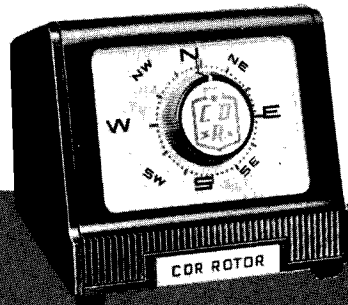


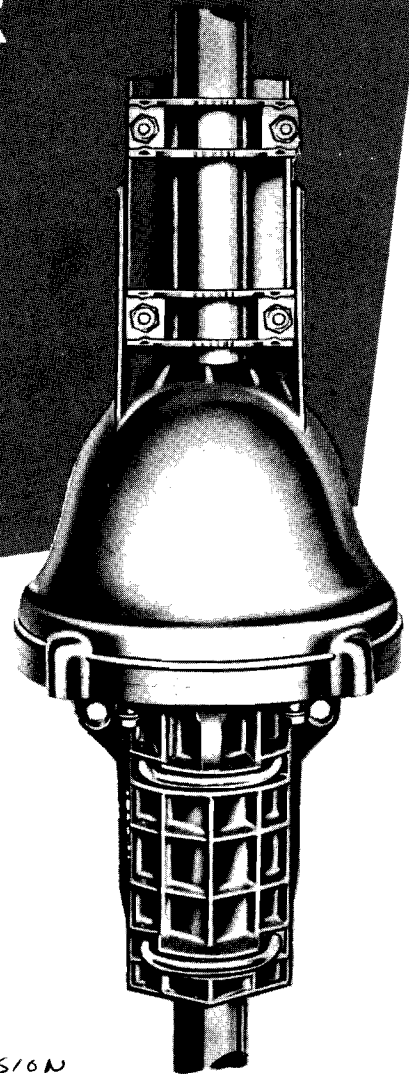
Series 3 W6



More info see CQ Feb 1963 p 73
Cap can be replaced by two back to
back 150wvdc @ 75ma + ie. - 16H+

CDR ROTOR

Service Manual



MODELS
AR-22
AR-22-220

ORDER REPLACEMENT PARTS FROM
CORNELL-DUBILIER ELECTRONICS DIVISION
ROTOR PARTS DEPT
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CORNELL-DUBILIER ELECTRONICS DIVISION
FEDERAL PACIFIC ELECTRIC COMPANY
Rotor Department
Fuquay Springs, North Carolina

Servicing THE AR-22 and AR-22-220 ROTOR CONTROL UNITS

General

The control unit was designed with one knob control for easy and simple operation. A 360° rotation of the knob on the control unit corresponds to a complete rotation (360°) of the antenna.

The end of rotation on the knob corresponds to the end of rotation on the Rotor. The knob will rotate 360° between ends of rotation and can be set in any of the 60 positions on the control unit dial, each representing 6° rotation of the antenna.

When turning the knob thru an angle greater than 330° allow the unit to pulse a few times before completing the turn. Do not force the knob when the end of rotation is reached.

(A) **IMPORTANT — IF LIGHTS REMAIN ON AFTER PULSING HAS STOPPED** it indicates [with the exception noted in (B)] that the rotor and control box are not synchronized with each other and the motor is stalled. Do not allow this condition to continue because the temperature of the motor is rising unnecessarily. Correct this condition by synchronizing per instructions on Page 4 or on the underside of the control box.

(B) **IMPORTANT — IF PULSING SOUND IS NOT EVIDENT WHEN YOU TURN THE KNOB**, either to the right or to the left, it indicates that the thermoswitch has come into play. This protective device automatically shuts off the power to the rotor unit when the rotator has been operated continuously for too long a period of time (usually 10 to 15 minutes) or when the rotor and control box have been allowed to remain out of synchronization with each other with the power on as mentioned above. To **REMEDY**, line the knob up with the red pointer and allow the rotator to rest until the temperature drops. This will take about 5 minutes. The thermo-switch will then close and the rotator will again be operative.

Electrical Service of the Control Unit

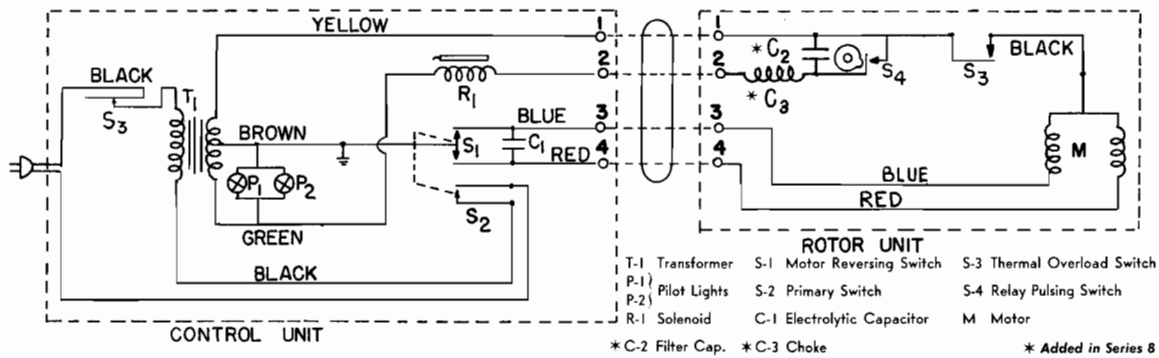
To service any part of the automatic control unit, first take off the rubber bumpers and remove cabinet from chassis. (See Fig. D). Check for obvious defects such as loose solder connections, burned out transformer, pitted contacts, etc. associated with the A.C. power source.

