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TM 9-1221

WAR DEPARTMENT TECHNICAL MANUAL

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AA MACHINE GUN TRAINER M9

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WAR DEPARTMENT • *16 MARCH 1944*

FOR ORDNANCE PERSONNEL ONLY

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WAR DEPARTMENT
Washington 25 D. C., 16 March 1944

TM 9-1221, Ordnance Maintenance: AA Machine Gun Trainer M9, is published for the information and guidance of all concerned.

[A.G. 300.7 (16 Feb 44)
O.O. 300.7/1130]

BY ORDER OF THE SECRETARY OF WAR:

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Chief of Staff.

OFFICIAL:
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(For explanation of symbols, see FM 21-6.)

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Section I

INTRODUCTION

1. SCOPE.

a. This Technical Manual is published for the information and guidance of Ordnance maintenance personnel. It contains instructions for inspection, disassembly, assembly, maintenance, and repair of the Antiaircraft Machine Gun Trainer M9, supplementary to those in the Field Manuals and Technical Manuals prepared for the using arms. Additional descriptive matter and illustrations are included to aid in providing a complete working knowledge of the materiel.

2. CHARACTERISTICS.

a. The Antiaircraft Machine Gun Trainer M9 consists of two guns, two units of sound equipment, one compressor, and one target system (figs. 1 and 2).

b. The guns are imitations of the cal. .50 water-cooled antiaircraft machine guns. Each gun is an electrically controlled, pneumatic device for shooting plastic pellets on a 1:30 scale range to simulate the time of flight of a cal. .50 bullet under actual firing conditions (fig. 3). A pellet loading hopper mounted on the left-hand side of the control cabinet, is provided for each gun (fig. 160). Air for operating the guns is supplied by a single cylinder compressor (fig. 4).

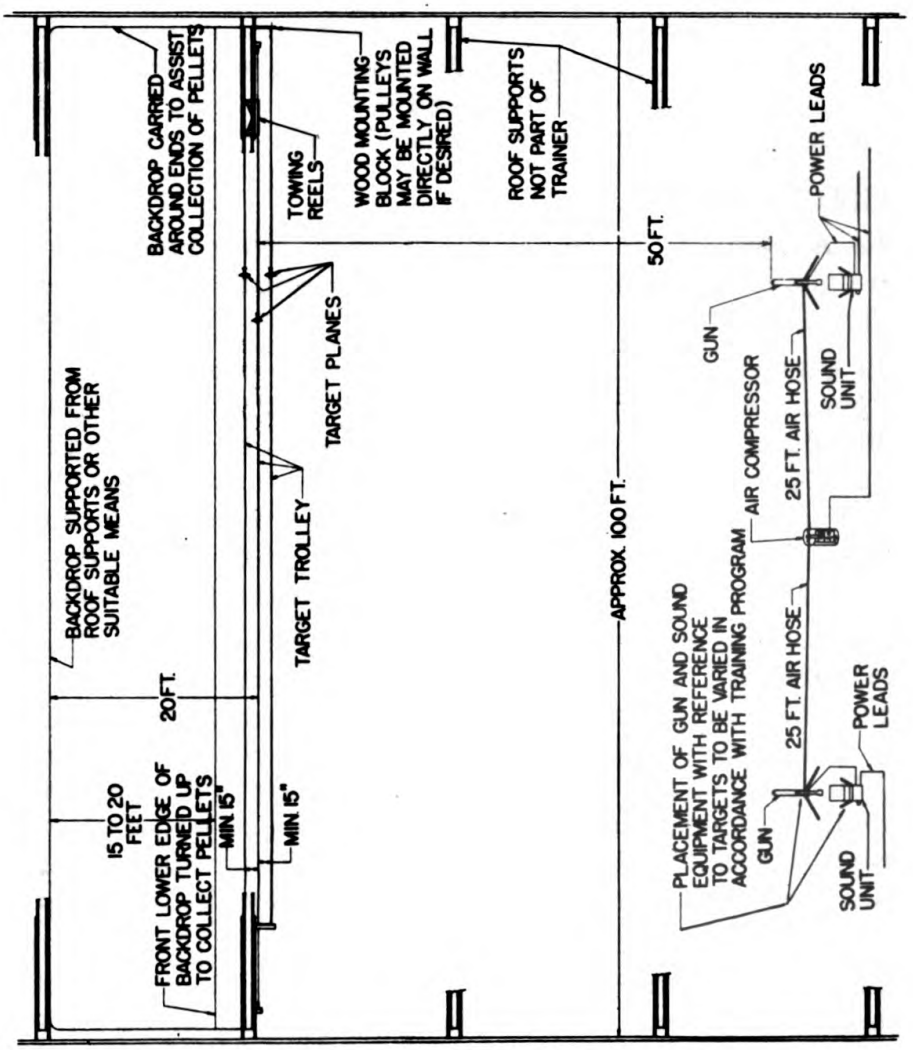
c. The sound units used in conjunction with the guns each consist of two cabinets. One cabinet contains the electrical control and timing mechanism for controlling the firing of the gun, the recoil, the gun blast, and battle sound effects. This cabinet is placed upon the ground. The cabinet also houses a record changer and an amplifier to produce the accompaniment of battle sound as an added element of confusion during training. The second cabinet houses the gun sound and battle sound speakers. It is supported by the control cabinet in an overhead position (fig. 5).

d. The target system (fig. 6) for daylight operations consists of three miniature airplanes. Each airplane is supported on a steel wire with a twine tow line attached, for use in imparting forward and backward movement. The steel wires are so positioned that one wire provides a horizontal target course, another a diving course, and the third a climbing course. Paper targets are also provided for registering the accuracy of the aim of the student (fig. 161).

e. The equipment may be used for night training. An ultraviolet lamp with 250-watt capacity is attached to the gun, and fluorescent pellets are shot in the path of the light from the lamp (fig. 3). An airplane coated with a fluorescent paint is provided as the target for night use.

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Figure 1 — Arrangement of Antiaircraft Machine Gun Trainer M9 — Typical Plan View

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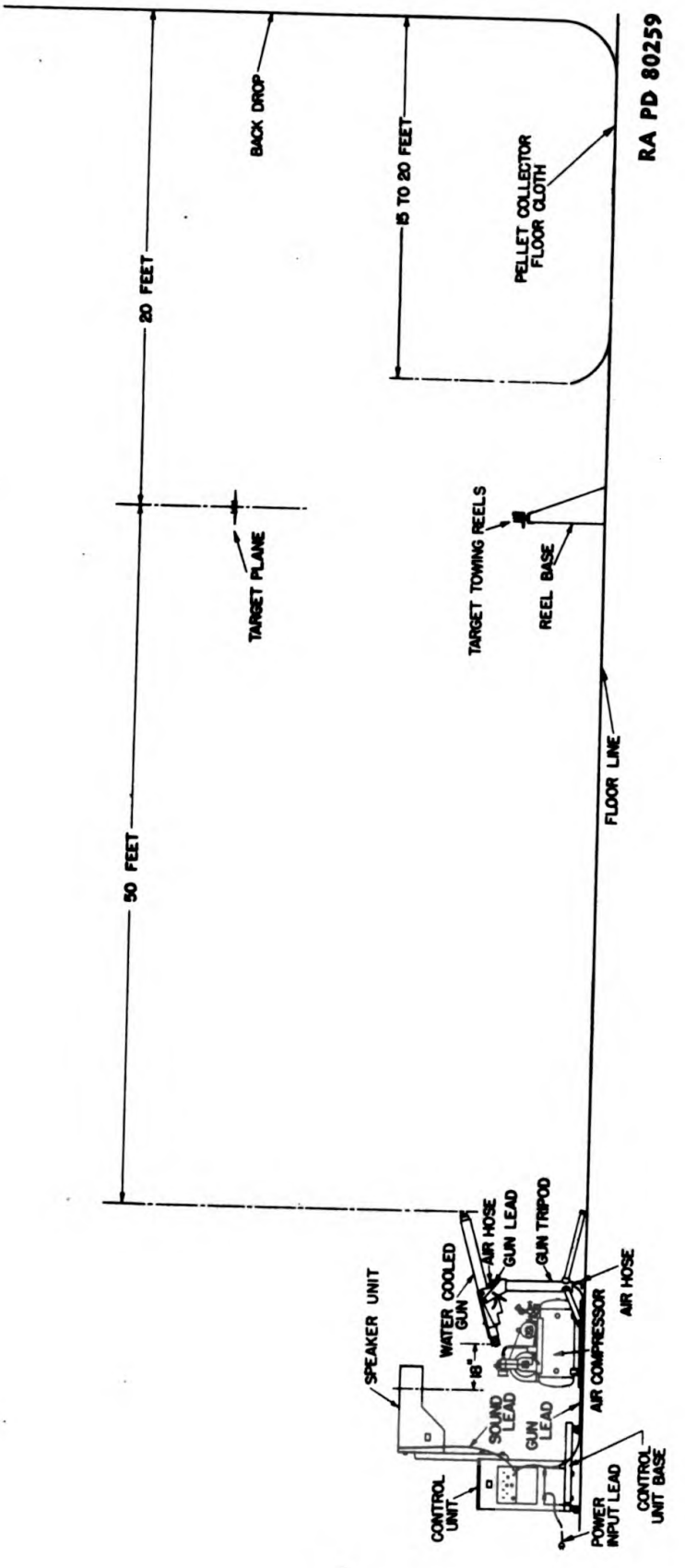


Figure 2 — Schematic Drawing of Antiaircraft Machine Gun Trainer M9

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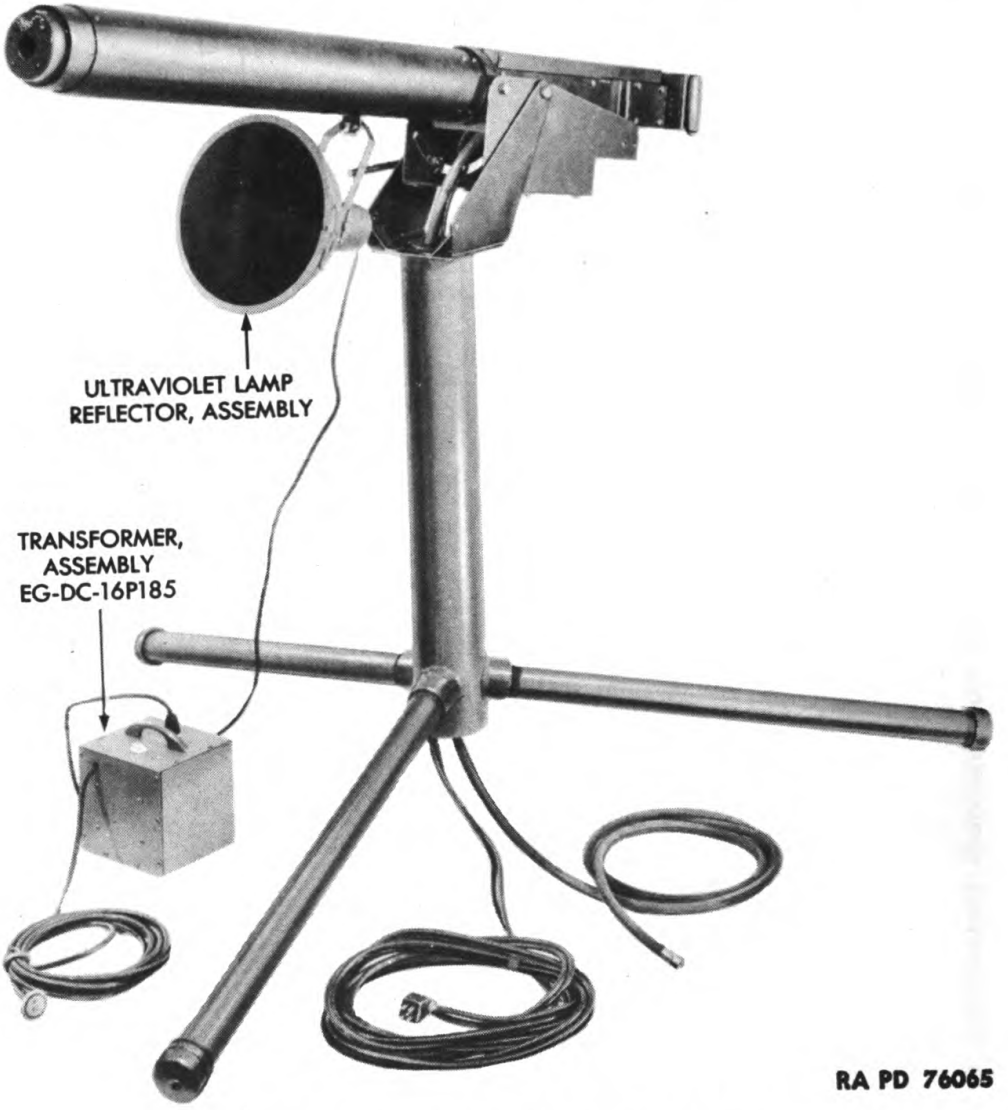


Figure 3 – Gun and Ultraviolet Light Equipment

f. Standard 115-volt, 15-ampere wall outlets may be used as sources of power for operating the trainer. Each gun and sound unit, and each compressor must be supplied from a separate 15-ampere circuit, or its equivalent.

3. DATA.

a. Dimensions and Weights of Components Are as Follows:

Unit	Length	Width	Height	Approximate Weight
Sound	69 in.	20 in.	88 in.	400 lb
Gun	67 in.	70 in.	52 in.	250 lb
Compressor	44 in.	18 in.	41 in.	400 lb
Reel	47 in.	18 in.	44 in.	40 lb
Ultraviolet lamp	Included in gun dimensions.			15 lb

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INTRODUCTION

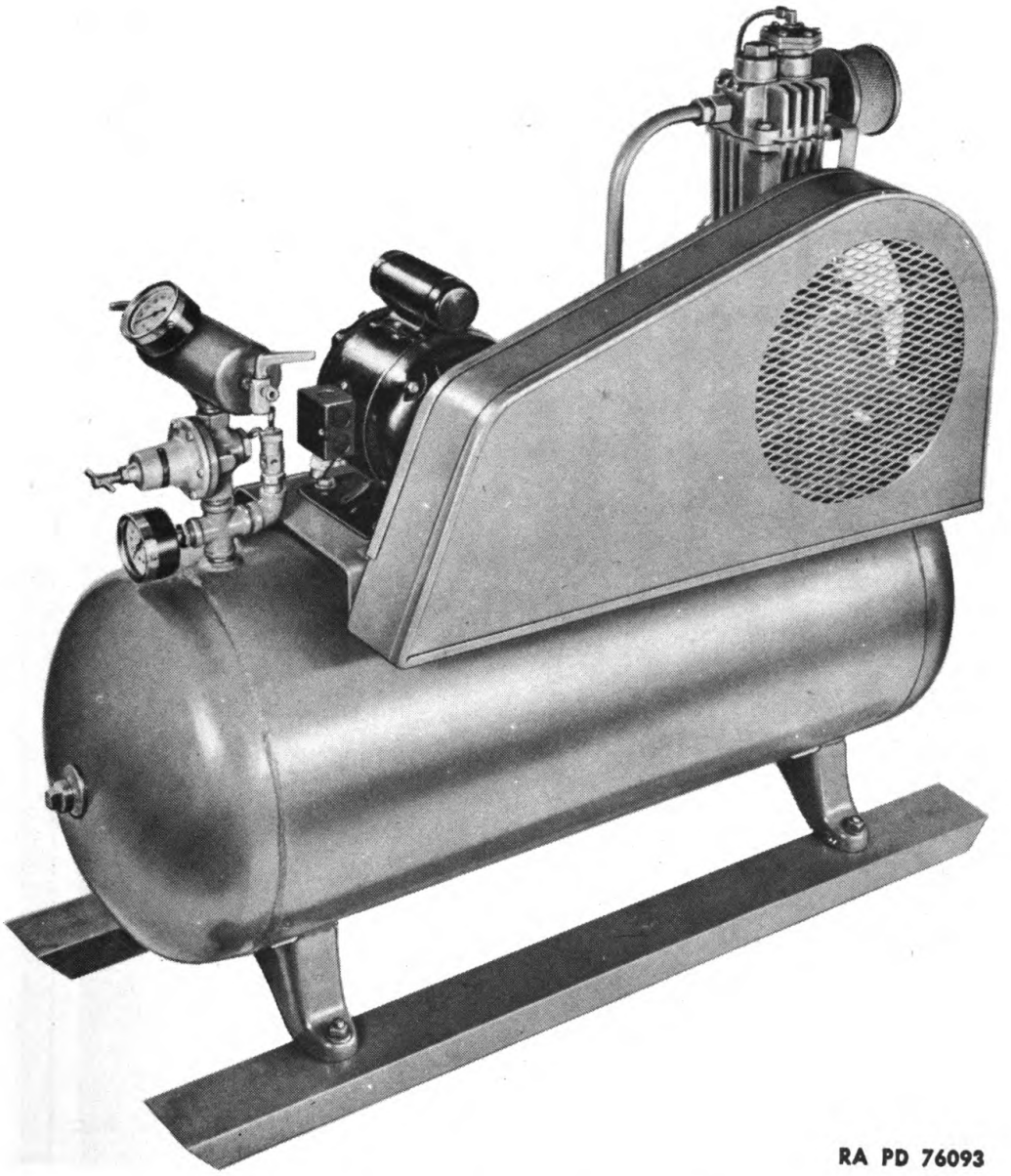
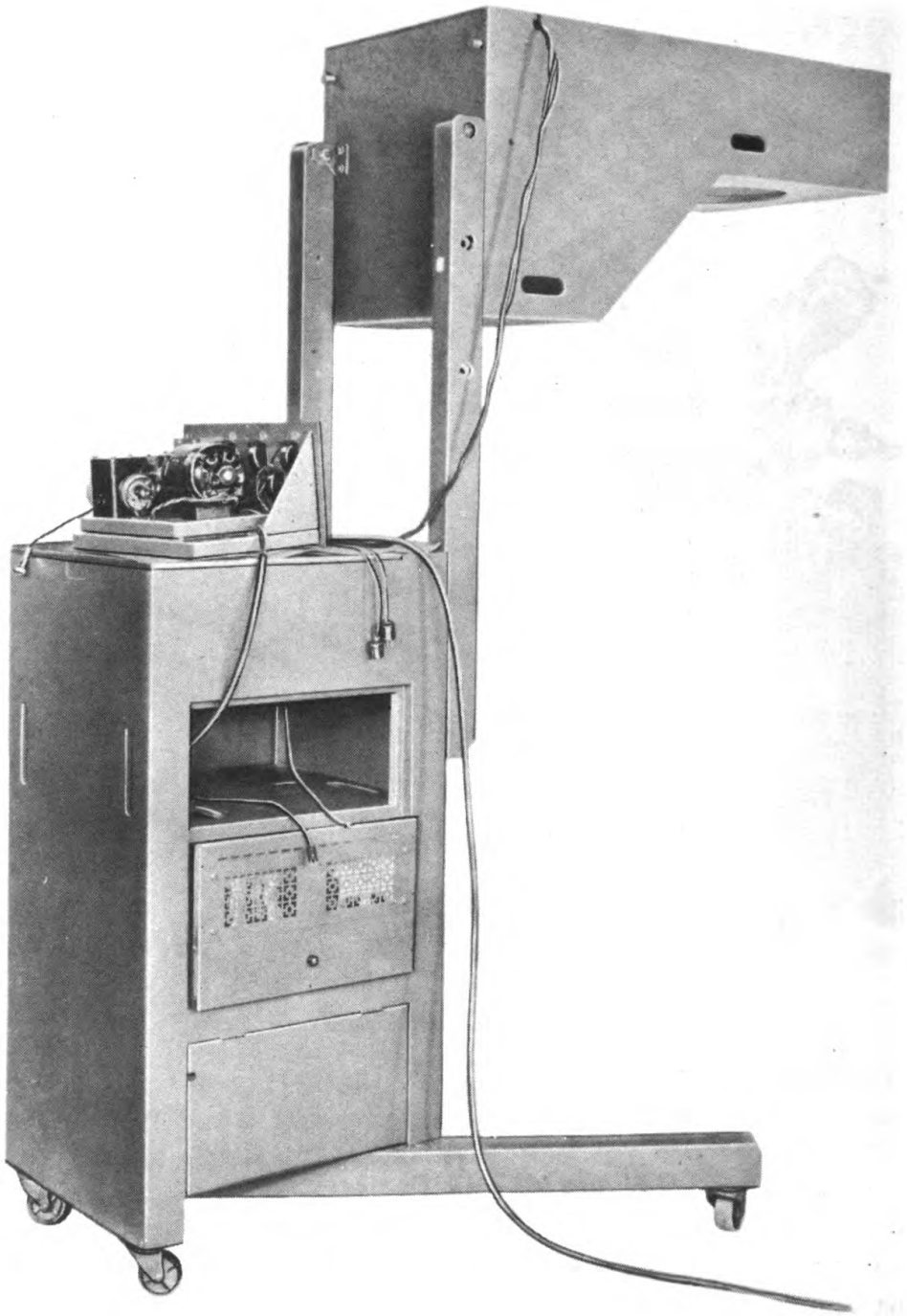


Figure 4 — Air Compressor

b. Part Numbers. All part numbers on the gun and target illustrations are Edison G.E. Appliance Company numbers (EG); all numbers on air compressor illustrations are Binks Mfg. Co. numbers (BNK); numbers on the sound equipment are either Operadio Mfg. Co. (OP) or Frankford Arsenal Numbers (FA). Part numbers having prefix GIC are General Industries Company; part numbers having prefix ASTATIC are Astatic Corporation.

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Figure 5 — Sound Units — Control Panel and Timer Removed

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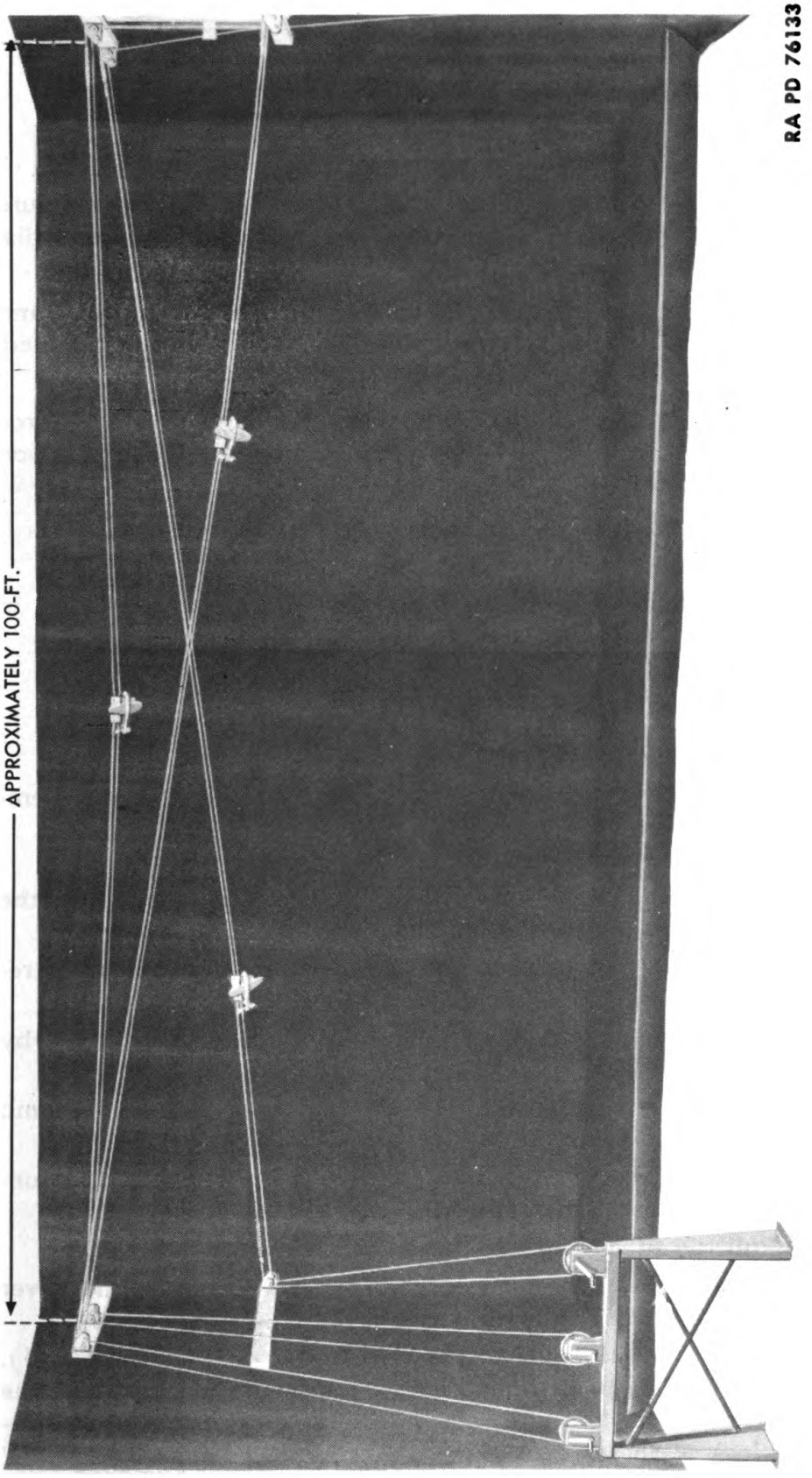


Figure 6 — Target System

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Section II

DISASSEMBLY AND ASSEMBLY

4. GENERAL.

a. The extent of disassembly is to be determined by the nature of repairs or adjustments required. Whenever possible, keep disassembly to a minimum.

b. To prevent loss of parts and save time in assembly, mark and tag all parts and electrical connections as they are disassembled. Keep small parts in clean containers.

c. To prevent damage, handle all parts carefully. Do not force any part. Parts can be removed and replaced without the application of a damaging force.

d. Prior to assembly, all parts must be cleaned and oiled according to instructions given in section IV.

e. Tools required for disassembly and assembly are listed in SNL G-91 and SNL G-92.

5. REMOVAL AND DISASSEMBLY.

a. Sound Equipment Amplifier.

(1) Consult figures 7 and 8 before proceeding with the disassembly.

(2) Disconnect the sound cabinet power cord.

(3) Pull the amplifier forward until the battle sound plug, the a-c input plug, and the speaker plug can be disconnected (fig. 9).

(4) Pull the a-c input plug and the speaker plug from their respective receptacles. Unscrew the battle sound input plug.

(5) The amplifier can then be removed from the cabinet by pulling the unit forward (fig. 10).

(6) Remove the grill (fig. 11) by removing the four thumb screws.

(7) Unsolder the two leads to the fuse assembly (fig. 12); unscrew the hexagonal nut and the fuse can be removed.

(8) Pull the tubes (fig. 12) from their sockets.

(9) Remove the four binding head screws fastening the cover (fig. 13) to the chassis to remove the cover.

(10) Unsolder the leads to the transformer B271531 (fig. 14). Unscrew the four hexagonal-head nuts from the screws fastening the transformer to the chassis and remove the transformer. Do not misplace the lock washers.

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DISASSEMBLY AND ASSEMBLY

TUBES	
ITEM NO.	PART NO.
1	6L6-G
2	6J5-GT
3	6SC7
4	523

RESISTORS	
ITEM NO.	SIZE IN OHMS — DESCRIPTION
5	POTENTIOMETER 100,000
6	1,000 — 1/2 WATT INSULATED
7	150,000 — 1 WATT INSULATED
8	10,000 — 1 WATT NON-INSULATED
9	125 — 20 WATT
10	5,000 — 40 WATT
11	10,000 — 10 WATT
12	1,600 — 20 WATT
13	150,000 — 1/2 WATT INSULATED
14	1 MEG — 1/2 WATT INSULATED

CONDENSERS	
ITEM NO.	DESCRIPTION
16	20 MFD. — 25V
17	.01 MFD. — 400V
18	.005 MFD. — 600V
19	20 MFD. — 150V
20	20-20 MFD. — 450V

MISC. PARTS	
ITEM NO.	DESCRIPTION
22	INPUT RECEPTACLE
23	DRIVER TRANSFORMER
24	OUTPUT TRANSFORMER
25	SPEAKER RECEPTACLE
26	CHOKE
27	CHOKE
28	POWER TRANSFORMER
29	3-AMPERE FUSE
30	A.C. RECEPTACLE
31	4 CONTACT TUBE SOCKET (PLAIN)
32	6 CONTACT OCTAL SOCKET (PLAIN)
33	RECEPTACLE

ITEM	CONNECTION
A	BATTLE SOUND INPUT
B	ECHO INPUT
C	AMPLIFIER A.C. INPUT
D	SPEAKER OUTLET
E	ECHO VOLTAGE SUPPLY

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Figure 7 — Wiring Diagram of Amplifier

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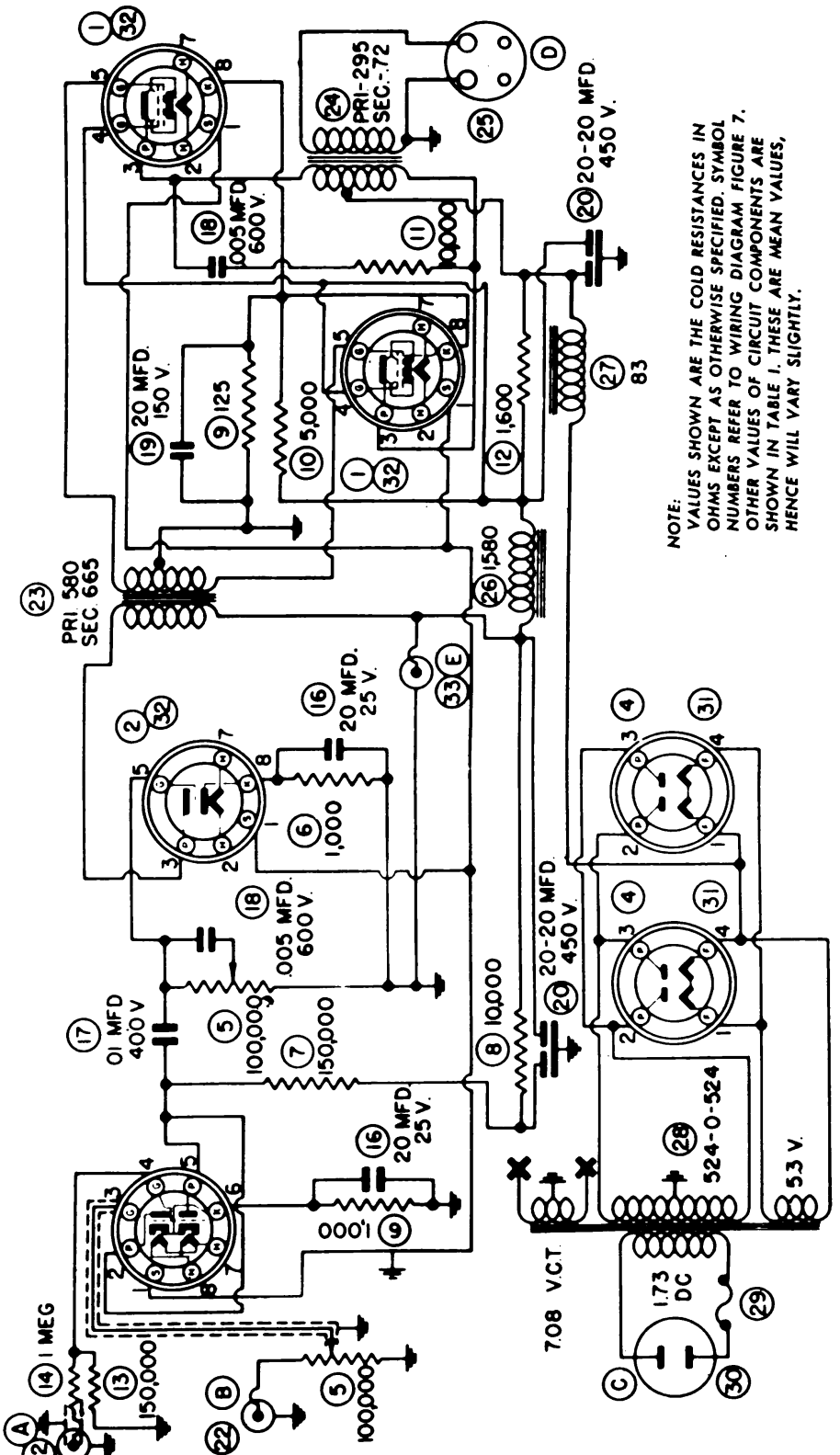
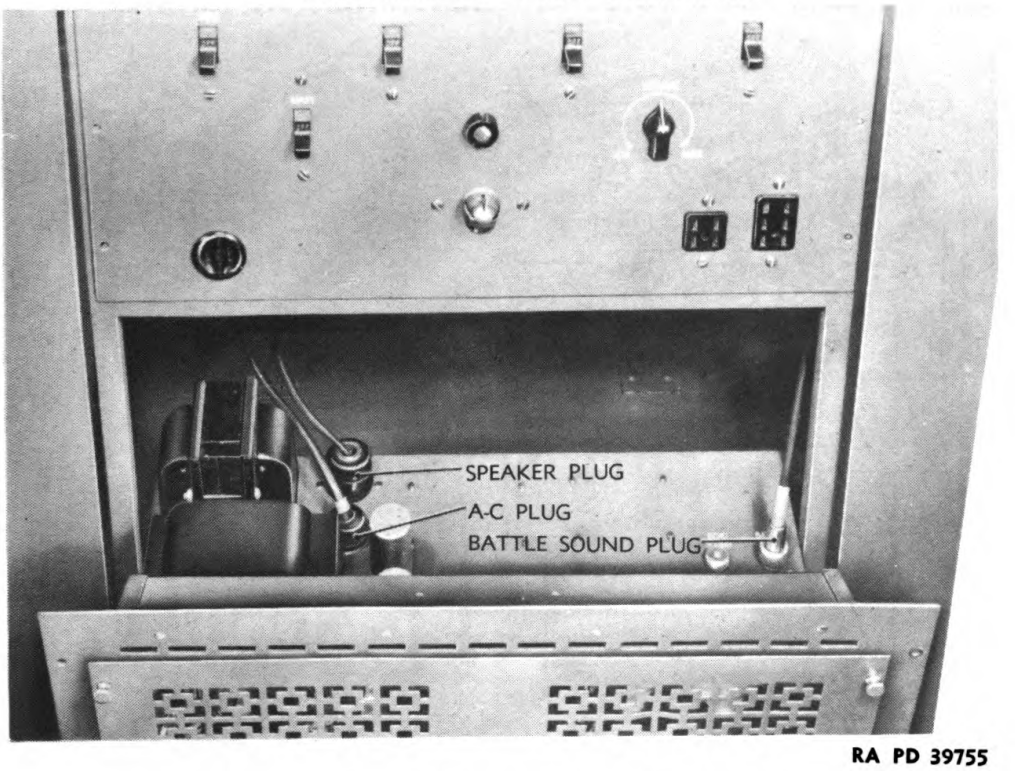


Figure 8 — Circuit Checking Diagram of Amplifier Unit

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DISASSEMBLY AND ASSEMBLY



RA PD 39755

Figure 9 — Control Cabinet — Amplifier Partly Removed

(11) Unsolder all connecting leads to the condenser and resistor assembly (fig. 15) and the transformer B271530. Remove the two hexagonal nuts and lock washers from the screws to remove the condenser and resistor assembly. Unscrew the four hexagonal nuts from the screws, fastening the transformer to the chassis.

(12) The condensers and resistors can be removed from the strip by unsoldering their connecting leads to the lugs as shown in figures 16 and 17.

(13) Unsolder the connecting leads to the choke B271529 (fig. 18) and resistor A321816. Unscrew the two drive screws fastening the choke to the chassis.

(14) Unsolder the connecting leads to the choke B271528 (fig. 19) and to the receptacle and socket. Unscrew the hexagonal nuts, remove the lock washers, and pull the screws fastening the choke to the chassis. The receptacle and the socket can be removed by driving out the rivets.

(15) Remove the four binding head screws and the seven rivets to remove the shield assembly (fig. 20) from the chassis.

(16) Unscrew the two hexagonal nuts; remove the lock washers; and pull out the two screws fastening the transformer (fig. 21) to the chassis.

