Compensator (580 K.C.) Part of 7			Lamp Socket Assembly	76-1107	Dial Scale	27-5657	
8	R.F. Transformer (S.W.)	32-3558		Light Sensitive Cell	76-1110	Dial Pointer	56-1856	
9	Oscillator Transformer	32-3530		Pivot Bracket Ass. (Mtg. Producer)	76-1111	Drive Cord (Pointer)	31-2487	
10	Silver Mica Cond. (98 mmfd.)	30-1186		Reproducer Arm (without Parts)	28-7316	Drive Cord (Band Indicator)	31-2488	
11	Compensator (Oscillator, 12 M.C.)	31-6378		Tube and Lens Ass. (for Lamp Socket)	76-1109	Drive Cord (Tuning Condenser)	31-2400	
11A	Comp. (1600 K.C.) Part of 11			Spring (Light Adjustment)	28-8968	Drive Drum (Tuning Condenser)	38-9883	
11B	Comp. (Adj. Light Beam Rep.) Part of 11			Screw (Light Adjustment)	W-2224	Indicator Bracket and Spring Ass. (dial)	76-1075	
12	Wave Switch	42-1602		Screw (Cover Mounting)	W-2234	Jewel	27-4777	
13	Resistor (33,000 ohms, 1/2 watt)	33-333344		Screw (Cell Mounting)	W-2222	Knob (Tuning, Volume)	27-4332	
14	Mica Cond. (250 mmfd.)	60-125157		Lock Washer (Cell Mounting)	W-2208	Knob (Push Buttons)	27-4824	
15	Padder Strip (Push-Buttons)	31-6572		56 Tubular Cond. (.002 mfd. 400 volts)	30-4579	Plug Assembly (Shunt)	76-1103	
16	Push Button and Power Switch Ass.	22-0003		57 Resistor (100,000 ohms, 1/3 watt)	33-410244	Speaker	16-0002	
17	Mica Condenser (250 mmfd.)	60-125157		58 Mica Condenser (100 mmfd.)	60-110157	Spring (Tuning Cond. Drive)	28-8751	
18	R.F. Choke	32-3559		59 Volume Control	33-5403	Spring (Pointer Drive Cord)	28-8953	
19	Tubular Cond. (.01 mfd. 400 volts)	30-4572		60 Resistor (330,000 ohms, 1/3 watt)	33-433244	Spring (Tuning Cond. Drive Shaft Grdg.)	28-8955	
20	Resistor (33,000 ohms, 1/2 watt)	33-333344		61 Tubular Cond. (.003 mfd. 1000 volts)	30-4469	Socket (Pilot Lamp) Cabinet	76-1128	
21	Electrolytic Cond. (8-12-16 mfd.)	30-2488		62 Resistor (4.7 megohm, 1/3 watt)	33-547244	Socket (Pilot Lamp) Indicator	76-1077	
22	Resistor (4700 ohms, 1/2 watt)	33-247344		63 Resistor (220,000 ohms, 1/2 watt)	33-422344	Socket (Pilot Lamp) Dial	76-1078	
23	Tubular Cond. (.05 mfd., 200 volts)	30-4519		64 Tone Control	33-5403	Socket (6 Prong Tubes)	27-6036	
24	Resistor (2.2 megohms, 1/3 watt)	33-522244		Palnut	W-2157	Socket—Rubber (Loktal type Osc. tube)	27-6129	
25	Tubular Cond. (.05 mfd. 400 volts)	30-4518		65 Tubular Cond. (.004 mfd. 400 volts)	30-4578	Socket (Loktal)	27-6131	
26	Resistor (4700 ohms, 1/2 watt)	33-247344		66 Mica Condenser (100 mmfd.)	60-110157	Socket (3 Prong Aerial)	27-6145	
27	1st I.F. Transformer	32-3465		67 Tubular Cond. (.01 mfd. 400 volts)	30-4572	Socket (Phonograph Reproducer)	27-6150	
28	Resistor (1 megohm, 1/3 watt)	33-510244		68 Resistor (470,000 ohms, 1/3 watt)	33-447244	Shaft (Tuning)	56-6086	
29	Tubular Cond. (.05 mfd. 200 volts)	30-4519		69 Resistor (1 megohm, 1/3 watt)	33-510244	Shaft "C" Washer	28-2043	
30	2nd I.F. Transformer	32-3466		70 Resistor (470,000 ohms, 1/3 watt)	33-447244	Tab Kit	40-6500	
31	Resistor (33,000 ohms, 1/2 watt)	33-333344		71 Tubular Cond. (.01 mfd. 400 volts)	30-4572			
32	Tubular Cond. (.05 mfd. 200 volts)	30-4519		72 Resistor (3900 ohms, 1/2 watt)	33-239344			
33	Resistor (330 ohms, 1/2 watt)	33-133366		73 Tubular Cond. (.0015 mfd. 1000 volts)	30-4616			
34	Resistor (1 megohm, 1/3 watt)	33-510244		74 Output Transformer	12-0014			
35	Tubular Cond. (.05 mfd. 200 volts)	30-4519		75 Cone Ass. (for Speaker 16-0002)	25-0024			
36	Resistor (10,000 ohms, 1/2 watt)	33-310344			36-4160			
39	Resistor (470,000 ohms, 1/3 watt)	33-447244		76 Field Coil (for Speaker 16-0002)	32-9585			
40	3rd I.F. Transformer	32-3534		77 Resistor (780-268-28-26 ohms)	33-3396			
40A	Compensator (Part of 40)			78 Pilot Lamps (push buttons, dial)	34-2064			
40B	Mica Condenser (Part of 40)			80 Power Transf. (115 volts, 60 cycle)	32-8132			
40C	Resistor (47,000 ohms, 1/2 watt, Part of 40)	33-347344		(115 volts, 25 cycle)	12-0013			
40D	Mica Condenser (Part of 40)			81 Dual Cond. (.01-.01 mfd.)	3903-ODG			
41	Tubular Cond. (.1 mfd. 400 volts)	30-4455		82 Phonograph Motor (115 volt, 60 cycle)	35-1255			
42	Mica Condenser (100 mmfd.)	60-110157		(115 volt, 25 cycle)	35-1256			
43	Resistor (680,000 ohms, 1/3 watt)	33-468244		83 Motor Switch	22-0008			
44	Tubular Cond. (.004 mfd. 400 volts)	30-4578		84 Socket (Test)	27-6150			
47	Resistor (100,000 ohms, 1/2 watt)	33-410344		Shunt Plug (Test Connec.)	76-1103			
49	Tubular Cond. (.001-1000 volts)	30-4601						
50	Resistor (330,000 ohms, 1/3 watt)	33-433244						
51	Tubular Cond. (.006 mfd. 200 volts)	30-4591						
52	Resistor (3300 ohms, 1/2 watt)	33-233344						
53	Tubular Cond. (.05 mfd. 200 volts)	30-4519						