Check for your difficulty by using the trouble-shooting chart included in this Manual. In the exploded views of the control unit (Fig. E) and the rotor unit (Fig. 5) the individual parts and their part numbers are shown. Use this reference to order parts by the proper part number.

Disassembly of Control Unit

The following disassembly procedure is given for information only. The unit should be disassembled only as far as need be for repair.

1. Remove rubber bumpers and lift the cabinet from the chassis.
2. Remove the dial knob by pulling forward, loosen set screw with allen wrench and remove knob sleeve.
3. Remove the two (2) screws that hold the dial crystal and dial face plate.
4. To remove any part of the mechanism remove the three (3) screws that hold it to the base plate. The unit is now free to be disassembled. The wiring does not have to be unsoldered as it is flexible enough to allow workable movement of the mechanism. By unsoldering only the part that is to be replaced, repair time can be minimized.
5. The pointer and gear can be removed by removing the retaining ring. Remove the four screws from the front plate assembly and lift from its position. This leaves the mechanism exposed to the repairman.
6. The nylon escape wheel is removed, then the right and left pawl, which are held together by the pawl spring can be removed as a unit. The pawl arm and connecting bar assembly can be removed from the stud by releasing the lever return spring and removing the cotter pin that connects the bar to the solenoid plunger.
7. To remove the gear and spring assembly, pry off retaining ring and remove the flat washer. Spring retainer and cover can be removed by taking off the locking ring and shim washer.
8. The insulator block and contacts can be removed from the rear mounting plate by removing the screw and gently prying block until the positioning stud clears the mounting plate. The wires need not be unsoldered unless block or wires are being replaced.
9. To remove the insulator disc assembly, the two wires will have to be unsoldered at the number 3 and 4 terminal connecting strip or the wires can be unsoldered at the left and right hand brass contacts and pulled through the shaft. This will allow for checking the hidden part of the wires for cracks or breaks. By removing the retaining ring, flat washer and the lost motion lever the insulator disc assembly can be removed.
10. To remove or replace the solenoid take off the screws that hold it to the rear mounting plate.



Circuit Diagram

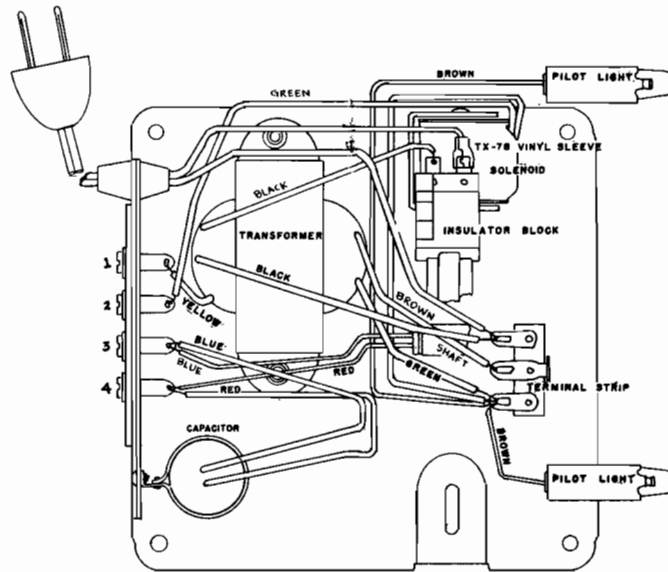


Fig. A

Fig. A shows wiring for Series 1, 2 & 3 Units. Starting with Series 4 the terminal strip was eliminated and lugs were added in the transformer. The Thermal Overload Switch was removed from the motor and imbedded in the transformer.

To Assemble

1. The solenoid is placed with the plunger facing the pawl connecting arm. Place rubber grommets in slotted holes and secure solenoid thereon with screws. Solenoid bracket has elongated slots for horizontal position adjustment. Adjust so that when plunger is fully seated the upper pawl is out of the escapement wheel slot and away from the wheel .020 to .032 inch. Grommets should keep solenoid base from touching mounting plate.
2. The insulator disc assembly is placed in position with the wires extending thru the rear mounting plate. Then the lost motion lever is slid over the wires and shaft with the formed end going thru the hole in the rear mounting plate. Next slide the flat washer on and lock in place with the retaining ring. Solder wires as shown in wiring diagram (Fig. A).
3. Place a thrust washer on the insulator disc shaft then slide the gear assembly on. Assemble the main spring and the spring retainer and replace cover. Wind spring to a fully wound position and release $720^\circ \pm 15^\circ$ (two full turns). (See Fig. E). Replace shim washer and snap retaining ring into groove. The plastic screw on the gear is adjusted to open the points .025 inch.

4. The insulator block and contacts are positioned with the two contacts riding on either side of the insulator disc gear and the ball or radius of the detent spring in the teeth of the gear. Secure it in place with the screw. (See item 8 for adjustment.)
5. Replace the pawl lever and the right and left hand pawls with the straight tabs locating in the rectangular holes in the pawl lever and the formed ends in the grooves or resting on top of the nylon escape wheel. Spring to be hooked to the pawls with the hooks going through the holes first and extending over the edges of the R.H. and L.H. pawls.
6. The gears to be meshed only when an index mark on the nylon gear is in line with the point of the lanced triangle in the large stamped gear or the index marks if it is a die cast gear.
7. Attach front plate.
8. Spring and ball assembly to be adjusted in a position such that the finger of the upper pawl will rest in the center of a groove on the escape wheel at zero torque between the insulator wheel and the spur gear.