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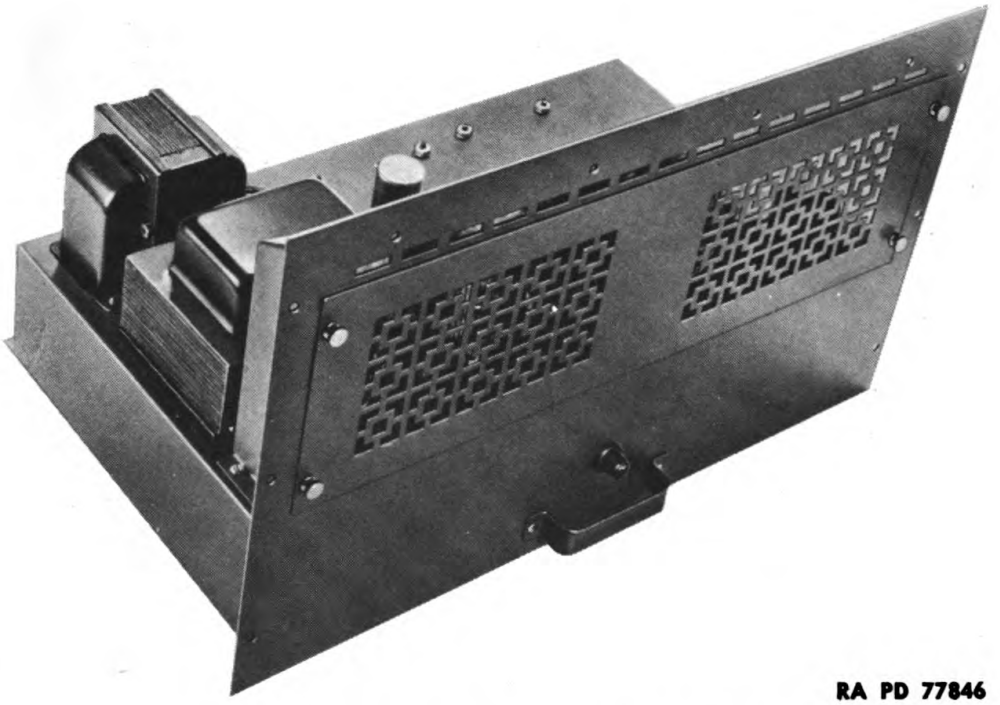


Figure 10 — Amplifier — Front View

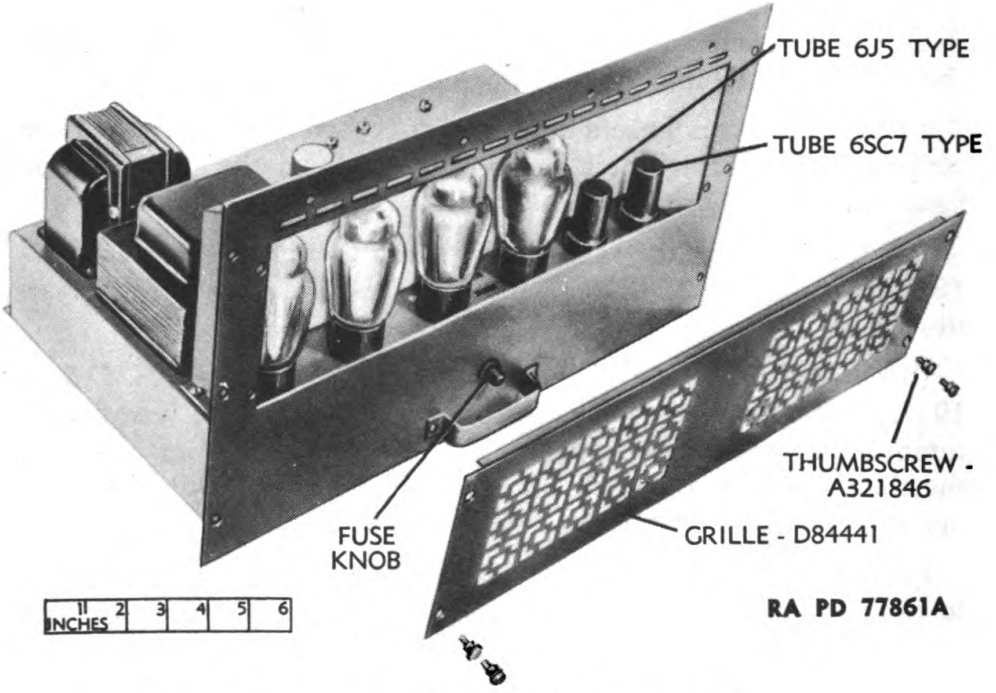


Figure 11 — Removal of Grill From Amplifier

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DISASSEMBLY AND ASSEMBLY

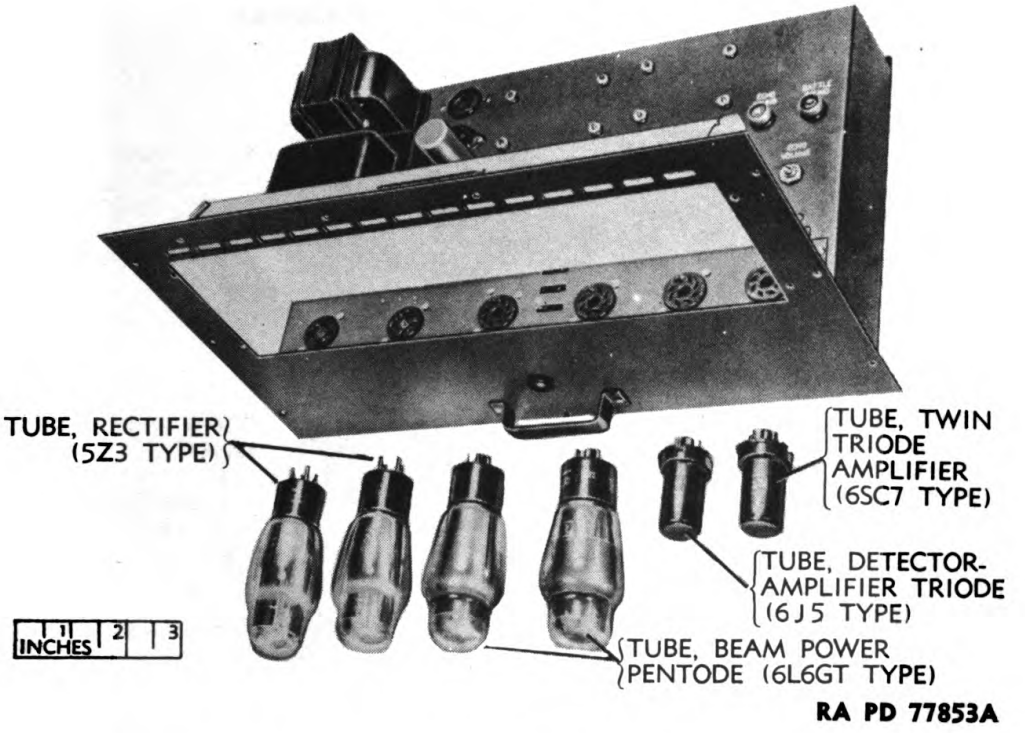


Figure 12 — Removal of Vacuum Tubes From Amplifier

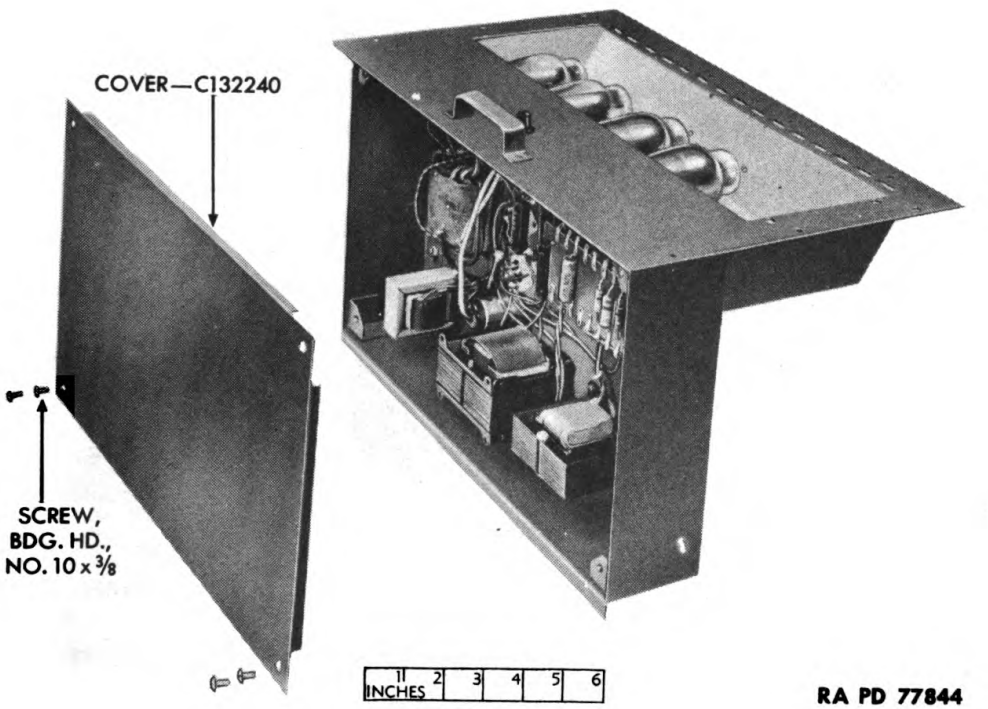


Figure 13 — Removal of Cover From Amplifier

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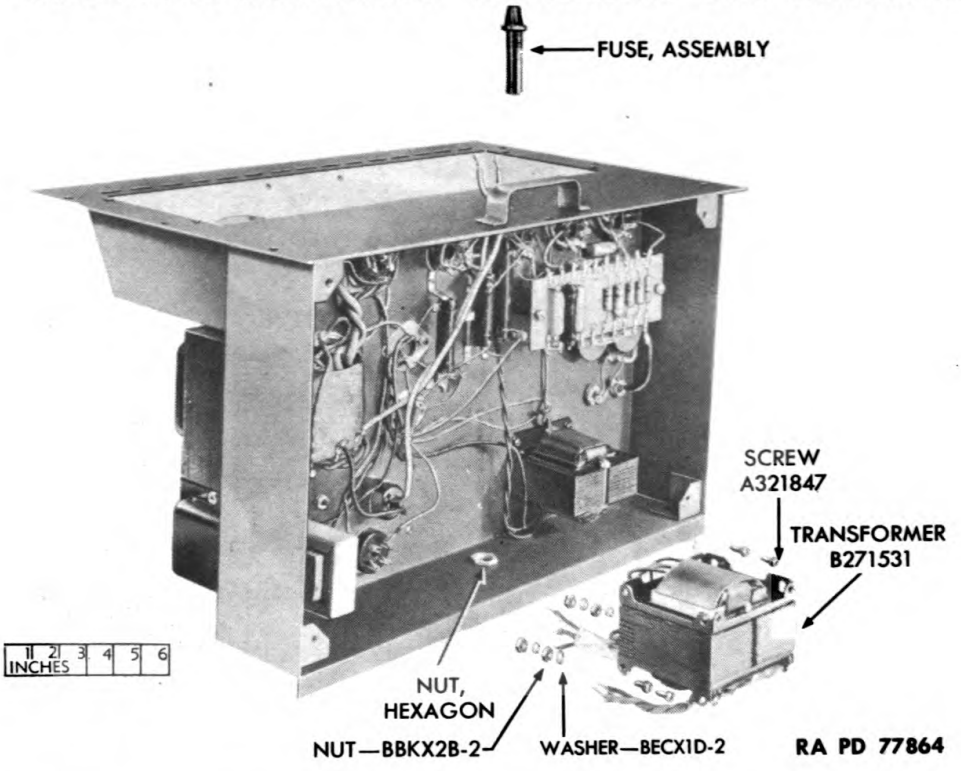


Figure 14 — Removal of Output Transformer and Fuse From Amplifier

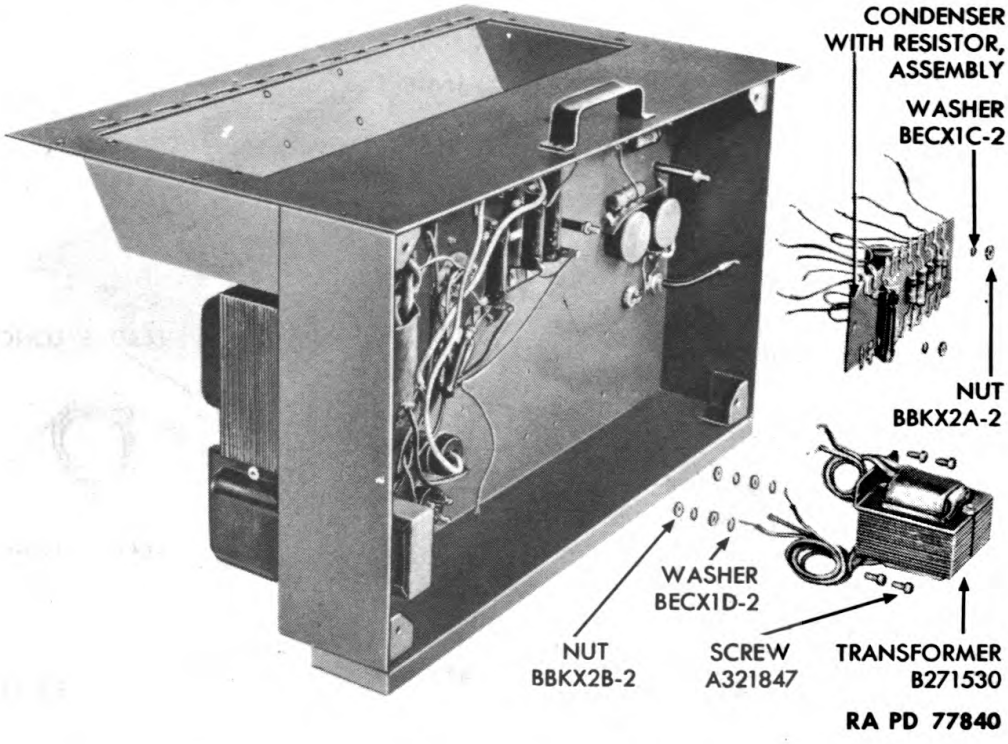


Figure 15 — Removal of Condenser With Resistor and Driver Transformer From Amplifier

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DISASSEMBLY AND ASSEMBLY

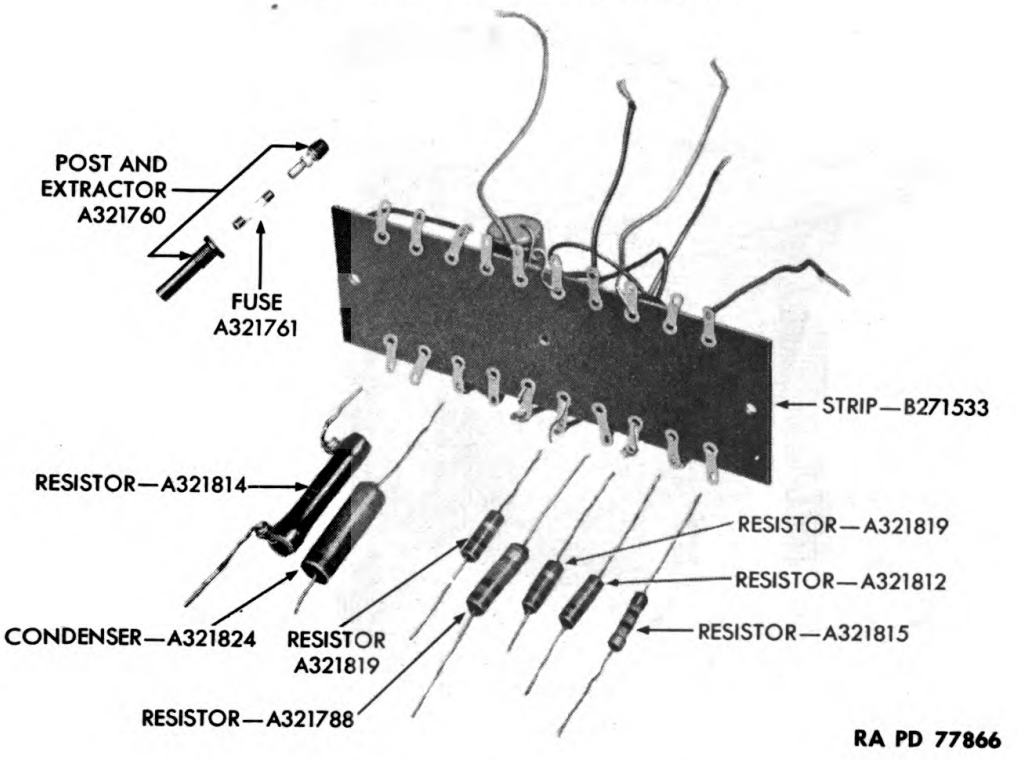


Figure 16 — Removal of Parts From Upper Side of Mounting Strip

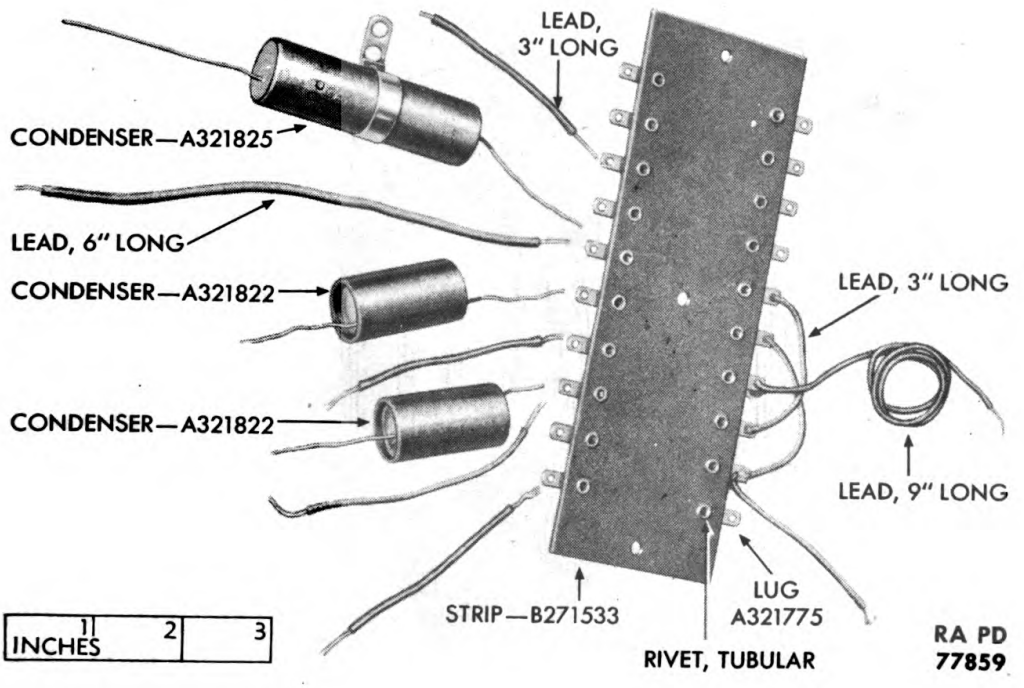


Figure 17 — Removal of Condenser and Leads From Lower Side of Mounting Strip

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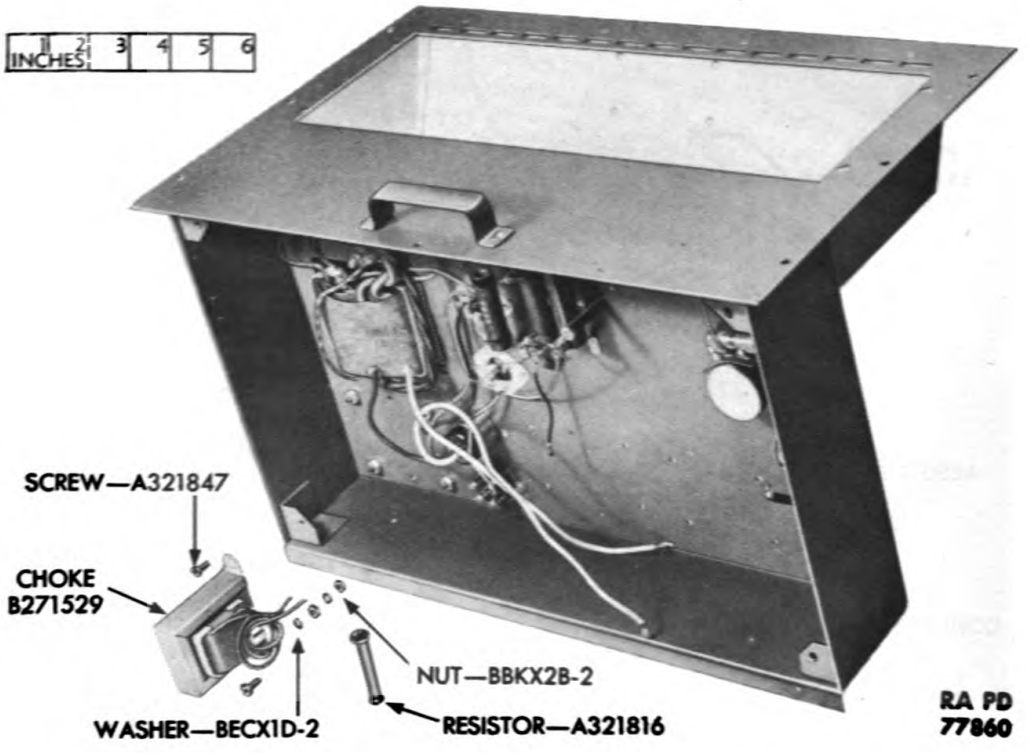


Figure 18 — Removal of Choke and Resistor From Amplifier

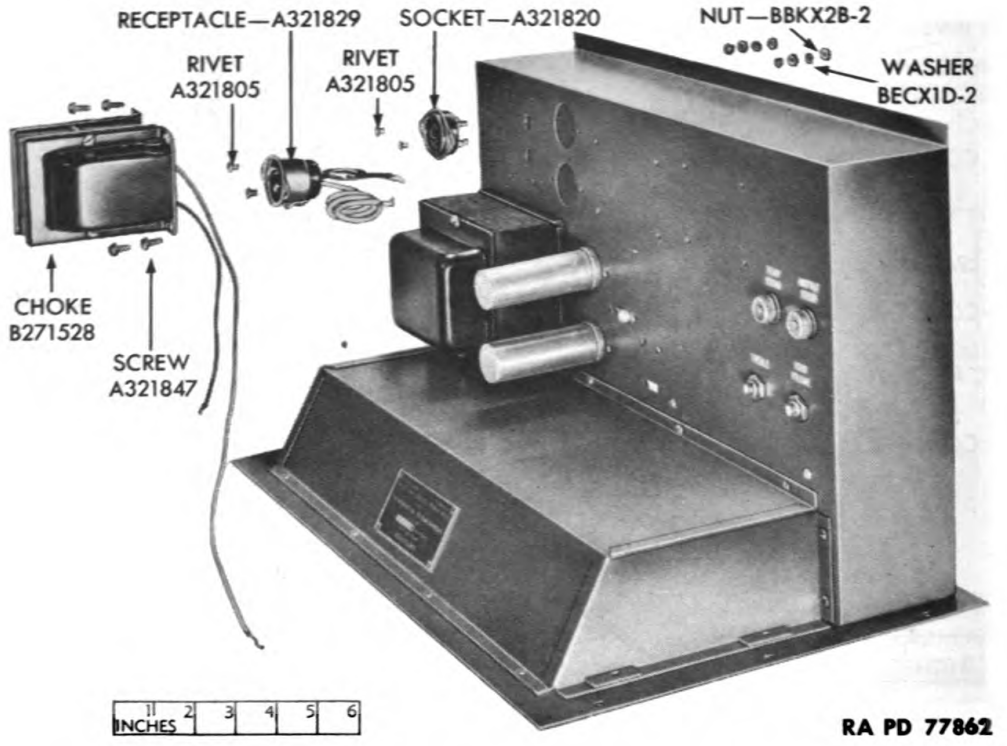


Figure 19 — Removal of Choke, Socket, and Receptacle From Amplifier

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DISASSEMBLY AND ASSEMBLY

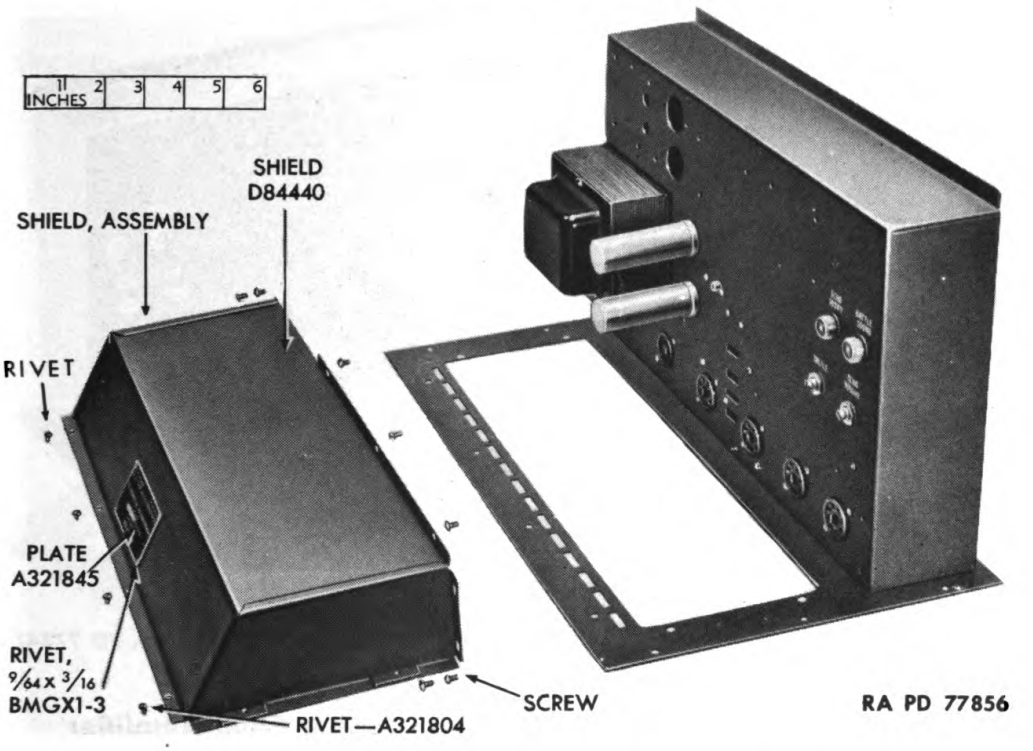


Figure 20 — Removal of Shield From Amplifier

(17) Remove the rivets, socket, and wafers to remove the condensers A321826 (fig. 22) from the chassis. Drive out the rivets holding the resistor A321813 in position.

(18) Unsolder the connecting leads of condenser A321823 (fig. 23) to remove it from the potentiometer assemblies. Drive out the rivets and remove the lock washers to remove the resistors A321817 and A321818.

(19) The potentiometers (fig. 24) are removed by unscrewing the hexagonal nuts from the potentiometer shaft housings. The receptacles A321830 are removed by unscrewing the hexagonal nuts holding them to the chassis. Do not misplace the lock washer or the fiber insulating washers.

(20) Removal of the leads and condenser A321824 is shown in figure 25.

(21) The tube sockets (fig. 26) are removed from the chassis by driving out the retaining rivets.

b. Sound Equipment Control Panel and Timer.

(1) Consult figures 27, 28, and 29 before proceeding with disassembly.

(2) Remove the amplifier as described in paragraph 5 **a.**

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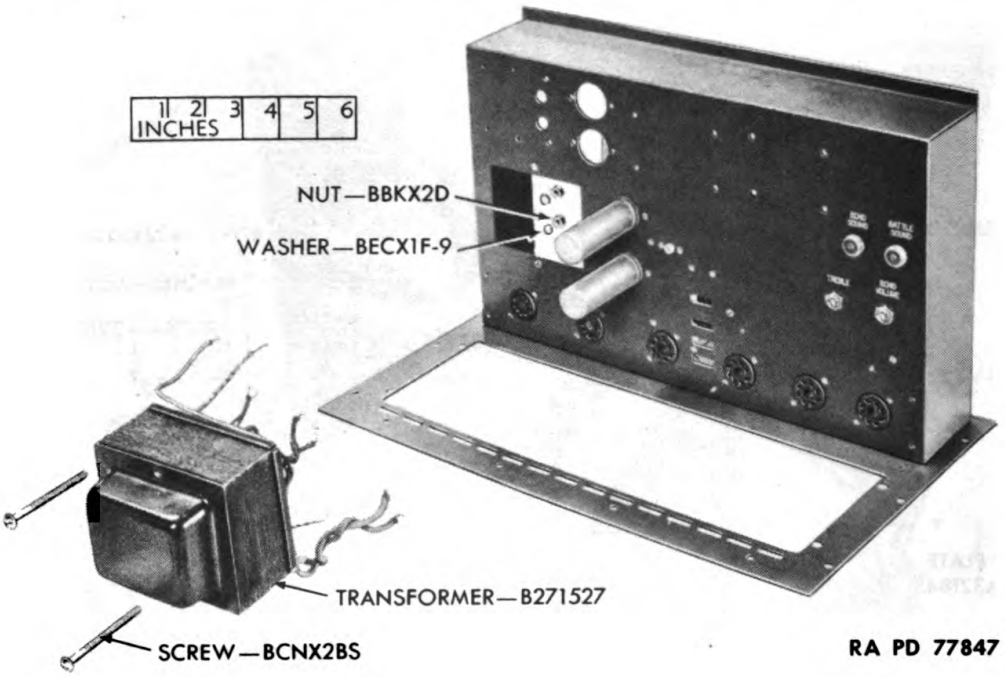


Figure 21 — Removal of Power Transformer From Amplifier

(3) Remove the seven wood screws holding the sound control panel in the sound cabinet.

(4) Pull the control panel forward until the power input lead terminals (fig. 30) are exposed. Unscrew the terminal screws and remove the power input lead.

(5) Pull the record changer power input plug and the shield tone arm lead plug from their respective receptacles.

(6) Remove the control panel (fig. 31), together with the timer, from the sound cabinet by pulling the entire unit forward.

(7) The timer (fig. 34) is removed from the control panel assembly by removing the six hexagonal nuts, washers, and screws. After removing the screws, pull the timer free from the control panel assembly and unsolder the connecting leads between the two units. The assembled view of the timer removed from the control panel is shown in figure 35.

(8) Loosen the set screws (fig. 36) in the motor coupling; remove the four round-head screws and lock washers holding the motor and mounting block to the chassis; and the motor and coupling can be removed. Do not misplace the coupling and the shock absorber insert.

(9) Unsolder the connecting leads to the condenser A321785 (fig. 38). Unscrew the two binding head screws fastening it to the

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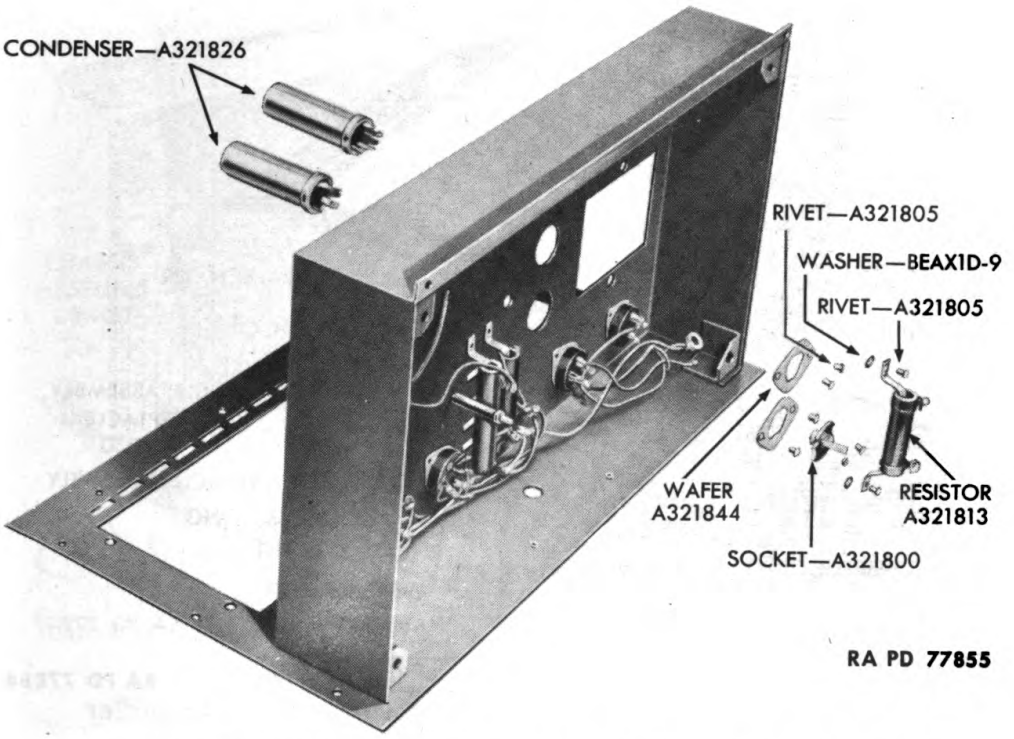


Figure 22 — Removal of Condensers and Associated Parts From Amplifier

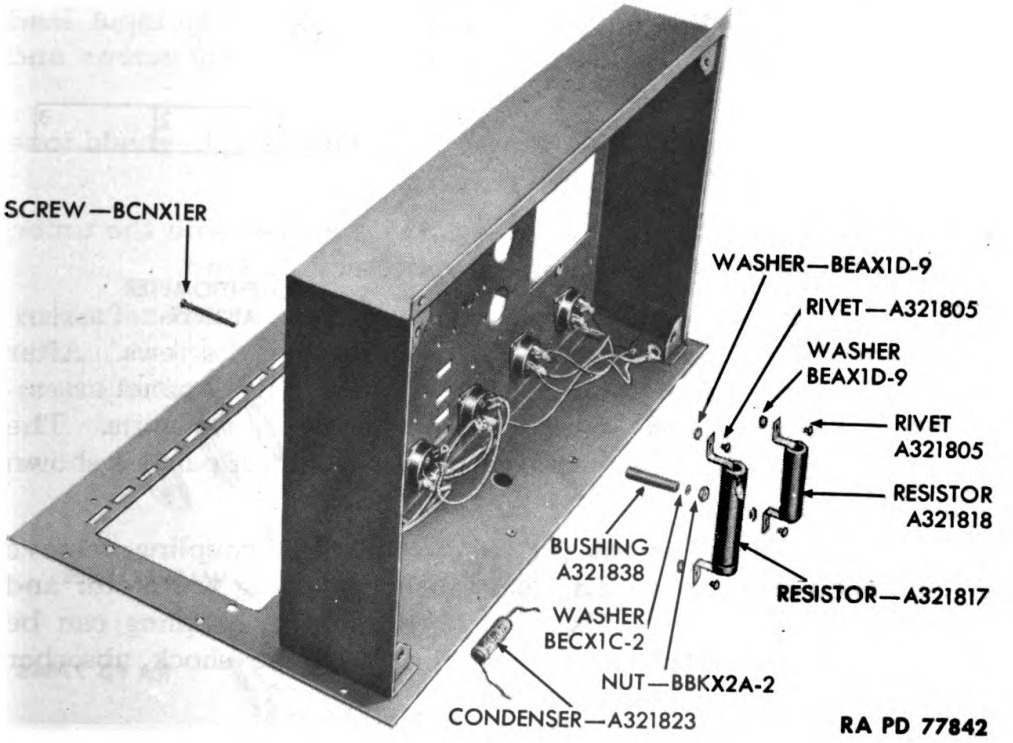


Figure 23 — Removal of Resistors and Related Parts From Amplifier

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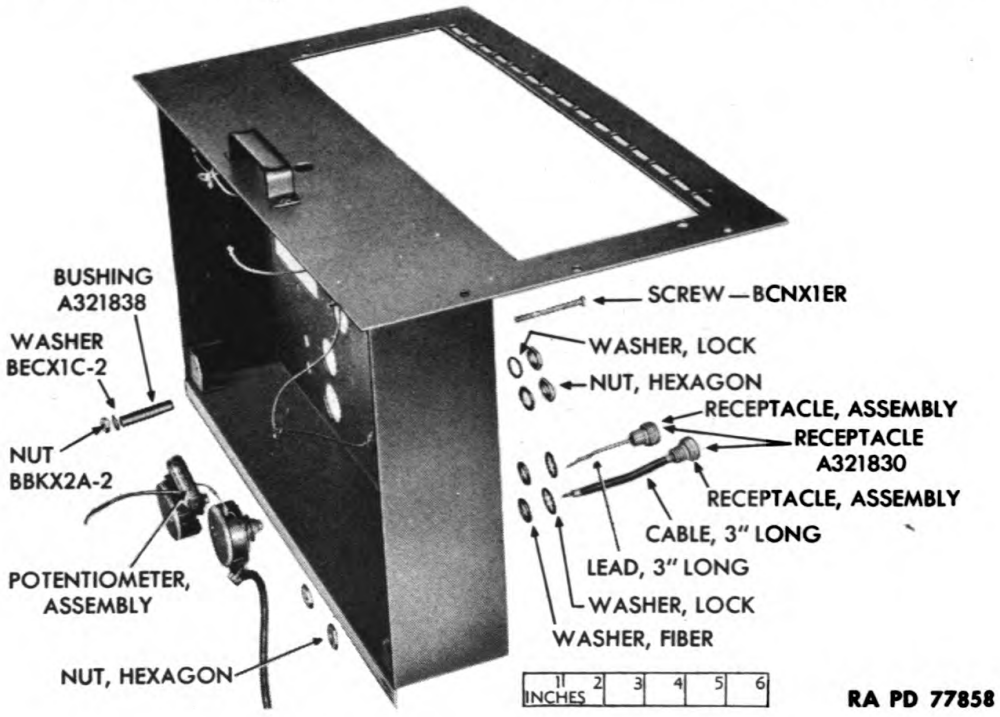


Figure 24 — Removal of Potentiometer and Receptacles From Amplifier

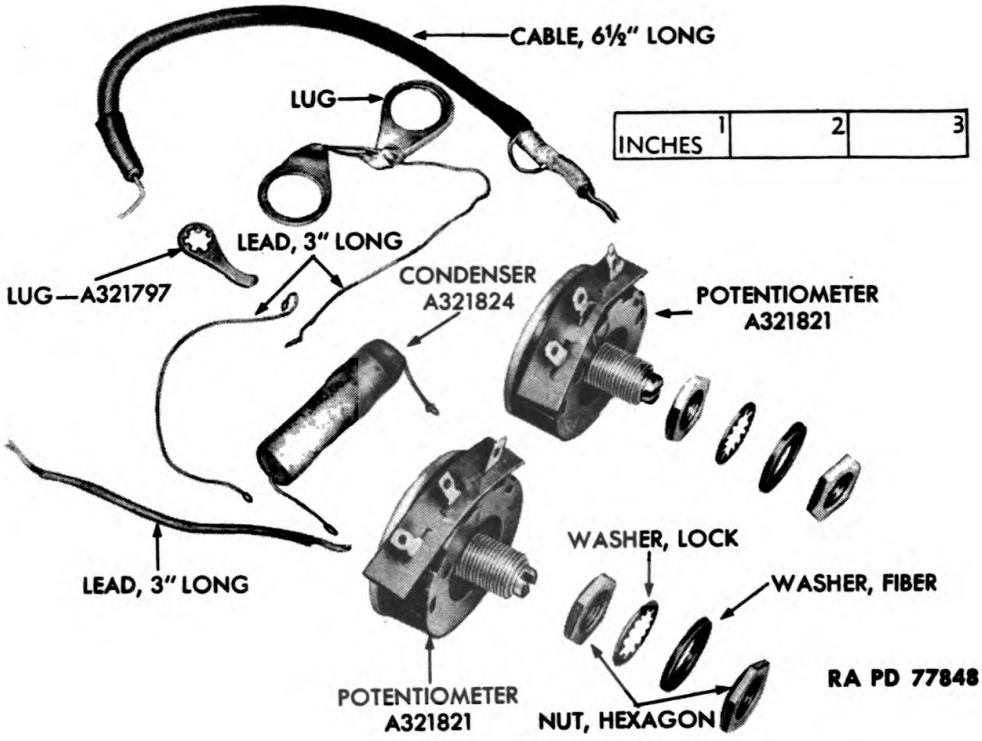


Figure 25 — Potentiometer — Parts

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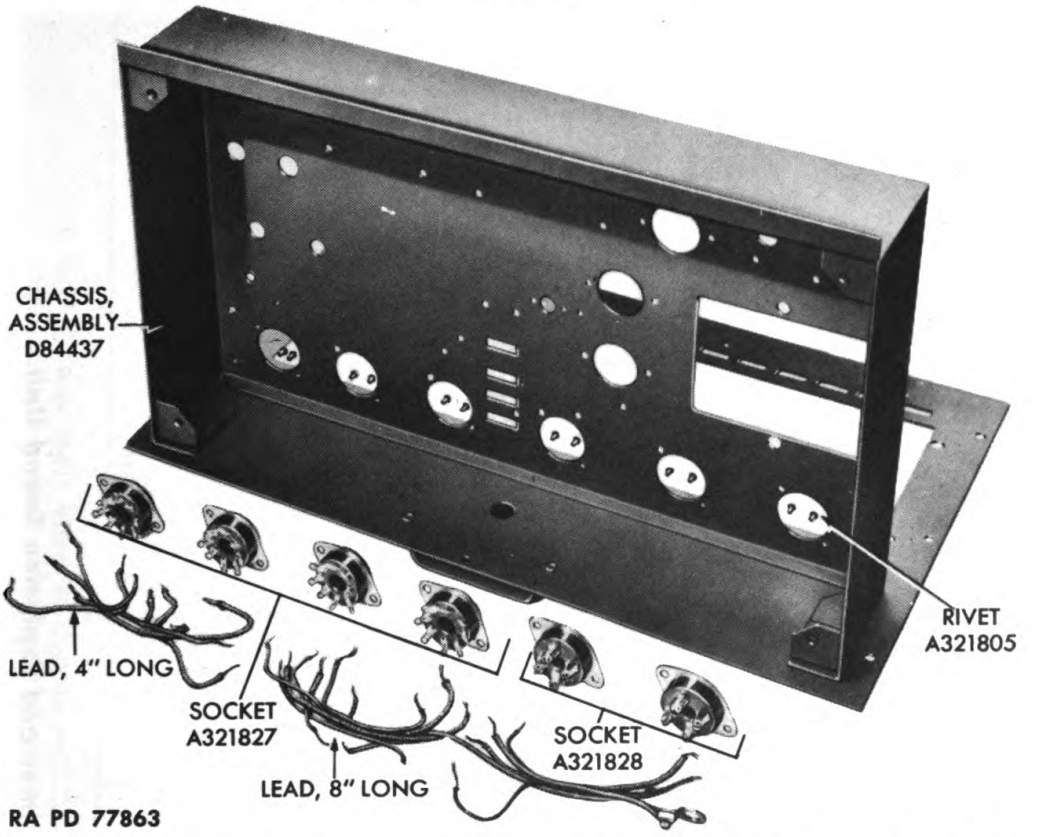