MOUNTING PARTS

Palnut (1st, 2nd, 3rd I.F. Transf.)	W-1949
Nut (Speaker Mounting)	W-124
Nut (Changer Mounting)	W-149
Rubber Corner (Chassis)	54-4015
Rubber Grommet (Tuning Unit to Cabinet, P.B., S.W. Mounting)	27-4596
Rubber Connector (Tuning Cond. Drive)	27-9432
Washer (Chassis Mounting)	W-151
Rubber Washer (Changer Mounting)	54-4040
Sleeve (Loop Mounting)	56-1907
Sleeve (Tuning Unit to Cabinet)	28-2258
Sleeve (P.B.S.W.)	28-5665
Sleeve, (Tuning Condenser)	56-1505
Sleeve (Loop)	28-2257
Scale Strap	56-1881
Screw (Loop)	W-288
Screw (Chassis Mounting)	W-1825
Screw (Push Button Bezel)	W-2071
Bolt (Changer Mounting)	W-2225
Spring (Mounting Changer)	28-8970
Washers (Mounting Changer)	W-1715

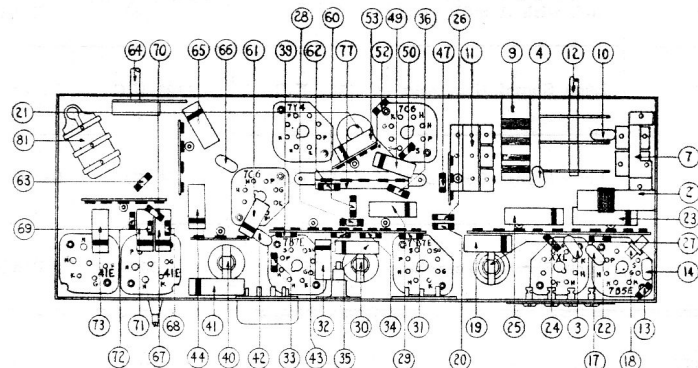
MISCELLANEOUS PARTS

Automatic Record Changer with 115 volt	
60 cycle motor	35-1246
25 cycle motor	35-1247
Bezel (push button)	56-1893

TUBE SOCKET VOLTAGES

D.C. voltages indicated at the tube elements in the diagram were measured with a 1000 ohms per voltmeter, Philco Model 028. Line voltage 120 volts A.C. no signal being received—range switch broadcast.