9. Now place gear sleeve, and point assembly in mesh with gear of nylon escape wheel then place the retaining ring into groove of front plate sleeve to secure in place.

10. Replace the dial face by sliding it over the pointer and then the dial crystal and secure it in place with the two screws.

11. The mechanical assembly can now be secured to the base plate of the chassis with the three screws. Check all wires for solid connections using wiring diagram for correct connections. Fig. A.

12. Replace the knob sleeve and tighten set screw. Replace cabinet and rubber bumpers. Leave control knob off until the control box and rotor are synchronized. **DO NOT HAVE SET SCREW IN A POSITION WHERE IT WILL BE TIGHTENED ON THE FLAT OF THE SHAFT.**

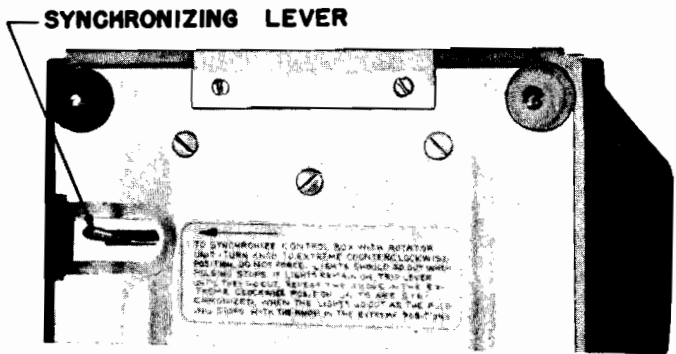


Fig. B

Synchronization The Rotor and Control Units can be synchronized in 2 steps as follows:

1. Turn the knob to the extreme counter-clockwise position. If the lights remain on after pulsing stops, trip the lever (on the underside of the control unit) until they go out.
2. Now turn the knob to the extreme clockwise position. If the lights remain on after pulsing stops, trip the lever until they go out.

The units are now synchronized.

To align the control unit first check antenna direction with Rotor at end of rotation. With the knob off move the red pointer so it indicates the direction the front of the antenna is facing. Use a small screw driver or similar object to set the red pointer. (See Fig. C.) Replace the knob with knob mark aligned with red pointer.

If the mark on knob does not line up exactly with dial markings, remove the knob far enough to clear the set screw in the sleeve and rotate the sleeve until the line and marks coincide.

To replace dial lights on the control unit, remove the four (4) rubber bumpers and lift cabinet from chassis. (See Fig. D.) Replace with Type #47 Dial Lamps.