Figure 26 — Removal of Tube Sockets and Leads From Amplifier

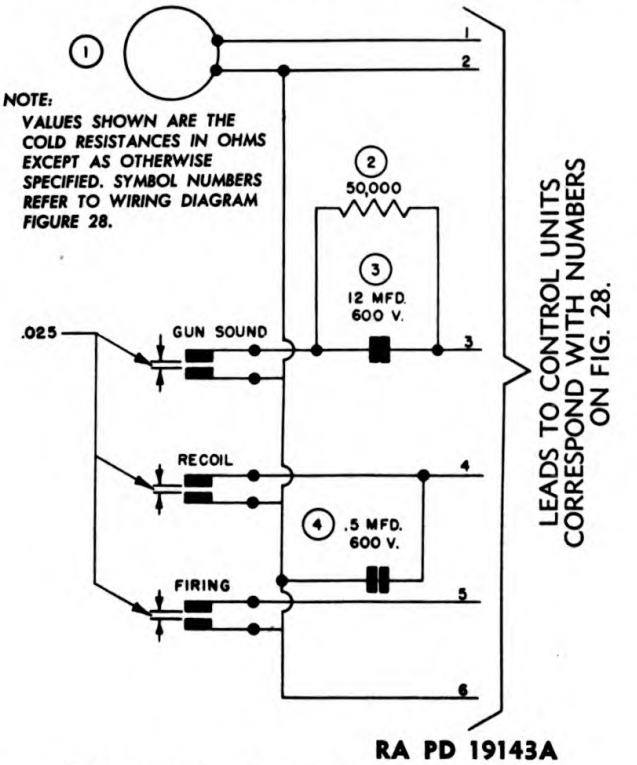
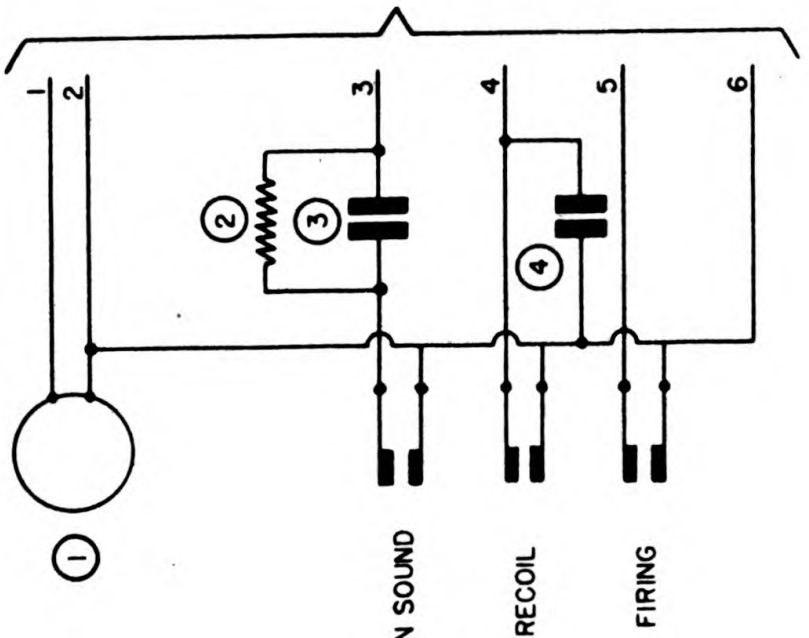


Figure 27 — Leads to Control Unit

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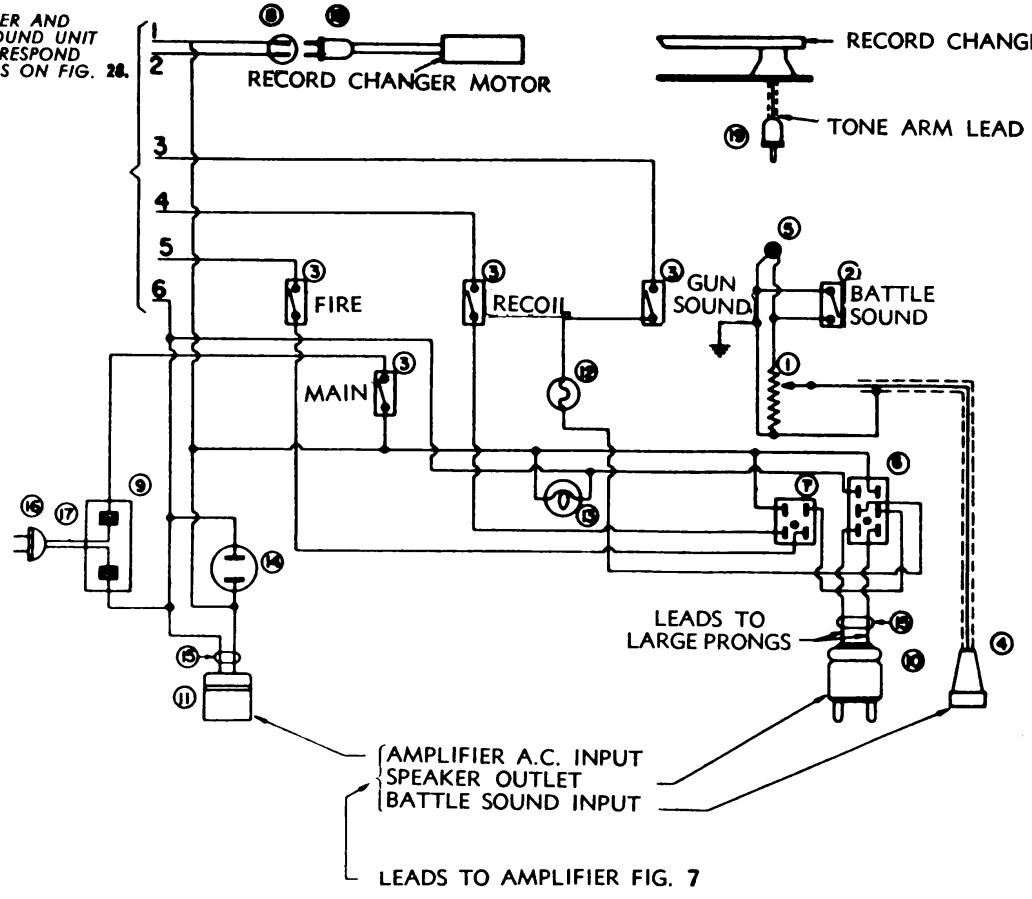
ITEM NO.	DISCRIPTION
1	SYNCHRONOUS MOTOR
2	RESISTOR 50,000 OHMS-1 WATT-INSULATED
3	CONDENSER 12MFD. 600 V.
4	CONDENSER .5MFD. 600 V.

LEADS TO CONTROL UNIT
NUMBERS CORRESPOND WITH NUMBERS
ON FIG. 29.

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Figure 28 — Wiring Diagram of Timer and Explosion Sound Unit

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ITEM NO.	DESCRIPTION
1	VOLUME CONTROL 2-1/2 MEG.
2	MERC. SWITCH-REVERSED ACTION
3	MERCURY SWITCH
4	MICROPHONE CONNECTOR
5	SINGLE CONTACT RECEPTACLE
6	RECEPTACLE (6 CONTACT)
7	RECEPTACLE (4 CONTACT)
8	RECEPTACLE (2 CONTACT)
9	TERMINAL STRIP
10	4 PRONG PLUG & CAP
11	A.C. PLUG (2 CONTACT FEMALE)
12	FUSE POST & EXTRACTOR
13	PILOT LIGHT ASSEMBLY
14	A.C. RECEPTACLE
15	2 CONDUCTOR SJ CORD
16	POWER PLUG
17	POWER CORD
18	FLUSH MOTOR PLUG (2 CONTACT)
19	SINGLE CONTACT PLUG

ITEMS 6 AND 7 ARE SHOWN AS VIEWS OF FRONT, OR PRONG ENTRANCE.

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Figure 29 — Wiring Diagram of Control Unit

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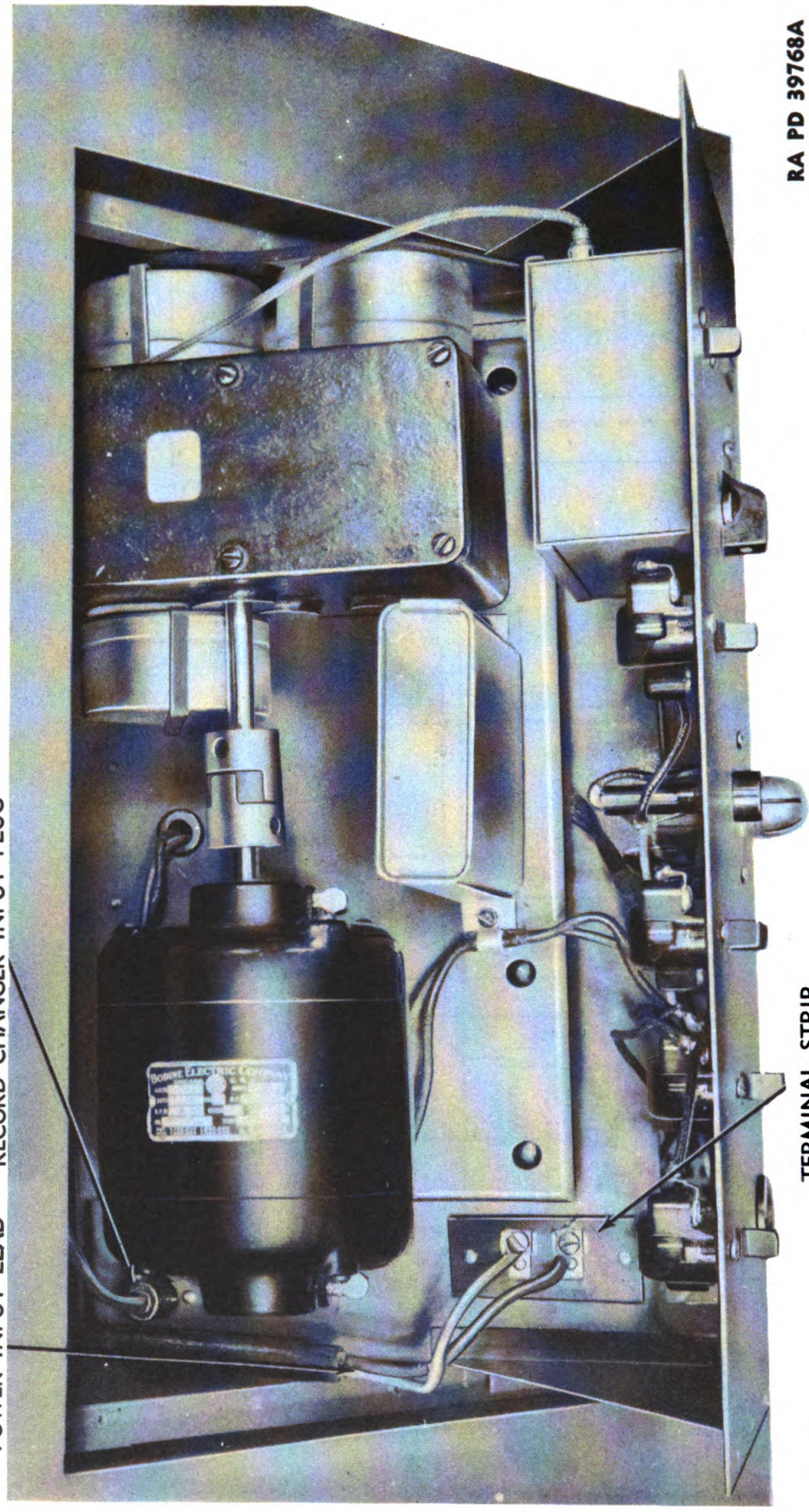


Figure 30 — Sound Equipment Control Panel and Timer — Partly Removed

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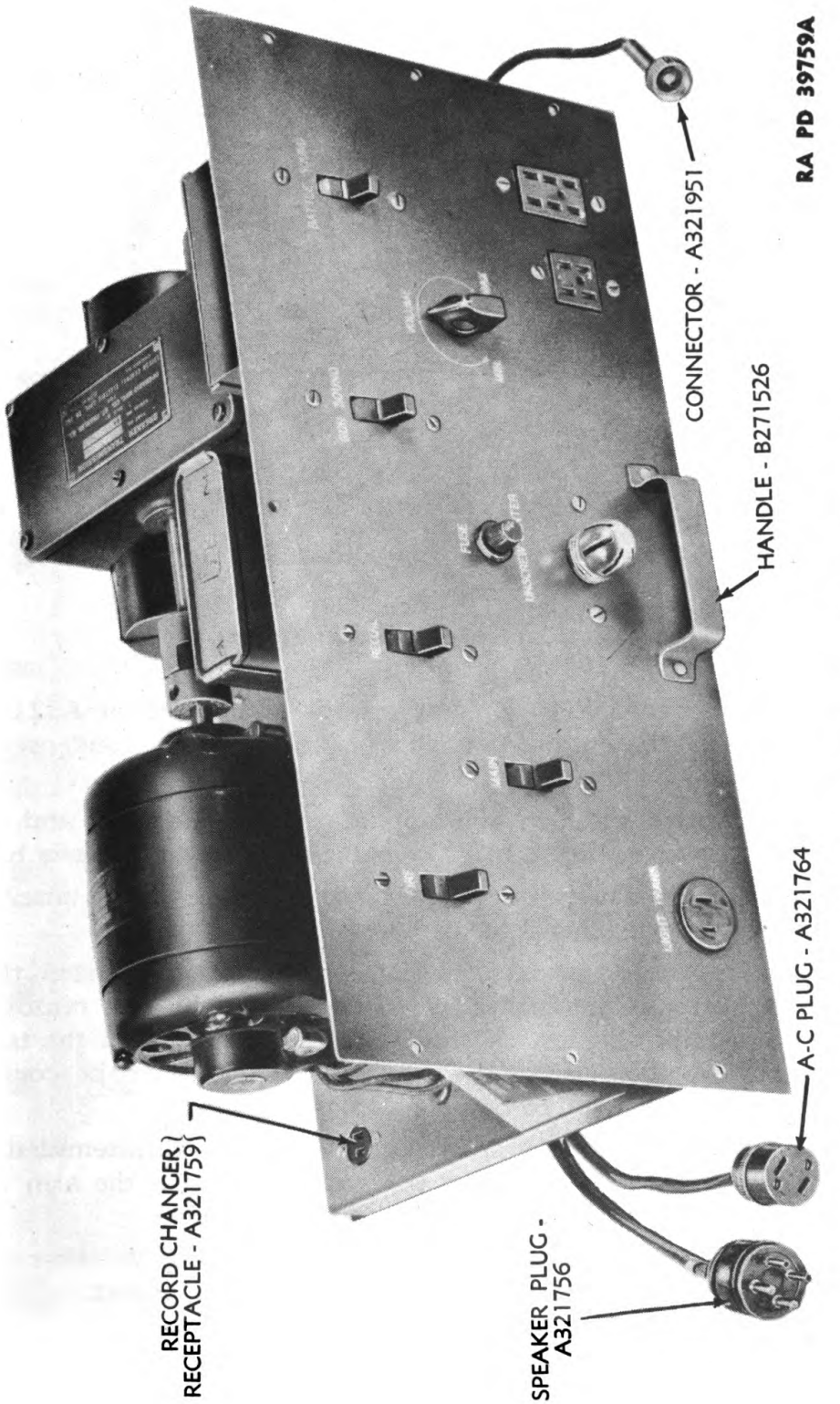


Figure 31 — Control Panel and Timer — Front

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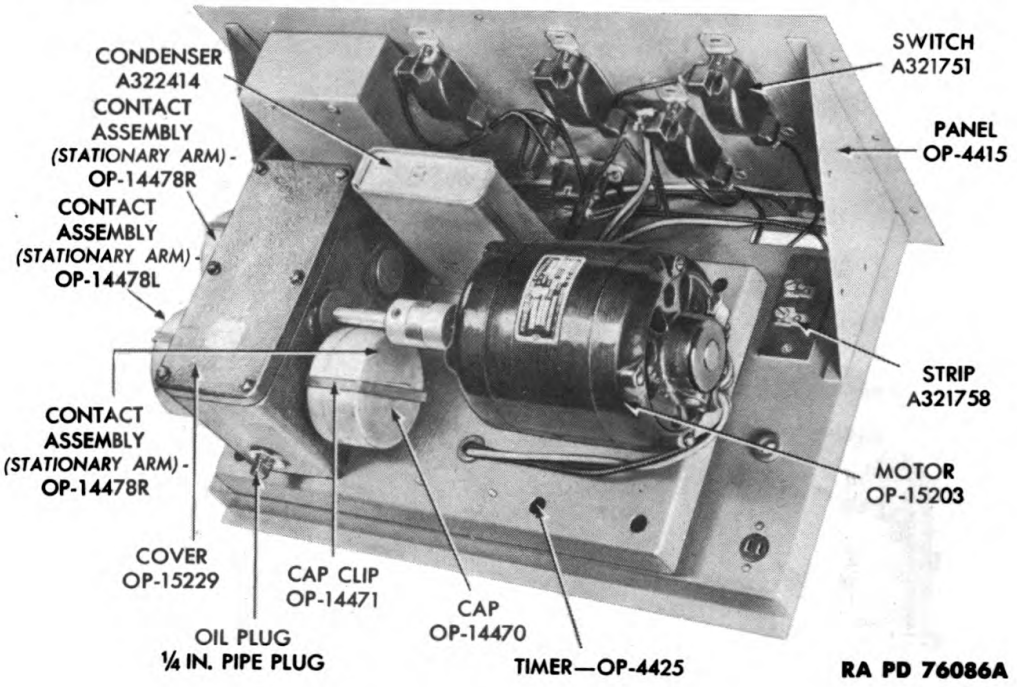


Figure 32 — Control Panel and Timer — Rear

bottom of the chassis. Unsolder the leads of the resistor A321787 connecting it to the bottom terminals of the 12 M.F.D. condenser to remove it.

(10) Remove the two self-tapping screws (fig. 39) and the brackets to remove the 12 M.F.D. condenser from the chassis base.

(11) Remove the contact breaker assembly (fig. 40) by unscrewing the six screws holding it to the chassis base.

(12) The contact assemblies (fig. 41) are removed from their respective shafts in the contact breaker assembly by first removing the dust cap clips, the dust caps, and the cams. Drive out the taper pins to remove the cams, and loosen the set screws in the contact assemblies to allow them to be pulled from their shafts.

(13) The contact assemblies can be further disassembled as shown in figure 42 by removing the screws fastening the arm and bracket to their support, but this is not recommended.

(14) Remove the six round-head screws fastening the cover (fig. 43) to the gear case. Use care not to damage the gasket.

(15) The gears and their respective shafts (fig. 44) are removed from the gear case by first driving out the taper pins fastening the gears and collars to their shafts. Slip the shafts from the bushings in the gear case. Use care not to damage the rubber oil seals. The plugs must be removed from the gear case before the idler shaft can be re-

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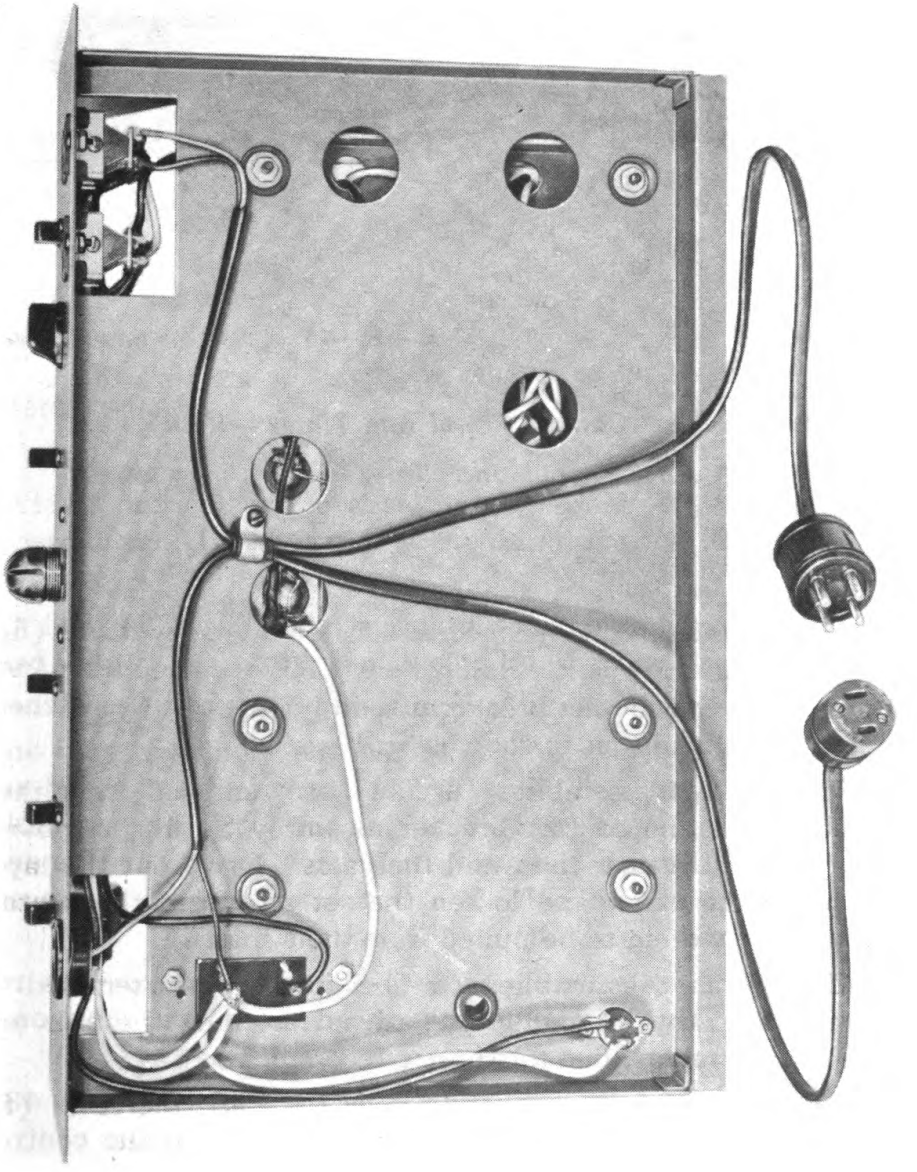


Figure 33 — Control Panel and Timer — Bottom

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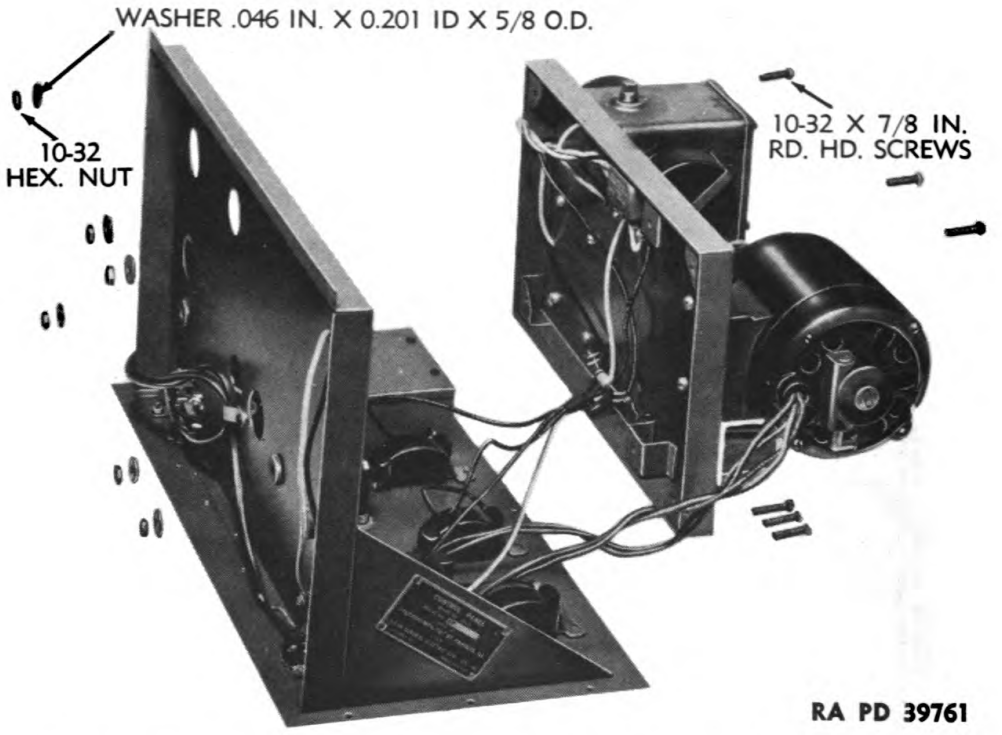


Figure 34 — Control Panel and Timer — Timer Removed

moved. This can be done by driving out the plugs from one side of the case and then the other.

(16) Remove the binding head screws fastening the switches (fig. 45) to the control panel chassis. Pull the switches free from the panel and unscrew the screws holding the connecting leads to the switches.

(17) Remove all electrical leads to the pilot light assembly and to the fuse and extractor post (fig. 46). Unscrew the cap and remove the two binding head screws fastening the pilot light assembly to the front panel. Unscrew the hexagonal nut fastening the fuse and extractor post to the front panel. The component parts of these assemblies are shown in figure 50.

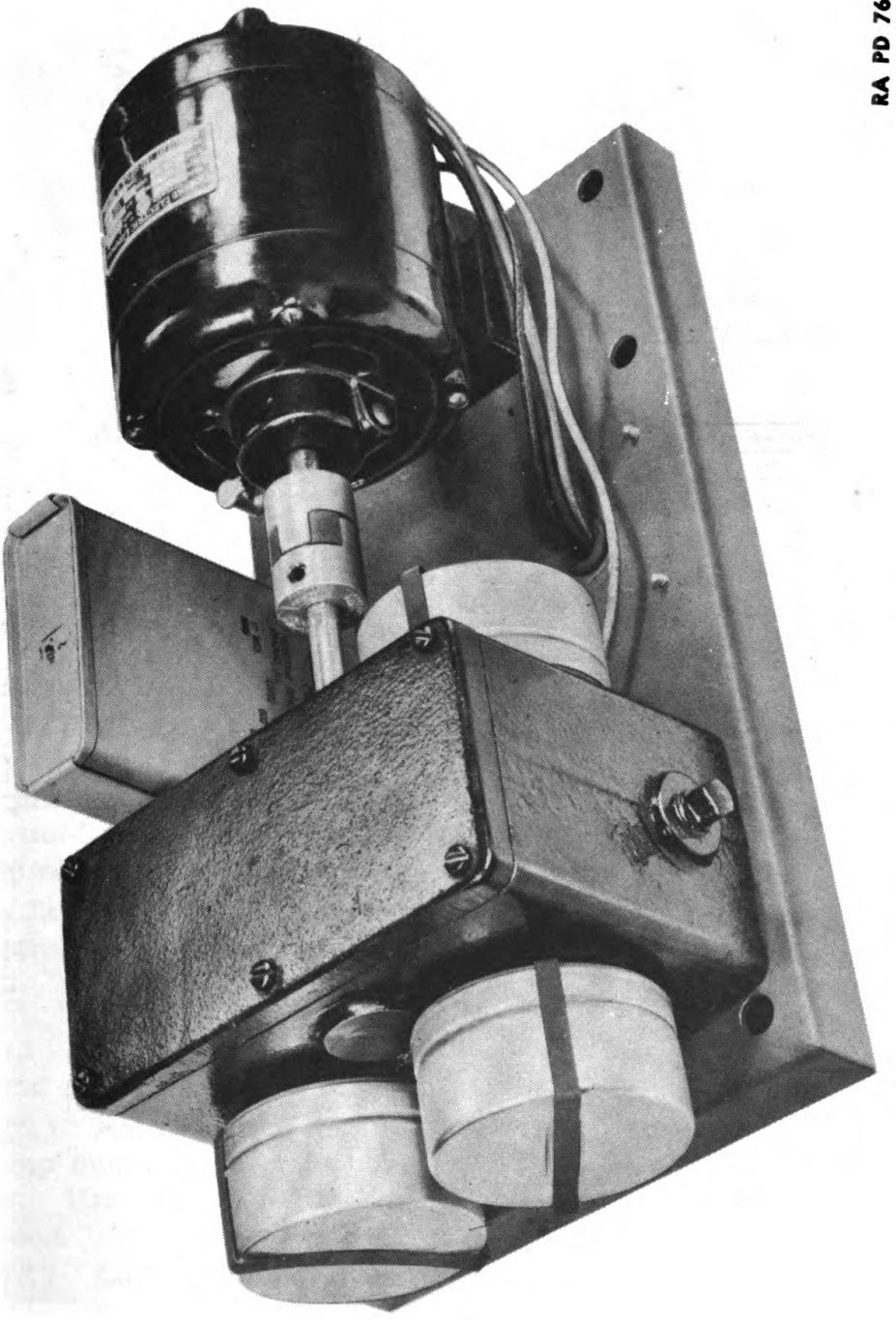
(18) Remove the electrical leads to the gun and speaker receptacles (fig. 47). Unscrew the binding head screws and hexagonal nuts fastening the receptacles to the front panel.

(19) Unsolder all electrical leads to the terminal strip (fig. 48) and drive out the retaining rivets fastening the strip to the control panel. Pull the a-c plug and cord out. Pry off the retaining ring to remove the ultraviolet lamp receptacle.

(20) Remove the set screws in the volume control knob (fig. 49) and pull the knob from the shaft. Unscrew the hexagonal nut and the two binding head screws holding the switch shield to the control

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Figure 35 — Timer — Assembled View

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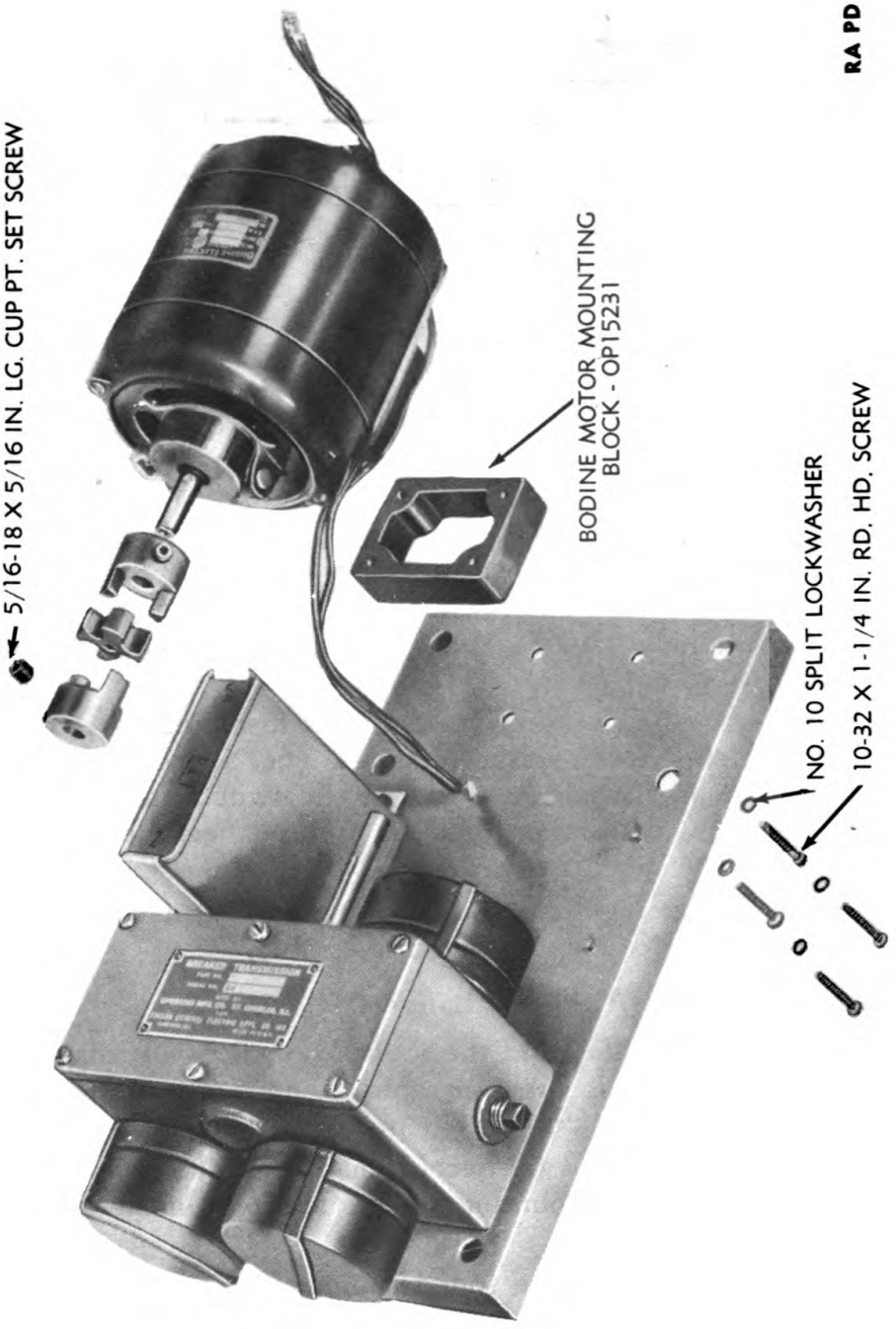


Figure 36 — Timer — Motor and Coupling Removed

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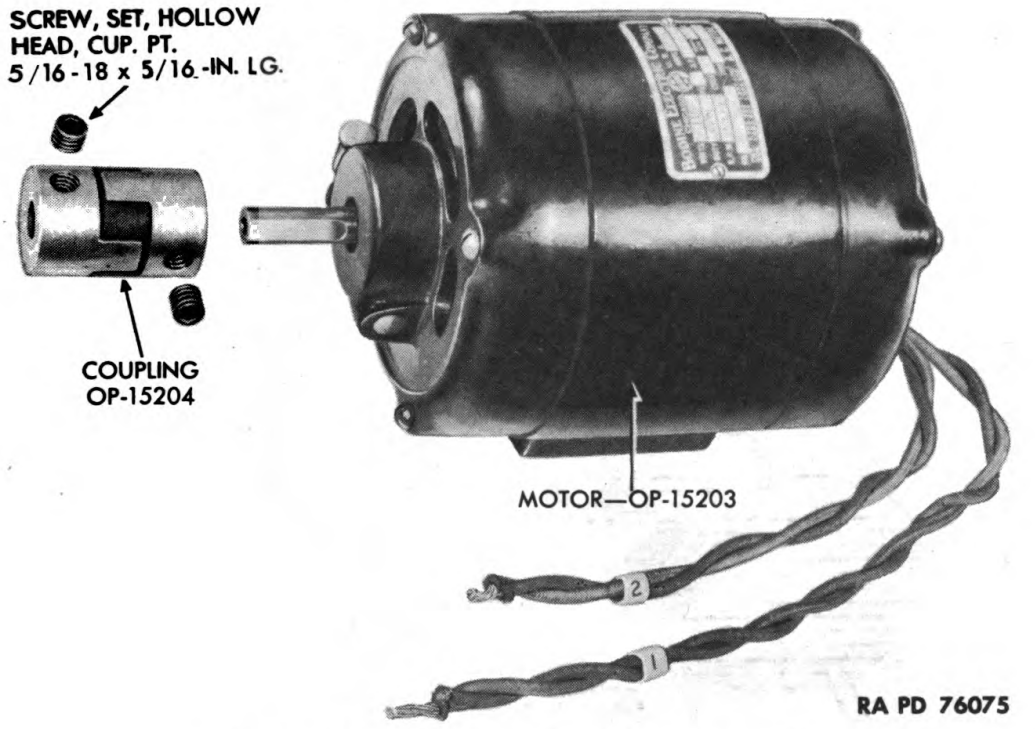


Figure 37 — Motor — Coupling Removed

panel. The switch shield contains the battle sound switch and the volume control.

(21) Remove the four binding head screws fastening the cover (fig. 50) to the shield. Remove the set screw (fig. 51) holding the volume control lead in the connector. Pull the switch and volume control from the shield. Unsolder the leads to disconnect the volume control from the battle sound switch.

(22) Pull the rubber grommets (fig. 52) and mounts from the control panel assembly to complete the disassembly.

c. Sound Equipment Record Changer.

(1) Remove the amplifier and the sound control panel from the sound cabinet as described in subparagraphs **a** and **b**, above.

(2) Remove, from the under side of the record changer, the four clamp nuts (fig. 54) that hold the record changer in the sound cabinet. Use care so that the mounting springs and nuts are not misplaced.

(3) Lift the top cover on the sound cabinet.

(4) Remove the record changer by lifting it from the cabinet (fig. 55). Use care so that the mounting springs, which normally are located between the record changer base panel and the supporting members in the cabinet, are not misplaced during the disassembly.