Tube	Location	Radio Position D. C. Voltage	Phono. Position D. C. Voltage
7B5E Osc.	Plate	27	185
" "	Screen	27	185
" "	Bias (Grid Leak)	7	47
XXL 1st Det.	Plate	130	180
" "	Bias (Cathode)	6	8
7B7E 1st & 2nd I.F.	Plate	227	185
" "	Screen	72	185
" 2nd I.F.	Bias (Cathode)	1.5	57
7C6 2nd Det.	Plate	165	140
1st Audio			
7C7E Preamp.	Plate	45	65
" "	Screen	20	28
41E Output			
" Phase inverter	Plate	222	183
41E Output	Screen	213	177
41E Output	Plate	222	183
" "	Screen	227	185
	12 mf. elect. to ground	305	290
	16 mf. elect. to ground	227	185
	8 mf. elect. to ground	137	178



PART LOCATIONS — UNDERSIDE CHASSIS

MODEL 715

ALIGNING R.F. AND I.F. COMPENSATORS

EQUIPMENT REQUIRED

1. **Signal Generator:** Covering the frequency range of the receiver, such as Philco Model 177.
2. **Aligning Indicator:** Either a vacuum tube voltmeter or an audio output meter may be used as an aligning indicator. Philco Model 028. Circuit testers contain both these meters.
3. **Tools:** Philco Fibre Screw Driver, Part No. 45-2610.

CONNECTING ALIGNING INSTRUMENTS

Vacuum Tube Voltmeter: To use the vacuum tube voltmeter as an aligning indicator, make the following connections: Attach the negative (—) terminal of the voltmeter to any point in the circuit where the A.V.C. voltage can be obtained. Connect the positive (+) terminal of the vacuum tube voltmeter to the chassis.

Audio Output Meter: Terminal No. 1 is provided on the loop aerial panel for connecting one lead of the audio output meter to the voice coil of the speaker. The other lead of the meter is connected to the chassis. When using these connections, the lowest A.C. scale of the meter must be used. (0 to 10 volts).

The audio output meter can also be connected between the plate of the output tube and the ground of the chassis.

Signal Generator: When adjusting the "I.F." padders, the high side of the signal generator is connected through a .1 mfd. condenser to the antenna section of the tuning condenser. Connect the ground or low side of the generator to the chassis.

When aligning the R.F. padders a loop is made from a few turns of wire and connected to the signal generator output terminals; the signal generator is then placed close to the loop of the radio.

When adjusting the radio outside the cabinet the loop aerial should be placed in approximately the same position around or near the chassis as when assembled.

The receiver can be adjusted in the cabinet or removed from the cabinet. If adjustments are made outside the cabinet a Service Tuning Scale, Part No. 45-2825 will be required. This scale is placed underneath the pointer on the metal dial plate.

After connecting the aligning instruments, adjust the compensators as shown in the tabulation below. Locations of the compensators are shown in the schematic diagram. If the indicating meter pointer goes off scale when adjusting the compensator, reduce the strength of the signal from the generator. Keep volume control of radio at maximum position.

Operations in Order	SIGNAL GENERATOR		RECEIVER			SPECIAL INSTRUCTIONS
	Output Connections to Receiver	Dial Setting	Dial Setting	Control Settings	Adjust Compensators in Order	
1	Ant. Section of Tuning Cond. with .1 mfd. Cond.	460 K.C.	Tuning Cond. Closed	Vol. Max. Bands Switch S.W.	27A, 27B 30A, 40A	Note A
2	Loop Signal Generator	1500 K.C.	1500 K.C.	Bands Switch "Brdest"	11A, 7	Note B
3	Loop Signal Generator	580 K.C.	580 K.C.	Bands Switch "Brdest"	7A	Roll comp. (7A) to "max." Recheck Operation No. 2
4	Loop Signal Generator	12 M.C.	12 M.C.	Bands Switch S.W.	11, 6	Note C

NOTE A—Compensator (27A) must be adjusted before compensator (27B) and should be done in the following manner: Turn (27A) all the way up, then turn down selecting the first I.F. peak, compensator (27B) is now padded to maximum.

NOTE B—DIAL CALIBRATION: In order to adjust the receiver correctly, the dial must be aligned to track properly with the tuning condenser. To do this, proceed as follows: Turn the tuning condenser

to the maximum capacity position (plates fully meshed). With the condenser in this position, set the tuning pointer on the extreme left index line at the low frequency end of the broadcast scale.

NOTE C—Adjust padder (11) to the first signal peak from the tight position. Roll padder (6) slowly to maximum on the second peak from loose position.

AUTOMATIC RECORD CHANGER

The Changer plays twelve 10" or ten 12" records.
 To reload, revolve the two posts slightly, grasping them underneath the Shelf Plates. Turn them back after the played records are removed; they will fall and lock when in proper position. Then place the new records on the Shelf Plates, and push "R" button to put Changer in operation
 To play the other size records, turn the knob at top of each post until proper figure is opposite pointer, and press the "10" or "12" button, to agree with pointer setting To reject a record (or to start a change cycle as for testing purposes) simply press the "R" (Release or Reject) button, at any time while needle is upon a record
 To play manually, turn plates out of the way as for reloading, and press "M" button.