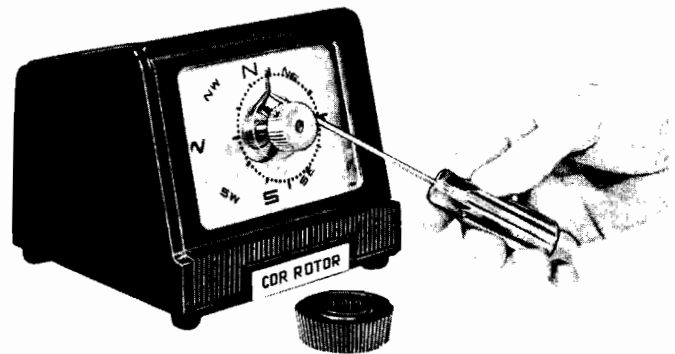


Fig. C

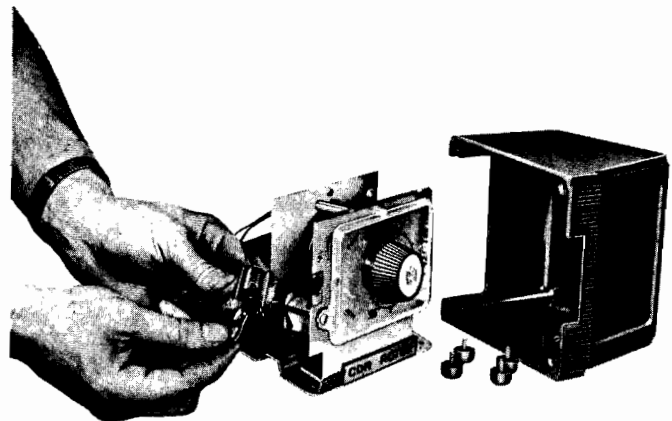
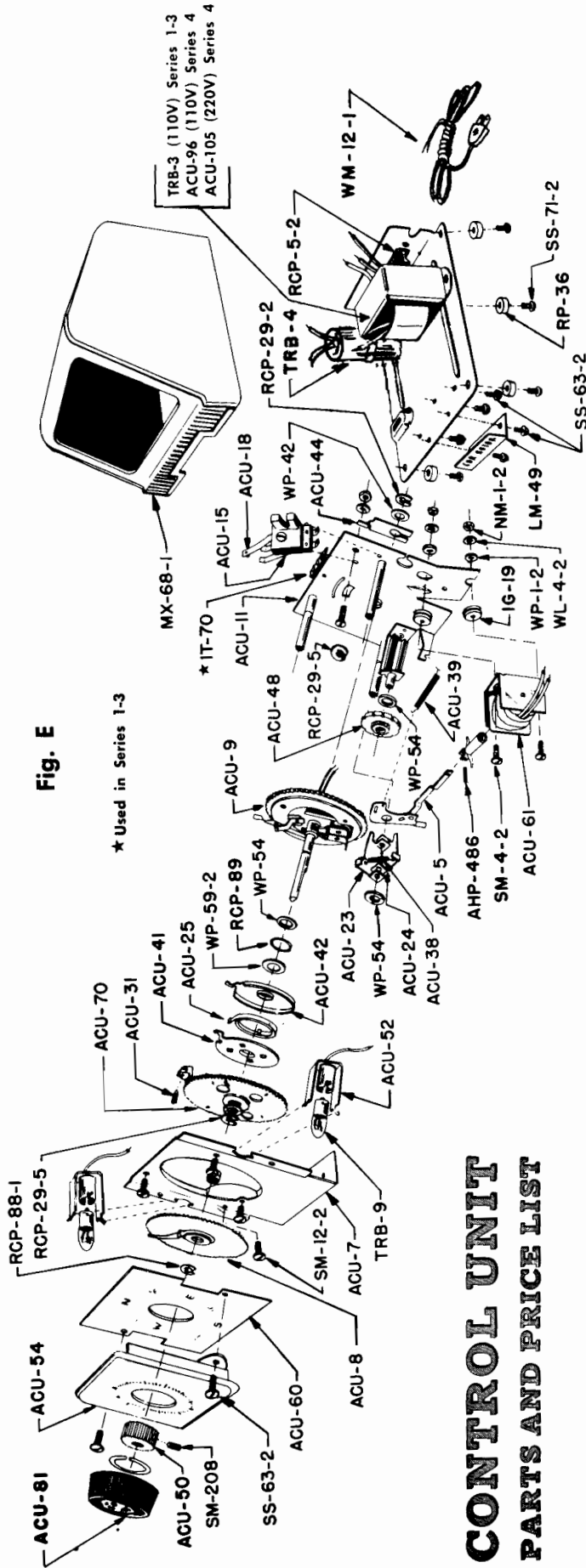


Fig. D

Fig. E



CONTROL UNIT PARTS AND PRICE LIST

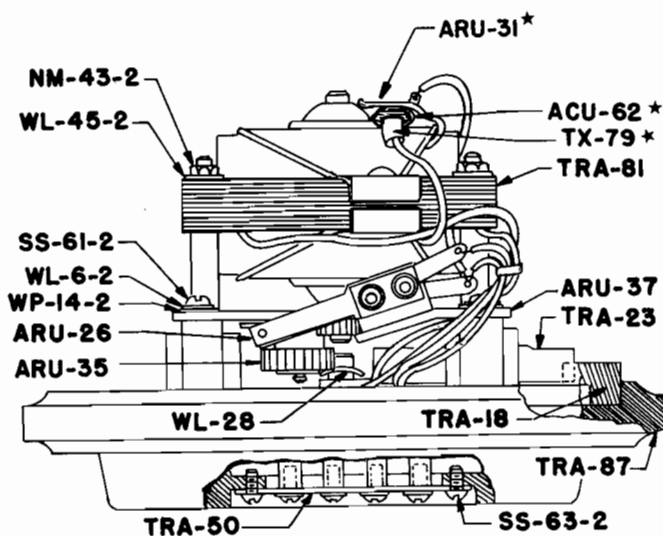
PART NO.	NAME	QUAN.	PRICE EACH	PART NO.	NAME	QUAN.	PRICE EACH	PART NO.	NAME	QUAN.	PRICE EACH
ACU-83	Control Unit (Walnut)	1	\$20.63	ACU-52	Socket, Lamp	2	\$.35	RP-36	Bumper, Recess	4	\$.05
ACU-83-W	Control Unit (Ivory)	1	22.74	ACU-54	Dial, Crystal	1	.50	SM-4-2	Screw, Rd. Hd. Mach. #6-32 x 1/2"	3	.05
ACU-5	Pawl Arm & Connect. Bar Ass'y.	1	.30	ACU-60	Face, Dial	1	1.00	SM-12-2	Screw, Rd. Hd. Mach. #6-32 x 1/4"	4	.05
ACU-7	Front Plate & Sleeve Ass'y.	1	.60	ACU-61	Solenoid	1	4.00	SM-208	Screw, Set #10-24 x 3/16"	1	.15
ACU-8	Gear Sleeve & Pointer Ass'y.	1	.50	ACU-70	Gear	1	1.00	SS-63-2	Screw, Rd. Hd.	7	.05
ACU-9	Insulator Disc Ass'y.	1	3.00	ACU-81-1	Dial Knob, Ass'y. (Brown)	1	.75	SS-71-2	T. C. #6-32 x 3/8" (Type 23)	4	.05
ACU-11	Rear Mtg. Plate Ass'y.	1	2.95	ACU-81-2	Dial Knob, Ass'y. (Ivory)	1	.75	SS-71-2	Screw, Rd. Hd.	4	.05
ACU-15	Insulator Block & Contacts Ass'y. (Includes ACU-18)	1	.50	ACU-96	Transformer (110 V)	1	5.75	TRB-3	Transformer	1	5.00
ACU-18	Detent Spring & Ball Ass'y.	1	.05	ACU-105	Transformer (220 V)	1	6.00	TRB-4	Capacitor	1	3.00
ACU-23	Pawl R. H.	1	.10	AHP-486	Pin, Cotter - 1/16" x 1/2"	1	.05	WL-4-2	Lockwasher, Int. Tooth #6	4	.05
ACU-24	Pawl L. H.	1	.10	IG-19	Grommet	2	.05	WM-12-1	Cord & Plug-A.C. (Brown)	1	.80
ACU-25	Spring, Main	1	.35	IT-70	Terminal Strip	1	.10	WM-19-1	Cord and Plug (Ivory)	1	.05
ACU-31	Screw, Plastic	1	.15	LM-49	Name Plate	1	.25	WP-1-2	Washer, Flat 3/8" O.D. x .140" I.D. x .032"	2	.05
ACU-38	Spring, Pawl	1	.10	MX-68-1	Cabinet (Walnut)	1	2.75	WP-42	Washer, Flat	1	.05
ACU-39	Spring, Lever	1	.10	MX-68-2	Cabinet (Ivory)	1	4.75	WP-54	Washer, Flat	3	.05
ACU-41	Cover, Spring	1	.15	NM-1-2	Nut, Hex #6-32	4	.05	WP-59-2	Washer, Shim-3/4" O.D. x .500" I.D. x .005"	1	.05
ACU-42	Retainer, Spring	1	.20	RCP-5-2	Strip, Terminal	1	.35				
ACU-44	Lever, Lost Motion	1	.05	RCP-29-2	Ring, Retainer	1	.05				
ACU-48	Wheel, Escape	1	.40	RCP-29-5	Ring, Retainer	2	.05				
ACU-50	Sleeve, Knob	1	.30	RCP-88-1	Ring, Retainer	1	.05				
				RCP-89	Ring, Retainer	1	.05				