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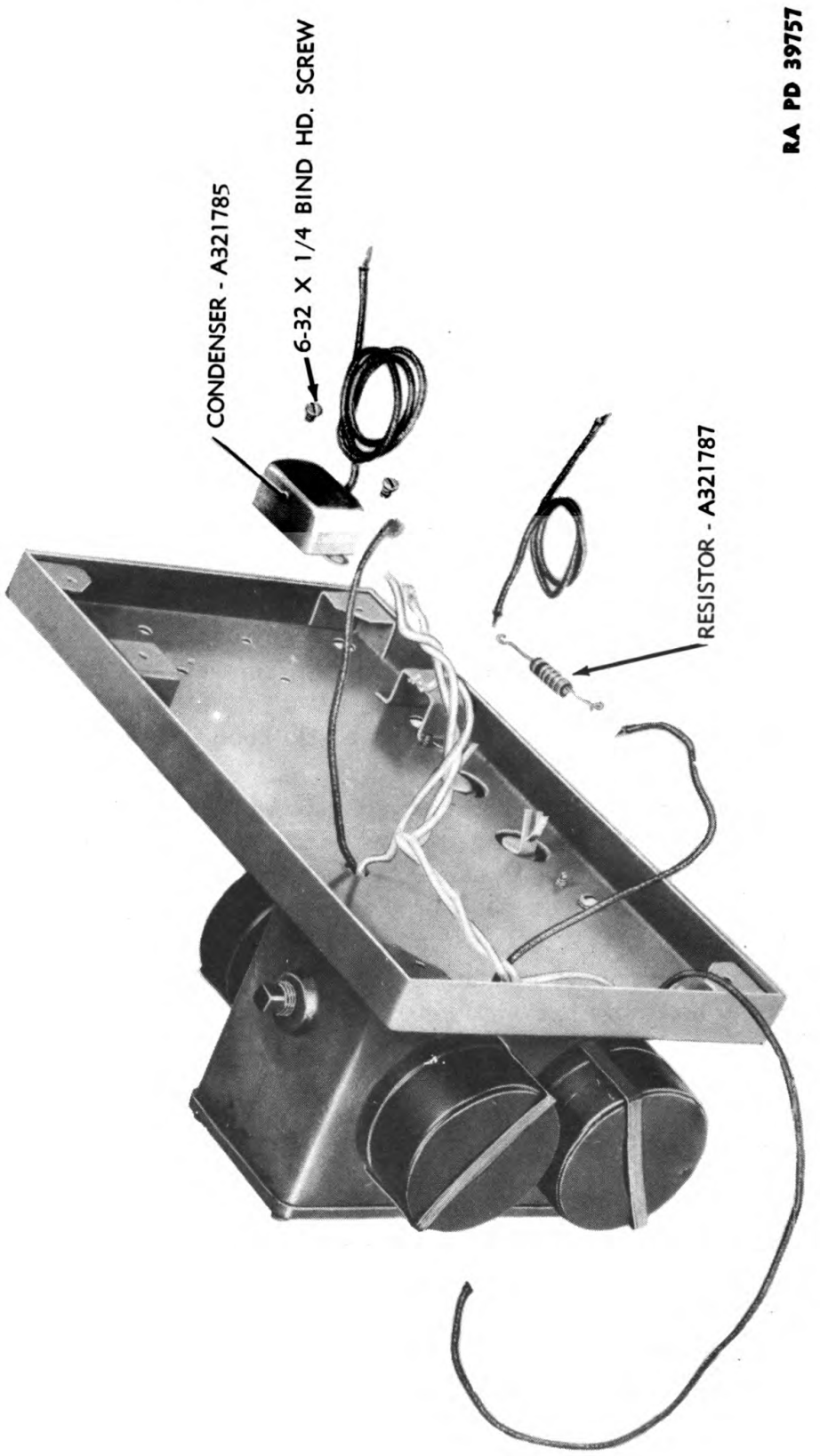


Figure 38 — Timer — Condenser (0.5 M.F.D.), Resistor, and Connecting Leads Removed

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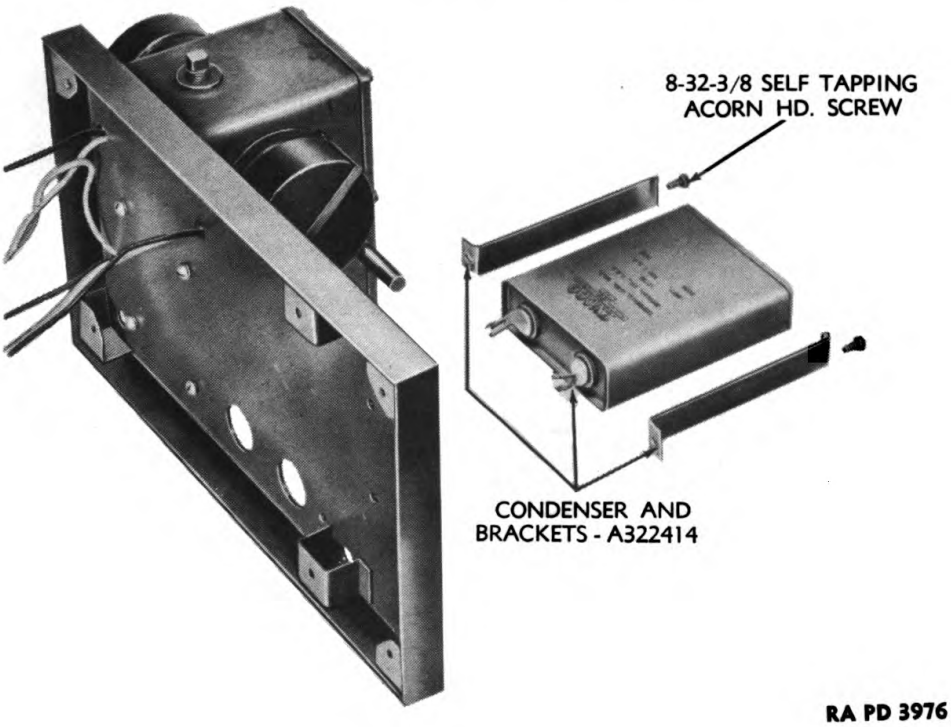


Figure 39 — Timer — Condenser (12 M.F.D.) Removed

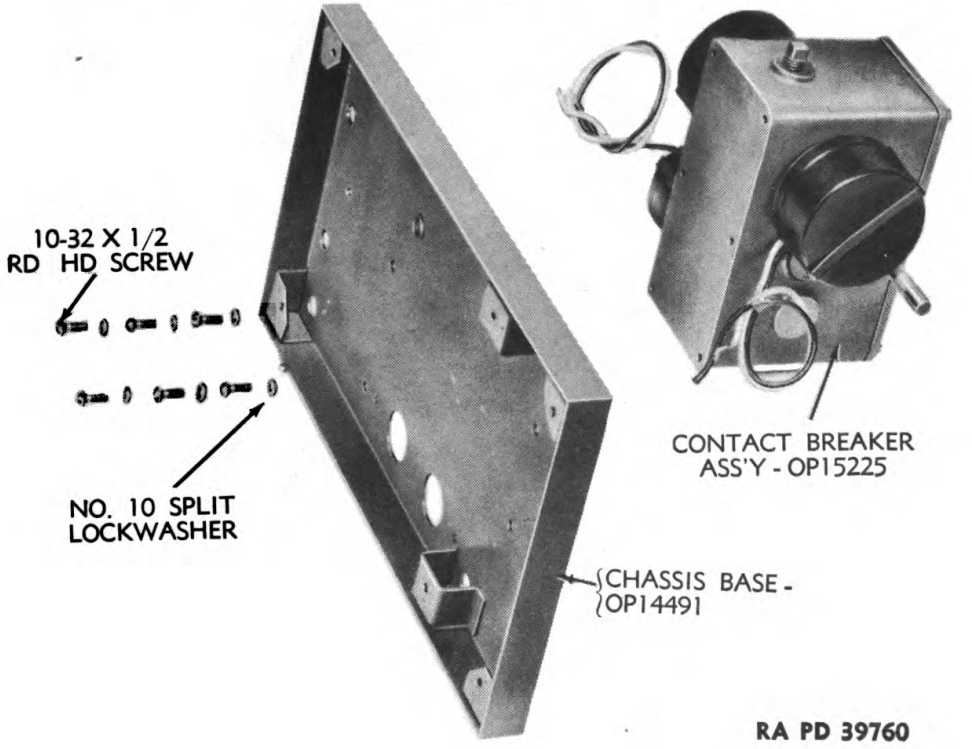


Figure 40 — Timer — Control Breaker and Base Removed

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Figure 41 — Breaker Transmission — Dust Caps and Contact Assemblies Removed

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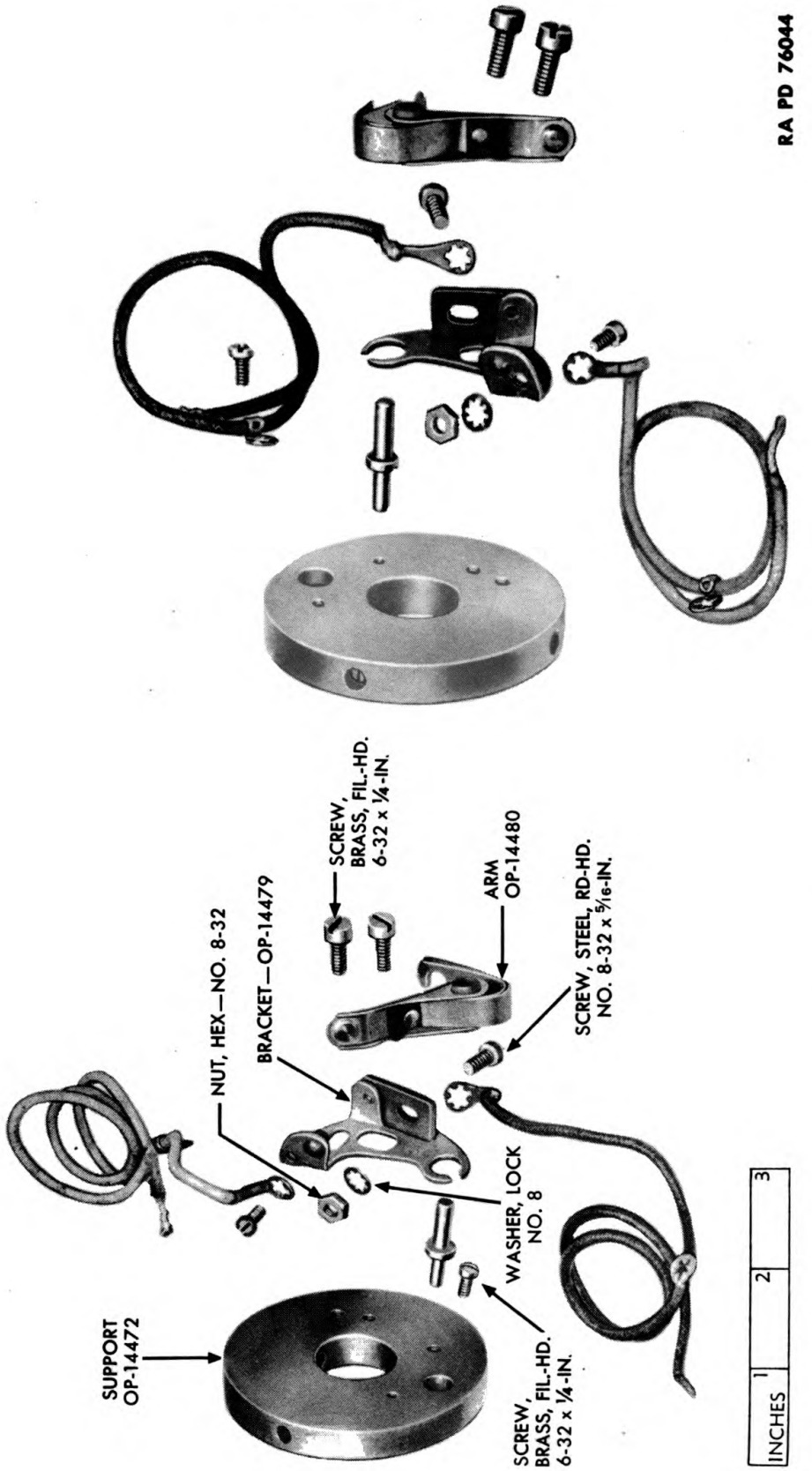


Figure 42 — Contact Assemblies — Parts

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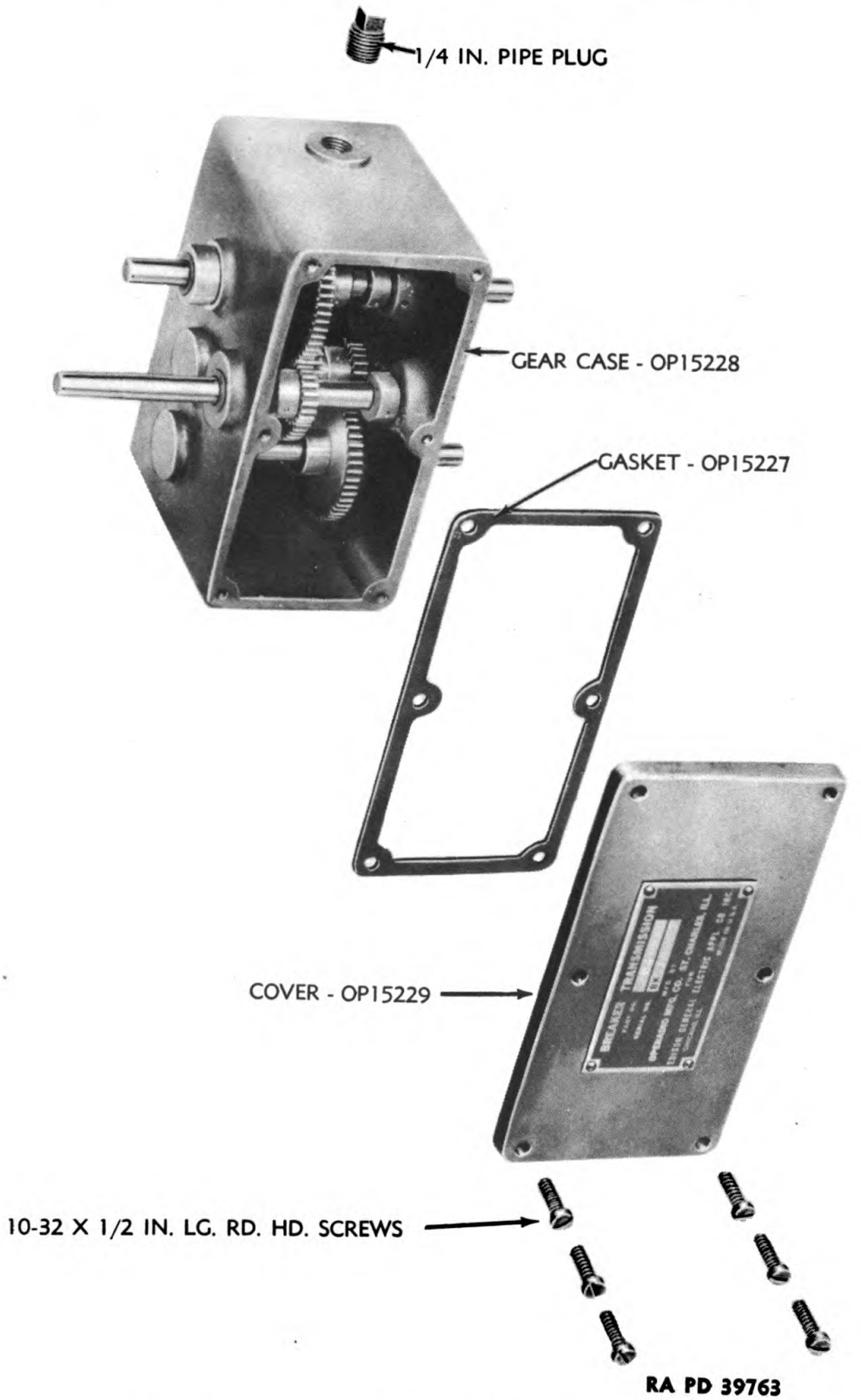
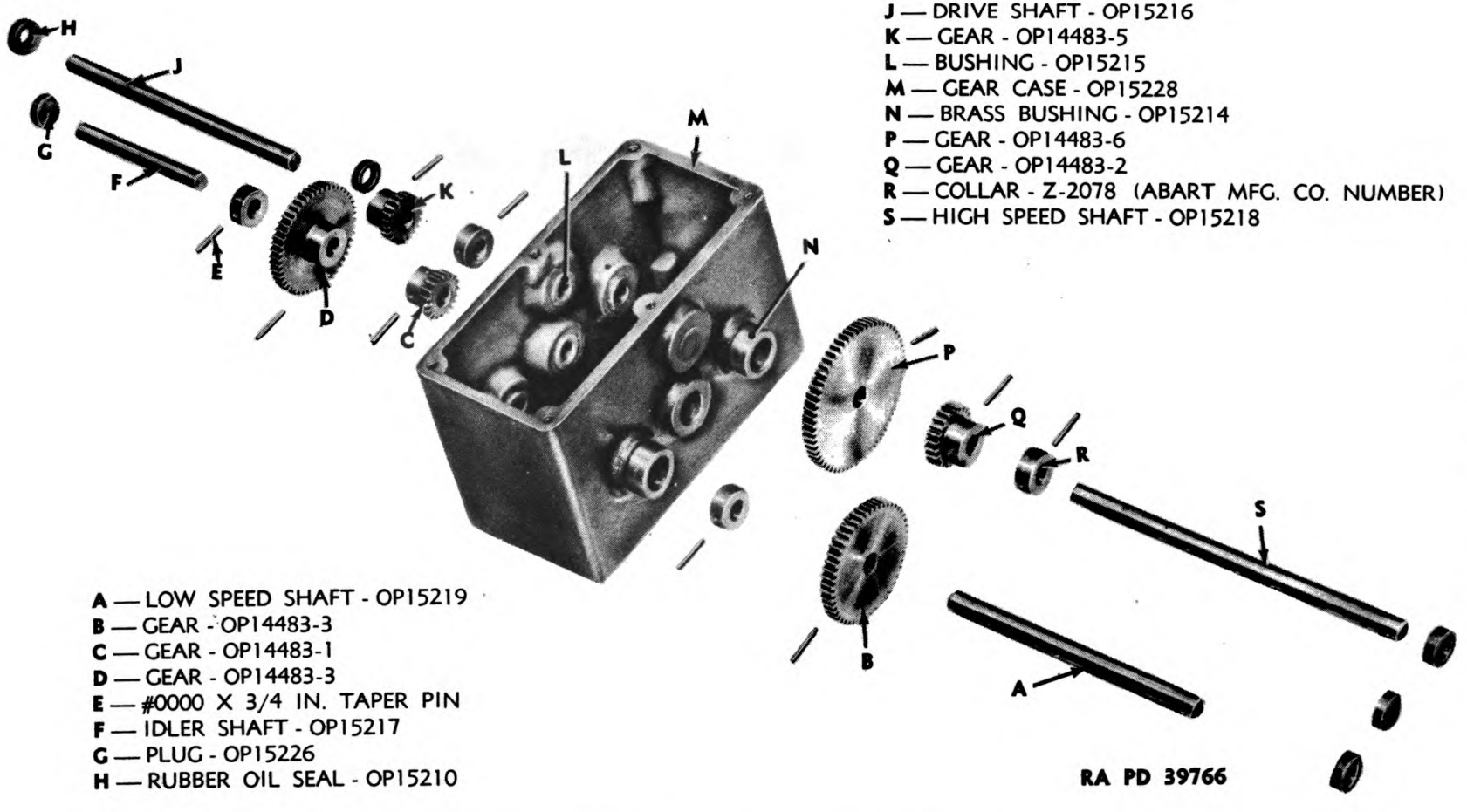


Figure 43 — Breaker Transmission — Cover and Gasket Removed

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J — DRIVE SHAFT - OP15216
K — GEAR - OP14483-5
L — BUSHING - OP15215
M — GEAR CASE - OP15228
N — BRASS BUSHING - OP15214
P — GEAR - OP14483-6
Q — GEAR - OP14483-2
R — COLLAR - Z-2078 (ABART MFG. CO. NUMBER)
S — HIGH SPEED SHAFT - OP15218

A — LOW SPEED SHAFT - OP15219
B — GEAR - OP14483-3
C — GEAR - OP14483-1
D — GEAR - OP14483-3
E — #0000 X 3/4 IN. TAPER PIN
F — IDLER SHAFT - OP15217
G — PLUG - OP15226
H — RUBBER OIL SEAL - OP15210

Figure 44 — Breaker Transmission — Gears and Shafts Removed

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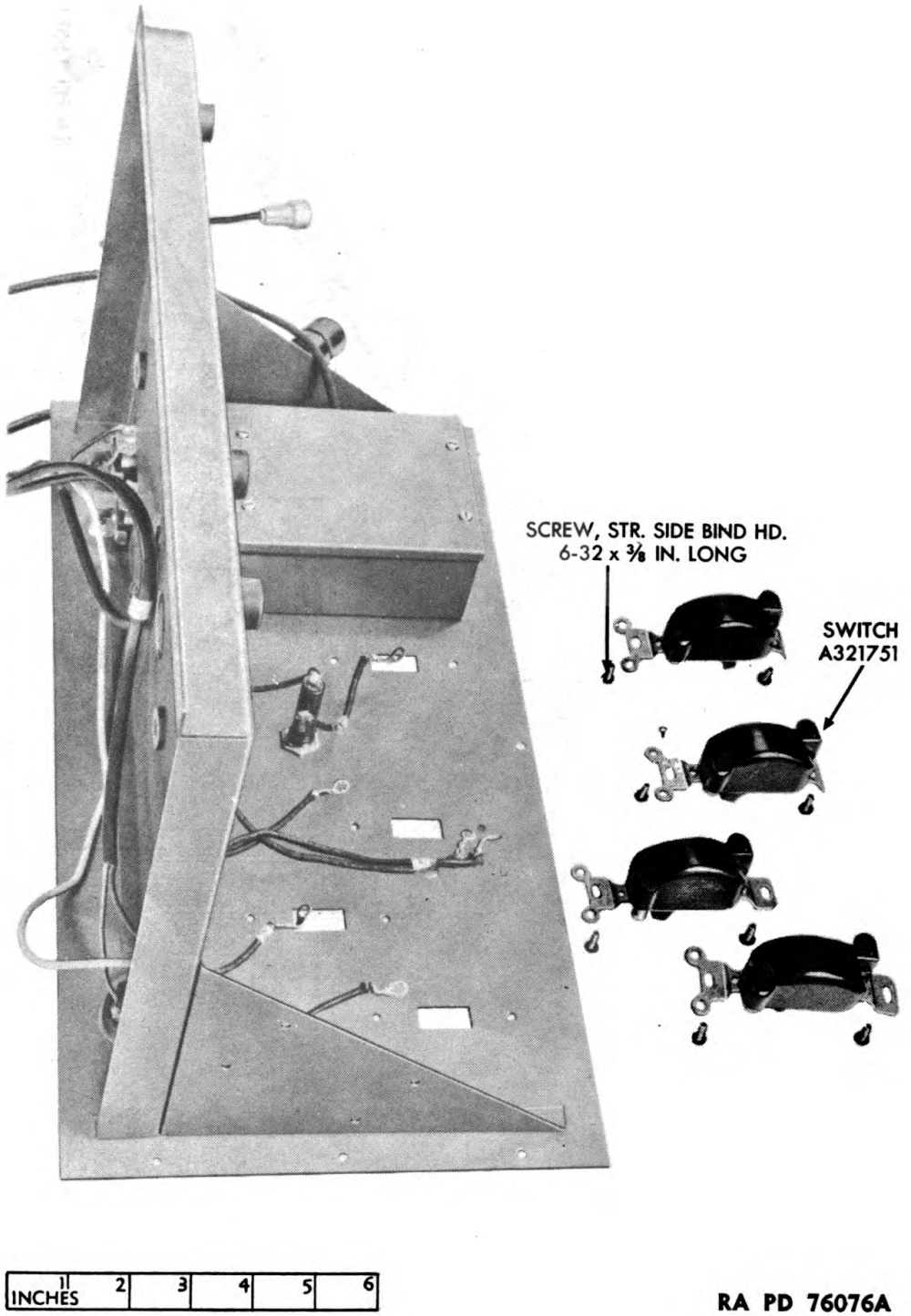


Figure 45 — Control Panel — Switches Removed

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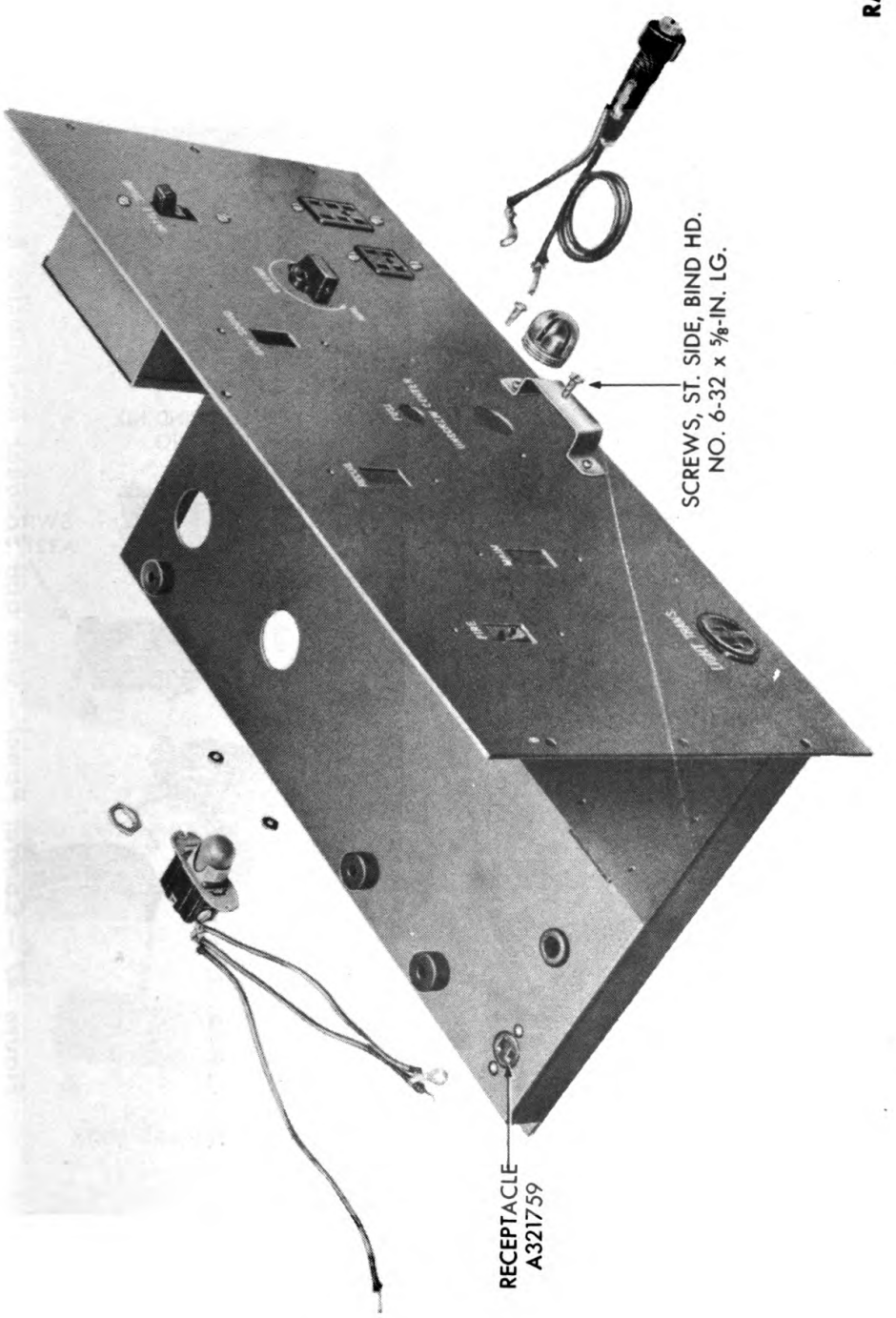


Figure 46 — Control Panel — Fuse Holder and Pilot Light Removed

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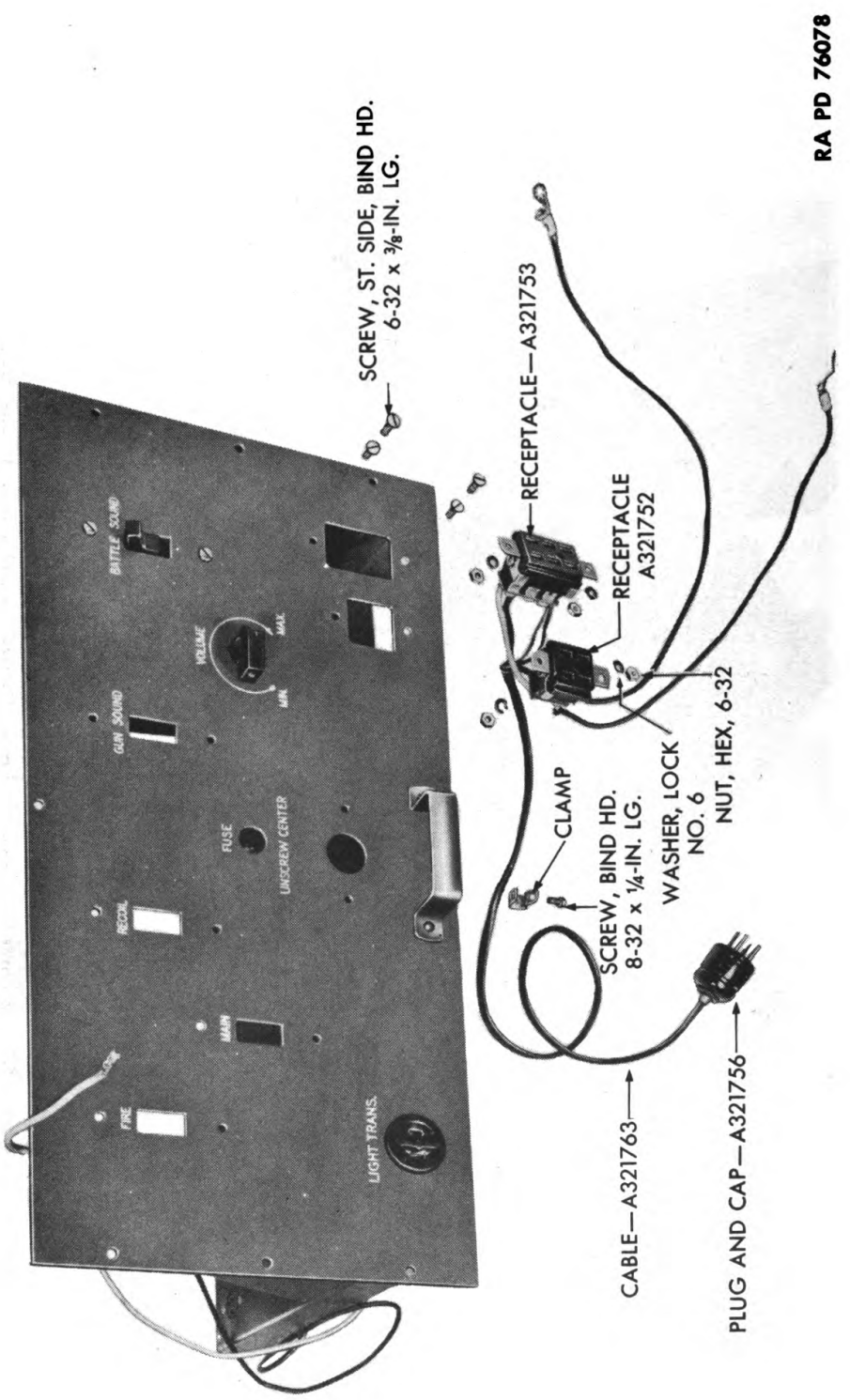


Figure 47 — Control Panel — Gun and Speaker Receptacles Removed

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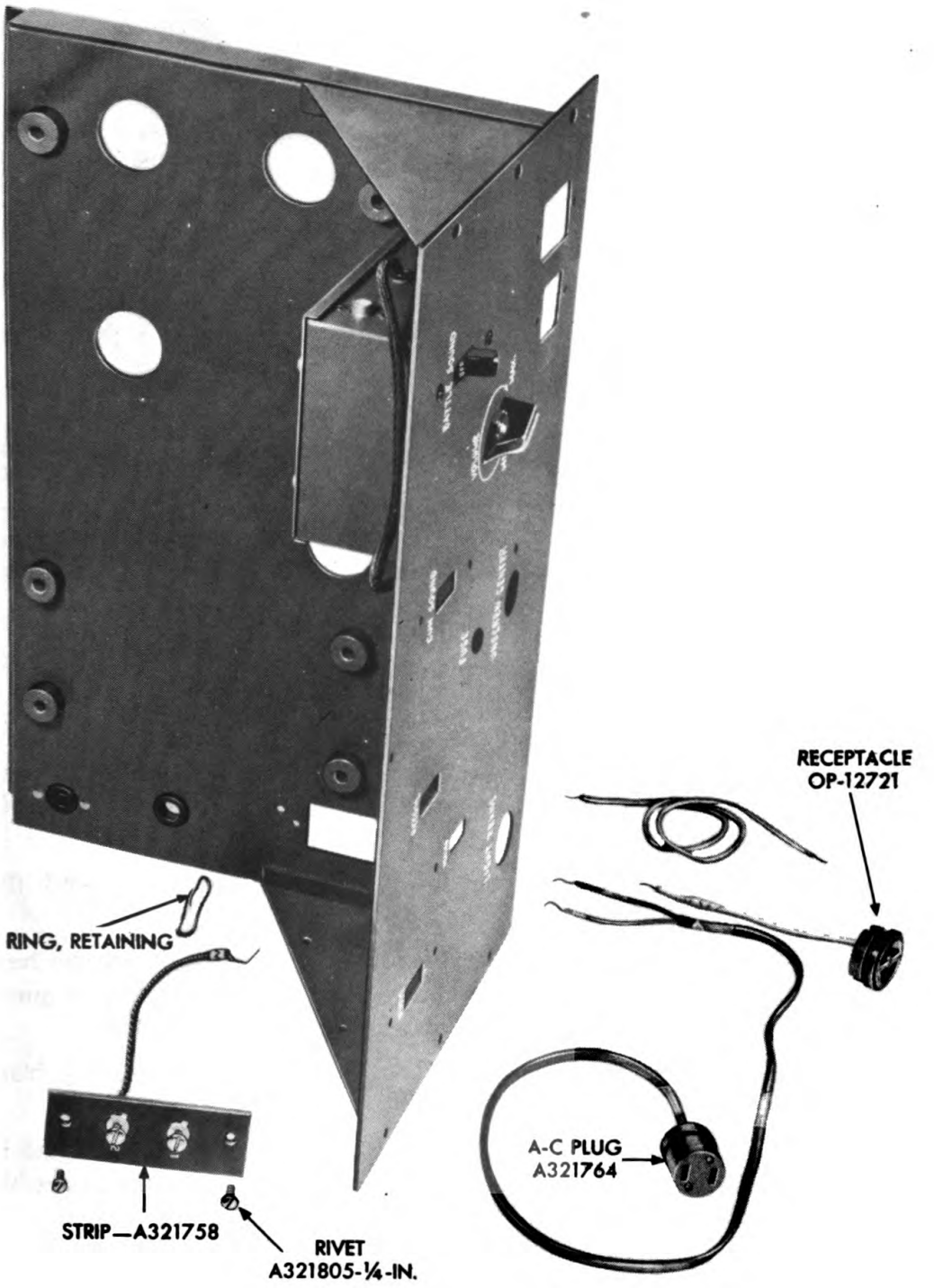


Figure 48 — Control Panel — Ultraviolet Lamp Receptacle, Terminal Strip, and A-C Plug Removed

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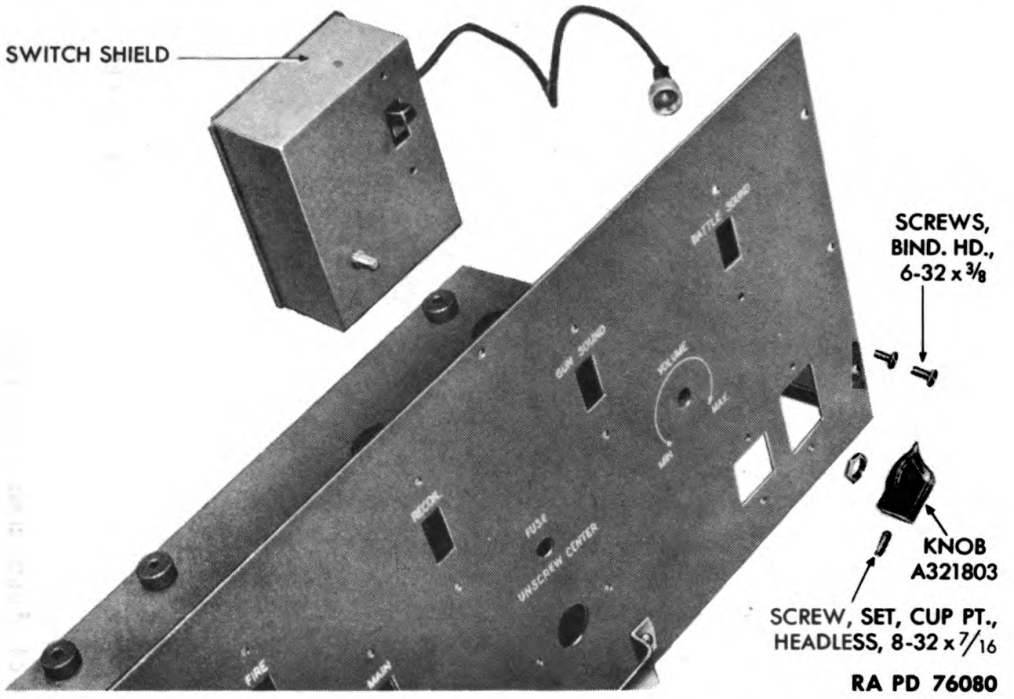


Figure 49 — Control Panel — Battle Sound Switch and Volume Control Removed

(5) Remove the turntable (fig. 57) by pulling it from the spindle. Remove the arm and blade assemblies by removing the two screws fastening them to the post. The parts of the arm and blade assembly are shown in figure 58.

(6) Unsolder the power cord leads, the motor leads, and the tone arm leads as shown in figure 59.

(7) Remove the U-shaped washers, the two screws, and the hexagonal nut and washer to remove the gear assembly and related parts as shown in figure 60. Do not misplace the washer A321945.

(8) Pull the gear assembly (fig. 61) and the link assembly from the spindle and housing assembly.

(9) The housing with spindle assembly is shown disassembled in figure 62. Drive the pin fastening the gear to the spindle assembly to disassemble the parts. Remove the hexagonal nut and lock washer to separate the shaft from the housing. File off the end of the stud to remove the link assembly. The bearing wafers and plate are removed by unscrewing the two screws.