ILLUSTRATIONS

The three photos illustrate all vital parts of the Changer. Letters are used alphabetically, to refer to points on the photos; thus, Motor Oiling Holes, "AI" are found simply glancing down Column A (right side of Photo A-B) to letters AI.

REPLACEMENT PARTS

When ordering parts for this mechanism, refer to the part number of the entire mechanism in addition to the letters and names of the parts shown in the figures of this bulletin.

OILING

The Changer should be lubricated once a year with about a dozen drops of a good light machine oil at each of the following 6 points. All points can be reached from above, through holes in the mounting plate as follows:

- Nos. 1, 2, 3: Three oil holes on motor gear housing. Reach all three through two holes AI.
- No. 4: Through hole marked AJ, drop the oil upon flat surface of cam. It will distribute itself to proper points.
- No. 5: Through hole marked AM, see felt wick, and drop the oil directly upon it.
- No. 6: Through hole marked AL, see felt wick, and drop the oil directly upon it.

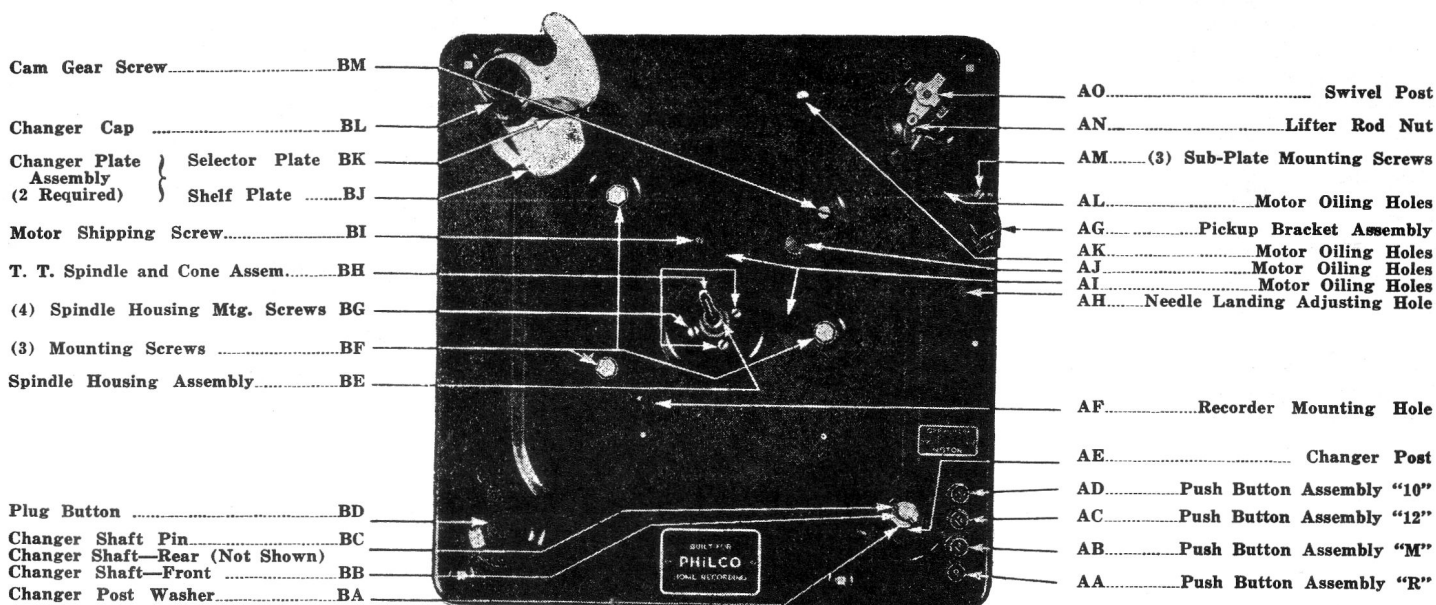


PHOTO A-B. TOP VIEW.

Pickup Plunger CA
 Lifter Guide (Specify Type of Reproducer) CB
 Hinge Spring Screw (Specify Type of Reproducer) CC
 Hinge Spring (Specify Type of Reproducer) CD

Key Control Assembly CE
 Pickup Plunger Spring (Inside Sleeve) CF
 Manual Key Rod CG
 Rejection Key Rod CH
 Pickup Plunger Sleeve CI
 Lifter Rod Nut (AN) CJ
 Swivel Tube and Trunnion Assembly CK
 Trunnion Shoulder Screw (2 Required) CL
 Clutch Release Roller CM
 Guide Arm Spring CN
 Swivel Spreader Spring CO
 Spring CP
 Clutch Assembly CQ
 Clutch Lever and Sleeve Assembly CR
 Clutch Lever and Sleeve Spring CS
 Clutch Spring Retainer CT