Servicing the ROTOR

General

To service the Rotor, disconnect the cable from the terminal connections and remove the Rotor from its mounting mast.

Check for difficulty by using the trouble shooting chart included in this Manual. In the exploded view (Fig. 5) the individual parts of the Rotor with their part numbers are shown. Use this reference to order parts by proper part number.



*Used in Series 1, 2 & 3 Units

Fig. 1

Disassembly

To disassemble the Rotor, follow the steps given below:

1. Remove the lower mast support casting by removing the four hex head screws at the bottom of the Rotor.
2. To remove the upper mast support or bell housing, remove the four round head screws which hold the rotor base to the bell housing with a retaining ring. Hold the retaining ring to the bell housing and place the Rotor in an upright position on any flat surface being used as a working area. The bell housing can now be removed without disturbing the retaining ring from its position on the rotor base.
3. Remove the bell housing by lifting it straight up, the mechanical parts are now accessible as shown in Fig. 1.
4. The entire electrical system can be removed without unsoldering any connections. First, remove the two screws that hold the terminal strip (TRA-50) to

the rotor base. Shift the terminal strip until it can be slipped through the hole in the rotor base. Next, remove the two nuts and washers that hold the motor to the motor mounting studs. Remove the screw that holds the pulsing switch to the mounting plate and the complete electrical circuit can be lifted from the rotor base. The thermoswitch is held to the motor by a clip which can be removed by pulling from the motor. Now unsolder the wires from any of the three parts that are being replaced.

5. The three screws that hold the motor mounting plate are removed and the plate can be lifted from its position. The gears and spacers are now accessible and can be removed.

To Assemble the Rotor

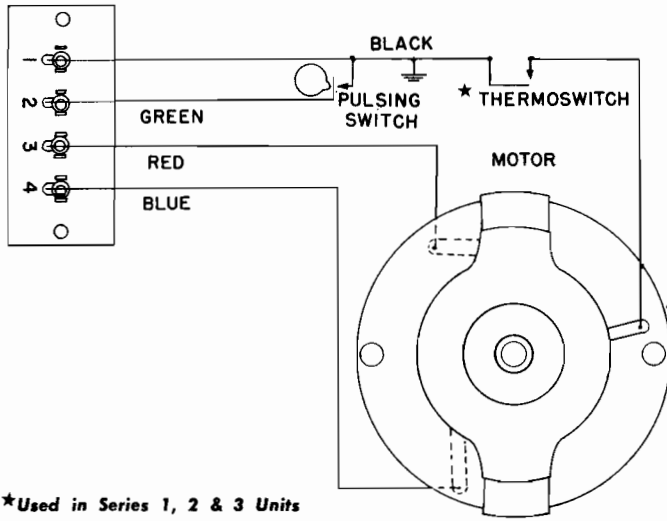
1. Use the gear train diagrams Fig. 3 for reference when replacing the gears and their spacers. If the ring gear has been removed, place it up against the stop in a counterclockwise position as shown in Fig. 4. Before replacing the motor mounting plate, the pulsing switch should be placed in its position on the plate. The mark on the cam gear should be lined up with the edge of the motor mounting plate as shown in Fig. 4. Place the plate in position and secure with the three screws. Before proceeding, check to make sure that the high point of the cam does not end on the button of the pulsing switch when the rotor is at either end of rotation.

2. Place the rotor base so that the terminal connecting strip hole at the bottom of the base is toward the repairman. The motor is then placed so that the elongated mounting hole of the motor is over the mounting plate stud that is to the left side of the repairman. The red lead wire on the motor will be to the left and the blue lead wire to the right of the repairman. Now adjust the motor pinion gear with the gear train. Move the motor back and forth along the elongated hole at the same time turn the gear train with the other hand until the best position of the motor is obtained. In the proper position, the gears will run quietly without binding, then tighten the motor with the two nuts.