(10) The principal parts of the drive gear assembly are shown disassembled in figures 63 and 64. Pull the ends of the two springs (fig. 63) from their studs or to their connecting points on the lever B271504 or the lever assembly B271503. Remove the screws fasten-

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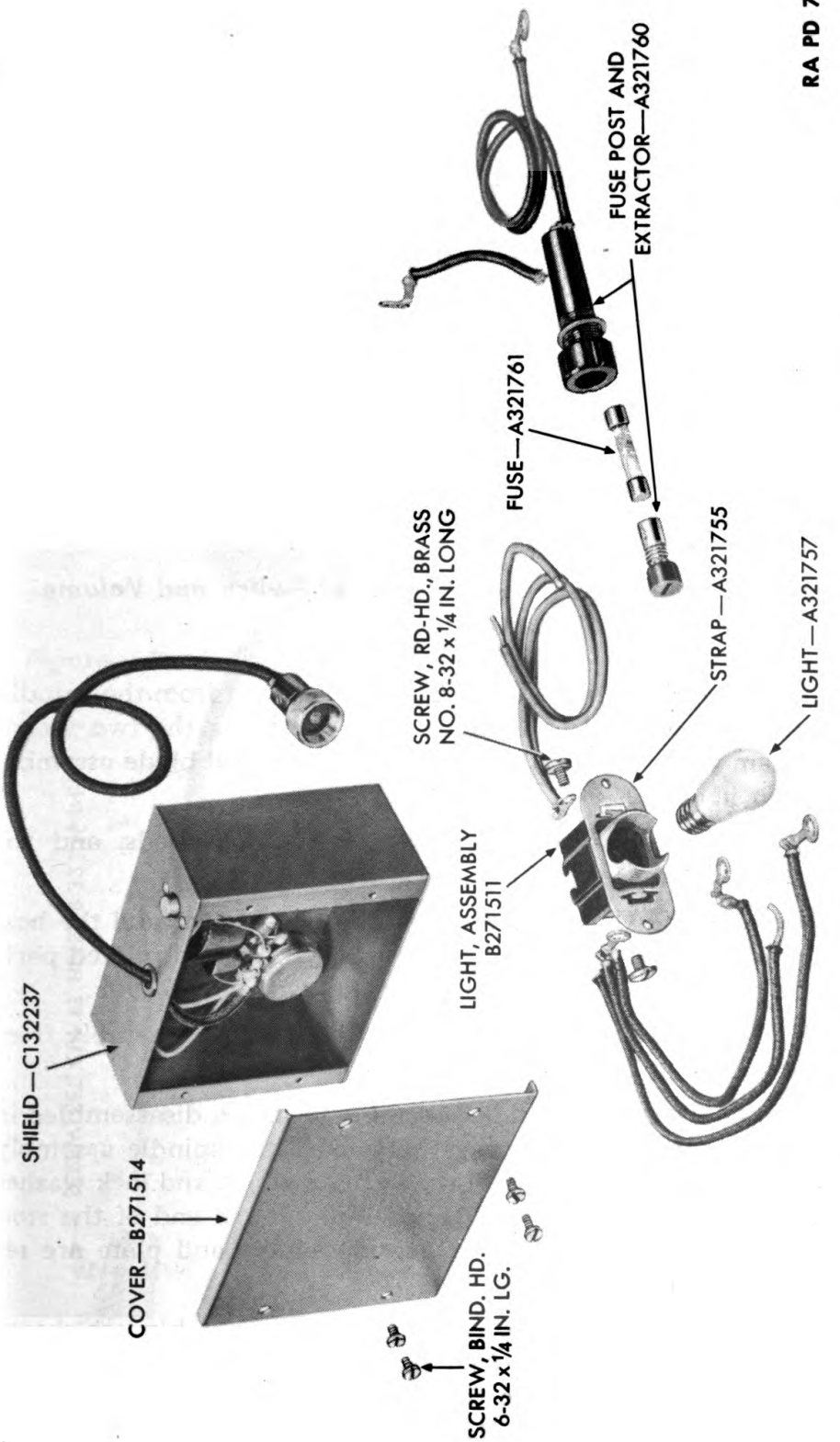


Figure 50 — Battle Sound Switch, Volume Control, Fuse, and Pilot Light

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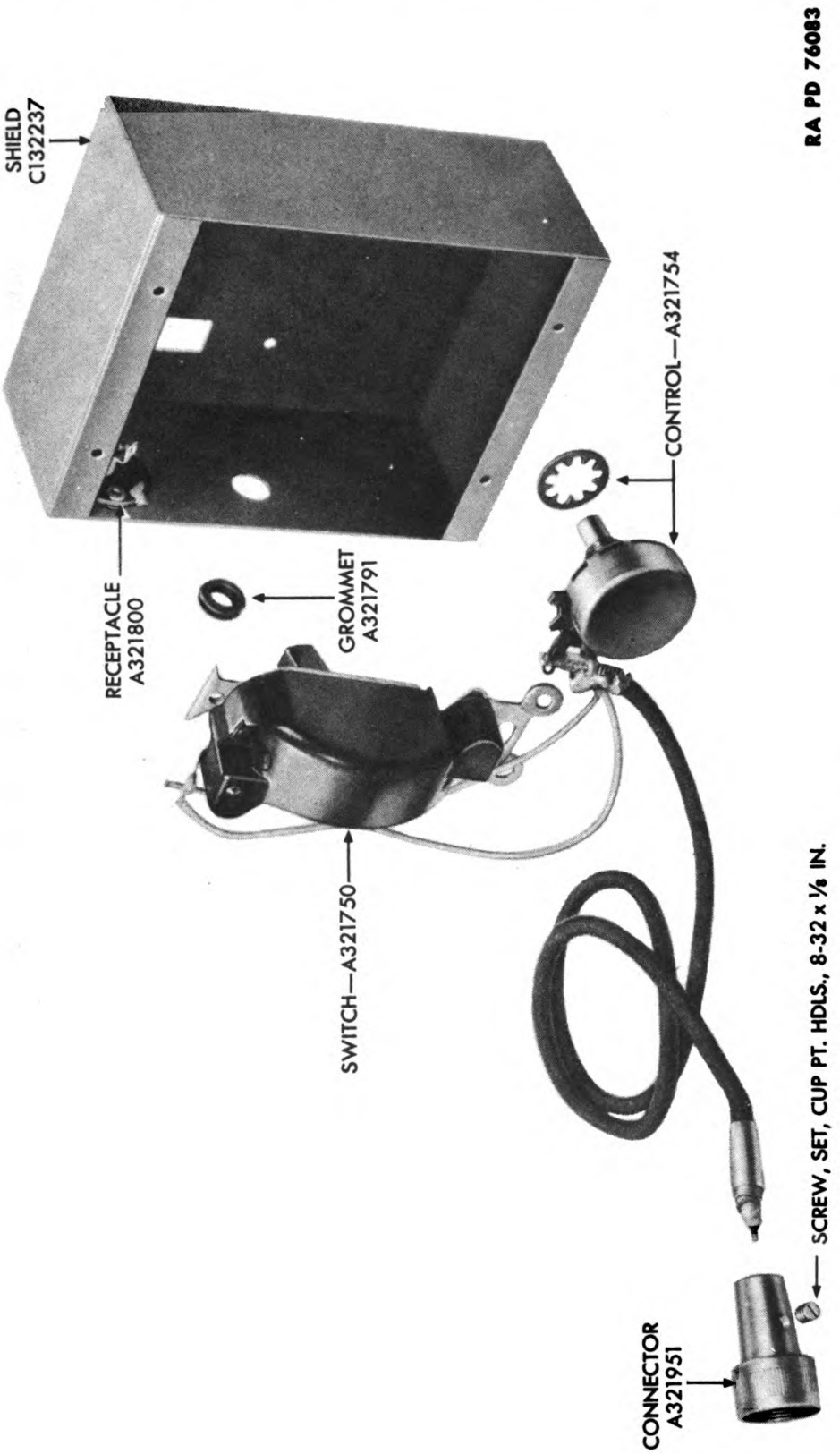


Figure 51 — Battle Sound Switch and Volume Control — Parts

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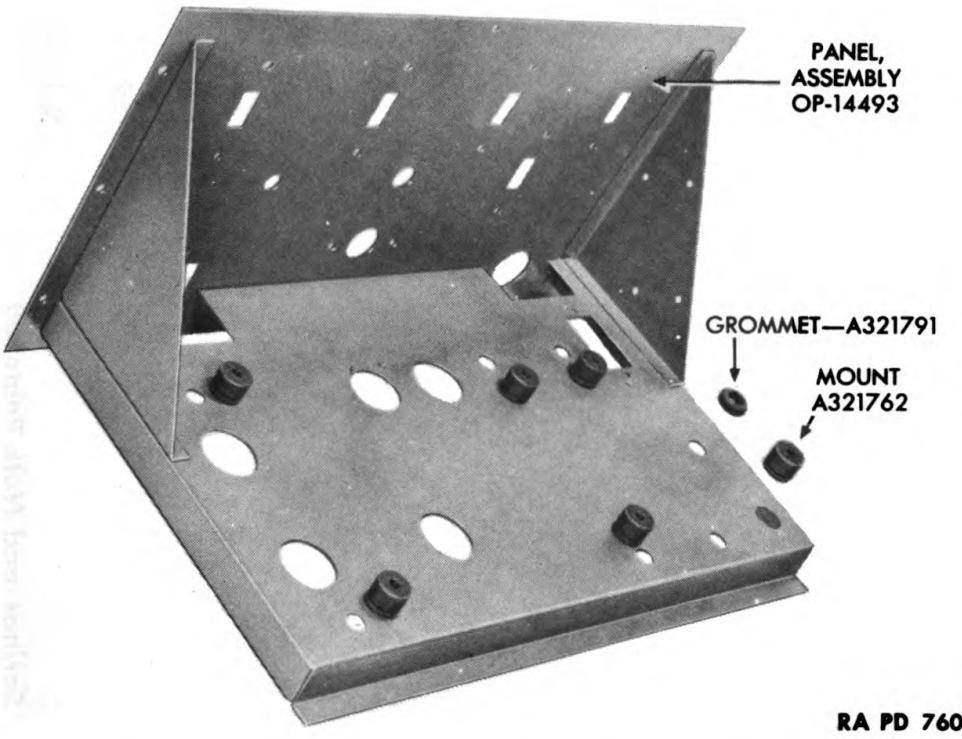


Figure 52 — Control Panel — Timer Mounting and Grommet Removed

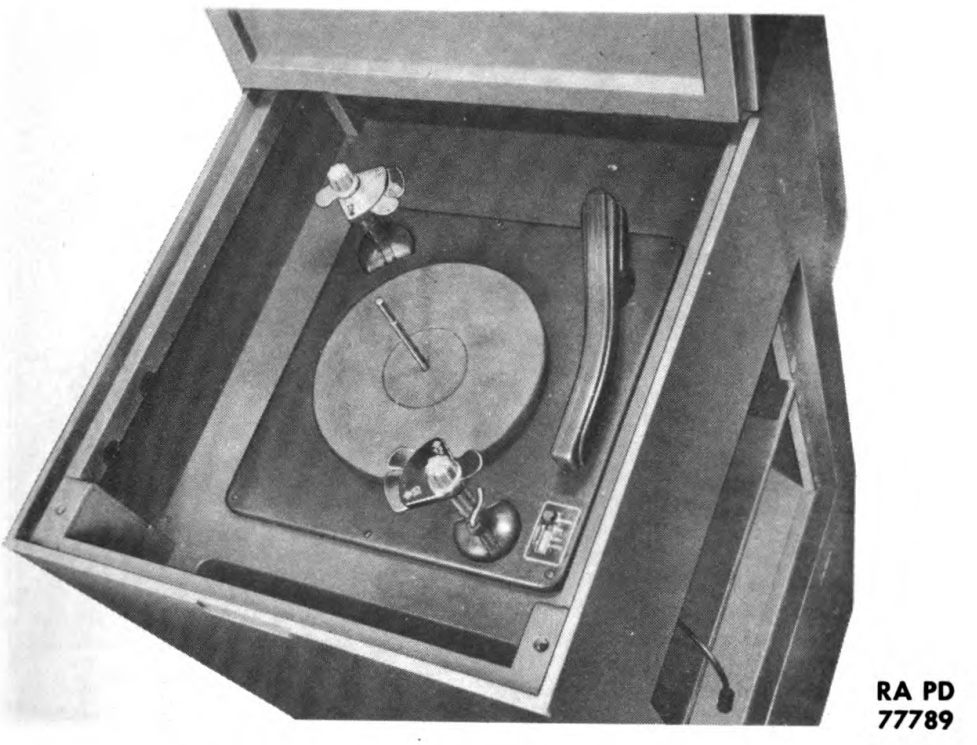


Figure 53 — Record Changer — Top View

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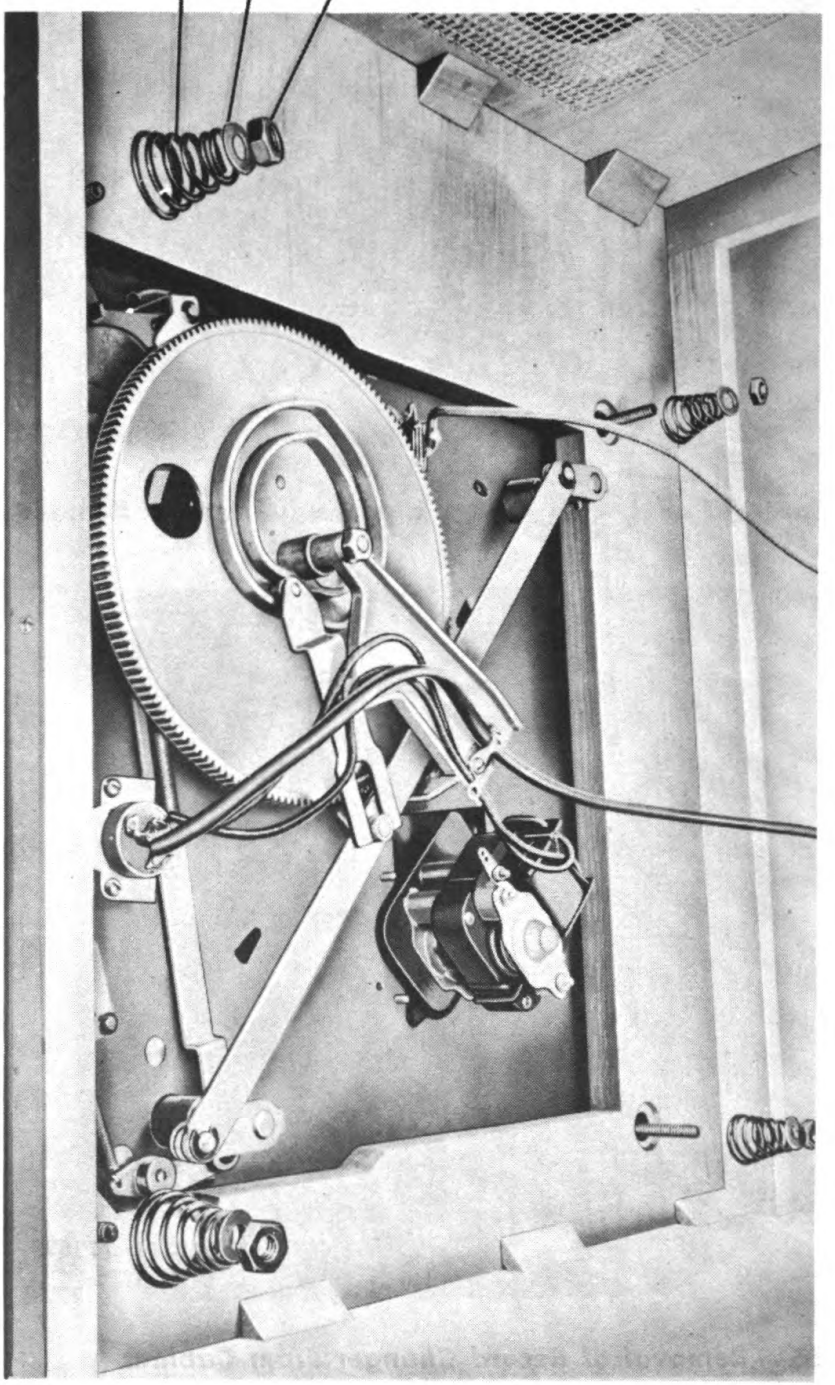


Figure 54 — Record Changer — Mounting Springs and Nuts Removed

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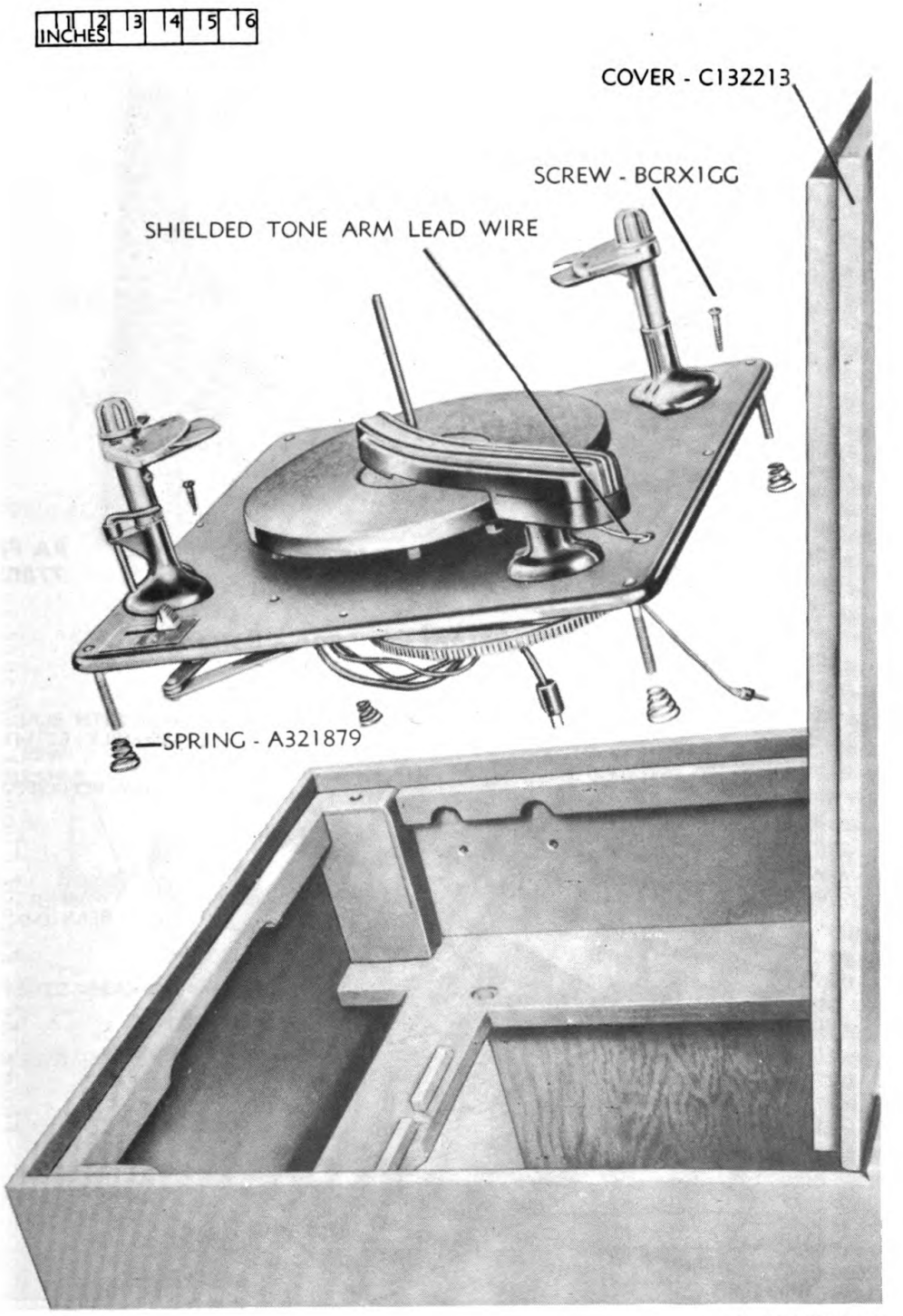


Figure 55 — Removal of Record Changer From Cabinet

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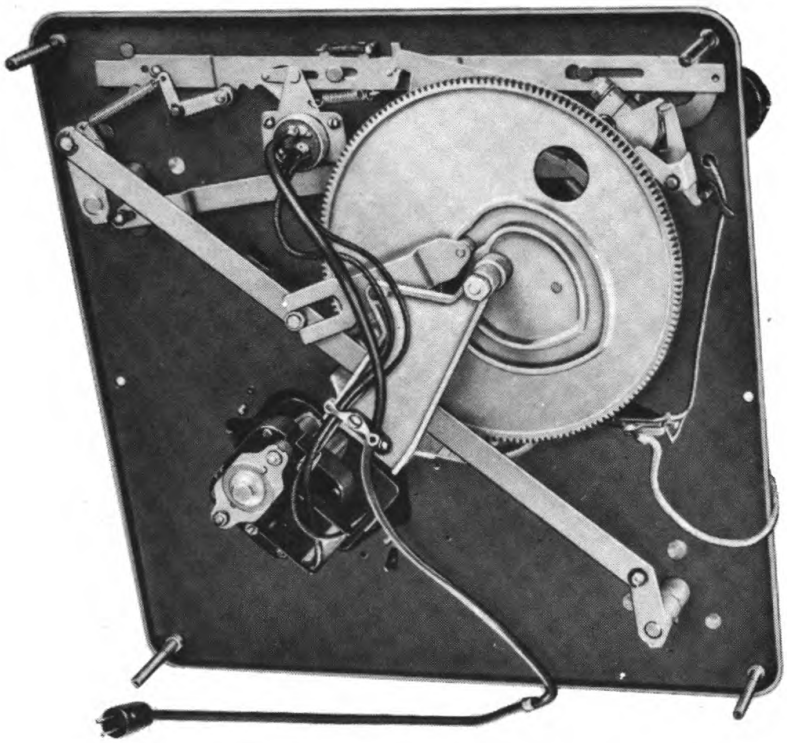


Figure 56 — Record Changer — Bottom

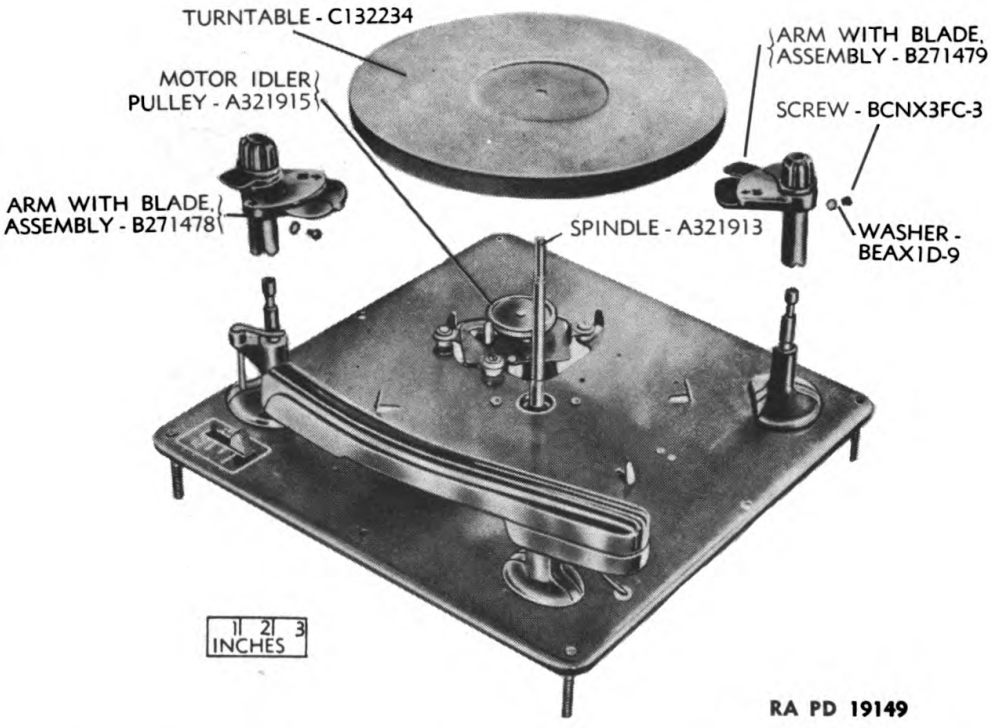


Figure 57 — Removal of Turntable and Arms With Blades From Record Changer

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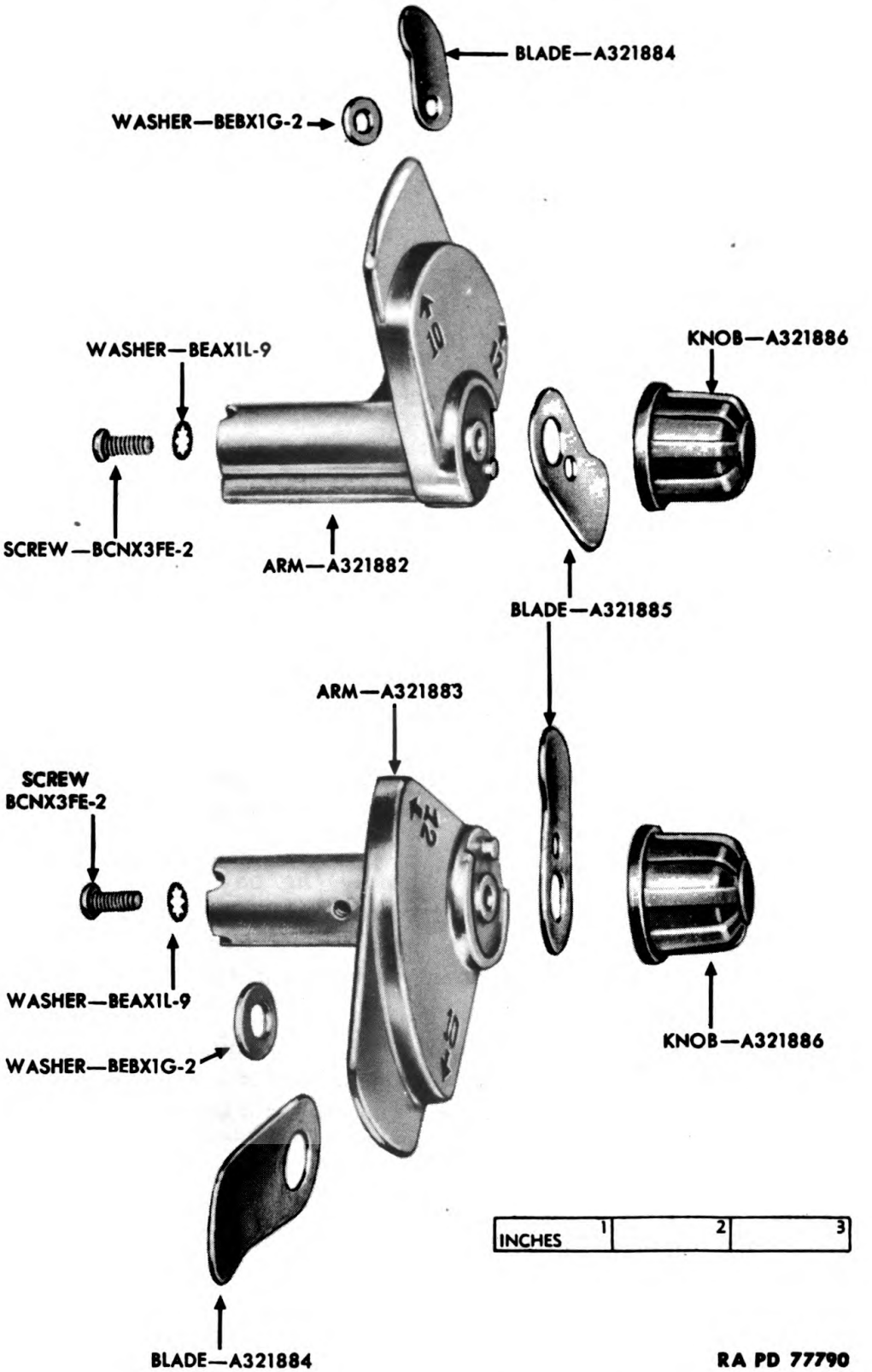


Figure 58 — Arms With Blades — Parts

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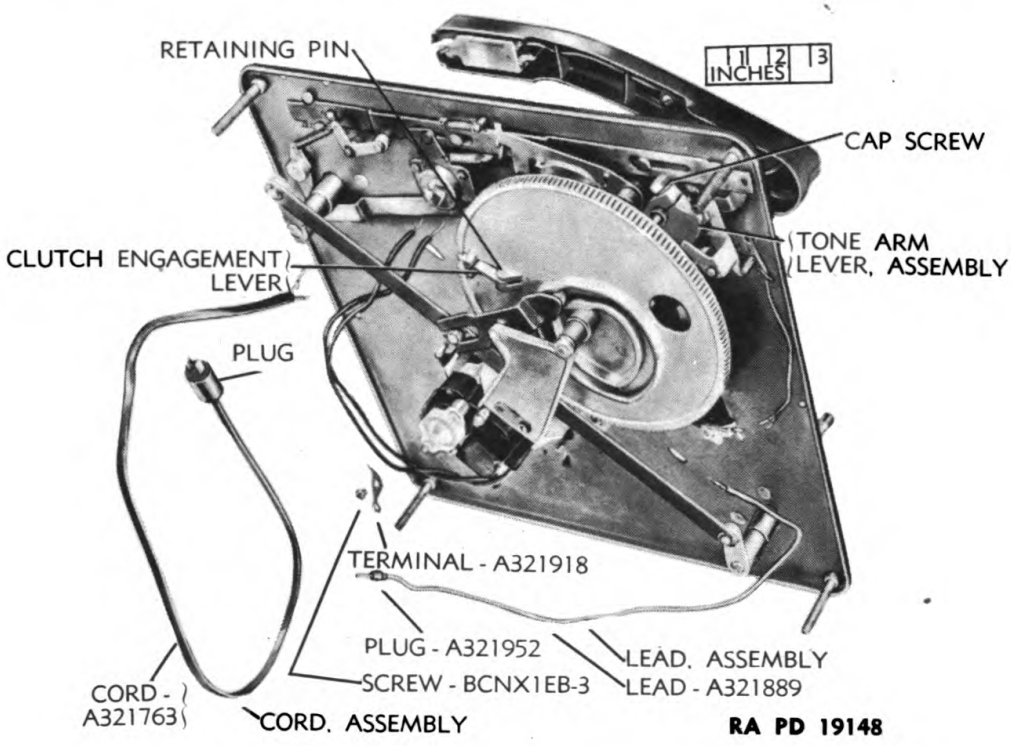


Figure 59 — Record Changer — Power Cord and Related Parts Removed

ing the lever and the lever assembly to the drive gear. Drive out the pin fastening the clutch engagement lever (fig. 64) to the drive gear to complete the disassembly.

(11) Remove the tone arm assembly (fig. 65) by loosening the hexagonal-head cap screw in the lever assembly. Pull the tone arm from the lever, taking care not to misplace the bearing assembly or the pin A321901. The component parts of the tone arm assembly are shown in figure 67.

(12) Remove the three screws, washers, bushings, rubber grommets, and the hexagonal nuts fastening the motor assembly (fig. 65) to the panel assembly. The pulley (fig. 66) can be removed by removing the cotter pin and plain washer. Do not misplace the felt washer.

(13) The selector shaft assembly (fig. 68) is removed from the crank assembly by removing the set screw and the taper pin. Remove the U-washer from the stud on the arm assembly and the U-shaped washer from the stud in the panel assembly. Slip the ends of the spring A321949 from their connecting holes in the arm assembly and the lever assembly. The lever assembly can be pulled from its panel stud and the arm assembly may be separated from the rod by loosening the set screw in the arm assembly. Remove the spring A321937

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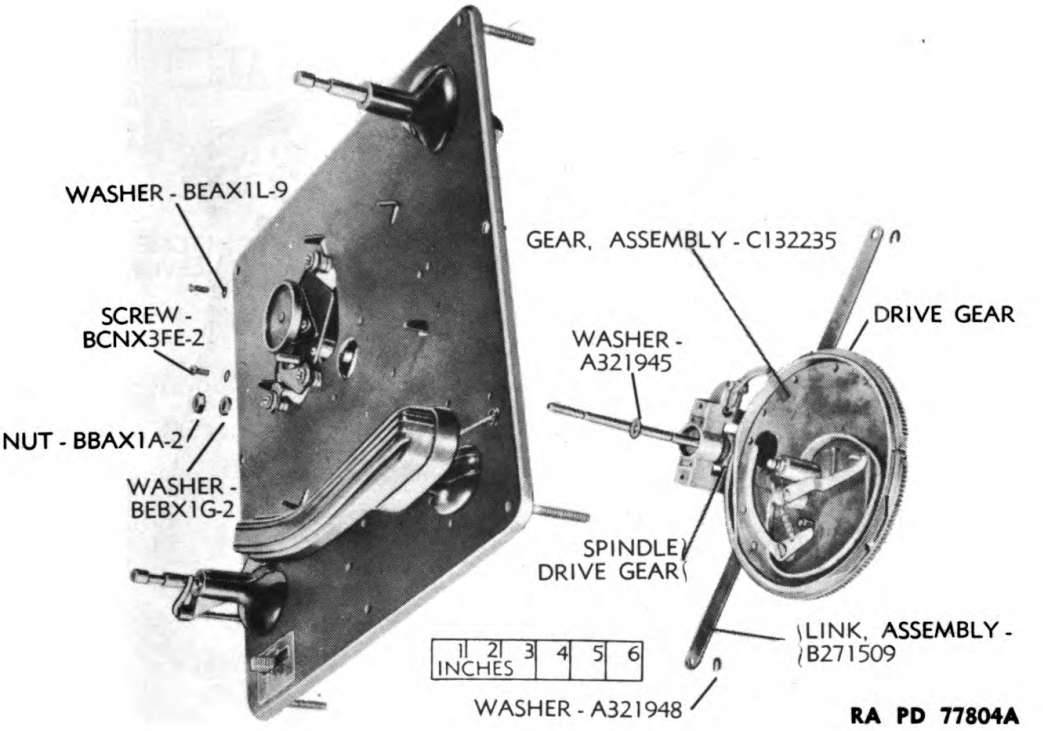


Figure 60 — Record Changer — Gear Assembly Removed

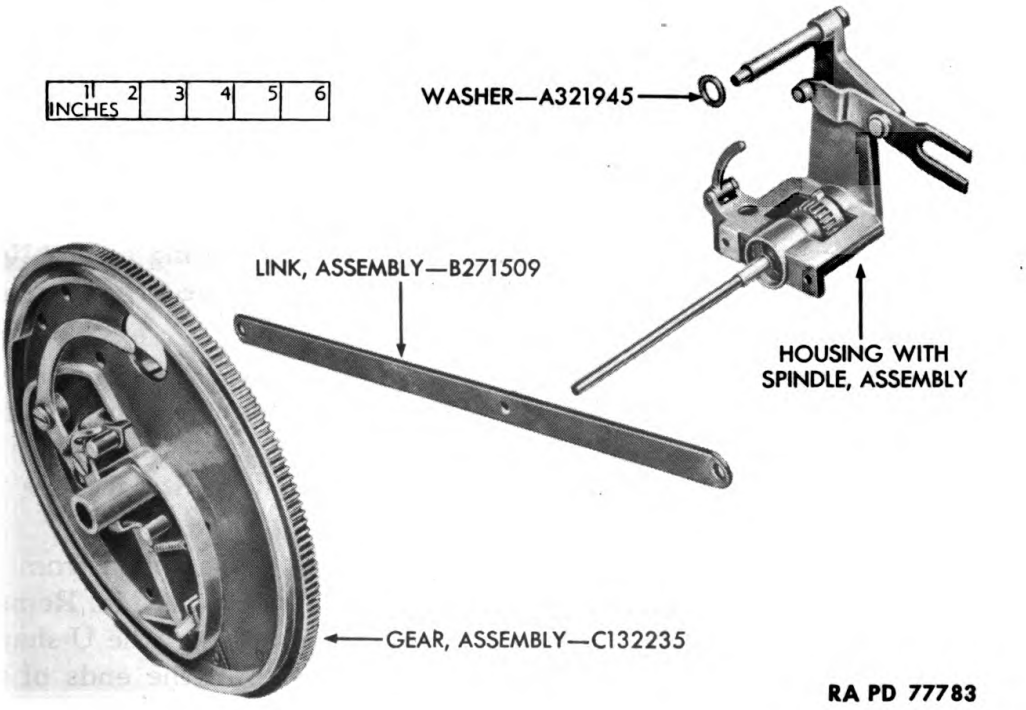


Figure 61 — Gear Assembly, Link, and Housing With Spindle Assembly

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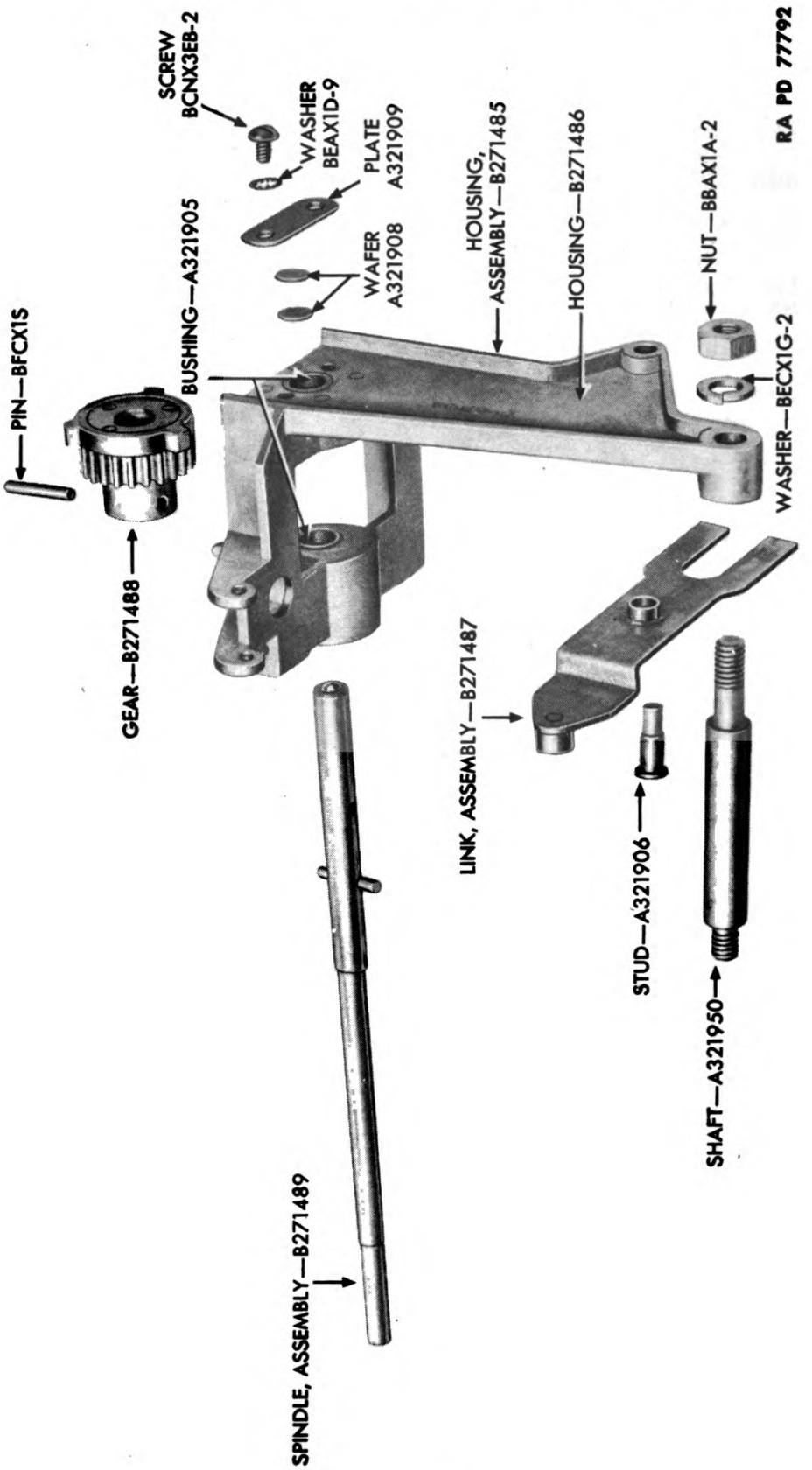


Figure 62 — Housing With Spindle Assembly — Parts

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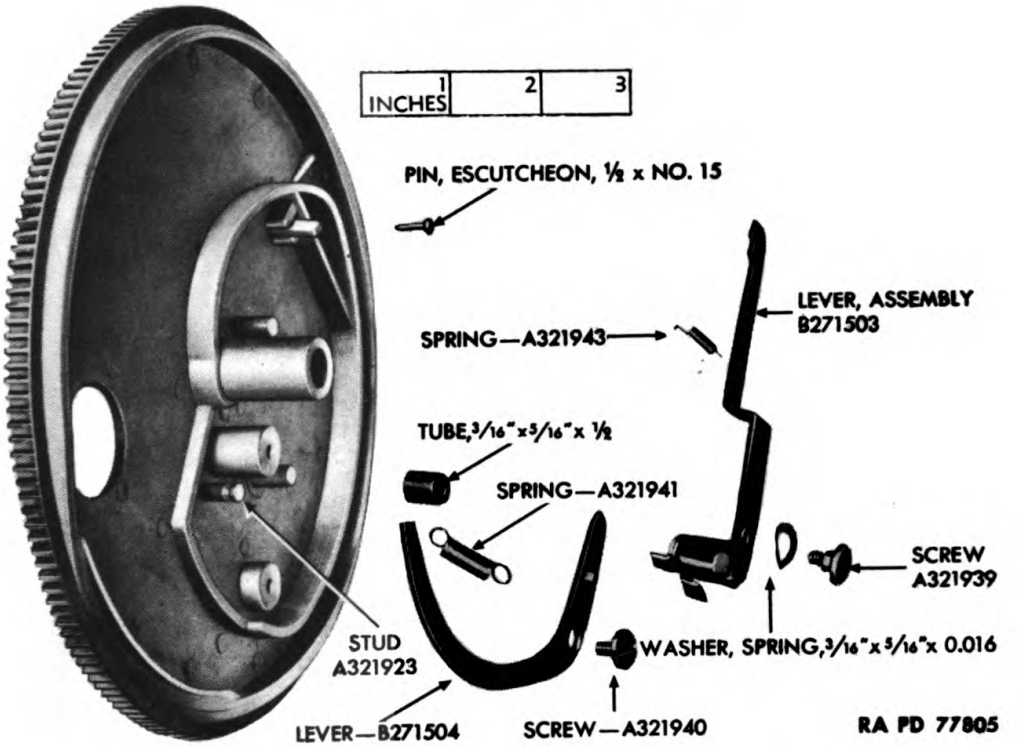


Figure 63 — Removal of Principal Parts From Upper Side of Drive Gear

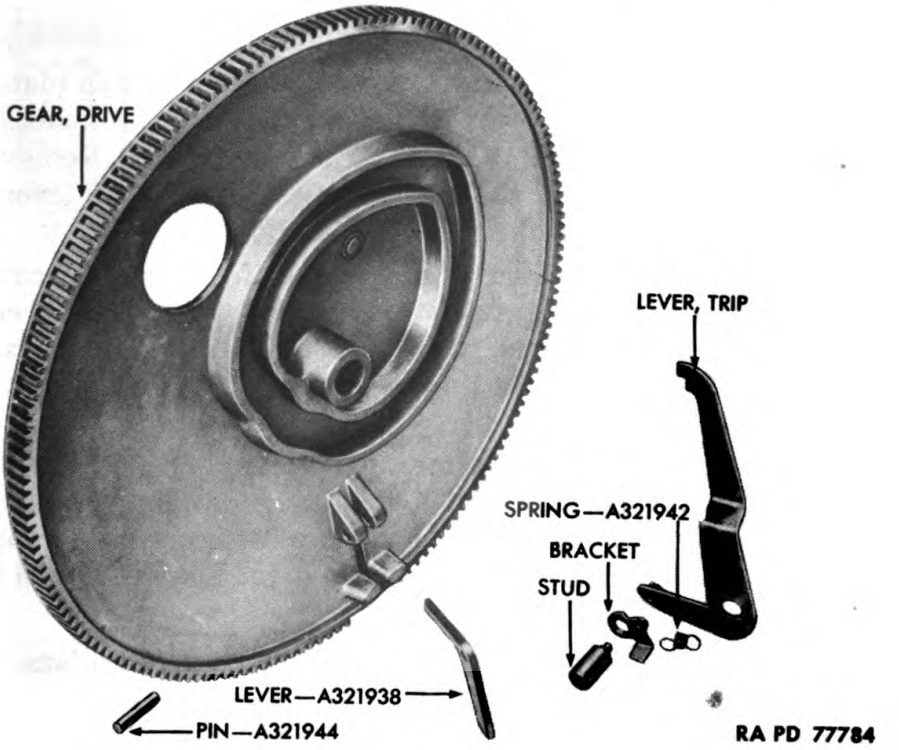


Figure 64 — Removal of Clutch Engagement Lever From Drive Gear

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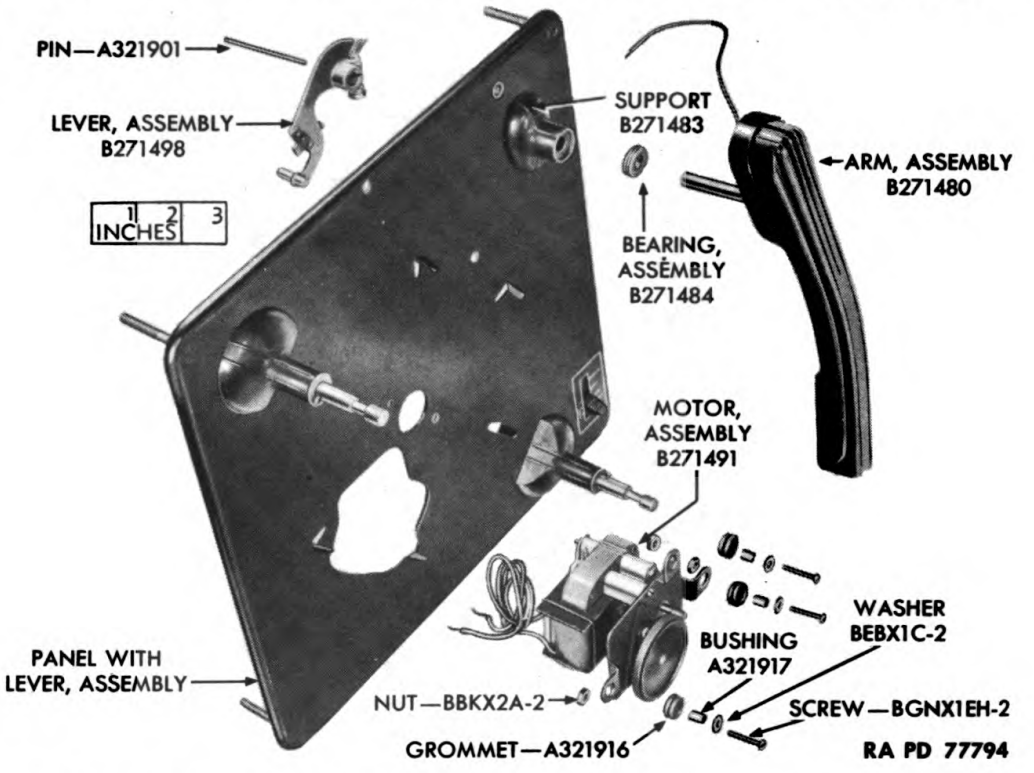


Figure 65 — Record Changer — Motor and Tone Arm Removed

from its stud and connection to the lever B271502. Slip the lever until the large end of the slot in the lever will slip off the panel stud.