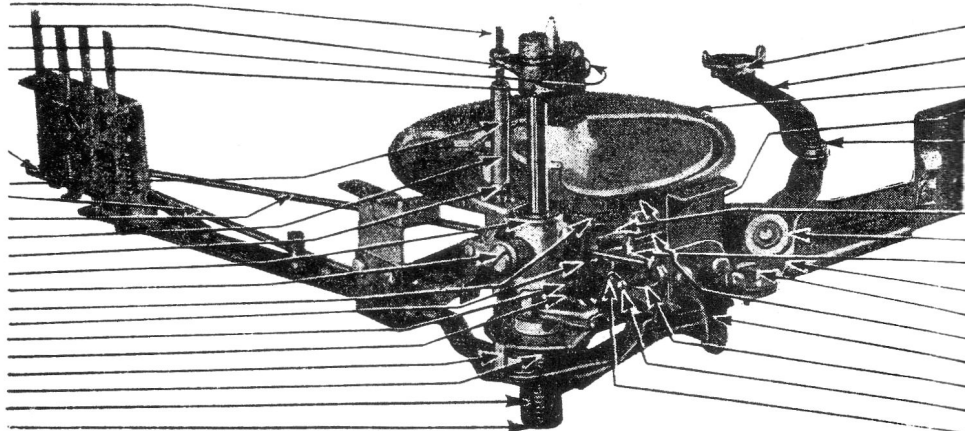


PHOTO C-D. VIEW OF SUB-PLATE ASSEMBLY, TOGETHER WITH CERTAIN OTHER A

Motor (Give Model No., Voltage and Frequency) EA
 Main Mounting Plate (Give Model No.) EB
 Plug and Shell EC
 Changer Shaft Collar ED
 Spreader and Hub Assembly EE
 Spring Roller EF
 Changer Spreader Spring EG
 Return Spring EI
 Return Spring Catch EJ
 Lever Pin EK
 Clutch Release Assembly EL
 Connecting Rod Nut EM
 Clutch Retainer Screw EN
 Clutch Release Adjusting Screw EO
 Cam Connecting Rod Lift Spring EP
 Changer Serial Number ER
 Adjusting Rod Assembly ES
 Lower Swivel Spreader ET
 Pickup Leader Spring EU
 Upper Swivel Spreader EV
 Post Nut (3 Required) EW
 Lock Washer (3 Required) EX

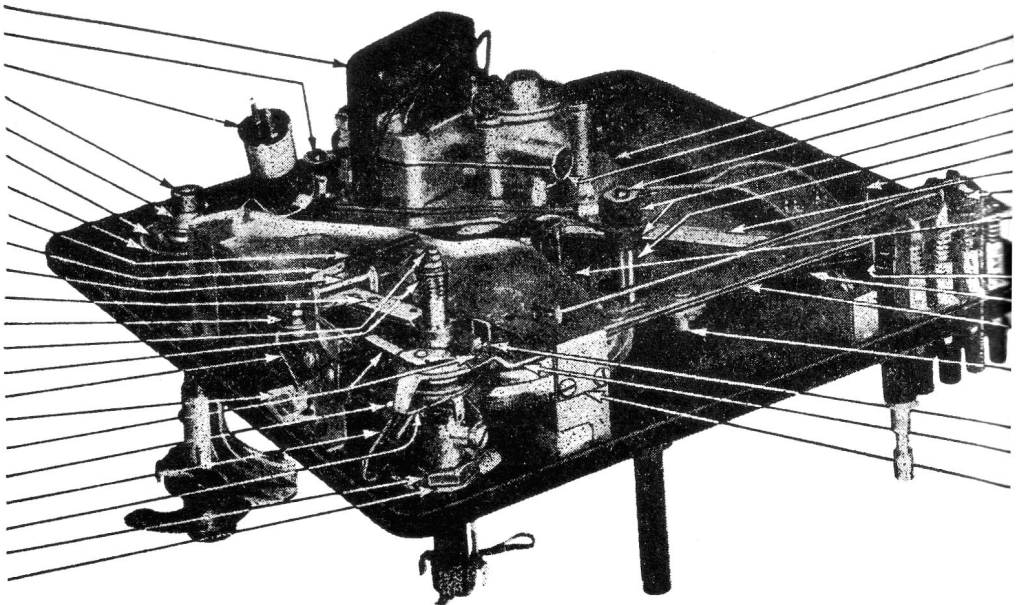


PHOTO E-F. BOTTOM VIEW.