3. After the bell housing is placed on the rotor base, shift it carefully until the slots fit into the lugs of driving gear. Replace the four round head screws of the housing retainer ring which holds the bell housing to the rotor base and replace the lower mast support.

AK-83 KIT

This kit contains sufficient parts to repair any of the gear train assemblies, as shown in the following drawing.



Wiring Diagram of Rotor

Fig. 2

4. Wire the assembled rotor to an AR-22 control unit leaving line #2 disconnected from terminal #2 of the rotor. Turn control knob one division right or left of red pointer and allow rotator to turn to its mechanical end of rotation stop. Return control knob in line with red pointer breaking the power source to the rotator. An open circuit condition (no continuity) must be established by this check between terminals #1 and #2 of the rotor. Recheck as above with the rotator turned to the opposite end of rotation. Any continuity between terminals #1 and #2 of the rotator at either end of rotation, indicates improper assembly of the ARU-35 cam in the associate gear assembly. (See Fig. 4.)

5. Replacement parts should be ordered through your local distributor. When ordering parts for the control box, give the identifying information stamped on the metal base plate of the control box and the part number which can be found in this Service Manual.

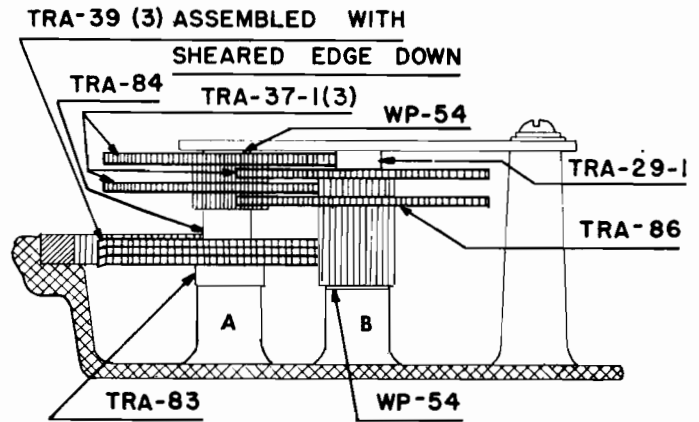
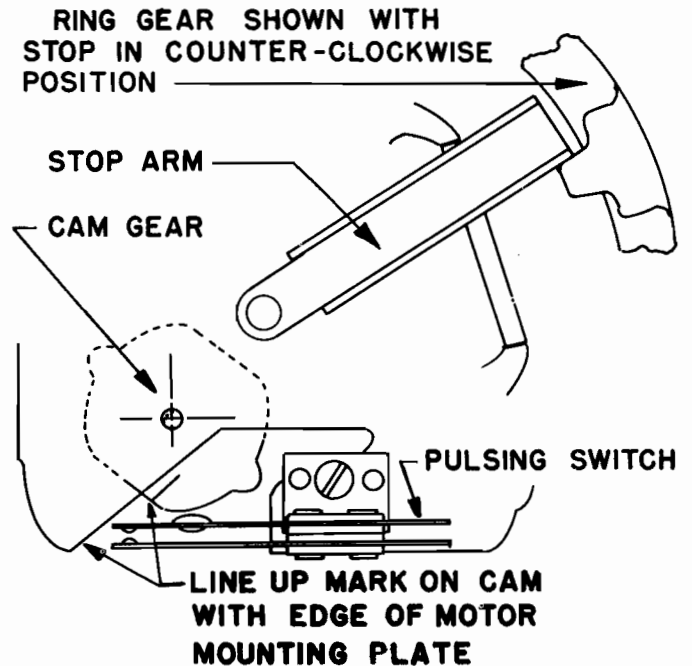


Fig. 3

If gear shaft protrudes $1\frac{3}{16}$ " from supports A & B, assemble parts as shown in drawing above.

If gear shaft protrudes 1" from support A, use TRA-114 bushing (long) through 3 TRA-39 gears instead of TRA-83 double diameter bushing and TRA-84 spacer (short).

If gear shaft protrudes 1" from support B, substitute TRA-37-2 gear and pinion assembly (short pinion) for TRA-86 gear and pinion assembly (long pinion).