(14) Remove the spring A321936 from the switch plate (fig. 69). Remove the two screws and washers to remove the switch. Slip the ends of the springs A321933 from the panel stud. Remove the two U-shaped washers, and the locator assembly and the lever B271499 may be removed from the panel assembly.

(15) Remove the screw and washer fastening the control lever (fig. 70) to the panel assembly. By sliding the control lever, the link, and the reject lever on the panel until the large end of the slots are in their proper position over the retaining studs in the panel, the parts can be removed.

(16) Remove the selector shaft assembly (fig. 71) from the crank assembly by driving out the taper pin and removing the set screw. Remove the lead terminal from its bracket by removing the two screws and lock washers to complete the disassembly of the record changer.

d. Sound Equipment Record Repeater Mechanism.

(1) Remove the record repeater from the cabinet in the same manner as that described for the record changer in subparagraph **c**, above. Remove the lock nuts and springs as shown in figures 54 and 55.

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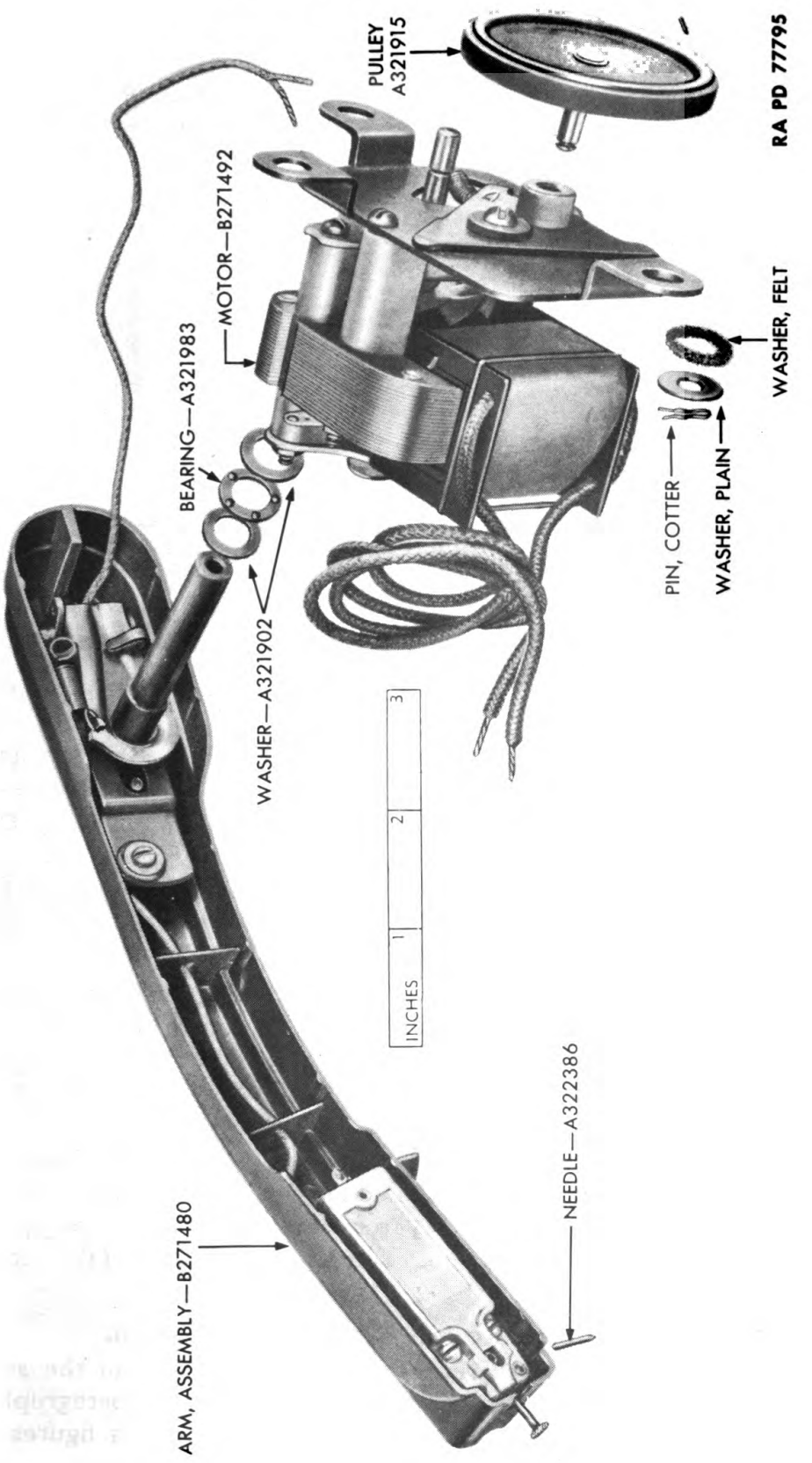


Figure 66 — Tone Arm and Motor

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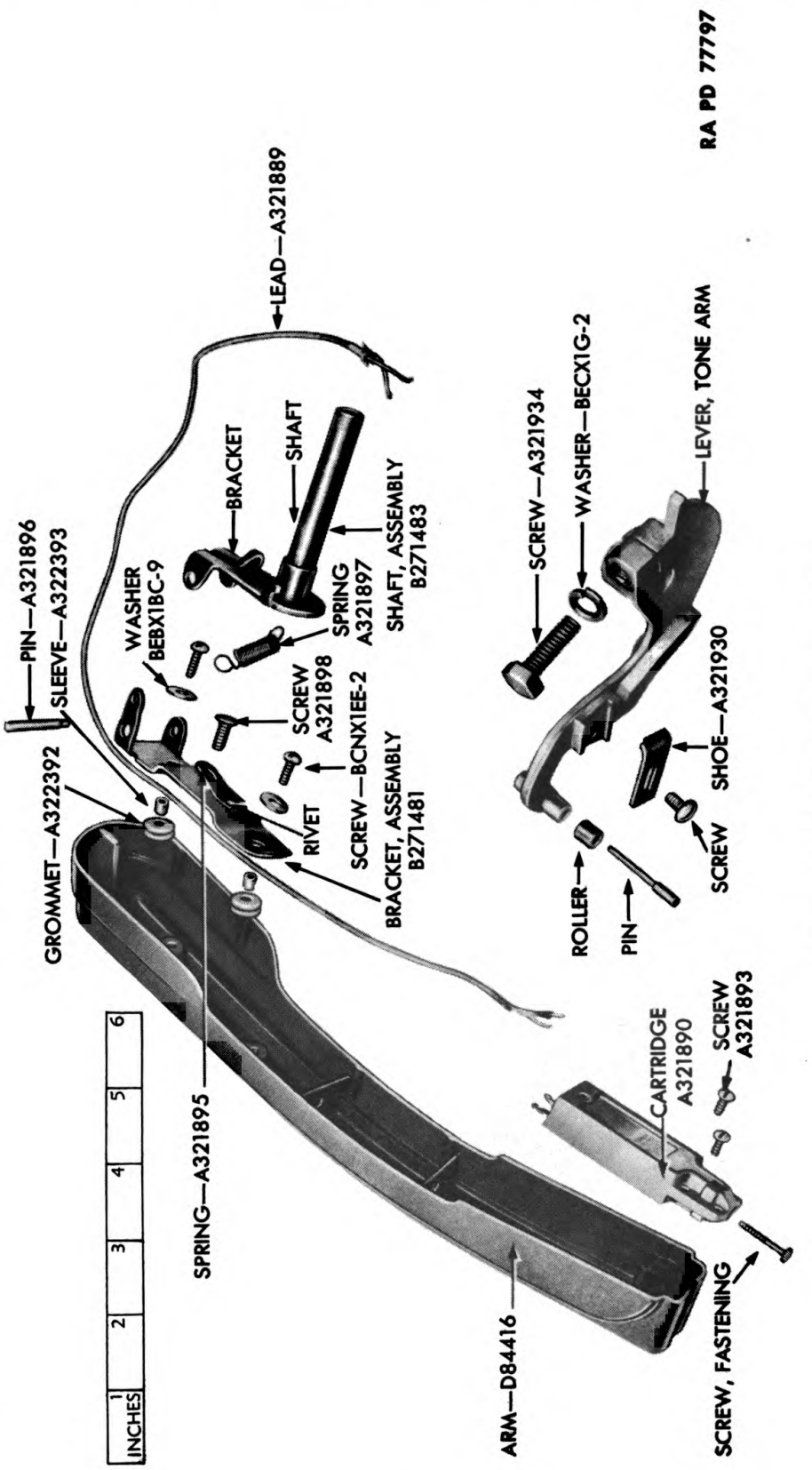


Figure 67 — Tone Arm — Parts

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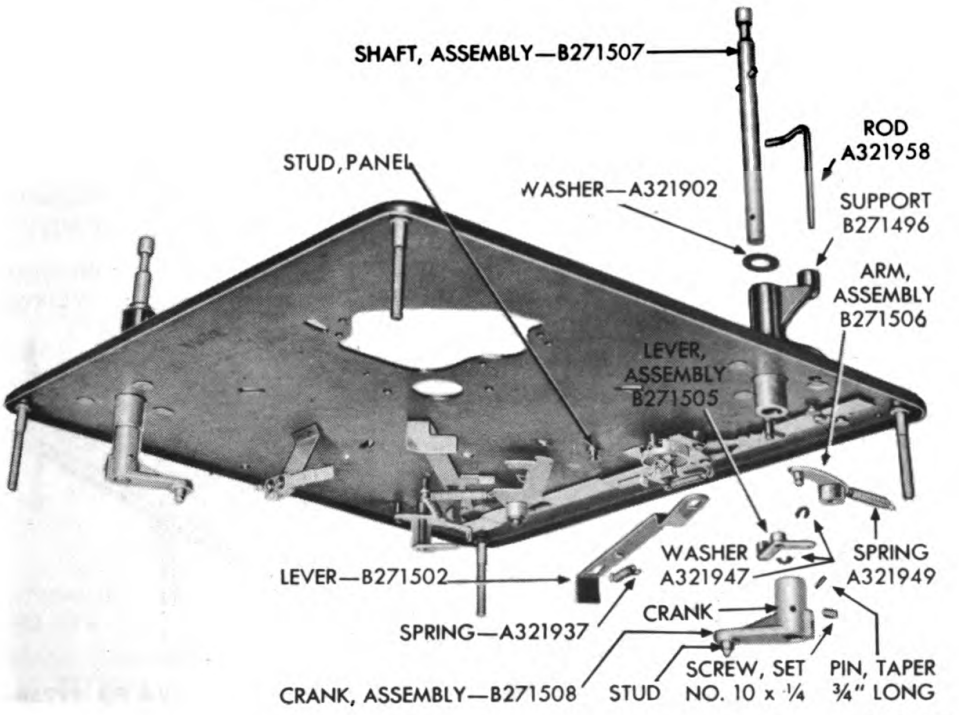


Figure 68 — Removal of Selector Shaft and Related Parts From Record Changer

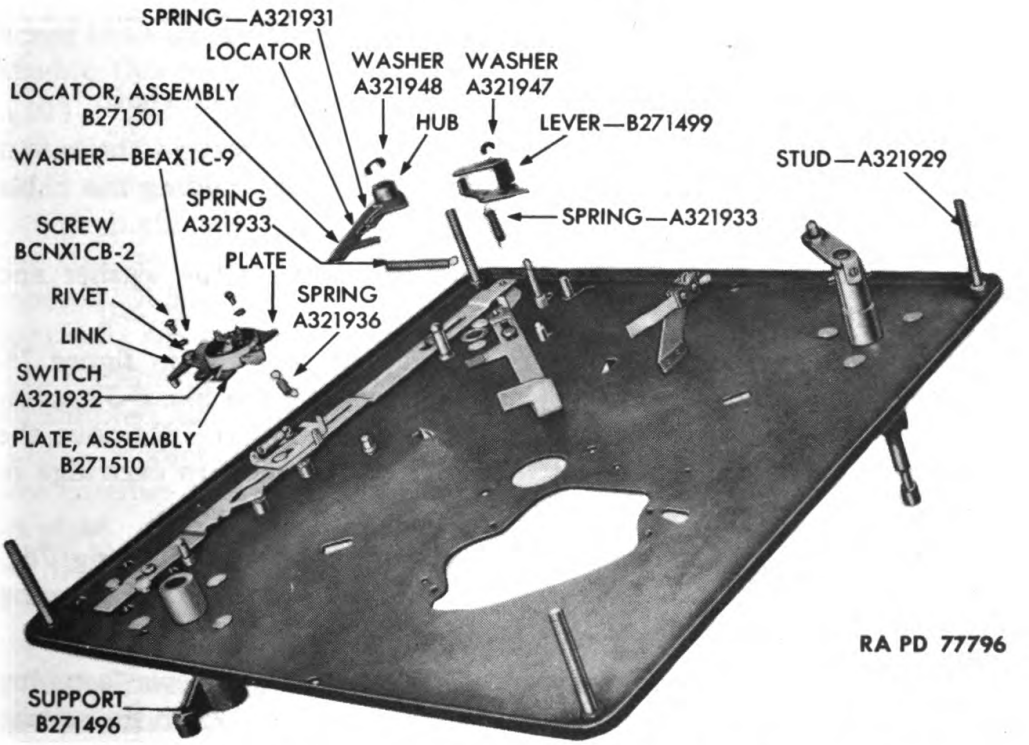


Figure 69 — Removal of Switch, Locator and Related Parts From Record Changer

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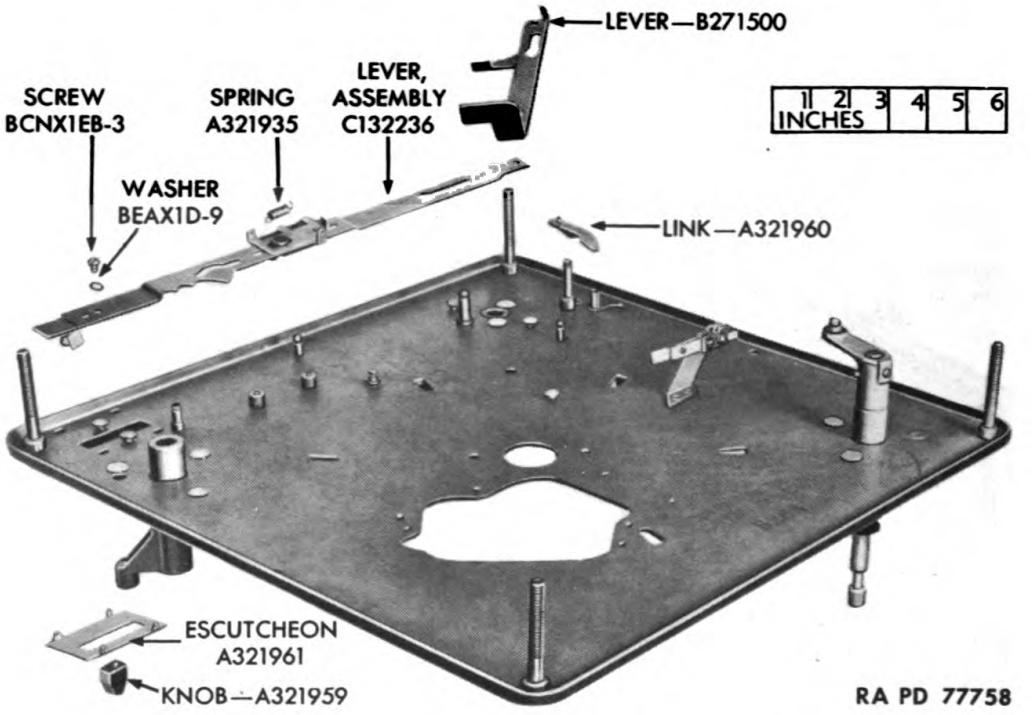


Figure 70 — Removal of Record Reject Lever and Control Lever From Record Changer

(2) The top and bottom views of the record repeater are shown in figures 72 and 73.

(3) Pull the turntable (fig. 74) from the turntable shaft.

(4) Drive out the rivet fastening the pick-up rest to the motor mounting plate. Unscrew the binding head screw holding the cable clamp in position.

(5) Unscrew the hexagonal palnut and remove the washer and pick-up assembly.

(6) The pick-up assembly is shown disassembled in figure 75. Slip the pivots from the die-cast arm and remove the No. 6-32 screw to disassemble the parts attached to the arm support. Remove the screws fastening the repeater trip arm, and the pick-up cartridge in position.

(7) Unsolder the motor and cable leads from the switch (fig. 76). Unscrew the switch nut fastening the switch to the motor mounting plate.

(8) Remove the three hexagonal nuts from the screws fastening the repeater assembly to the motor mounting plate. Loosen the square nut on the screw holding the pointer to the speed regulator post. Drive out the rivets fastening the speed regulator dial in position.

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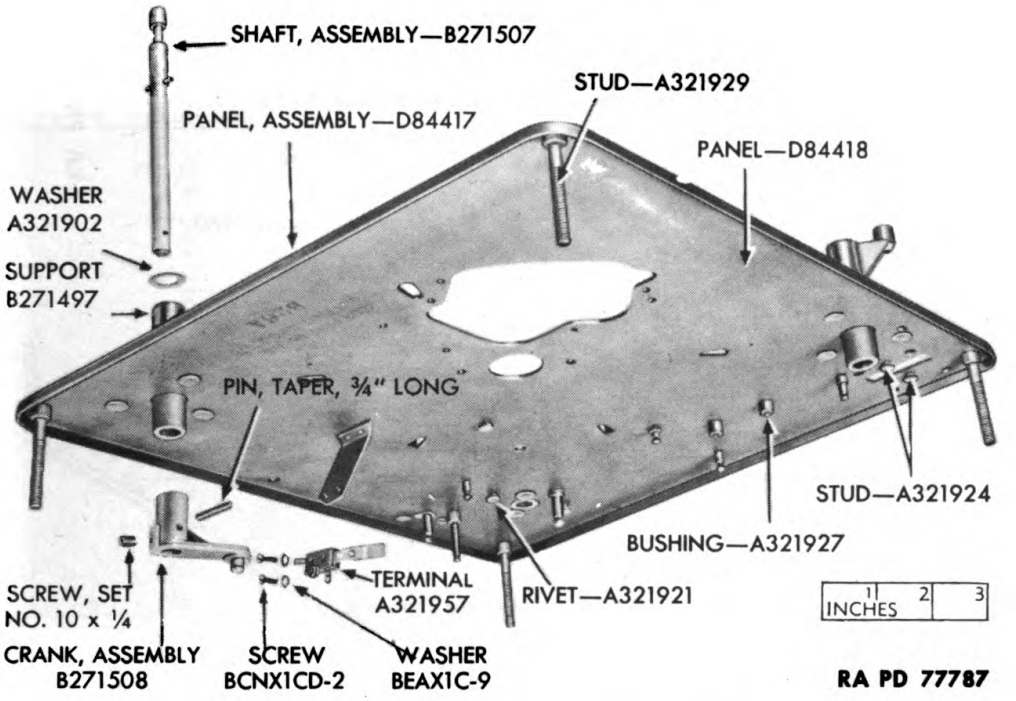


Figure 71 — Removal of Selector Crank and Lead Terminal With Related Parts From Record Changer

(9) Unscrew the knob and worm gear (fig. 77). Remove the binding head screws in the trip arm assembly and pick-up stop to disassemble the repeater assembly.

(10) Remove the hexagonal nuts and four screws fastening the motor assembly to the motor mounting plate (fig. 78).

(11) Unsolder the motor and cable electrical leads. Unscrew the two coil shield mounting screws (fig. 79) to remove the shield. Remove the field coil. Unscrew the screws in the governor housing to remove it. Loosen the set screw in the governor and pull it from the rotor shaft. *Do not attempt to separate the rotor from the shaft.*

(12) The governor housing and associated parts can be further disassembled as shown in figure 80.

(13) Remove the motor mounting brackets (fig. 81) from the frame casting. Remove the rubber support plate and the metal support plate. Remove the screw and pad holder to remove the felt pad from the frame casting.

(14) Disassemble the top plate and associated parts (fig. 82) from the frame casting. Use care not to damage the gasket.

(15) Remove the collar, tension washer, and turntable pin (fig. 83) to separate the turntable shaft and upper drive gear from the top plate. Pull the intermediate shaft and gear assembly from its bearing in the top plate.

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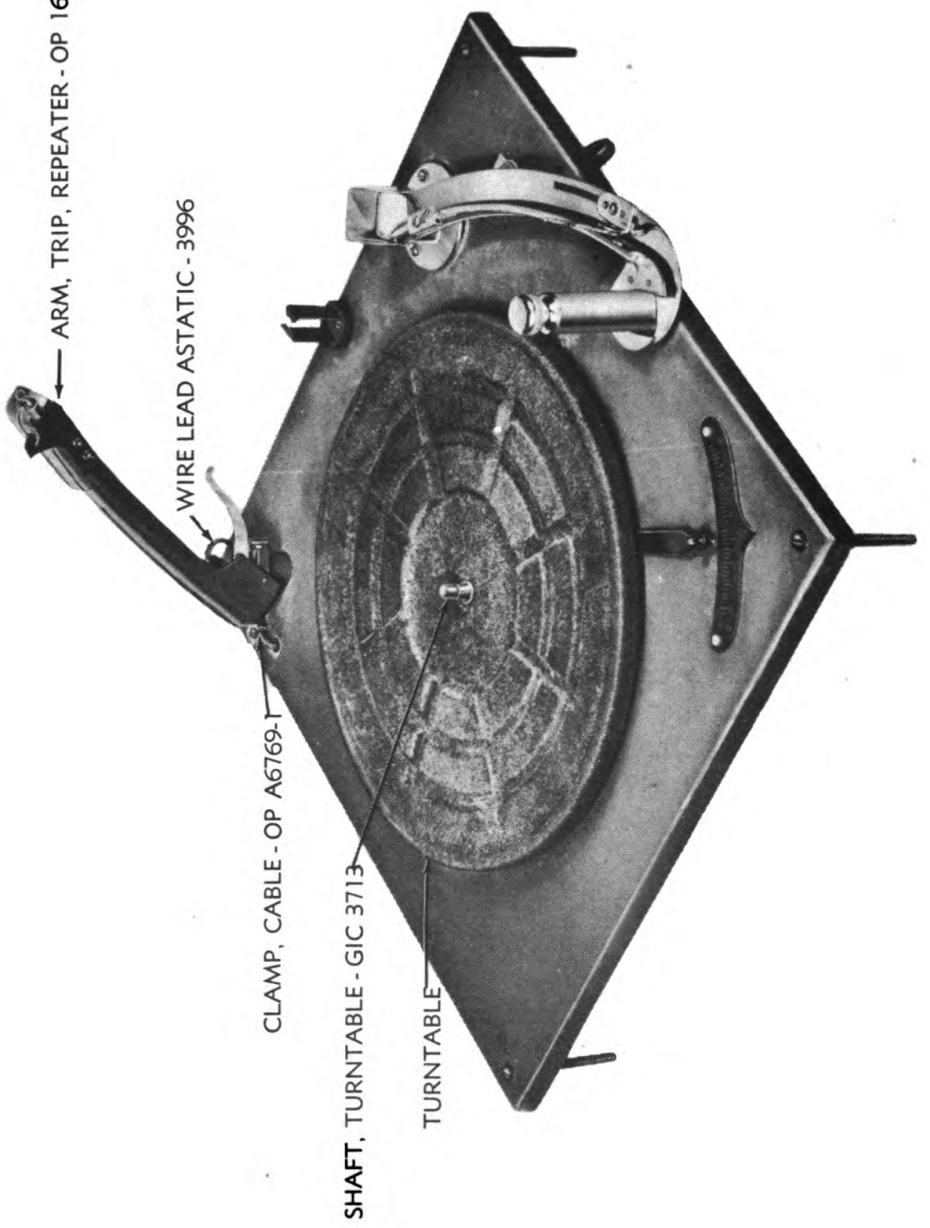


Figure 72 — Record Repeater Mechanism — Top View

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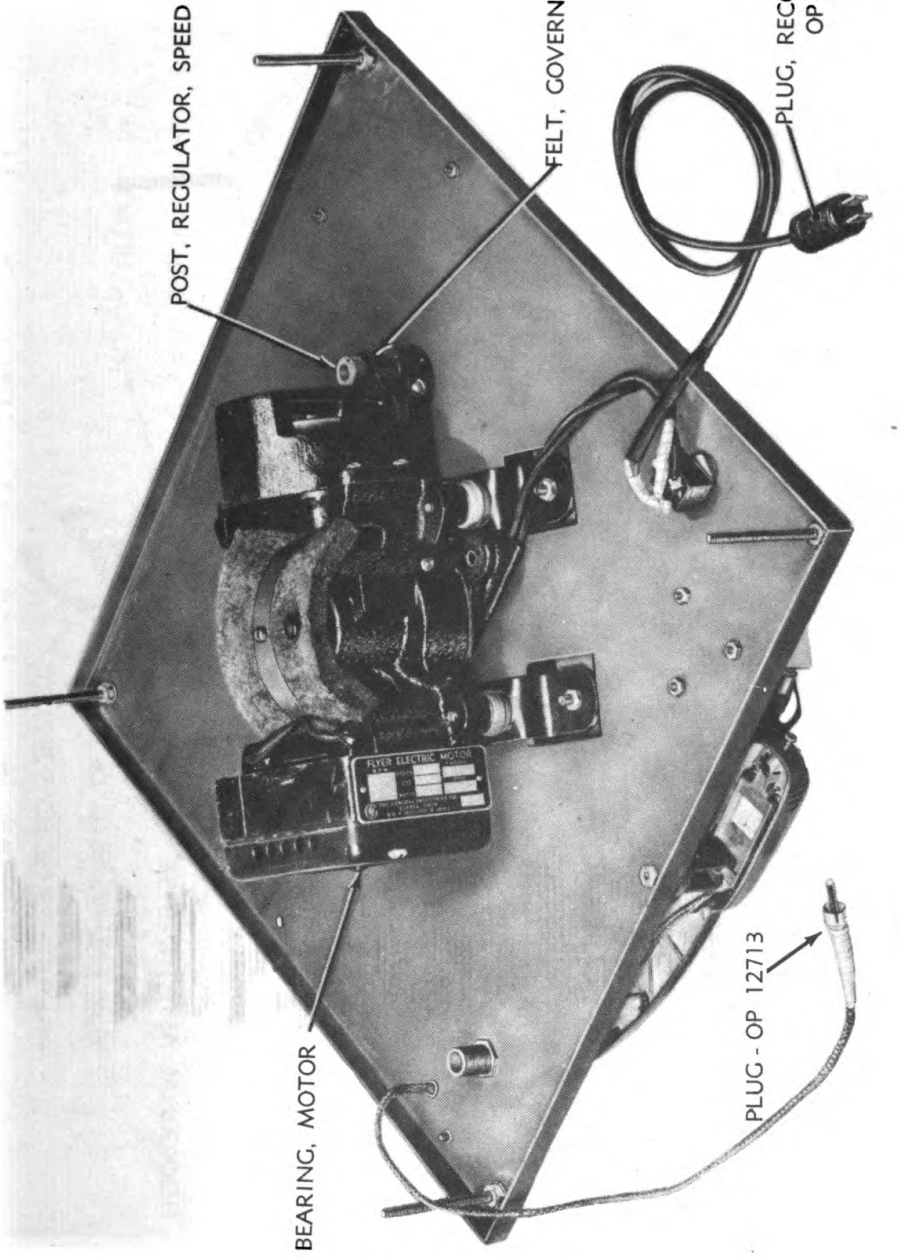


Figure 73 — Record Repeater Mechanism — Bottom View

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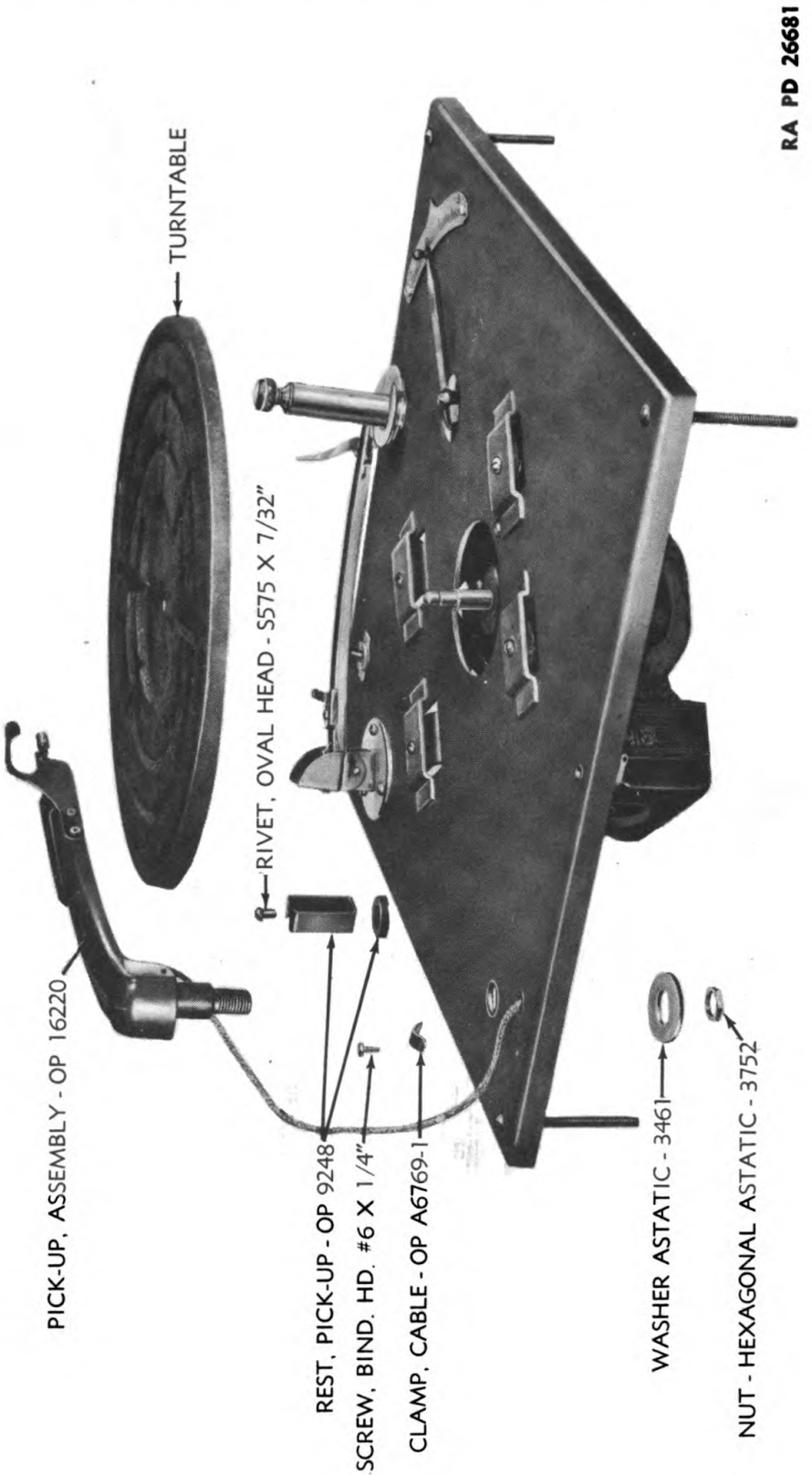


Figure 74 — Removal of Turntable and Pick-up Assembly

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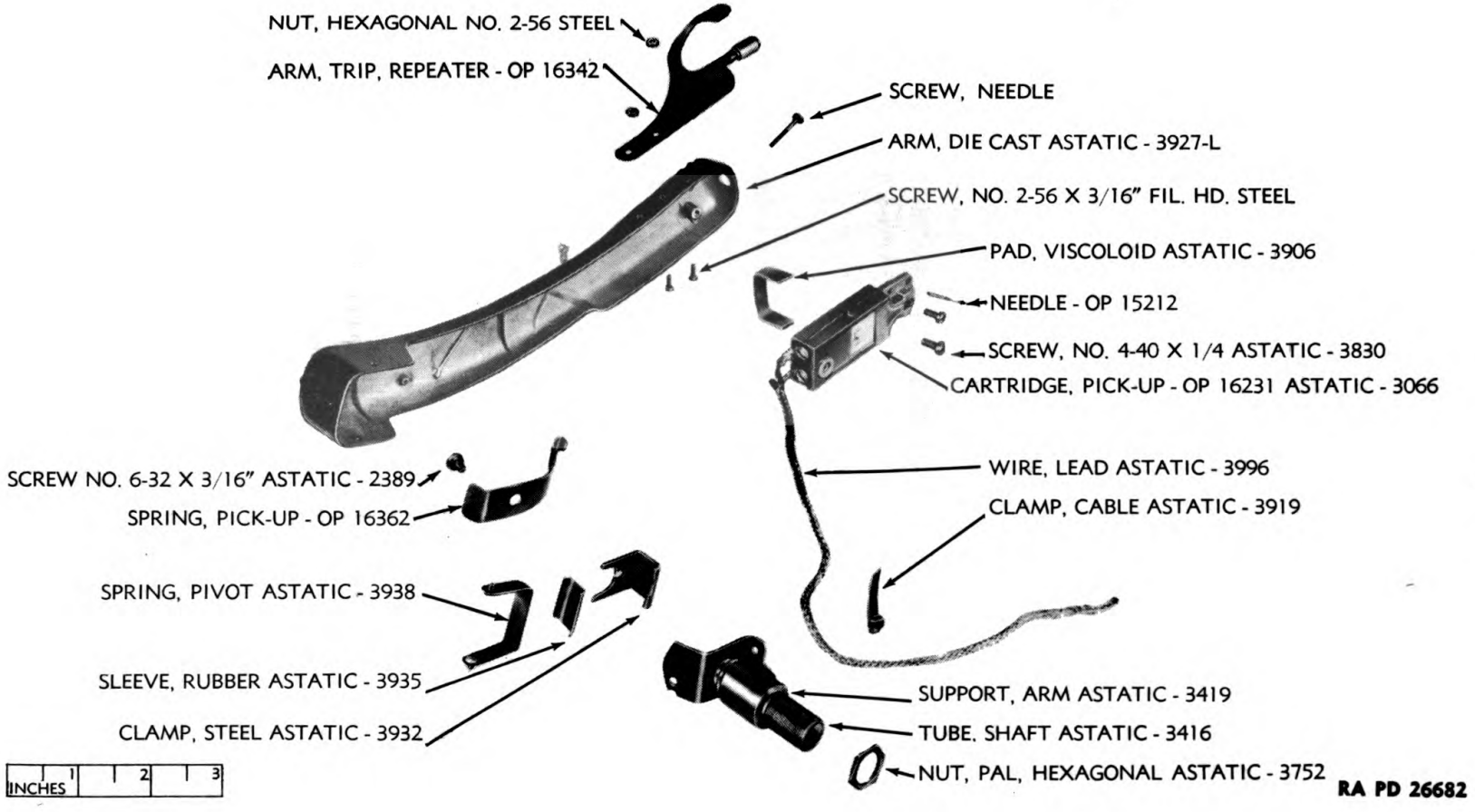


Figure 75 — Parts of Pick-up Assembly

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(16) Pull the clutch shifter arms (fig. 84) from the holes provided in the clutch shifter shaft assembly. This will permit removal of the clutch coupling, lower drive gear, and washer. Slip the rotor and the clutch shifter shafts from their bearings in the frame casting. Pry the spring holding the absorbing pad in position loose from the frame casting to complete the disassembly of the unit.

e. Sound Equipment Speakers.

(1) Consult figures 85 and 86 before proceeding with disassembly.

(2) Remove the wood screws holding the top panels on the speaker cabinet (fig. 87). Remove the 10 wood screws (fig. 88) holding the end panel in place. Remove the panels.

(3) Pull the two speaker plugs from their respective sockets in the power supply unit.

(4) Remove the battle sound speaker by unscrewing the eight screws (with nuts and washers) holding the speaker in place (fig. 89).

(5) Remove the gun sound speaker by unscrewing the four nuts on the mounting bolts (fig. 90).

(6) GUN SOUND SPEAKER.

(a) Remove the speaker support and cord as shown in figure 90.

(b) Separate the gun sound speaker field coil, the hum-bucking coil, the hum-bucking coil locating ring, and speaker cone assembly by removing the four cap screws as shown in figure 91.