TO CHECK OILING

If squeaks are heard compare the squeak with and without a load of records; any stack of records in motion is likely to squeak a little against a pin through their center. See that all five wicks are in position, including three $\frac{1}{4}$ " round wicks in frame of Motor, one washer-shaped wick on Lift, and one on Cam Lever DI. See that each wick is thoroughly saturated (as it may not be if insufficient oil or too heavy oil has been used). Lift out all three motor wicks, with tweezers; see if old oil has become gummy (commonly due to use of low-grade oil or low-viscosity oil). If necessary, **clean gummed-up wicks with kerosene**. See that each is saturated with good oil; then, before replacing them, drop a little good oil into the holes. The gearbox of the Motor is packed with a semi-fluid grease at the factory, and it should never be necessary to take it apart for lubrication purposes.

DA	.....	Spreader Hub Assembly (Lower)
DB	.....	Cam Connecting Rod
DC	.....	Cam Gear
DD	.....	Cam Lever Spring
DE	.....	Roller
DG	.....	Lifter Cam (Cam Gear Assembly)
DH	.....	Felt Wick
DI	.....	Cam Lever and Pawl Assembly
DJ	Cam Connecting Rod Lift Assembly DA, DB, DE, DH	
DK	.....	Shoulder Screw
DL	.....	Pawl Spring
DM	.....	Clutch Release Bracket
DN	.....	Release Trigger
DO	.....	Clutch Screw
DP	.....	Clutch Lever Spring

ASSEMBLIES.

FA	.....	Motor Mounting Plate
FB	.....	Coupling Assembly
FC	.....	Motor Mounting Screw (3 Required)
FD	.....	Motor Mounting Grommet (6 Required)
FE	.....	Motor Mounting Stud (3 Required)
FF	.....	Tee Nut
FG	.....	Changer Connecting Rod Assembly
FH	.....	Manual and Rejecting Rod Spring
FI	.....	Idler Gear
FJ	.....	Changer Lever and Hub Assembly (Front)
FK	.....	Adjusting Rod Spring
FL	.....	Adjusting Rod Extension
FM	.....	Needle Landing Adjusting Cam
FO	.....	Swivel Guide Arm Assembly
FP	.....	Adjusting Rod
FQ	.....	Adjusting Rod Bracket

GENERAL DESCRIPTION OF THE CHANGE CYCLE

An automatic record player for records of two sizes has three principal duties to perform. These duties are here performed by three mechanisms, interconnected and built together but largely separate in their operation.

(1) The record-changing mechanism — brought into operation originally by the contact of Lifter Cam DG with Pawl DI—is the simplest of the three. It is driven by the cam groove (not visible) on **under** side (in Photo C-D) of Cam Gear DC. As Cam Lever is forced, by the Pawl, out underneath Lift DJ (which is shown revolved to the right for visibility) the Lift rises and forces roller DE into the under groove in Cam Gear. The motion is transferred to Rear Changer Shaft (at ED) through Cam Connecting Rod EH, thence through Changer Connecting Rod FG to Front Changer Shaft at FJ.

(2) The pickup-operating mechanism — likewise brought into operation originally by the cam-and-pawl action upon Cam Lever — is driven in part by the groove in **upper** (visible) side of Cam Gear. As Cam Lever is forced out, at the beginning of the change cycle, against Link at FO, it causes the Link to push upward upon Pickup Plunger CA, thus lifting needle from record. The same pressure upon Link works, through Guide Arm at FO, to force Stud on Guide Arm down into the groove on the Cam Gear. **This rotates** the pickup arm, while Pickup Plunger **holds it up** off record. It is rotated first out beyond the turntable until Selector Plates BK have dropped the next record, then rotated back to proper position to start playing.

(3) The mechanism for bringing needle into correct starting position must operate accurately for both 10" and 12" records. Partly due to this requirement, the starting position is **not determined by the cam action**. The upper groove on Cam Gear is designed so that it, acting alone, would carry the needle **farther** back toward record pin than would ever be desirable as a starting adjustment. Travel of pickup arm toward Record Pin is then stopped, at proper point for lowering onto the record, by action of Lever Hub at CQ. The stopping takes place as lug (upon the Lever Hub) strikes the shoulder on Rod FP. This enables the entire mechanism rotated by cam action on Guide Arm to travel on **past** the proper point of rotation for record-starting, while the pickup arm itself, which is held rigid to Lever Hub, is accurately stopped at proper record-starting point.

Correct adjustment for starting position of needle requires therefore only correct adjustment of Rods FL and FP; the radial difference of 1 inch between correct starting position for 10" and 12" records is taken care of by exact dimensioning, at the factory, of surfaces at right end of Rod FP which stop against the "10" and "12" key stems. Due to this, when Adjusting Cam at FM is turned (as directed below under Adjustment A) the starting position of needle is simultaneously altered for both 10" and 12" records.