AR-22 ROTOR

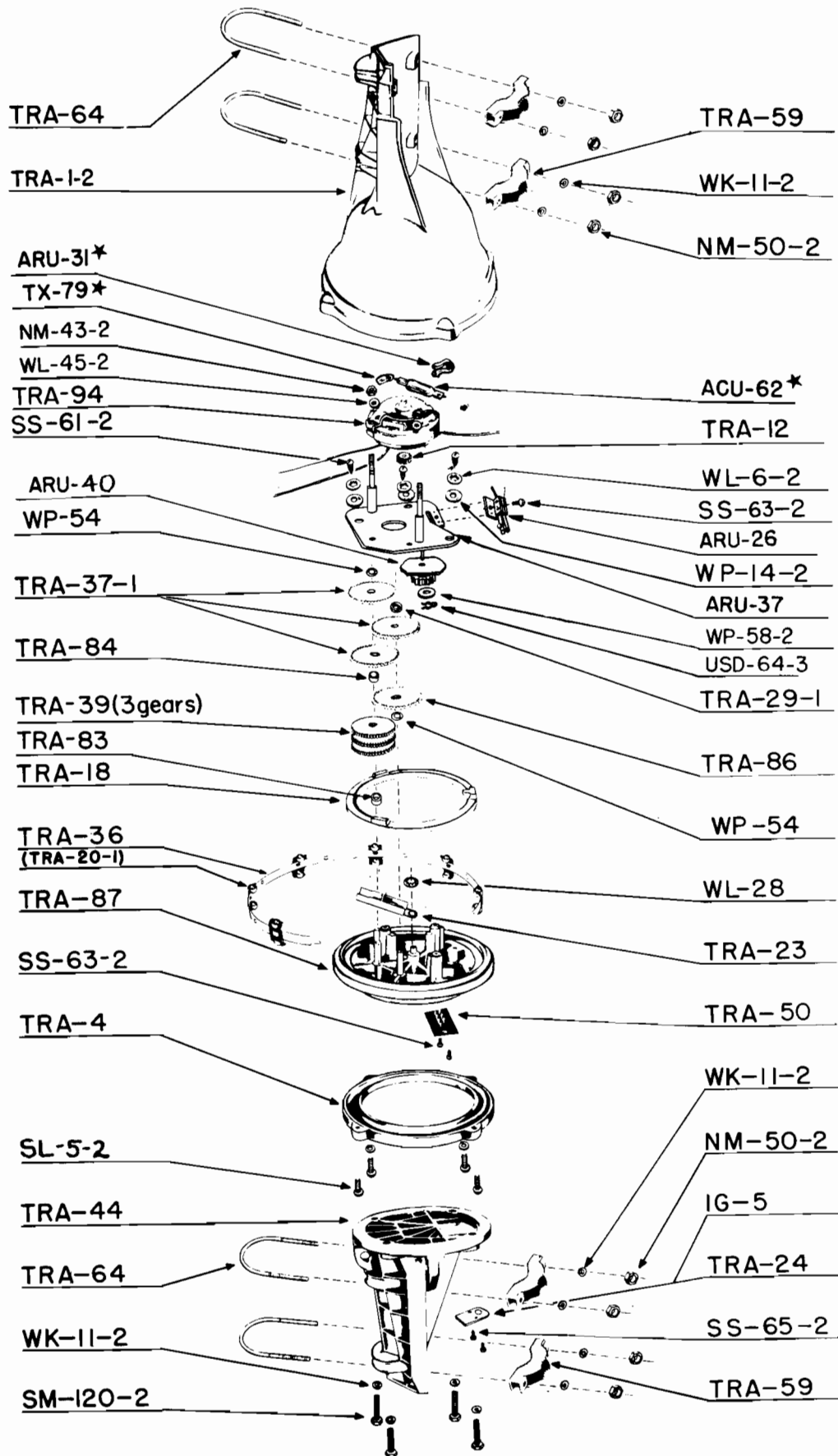


Fig. 5

AR-22 ROTOR

PARTS AND PRICE LIST

PART NO.	NAME	QUAN.	PRICE EACH	PART NO.	NAME	QUAN.	PRICE EACH
ARU-32	Automatic Rotor, Complete	1	\$35.11	TRA-87	Ass'y., Base and Gear Shaft	1	\$ 4.00
ACU-62*	Thermoswitch	1	1.50	TX-79*	Sleeve, Vinyl	1	.05
ARU-26	Ass'y., Pulsing Switch	1	.65	USD-64-3	Cotter, Hair Pin	1	.05
ARU-40	Ass'y., Cam and Pinion Gear	1	.40	WL-6-2	Lockwasher #10	3	.05
ARU-31*	Bracket	1	.05	WL-28	Lockwasher, Spring Grip	1	.05
ARU-37	Ass'y., Motor Mounting Plate	1	1.50	WL-45-2	Lockwasher #8	2	.05
IG-5	Grommet	1	.05	WP-14-2	Washer, Flat 1/2" O.D. x .203" I.D.	3	.05
NM-43-2	Nut, Hex #8-32	2	.05	WP-54	Washer, Flat 1/2" O.D. x .252" x .008/.010 Br.	As Req'd	.05
SL-5-2	Screw, Fil. Hd. Sems. #12-28 x 5/8"	4	.05	WP-58-2	Washer	1	.05
SS-61-2	Screw, Rd. Hd.	3	.05	AK-83	Gear Train Accessory Kit Consists of the following:	1	4.50
SS-63-2	Screw, Rd. Hd. T. C. #6-32 x 3/8"	1	.05	TRA-29-1	Spacer 3/8" dia. x .125"	1	.10
SS-65-2	Screw, Rd. Hd.	2	.05	TRA-84	Spacer	1	.10
TRA-1-2	Support, Upper Mast	1	8.50	TRA-37-1	Ass'y., Gear and Pinion	3	.75
TRA-44	Ass'y., Lower Mast Support	1	4.25	TRA-37-2	Ass'y., Gear and Pinion	1	.90
TRA-4	Ring, Retaining	1	1.25	TRA-39	Gear, Spur	3	.30
TRA-12	Pinion, Motor	1	.40	TRA-86	Ass'y., Gear and Pinion	1	.90
TRA-18	Gear, Driving	1	1.25	TRA-114	Bushing	1	.25
TRA-20-1	Bearing, Ball	12	.05	WP-54	Washer, Thrust Brass	4	.05
TRA-23	Ass'y., Pivot Arm and Stop Angle	1	.30	TRA-83	Shoulder Bushing	1	.15
TRA-24	Cover, Terminal	1	.10	AK-97	Accessory Kit Consists of the following:	1	4.00
TRA-29-1	Spacer	1	.10	NM-50-2	Nut, Hex 1/4-20	8	.05
TRA-36	Ass'y., Strap and Bearing Retainer	1	.50	TRA-59	Clamp, Mast Mount	4	.50
TRA-39	Gear, Spur	3	.30	TRA-64	Bolt, "U" Type	4	.25
TRA-50	Terminal Strip	1	.50	SM-120-2	Screw, Hex Hd. Mach 1/4-20 x 1"	4	.05
TRA-81	Ass'y., Motor and Pinion	1	9.75	WK-11-2	Lockwasher, split 1/4"	12	.05
TRA-83	Bushing	1	.15				
TRA-84	Spacer	1	.10				
TRA-94	Motor (Less Pinion)	1	9.50				
C-893	Capacitor	1	.65				
T-1432	Air Core Choke	1	.35				