(c) Remove the base plate from the speaker cone housing by removing the fillister-head screws (fig. 92).

(d) Separate the speaker cone from the cone housing, and the gasket from the speaker cone by breaking the lightly glued joints.

(e) The field coil is pressed in the housing and cannot be removed readily without disturbing the windings. It must be pried loose (fig. 91).

(7) BATTLE SOUND SPEAKER.

(a) Remove the screw and separate the false pot from the speaker (fig. 93).

(b) Remove the four cap screws from the field coil housing on the battle sound speaker. Break the glue joints and separate the cone and voice coil assembly and the gaskets from the cone housing (fig. 93).

(c) Separate the battle sound speaker field coil from the hum-bucking coil, mounting plate, field coil pot, and speaker housing by removing the four bolts which clamp the unit together (fig. 94).

(d) Break the glue joints in order to remove the inner and outer spider brackets from the battle sound speaker voice coil (fig. 95).

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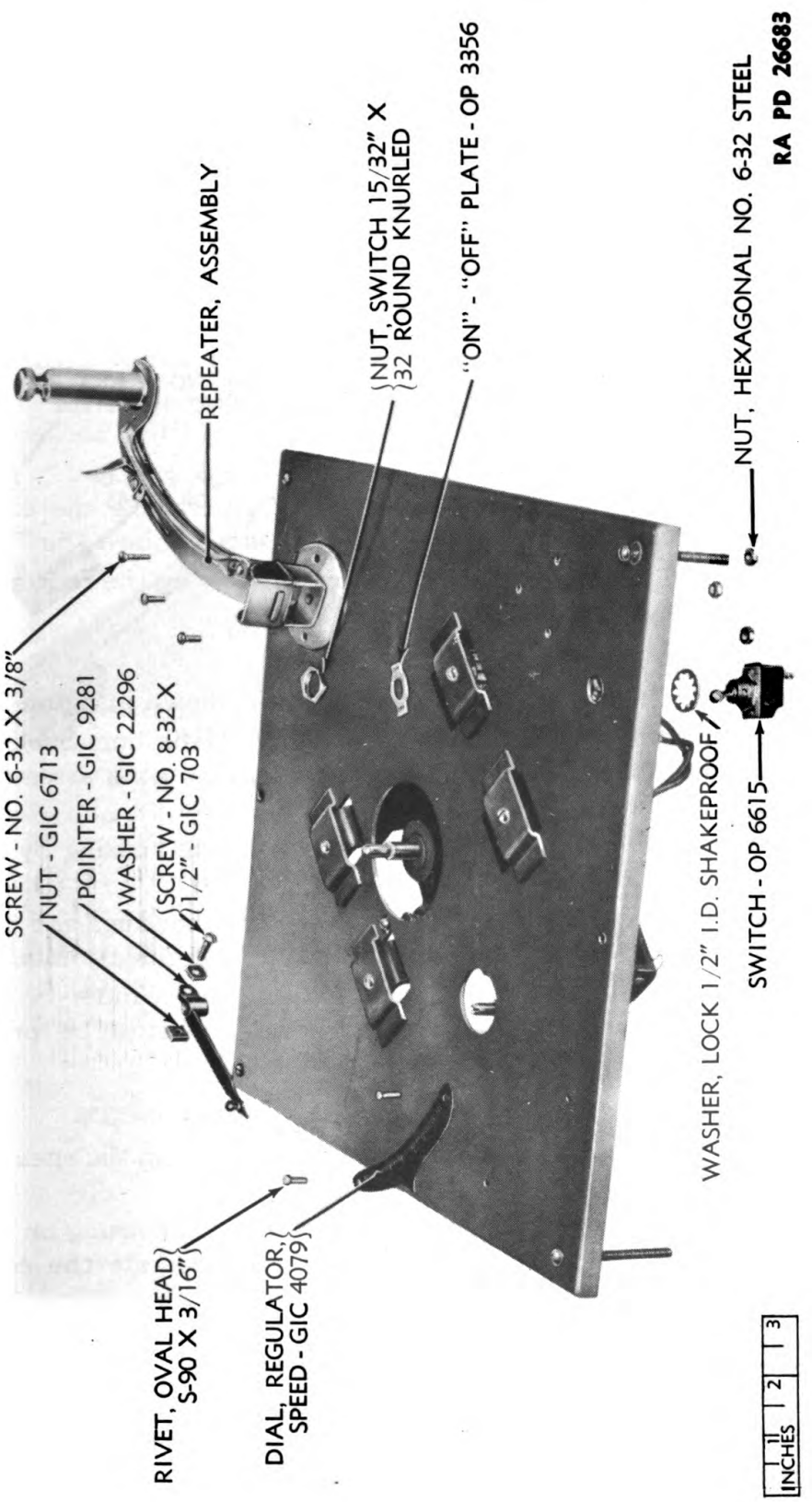


Figure 76 — Removal of Repeater Assembly, Switch, and Speed Regulator Parts

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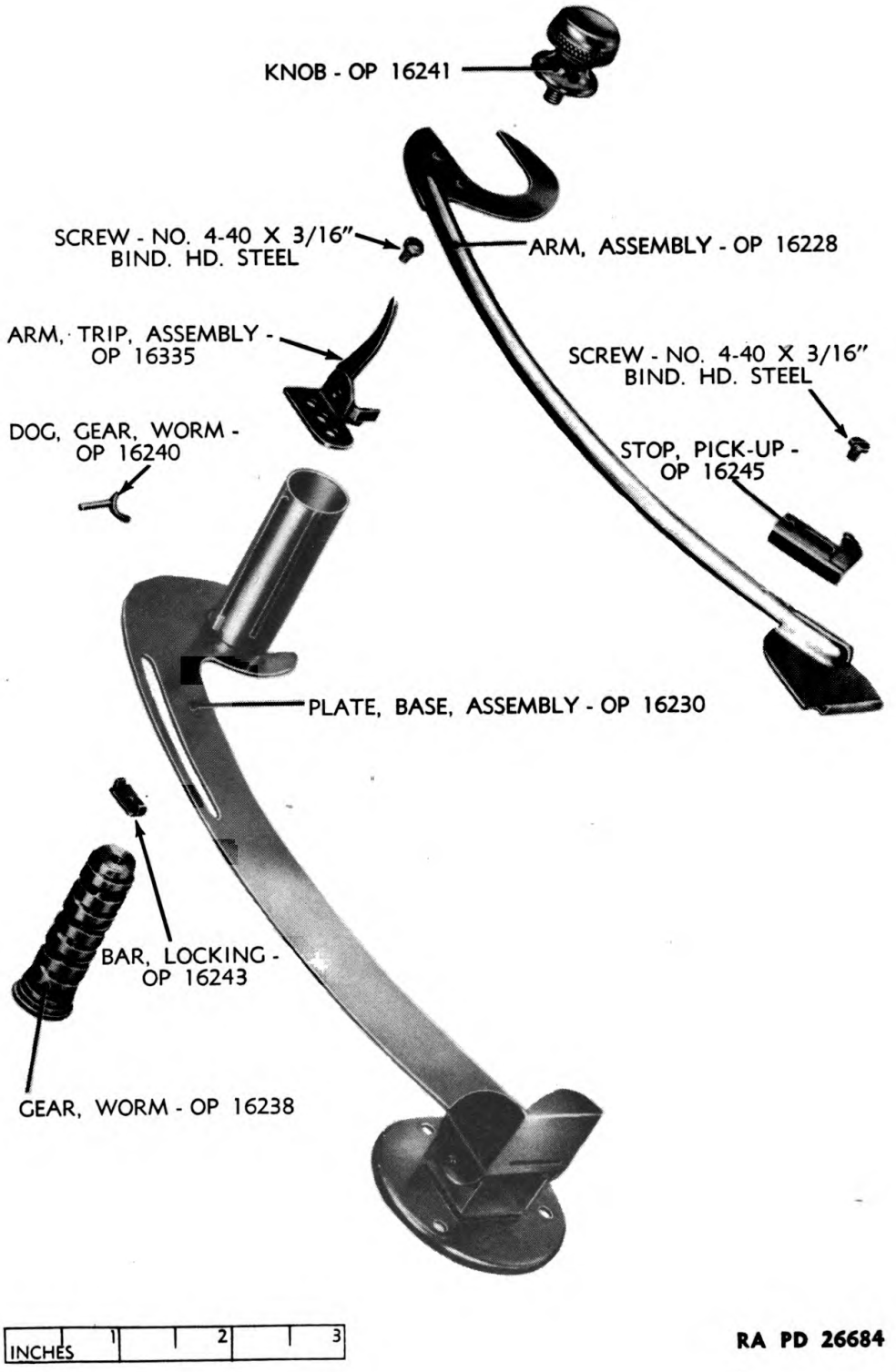


Figure 77 — Parts of Repeater Assembly

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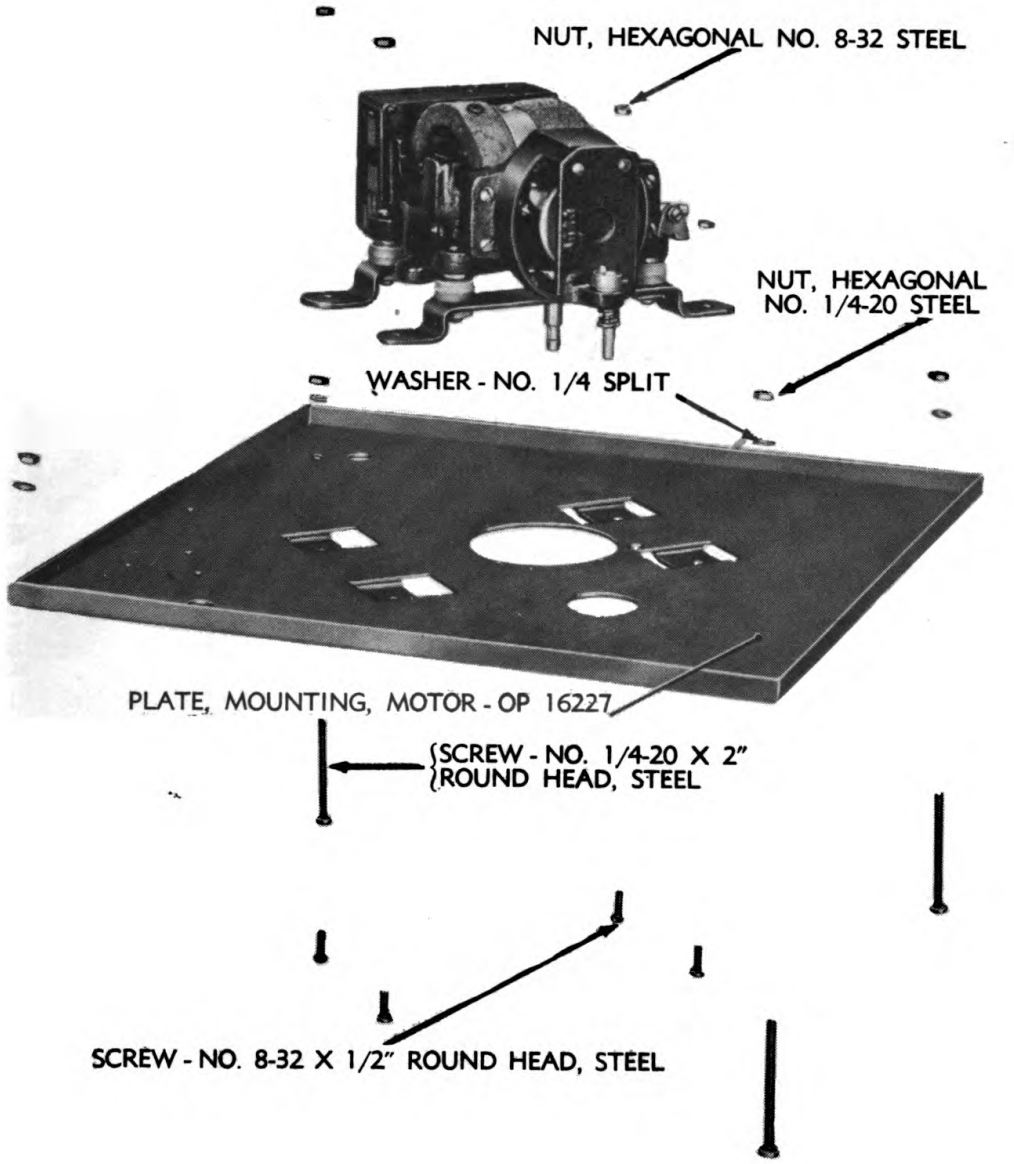


Figure 78 — Removal of Motor From Motor Mounting Plate

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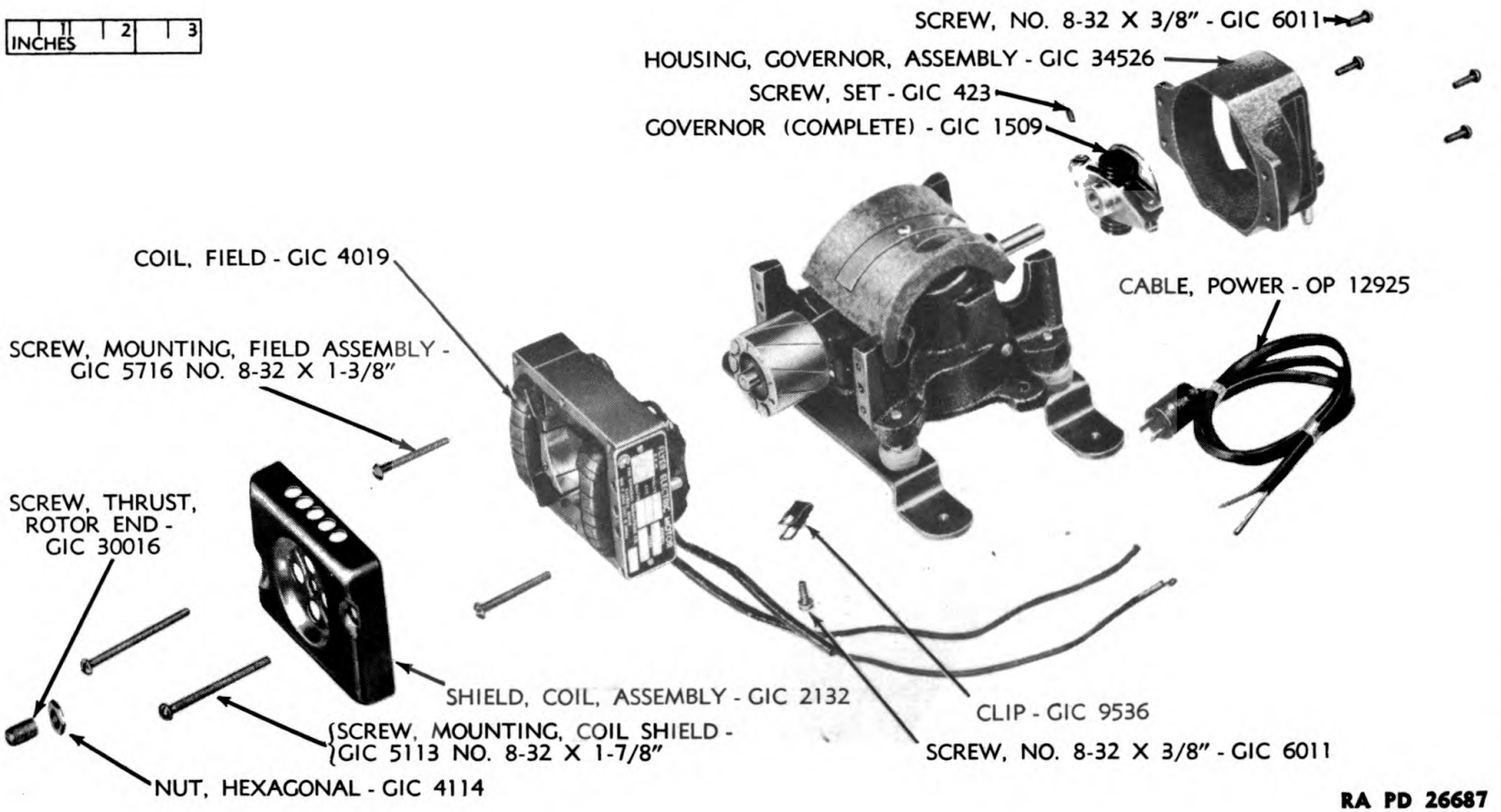


Figure 79 — Parts of Motor

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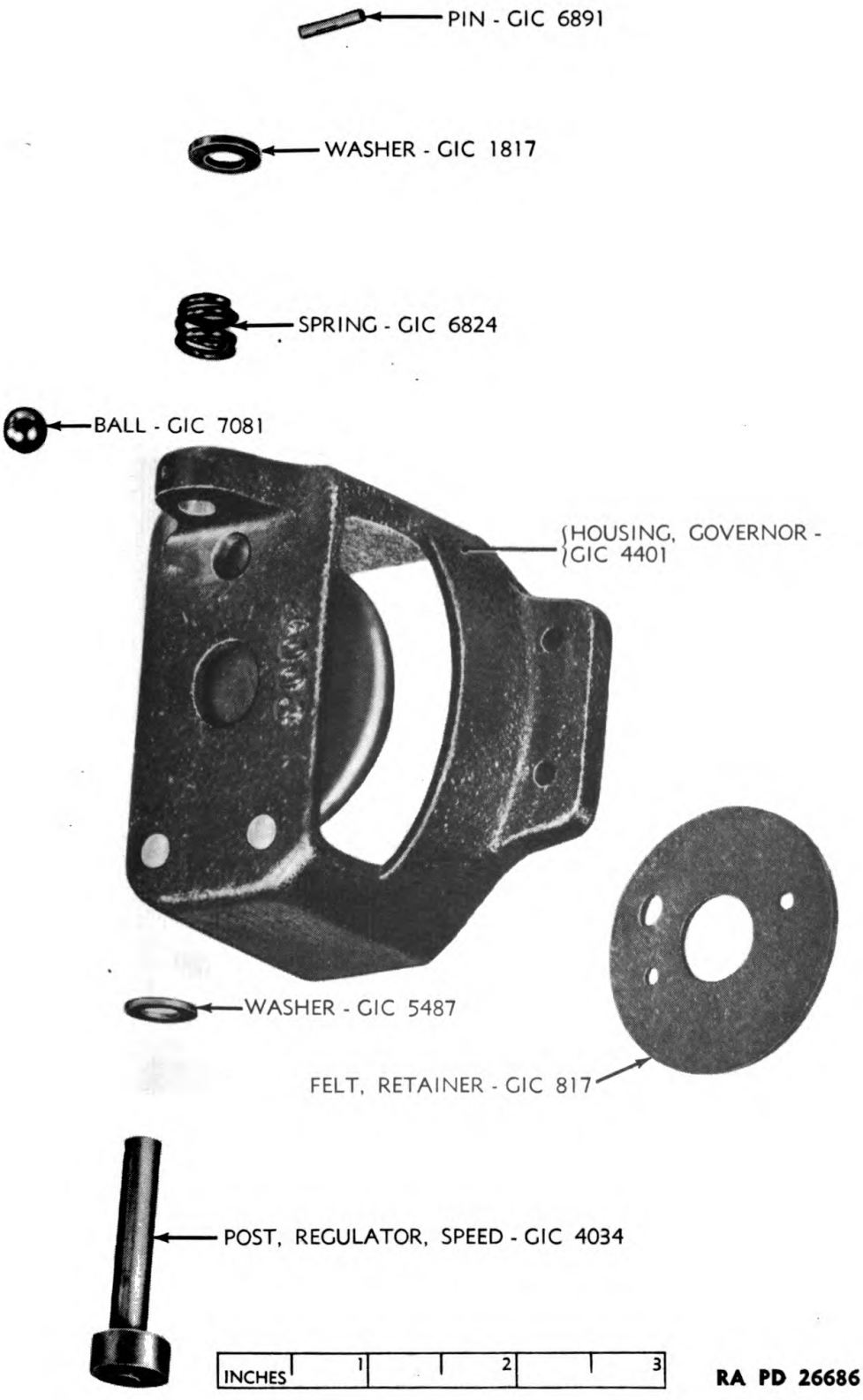


Figure 80 — Parts of Speed Regulator

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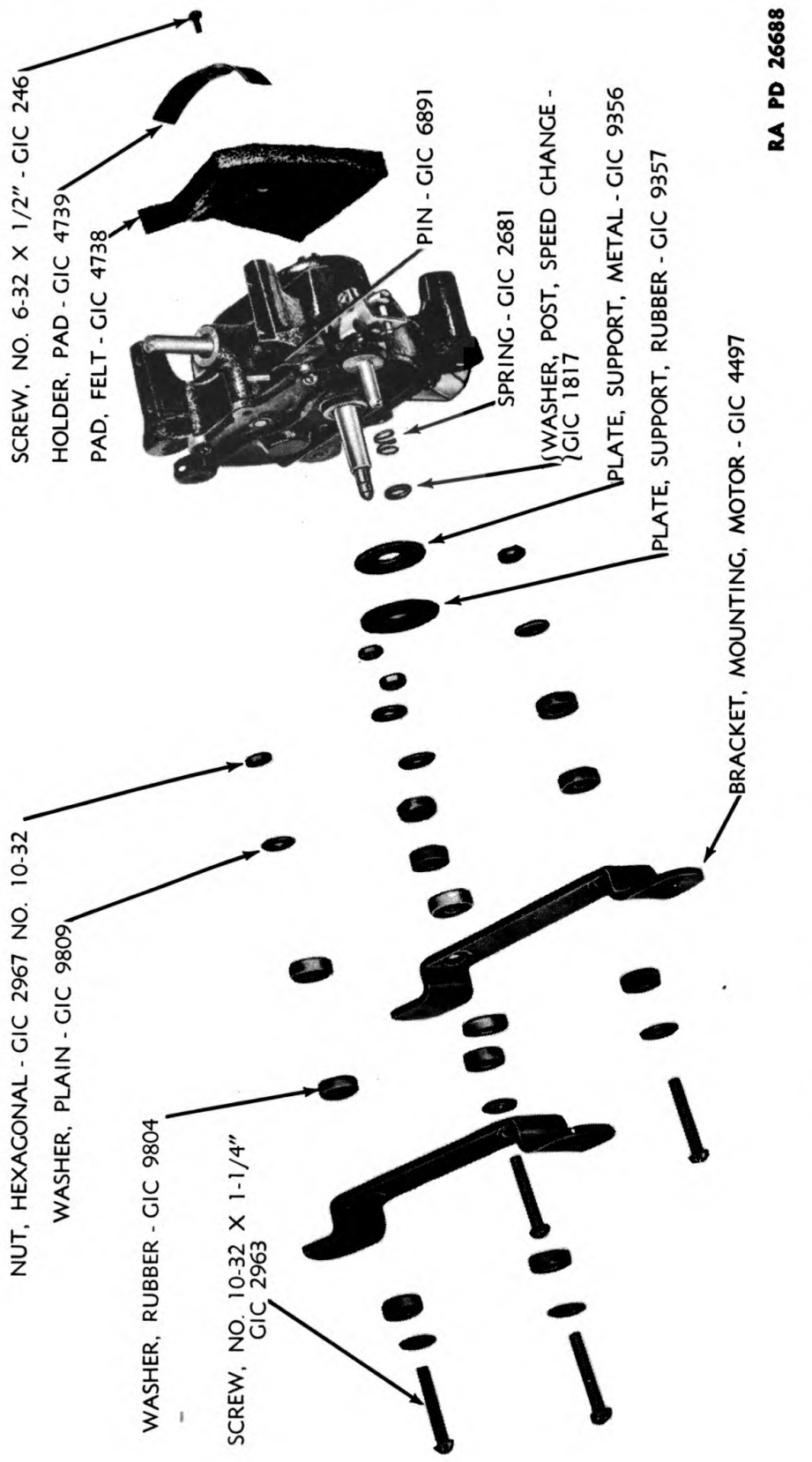


Figure 81 — Removal of Mounting Bracket and Felt Pad

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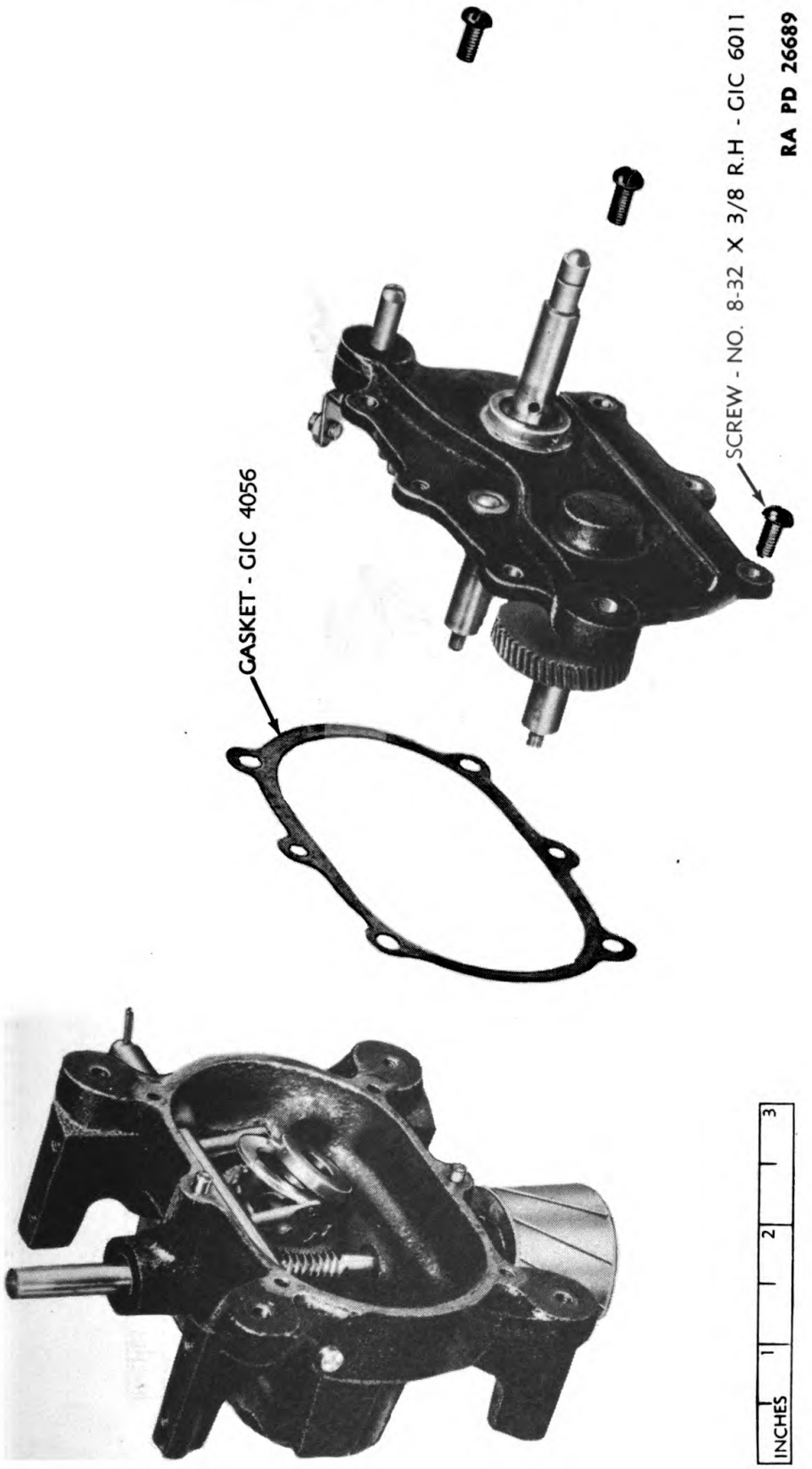


Figure 82 — Frame Casting With Gasket and Top Plate Removed

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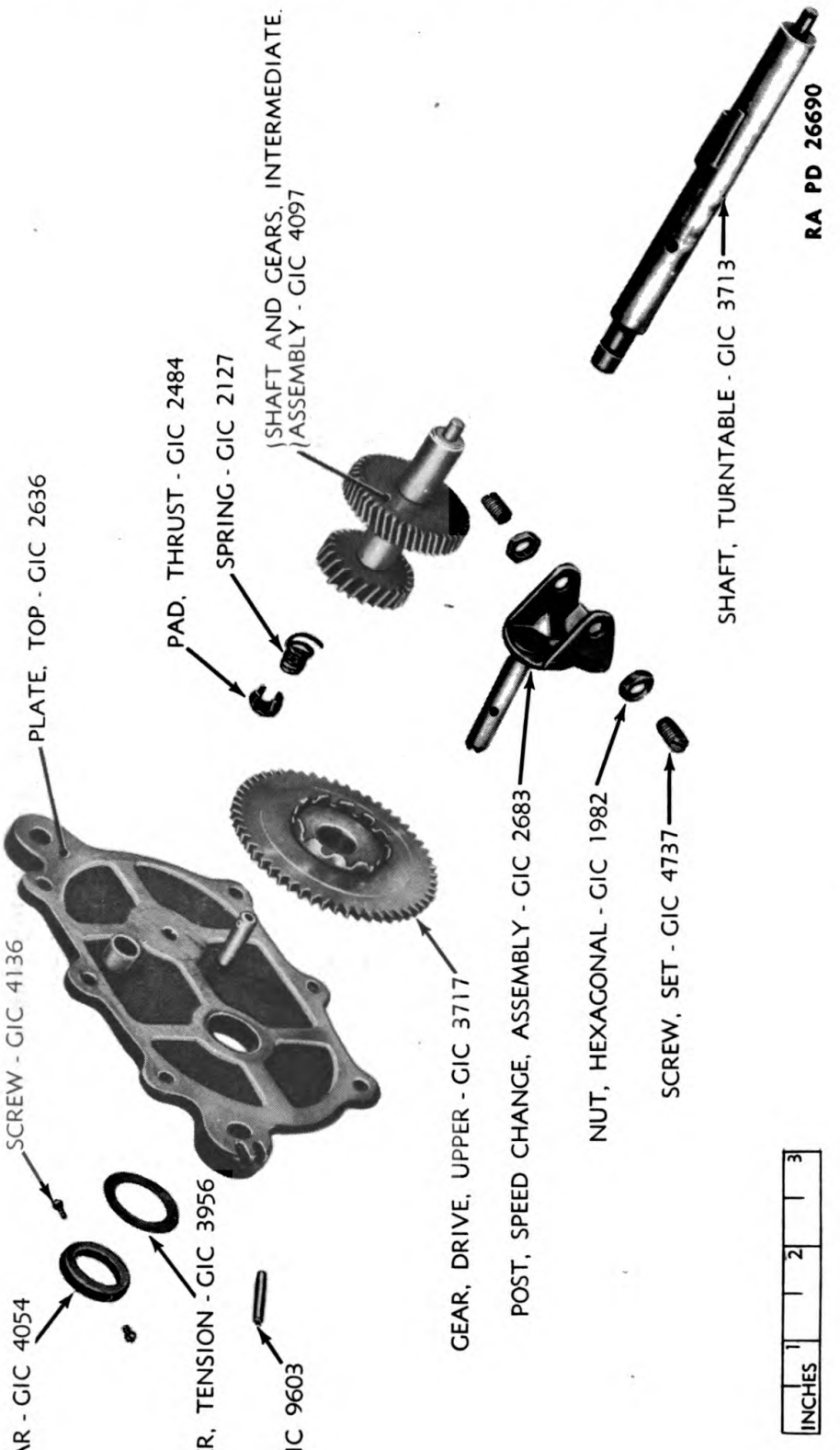


Figure 83 — Parts of Top Plate

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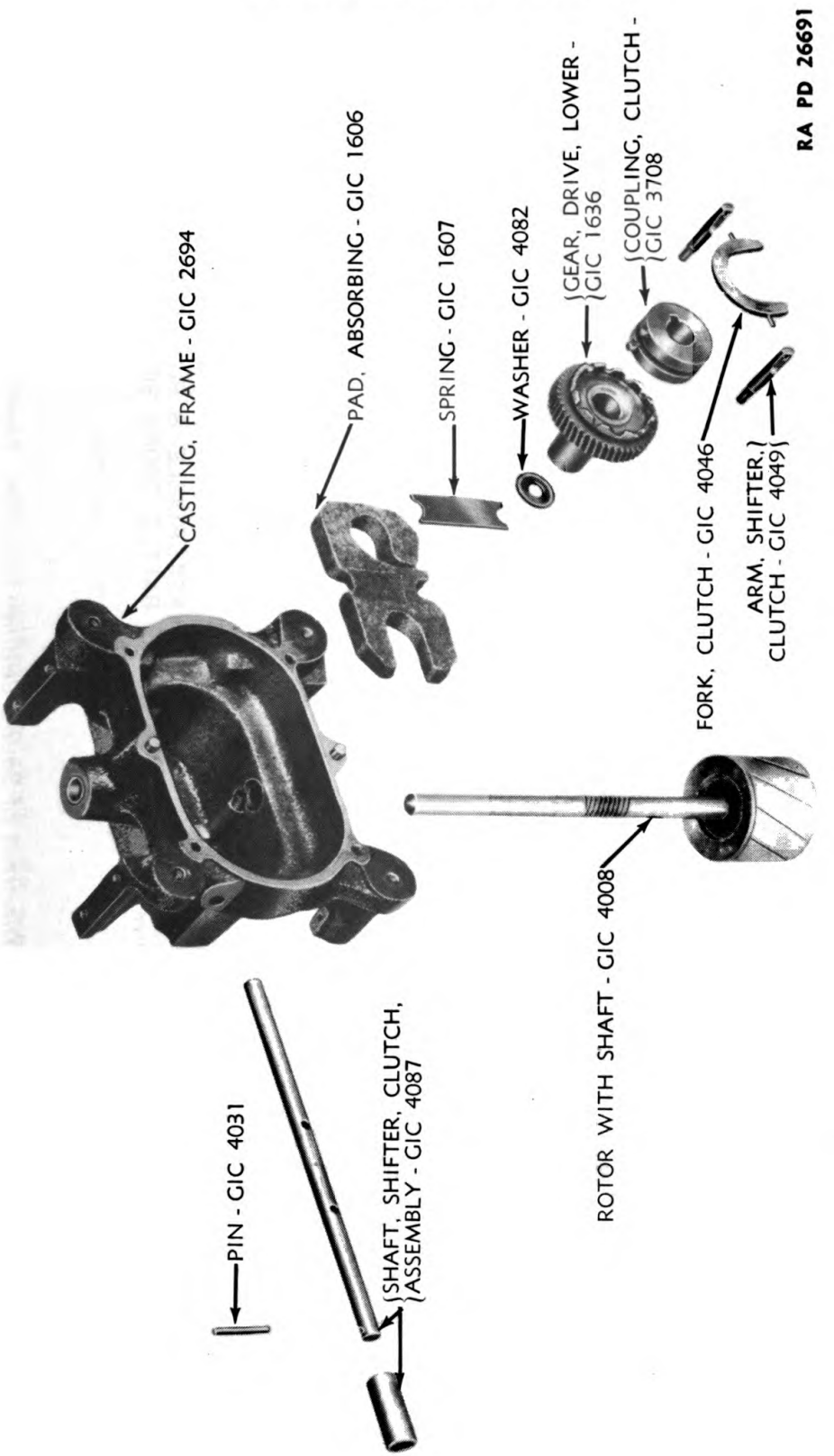
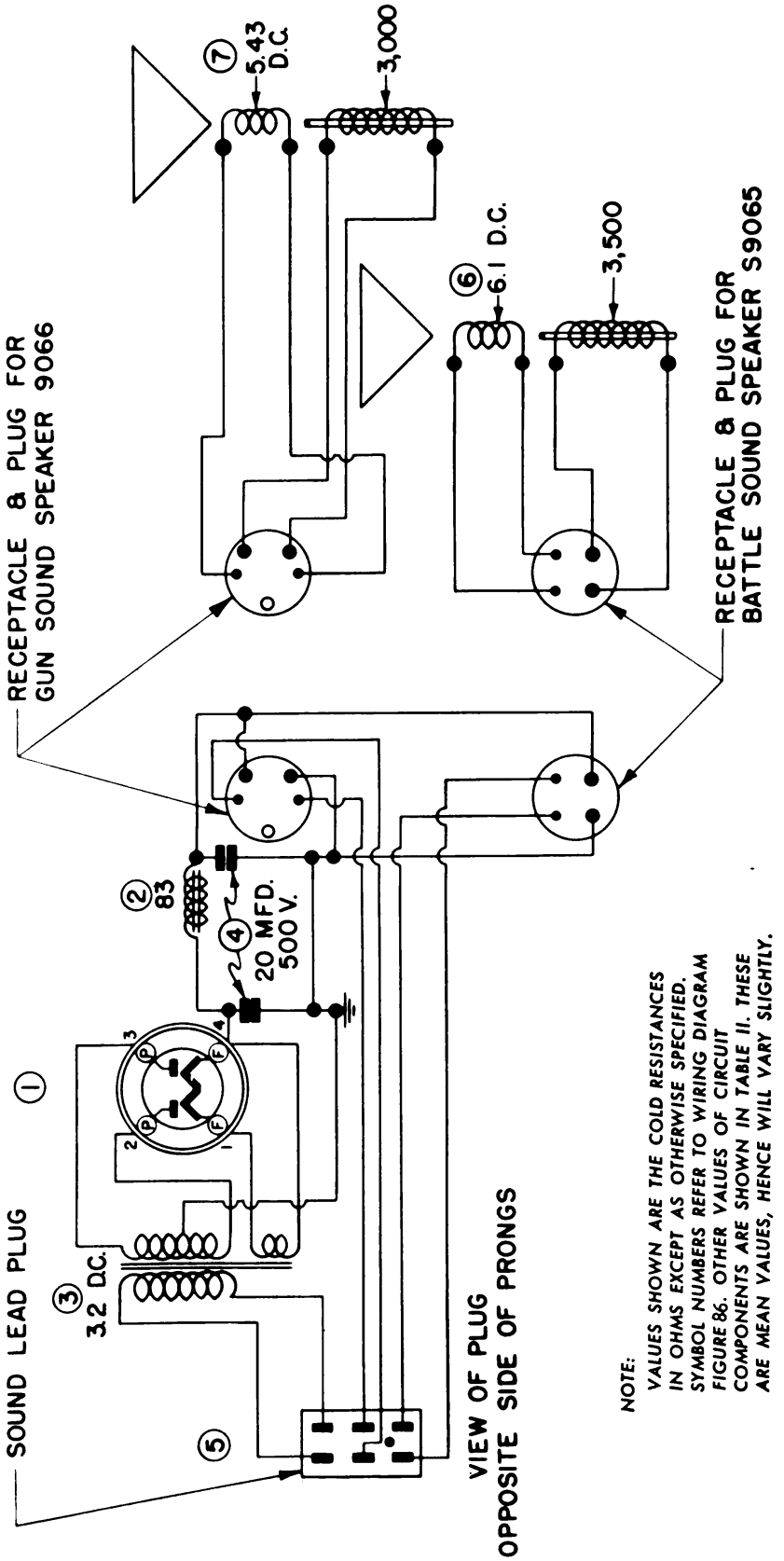


Figure 84 — Removal of Parts From Frame Casting

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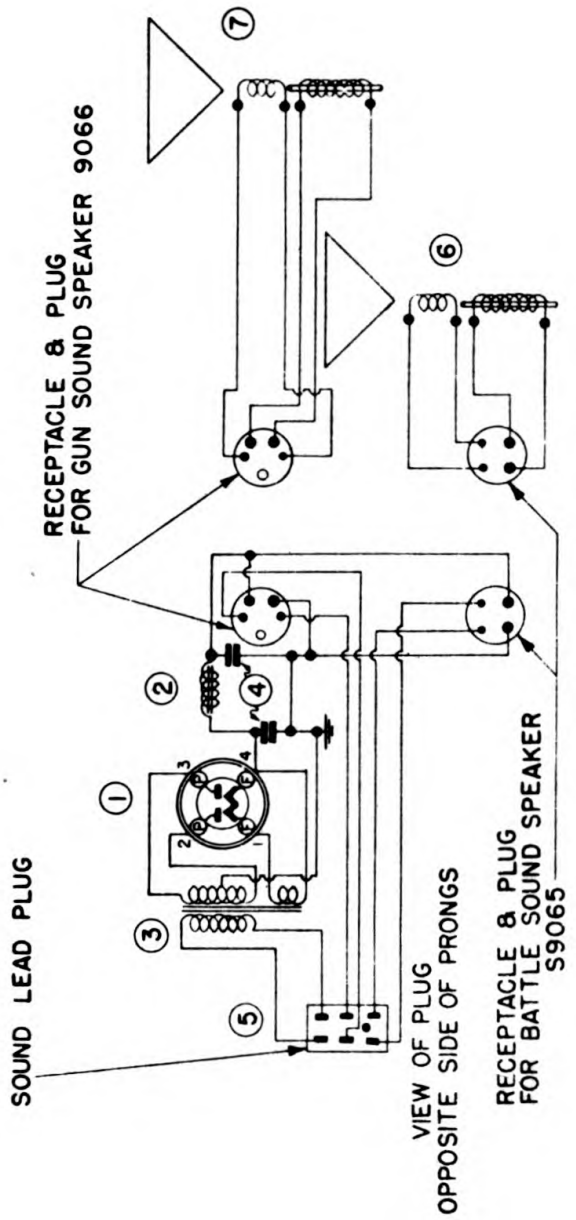


NOTE:
VALUES SHOWN ARE THE COLD RESISTANCES IN OHMS EXCEPT AS OTHERWISE SPECIFIED. SYMBOL NUMBERS REFER TO WIRING DIAGRAM FIGURE 86. OTHER VALUES OF CIRCUIT COMPONENTS ARE SHOWN IN TABLE II. THESE ARE MEAN VALUES, HENCE WILL VARY SLIGHTLY.