ADJUSTMENTS

There are two adjustments that can be made, **FROM ABOVE: CHANGER NEED NOT BE REMOVED FROM CABINET**. All adjustments are correctly made at the factory, and ordinarily need never be altered. Should it become necessary to readjust, due to accident or tampering, proceed as follows:

A. ADJUSTING LANDING POSITION OF NEEDLE ON THE RECORD. If needle comes down on the sound track, playing of records will not start at their beginning. Insert screw driver through hole AH. Turn screw head on Needle Landing Adjusting Cam FM **very slightly counter-clockwise**. If needle comes down too close to outer edge of record, or out beyond edge of record, turn Adjusting Cam clockwise.

The factory adjustment of needle landing is $\frac{1}{8}$ " in from outer edge of record.

Compare also Paragraph 12 on page 5.

B. ADJUSTING HEIGHT TO WHICH PICKUP ARM RISES. The arm should rise, during the change cycle, high enough so that it clears by only $\frac{1}{4}$ " the record above it, next to be played. (Be careful, before deciding that readjustment is necessary, to see

that the record at bottom of stack is not a warped one. To make this adjustment, **loosen Lock Nut CJ** and turn **Pickup Sleeve CI** to **lengthen or shorten Pickup Plunger CA**. However, if Pickup is made to rise too close to bottom record, Stud on Guide Arm at FO may not clear the groove in Cam Gear. In making this adjustment, therefore, care must be taken to see that Pickup Arm does not keep moving back and forth continuously (due to Stud remaining in engagement with groove). When correct adjustment is found, **tighten Lock Nut** securely.

REPLACING MOTOR

To adapt the Changer to a different power supply, or in case of any serious fault within Motor, remove entire Motor EA from the Changer, and replace it with a suitable new Motor. (In ordering a replacement Motor, specify the power supply and give Model Number.

In wiring up, use only C. E. S. A. Approved wire. **See that Motor Frame is well grounded** by wire soldered to lugs, as shown on bottom view photo.

TROUBLE SHOOTING

Cases of failure to operate satisfactorily will generally be found due either to neglect of proper lubrication, or to tampering with the mechanism after it leaves the factory, or to injuries accidentally sustained as by external vibration or by impact of some heavy object. In addition, there is always the possibility that any kind of spring may "go dead" (cease to operate without any visible breakage) even though the utmost factory precautions are taken against it — or that set screws may work loose due to some external vibration. For tightening set screws, a No. 8 size Allen (hexagon) wrench is required: Be sure that set screws are properly seated on the holes or flats provided. Damage from tampering is likely to take the form of bent parts; never bend any part during examination.

Among the principal trouble symptoms to which such causes may arise, are the following:

1. MECHANISM IS SLOW IN STARTING, OR MOTOR GETS HOT.

May be caused by:

a. Failure to lubricate properly. **Oil thoroughly.** See oiling instructions.

b. Check voltage. Line voltage may be abnormally low or high.

c. Motor windings damaged. If windings are found damaged, replace motor.

2. MOTOR FAILS TO RUN, EVEN WHEN IT IS ENTIRELY DISCONNECTED FROM OTHER WIRING AND PROPER VOLTAGE IS APPLIED DIRECTLY TO THE TWO ENDS OF ITS WINDINGS.

This indicates trouble in Motor windings. Unless the damage is easily seen and repaired, replace motor.

3. MOTOR IS SLOW IN STARTING.

a. Check oiling, as directed on page 7. It may not have been properly done; old oil may have become gummy.

b. Changer may have been in a very cold place, and may not yet have reached room temperature. Give it a fair chance to get warmed up before concluding that Motor is defective.

4. SQUEAKS OR OTHER NOISES, DURING PLAYING OF RECORDS.

Check oiling, as directed on page 7. (If squeaks are heard, they will usually be found to come from the records—not from the mechanism.) See “To Check Oiling.”

5. CHANGER IS NOISY WHEN IN CYCLE

Check oiling. Also see if any part has become loose or bent and is rubbing against a moving part such as the Swivel Guide Arm against the Cam Gear.

6. MOTION OF PICKUP TOWARD RECORD PIN WILL NOT TRIP CHANGER MECHANISM.

Manual button down. See that shipping bolts are removed.

If trigger is being properly actuated, probably Cam Lever at EL is binding against Sub-plate. Look for dirt or obstructions; see that Pawl and Trigger DN are working freely on their rivets. If the Lever engages the Pawl so that Lift forces roller up into the under groove on Cam Gear, and if set screws are tight, the change cycle must operate as Cam Gear turns.

7. PRESSING “R” BUTTON DOESN’T TRIP CHANGER MECHANISM.

a. Due to shipping bolts not being removed, causing a bind on manual rod, or manual button is down.

b. Check Key Control Unit CE: See whether there is an obstruction or a bent part which prevents “R” button from going clear down to the end of its travel.

c. Examine Reject Rod CH. If it does not trip, even when properly revolved by complete depressing of “R” button, the rod has probably been bent, and must be restored in some way. Grasp the two ends and twist it slightly.

d. If Trigger DN is being properly actuated but without starting a change cycle, see directions, Paragraph 6.