*Used in Series 1-3 Units

TROUBLE SHOOTING ANALYSIS CHART

If a failure occurs it is recommended that the following chart be consulted and the rotator checked in the order given. Doing so might save an unnecessary job of dismantling the rotor unit from the mast, particularly if the trouble is in the control box.

SYMPTOMS

I. Pilot lights fail to light when control knob is turned in either direction and no movement of the red indicator or pulsing sound is evident.

II. Pilot lights burn dimly when control knob is turned in either direction, the red indicator does not move and the pulsing sound of the solenoid is weak or absent.

CAUSE

1. No primary 115 Volt 60 Cycle source.
 - a. Defective wall socket, etc.
2. Open primary circuit.
 - a. Defective line cord.
 - b. Open transformer primary T₂.
 - c. Defective primary circuit switch S₂. (Bent or broken blade, contacts not coming together).

TEST: Disconnect the cord from the wall socket and with the control knob turned to either side of the red pointer a resistance check between the prongs of the male plug or the appliance cord should show approximately 25 ohms.

1. Frayed ends of control cable, making contact with metal portion of chassis or shorting between terminals.
2. Grounded control box chassis by contact with television receiver ground, booster, radiator, clock, or other device, at ground potential.
3. Defective transformer.

TEST: Disconnect the control cable and with the A.C. line cord plugged in, the control knob turned to right or left of red pointer, a voltage check should show 34 volts A.C., between terminals #1 and metal chassis. As above, find 6½ volts A.C. between chassis and terminal #2.

TROUBLE SHOOTING ANALYSIS CHART

SYMPTOMS

III. Pilot lights normal but the red pointer does not move when knob is turned to the right or left and solenoid pulsing sound is weak or absent.

CAUSE

1. Out of synchronization. See directions for synchronizing. If in attempting to synchronize, the red pointer does not move when the lever is tripped, the failure is mechanical and in the control unit mechanism.

2. Defective solenoid:

TEST: With A.C. cord plugged in and control cable disconnected, momentarily short terminals #1 and #2. Solenoid is OK and escapement mechanism functions properly if the red pointer moves toward the marker on the control knob each time short is applied.

3. Defective motor control switch S_1 and/or broken leads from S_1 to terminals #3 and #4.

TEST: With control unit disconnected from power source, a resistance check should show less than $2\frac{1}{2}$ ohms between terminals #1 and #3 with knob turned counter-clockwise and less than $2\frac{1}{2}$ ohms between #1 and #4 with knob turned clockwise.

4. Defective motor capacitor:

TEST: Disconnect line cord from source and with control knob positioned either side of red pointer, test leakage resistance between terminals #3 and #4. This should be greater than 200,000 ohms after the condenser has charged. If available, a condenser checker may be used to check capacity across these terminals. Rated capacity is 100 to 120 Mfds.

TROUBLE SHOOTING ANALYSIS CHART

SYMPTOMS

IV. No movement of red pointer or pulsing sound is evident when the knob is turned to the right or left and observation shows that the rotor unit is rotating. It is assumed that the control unit has been checked out as in I, II, and III, and has been found OK.

V. Control Unit checked out as above and observation indicates that rotor is operating when knob is turned to the right or left of red pointer but no movement of pointer or pulsing sound is evident. Turn control knob fully away from pointer both directions as rotor may be at end of rotation.

CAUSE

1. Out of synchronization. Follow instructions on page 4.
2. Protective thermoswitch in open circuit condition due to operating over too long a period of time continuously. See Paragraph B page 2.
3. Faulty control lines or defective motor. Control line continuity and motor resistance check can be made at the control unit end of the control cable by checking resistance between lines #1 and #3 and lines #1 and #4. Between either of these pairs the resistance of the motor will be between $2\frac{1}{2}$ to $4\frac{1}{2}$ ohms plus 1 ohm for each 100 feet of control cable used.

1. Broken or disconnected #2 control wire between rotor and control unit. With line cord disconnected from source, short control unit terminals #1 and #2 and check continuity of lines #1 and #2 at rotor terminals. Resistance measured will vary with length of control cable approximately 1 ohm per 100 feet.
2. Defective pulsing switch S_4 or associated mechanism. This condition most readily detected by observation.

SERIES CHANGES AR-22

THE FOLLOWING CHANGES WERE MADE ON THE AR-22 ROTOR:

SERIES 2 — Changed to wider insulator disc and insulator block.

SERIES 3 — Changed insulator block contacts and detent spring.

SERIES 4 — Thermoswitch removed from motor in rotator unit and imbedded in transformer of control unit.

SERIES 5 — Capacitor added to reduce RFI.