8. PRESSING “M” BUTTON FAILS TO PUT CHANGER MECHANISM OUT OF ACTION SO AS TO ENABLE MANUAL OPERATION.

a. First see that button goes clear down; then follow its action through Manual Rod CH.

b. Also caused by the manual rod being bent and not projecting up through Sub-plate and stopping Cam Lever when it is released from the Trigger.

9. TRIPS TOO SOON OR BEFORE RECORD HAS FINISHED PLAYING.

This caused by too little clearance between the trigger and the clutch lever assembly. To get more clearance on this adjustment, turn the adjusting screw DO in a clockwise direction a half-turn or whatever is necessary to make tone arm trip on $\frac{1}{4}$ ” motion.

10. TONE ARM FALLS OFF RECORD.

Needle sits down too close to edge of records, not adjusted in far enough, or needle landing adjusting cam reversed. It should contact lug on adjusting rod on the long side of cam. Check pick-up leader spring EU. It may have become loose; more tension can be given it by bending down lug.

11. TONE ARM SITS DOWN TOO FAR IN.

Due to adjusting rod bending and not measuring properly. If found to be bent, should be straightened to correct shape so that it will operate freely.

12. NEEDLE LANDS PROPERLY ON RECORD BUT FAILS TO MOVE OVER INTO RECORD GROOVE.

Pickup arm is normally impelled toward center of records by Lead Spring EU. Should a slight increase in its tension be found necessary, this can be easily obtained by slightly bending the lug, to which it is attached, down against Main Plate.

13. WOW IN RECORD REPRODUCTION.

a. Record is warped or otherwise defective or instrument is not being operated at normal room temperature, 70° F.

b. Motor mounting plate being bent will cause "wow." Straighten it if possible or replace with new plate if too badly bent to warrant straightening. This is only found where rough handling is evident.

c. Motor shaft out of alignment with the turntable shaft (also due to rough handling). To correct, move the motor on its mounting until motor shaft is parallel to the turntable shaft and the Universal coupling is exactly at right angles to motor and turntable shafts, then tighten motor mounting screws securely.

14. LAST RECORD DROPS ON ONE SIDE ONLY.

This suggests a Changer Post bent out of perpendicular to Main Plate. If Post must be straightened, be careful not to bend other parts.

15. CHANGER CONTINUES CYCLING.

a. Probably due to failure of Lift at DJ to be drawn back out of engagement with Cam Gear. Check the various rivets at which motion occurs, to find the point where friction or binding is interfering with freedom of motion.

b. Make sure that trigger spring is not disconnected. Also that clearance between trigger and clutch lever is sufficient. A sticking pawl will also cause this condition.

16. RECORD IS DRIVEN, BUT NOT HEARD, OR NOT HEARD WITH PROPER VOLUME.

See that Pickup cord is plugged in. Check amplifier and speaker and connections to them, thoroughly. If then trouble is still suspected in pickup, test its output with a vacuum-tube voltmeter. Playing an average record, output should test 1 to 2.5 volts if pickup cartridge is of crystal type. If pickup cartridge is found not to deliver proper output, remove it and install another.

17. RECORD JAMS.

Most slicing trouble (record jams) is due to offsize or defective records, and is no fault of the record

changer or record changer adjustment. Properly manufactured records have a uniform semi-circular edge and can be successfully handled by record changers, even though the records vary considerably in thickness.



Cross section of record edge showing a perfect and three imperfect edges.

Records that prove troublesome in the selecting or slicing process can usually be corrected by using a piece of fine sand paper or emery cloth to touch up the edge.

18. AUDIO HOWL.

Record changer not floating on cushions or spring mounting. See that shipping bolts are removed. If unit still does not float, loosen the nuts or mounting assembly allowing unit to rise and float.

19. TURNTABLE IS TIGHT.

This turntable is assembled to the turntable shaft with a taper lock fit in the center. To remove, grasp turntable with both hands, turn slightly forward and backward at the same time pulling upward, or run motor and grasp the turntable while it is revolving, and pull up.

20. THUMP HEARD IN RECORD REPRODUCTION.

This is caused by the motion of the friction clutch when it is momentarily released by the motion of the release lever, which in turn is actuated by the hump on the cam gear. If thump is objectionable, it can be reduced by adjusting the clutch lever at EO to allow only a slight amount of motion of the clutch assembly; also if the clutch spring is too strong, replace with a new spring or cut one-quarter of the length of the old spring or whatever is necessary to assure satisfactory operation. Be sure that clutch assembly parts are free from dirt and burrs and work freely without binding.