Figure 85 — Circuit Checking Diagram of Sound Cabinet Including Power Supply Unit

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ITEM NO.	PART DESCRIPTION
1	RECTIFIER TUBE
2	CHOKE
3	POWER TRANSFORMER
4	CONDENSER 20 MFD. 500 V.
5	6 PRONG PLUG
6	CONE HOUSING ASSEMBLY
7	CONE HOUSING ASSEMBLY

Figure 86 — Wiring Diagram of Sound Cabinet Including Power Supply Unit

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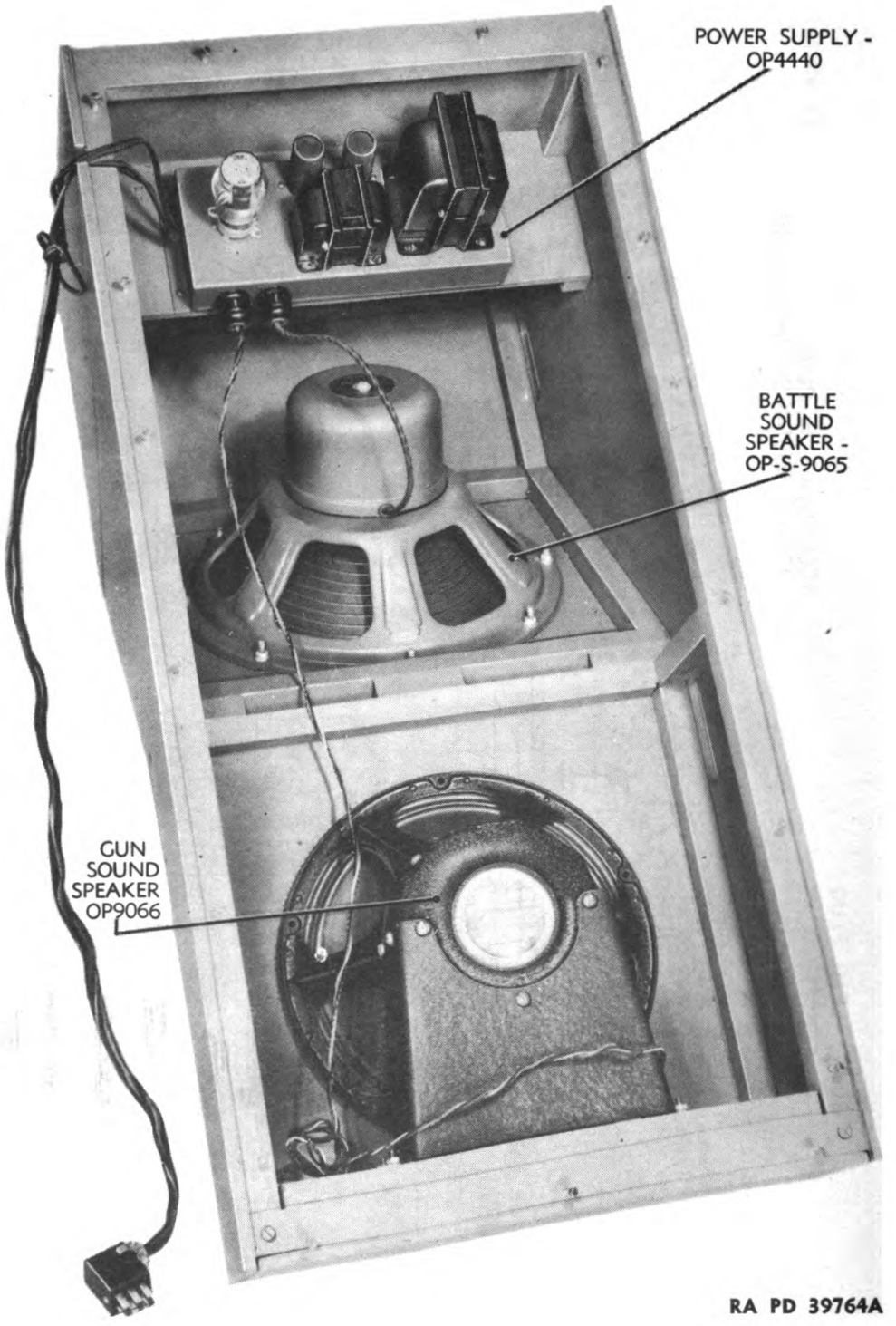


Figure 87 — Interior of Speaker Cabinet — Top View

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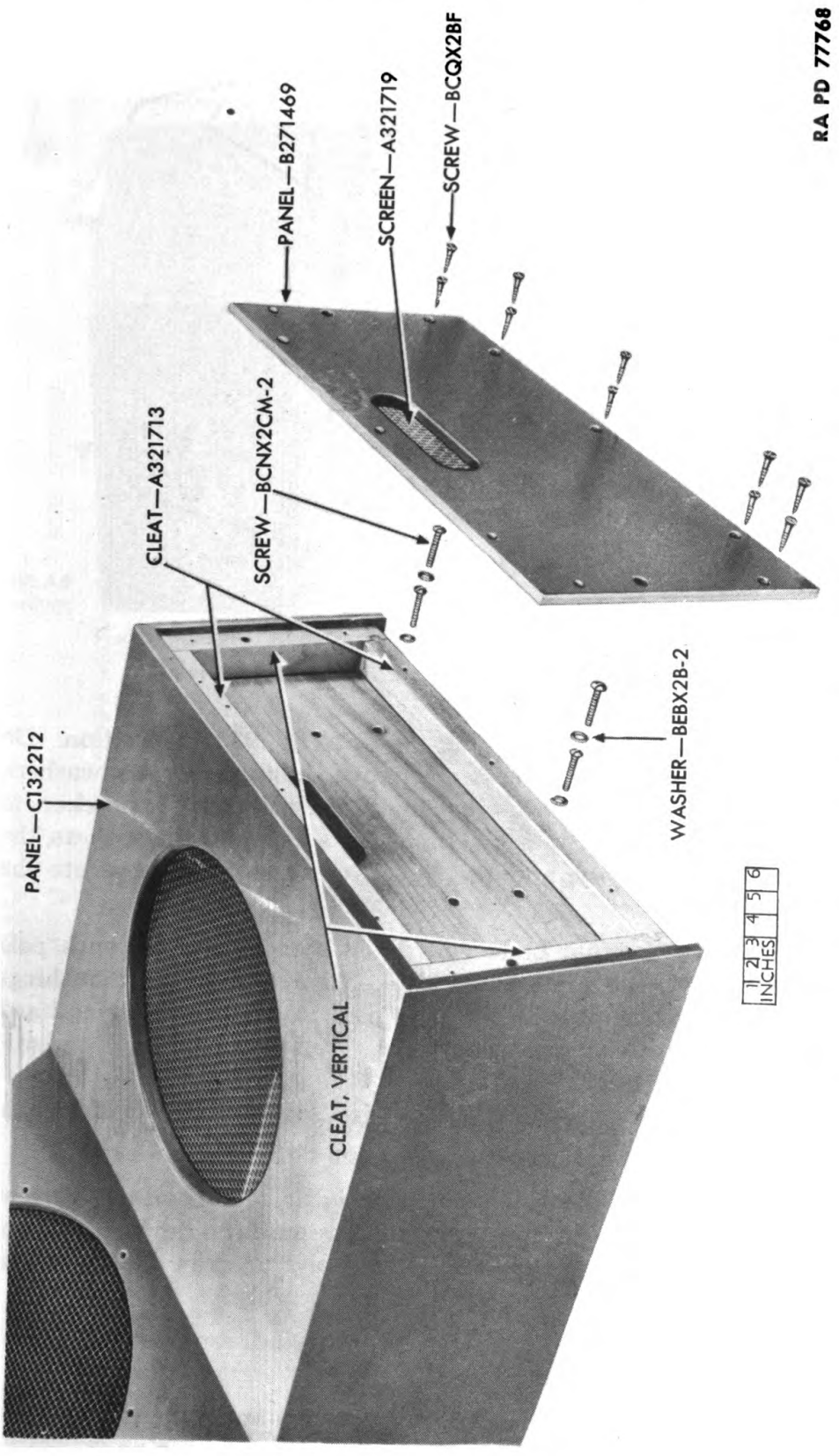


Figure 88 — Removal of Front Panel From Speaker Cabinet

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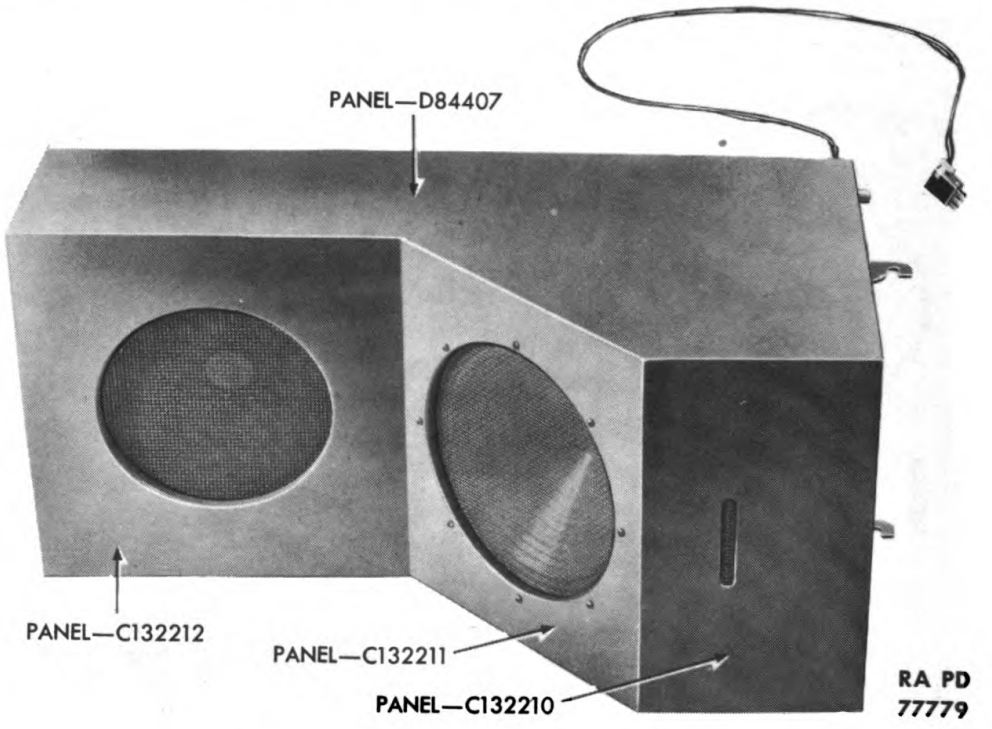


Figure 89 — Speaker Cabinet — Bottom View

(8) Remove the screw holding the pot (fig. 93) in position. Do not misplace the gasket or spacer. Remove the three screws, washers, lock washers and hexagonal nuts fastening the coil support brackets to the housing assembly. Break the glue joints between the gaskets, the coil with cone assembly, and the housing assembly to separate the parts from each other.

(9) Remove the four bolts (fig. 94) fastening the pot with pole piece assembly to the plate assembly. Drive out the four bushings holding the plate assembly to the housing. Pull the bucking coil and field coil assembly from the pole piece. Unsolder the leads to separate the coils from each other.

(10) The inner and outer brackets (fig. 95) may be separated from the cone by breaking the glue joint between the parts.

NOTE: If the battle sound speaker is provided with a current limiting device (fig. 96), remove and disassemble the device as shown in figure 97. Unsolder the electrical leads and unscrew the five fillister-head drive screws to complete the disassembly.

(11) Unscrew the four mounting nuts and remove the power supply unit from the cabinet (fig. 98).

(12) Loosen the screw in the tube clamp and pull the rectifier tube (fig. 99) from its socket. The cover of the power pack can be

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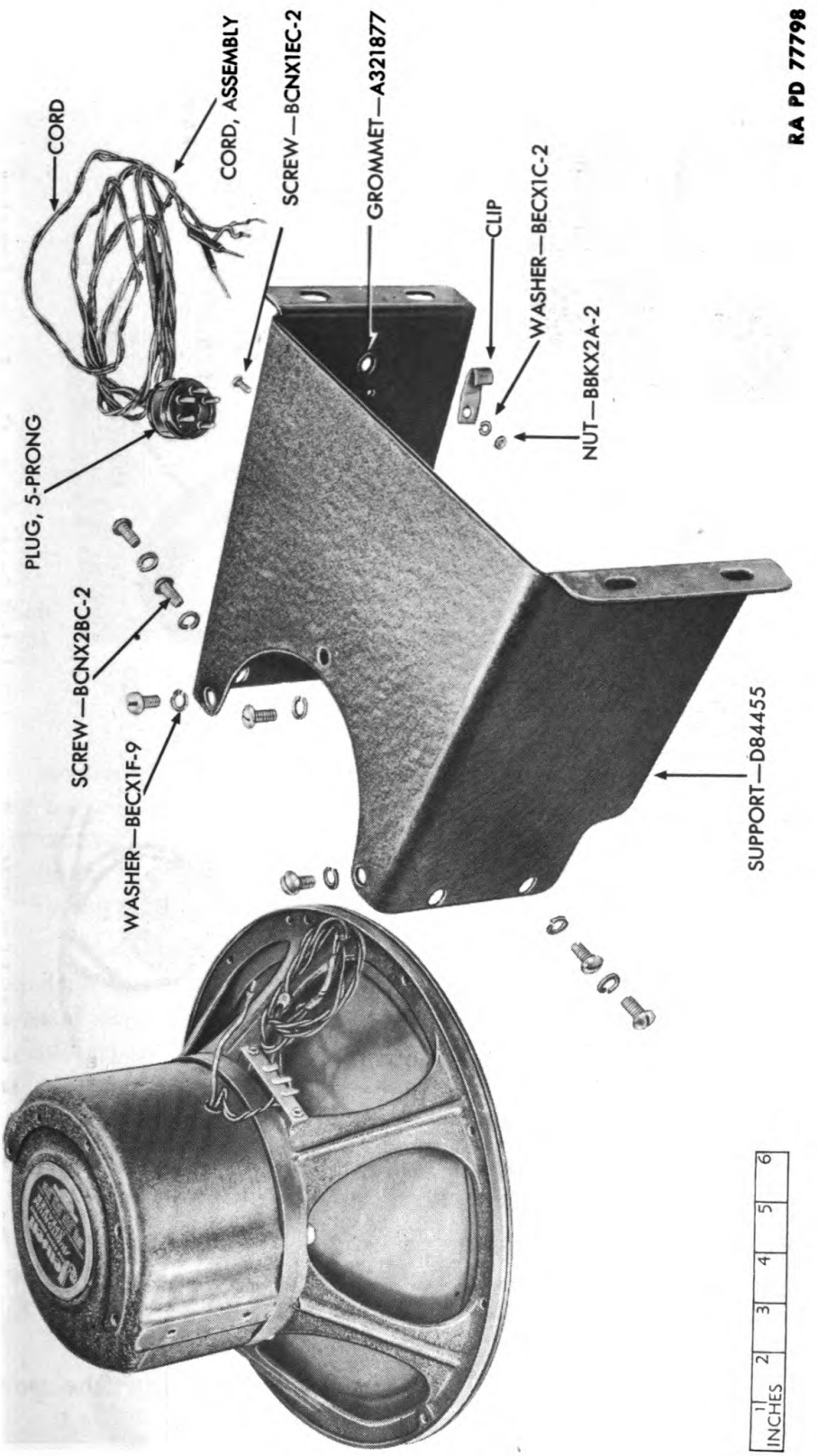


Figure 90 — Removal of Support and Related Parts From Gun Sound Speaker

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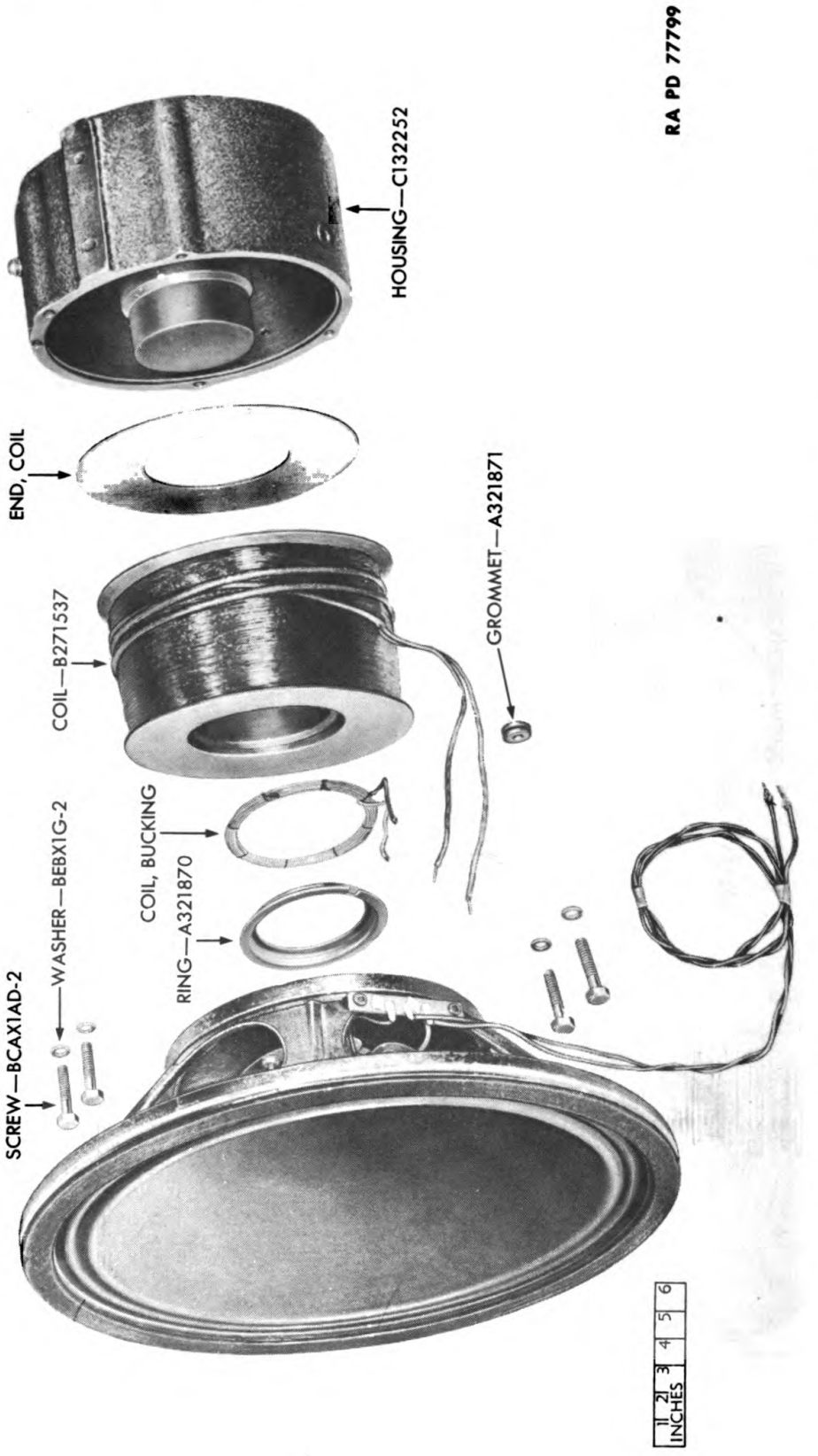


Figure 91 — Removal of Field Coil Housing and Related Parts From Gun Sound Speaker

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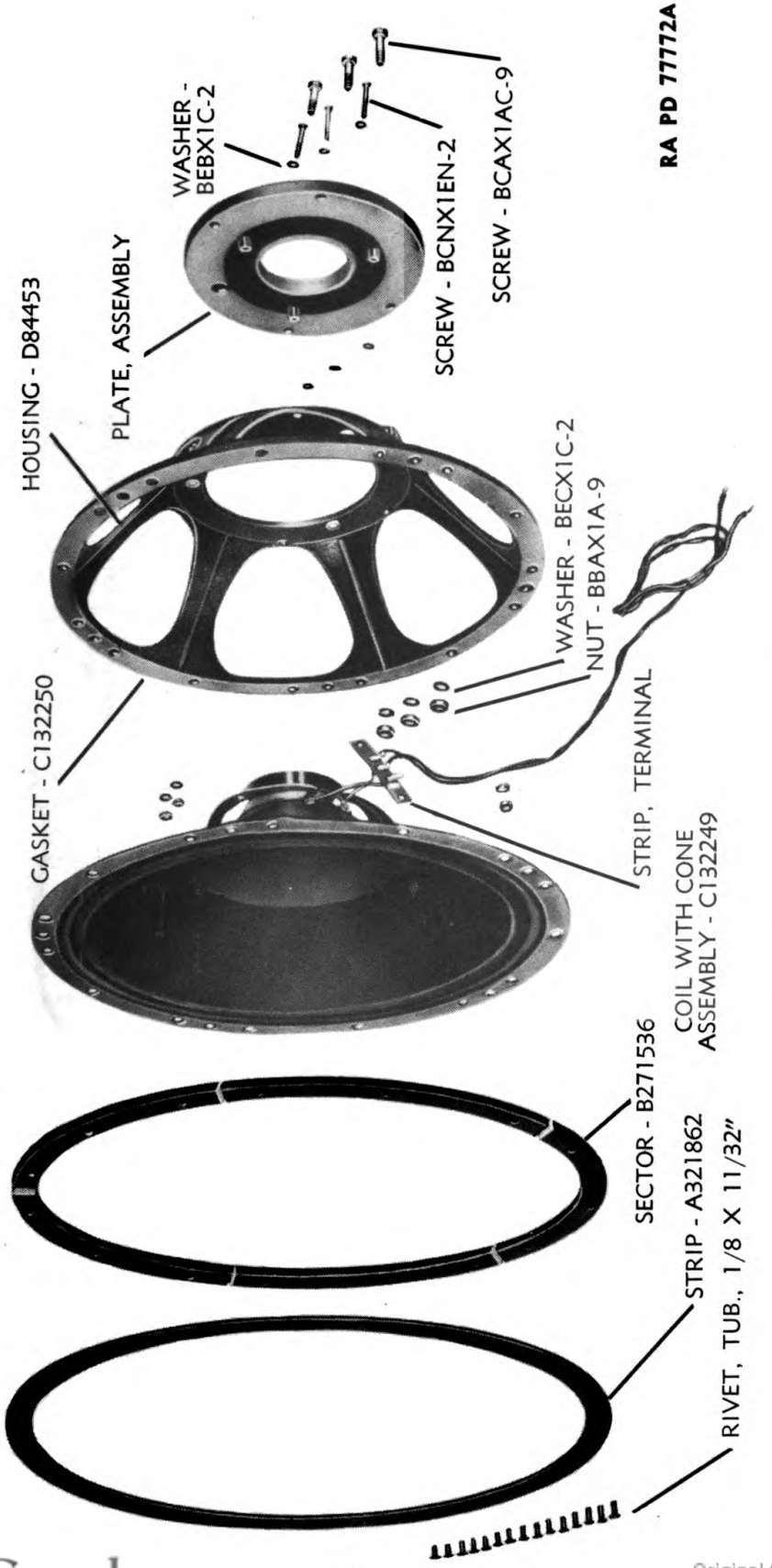


Figure 92 — Gun Sound Speaker — Parts

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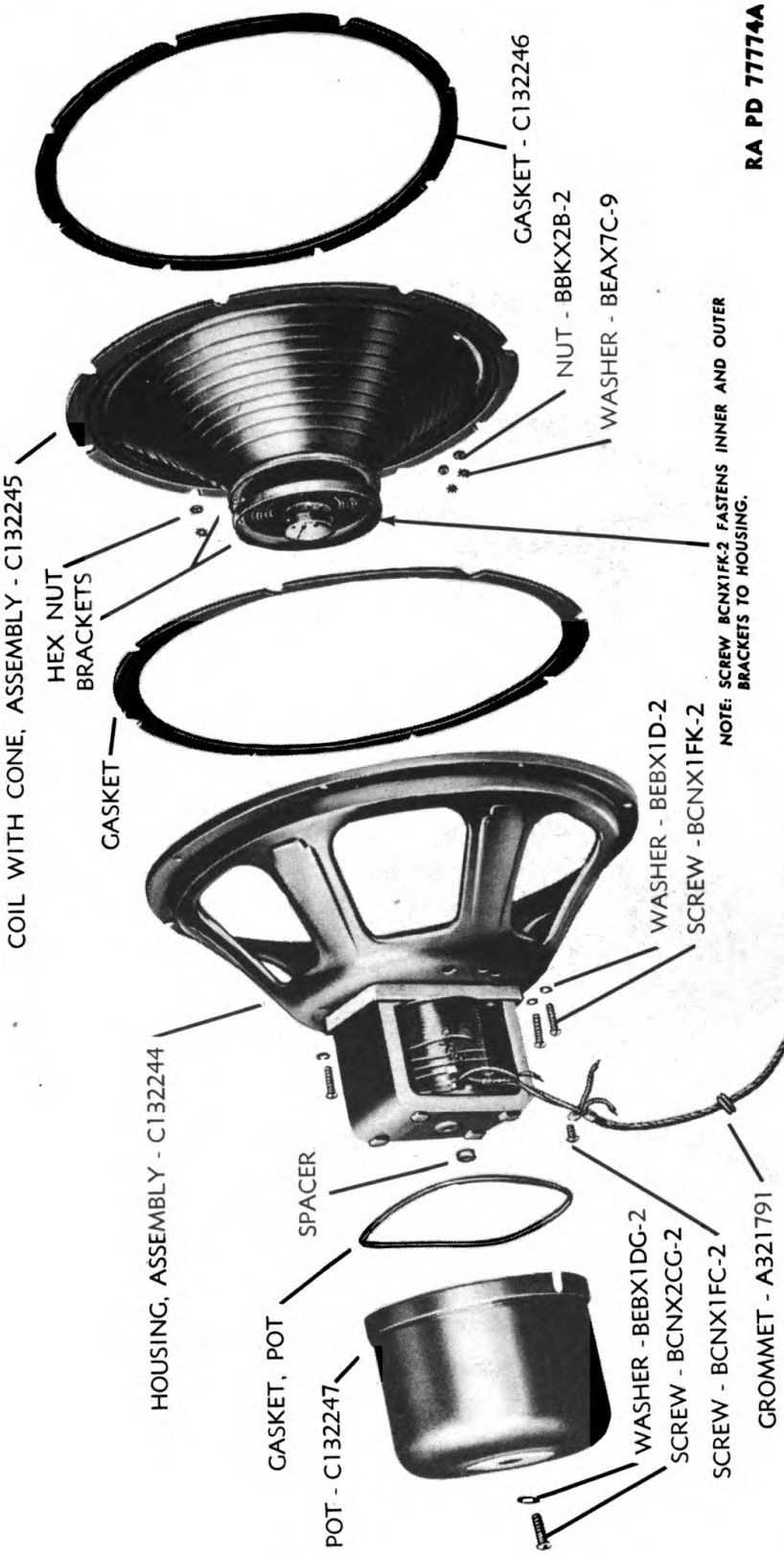


Figure 93 — Battle Sound Speaker — Parts

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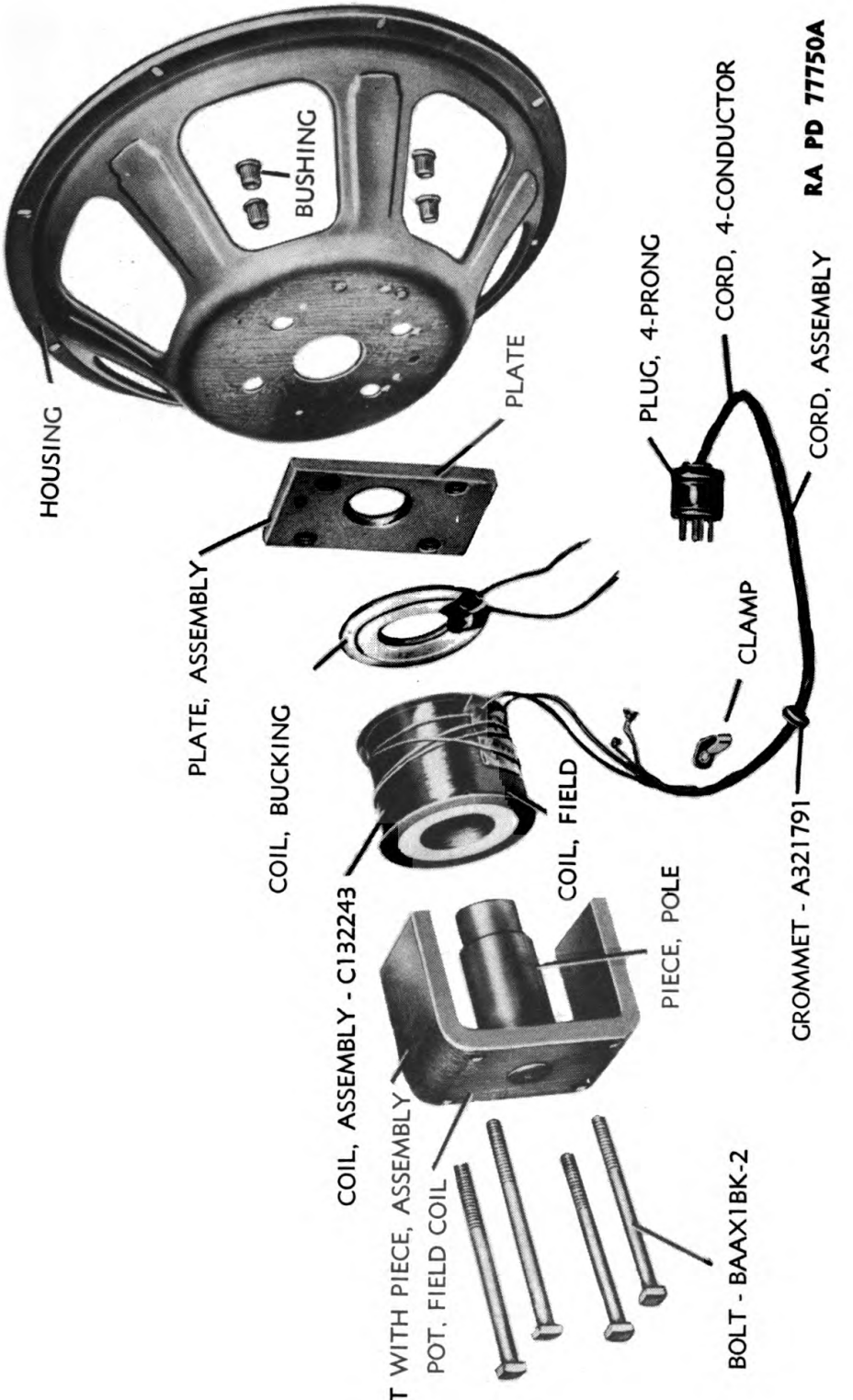


Figure 94 — Battle Sound Speaker Housing and Related Parts

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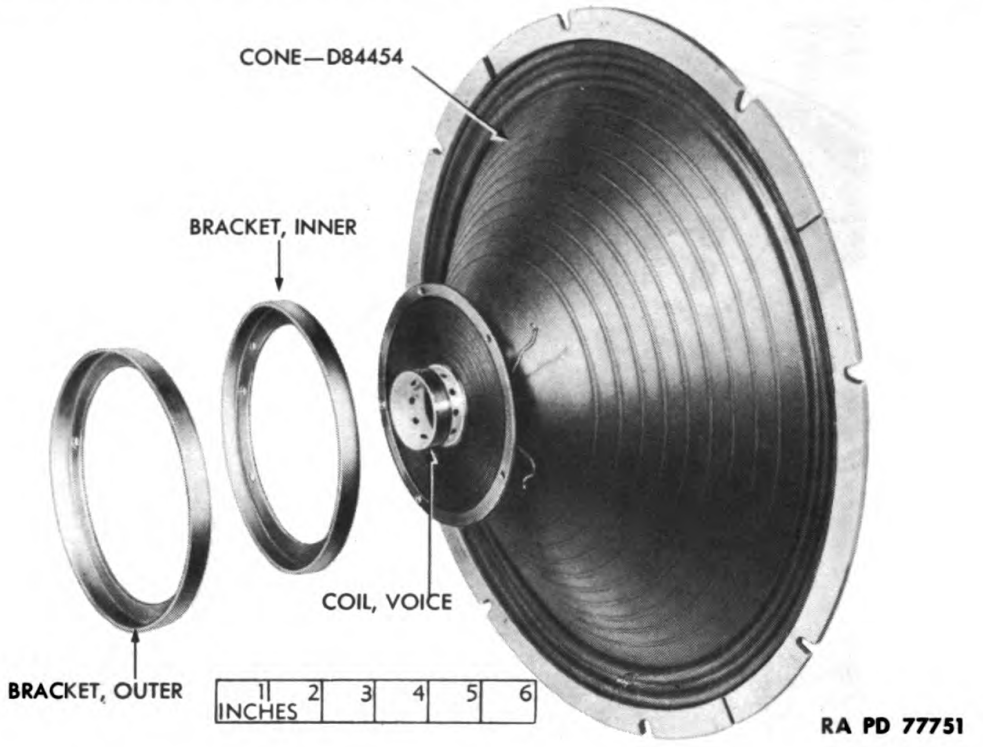


Figure 95 — Field Coil and Cone

removed by prying it from the chassis after the screws and nuts are removed, as shown in figure 98.

(13) Unsolder the power transformer (fig. 100) connections. Remove the power transformer from the power supply chassis after removing the four hexagonal nuts, four lock washers, and the four binding head screws.

(14) Unsolder leads to the choke (fig. 101). Remove the four screws, lock washers, and hexagonal nuts to permit removal of the choke. Drive out the retaining rivets to remove the tube socket and the clamp assembly.

(15) Unsolder all remaining electrical leads to the sockets and the condensers as shown in figures 102 and 103. This will free the cable assembly shown in figure 104.

(16) Drive out the rivets in the condenser wafers (fig. 104) and straighten the connectors on the condensers to remove the parts from the power supply chassis.

(17) Drive out the rivets fastening the speaker sockets to the chassis to complete the disassembly of the power supply (fig. 105).

f. Gun.

(1) Consult figures 106 and 107 before proceeding with disassembly.

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Figure 96 — Speaker With Current Limiting Device

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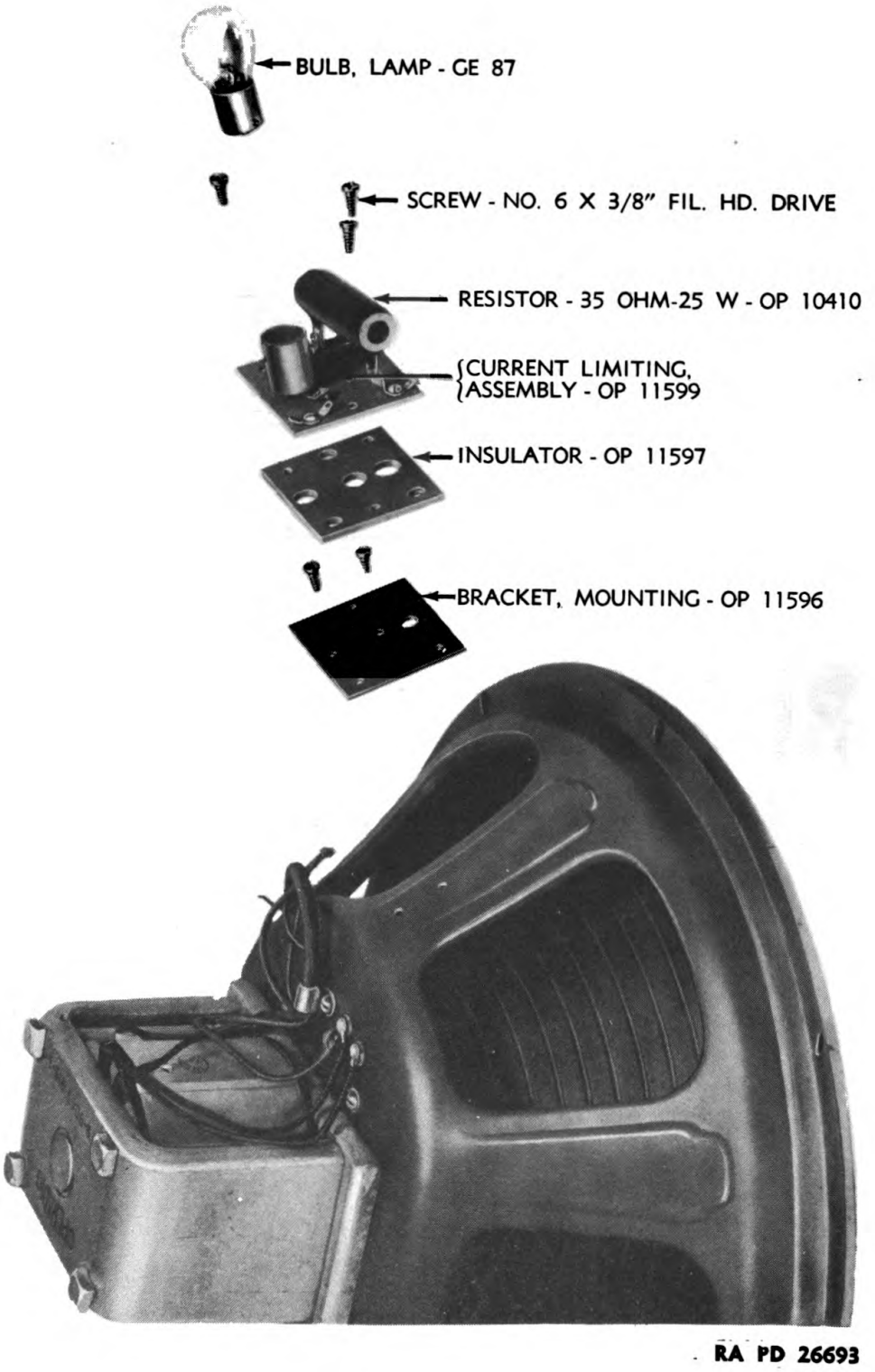


Figure 97 — Removal of Current Limiting Device

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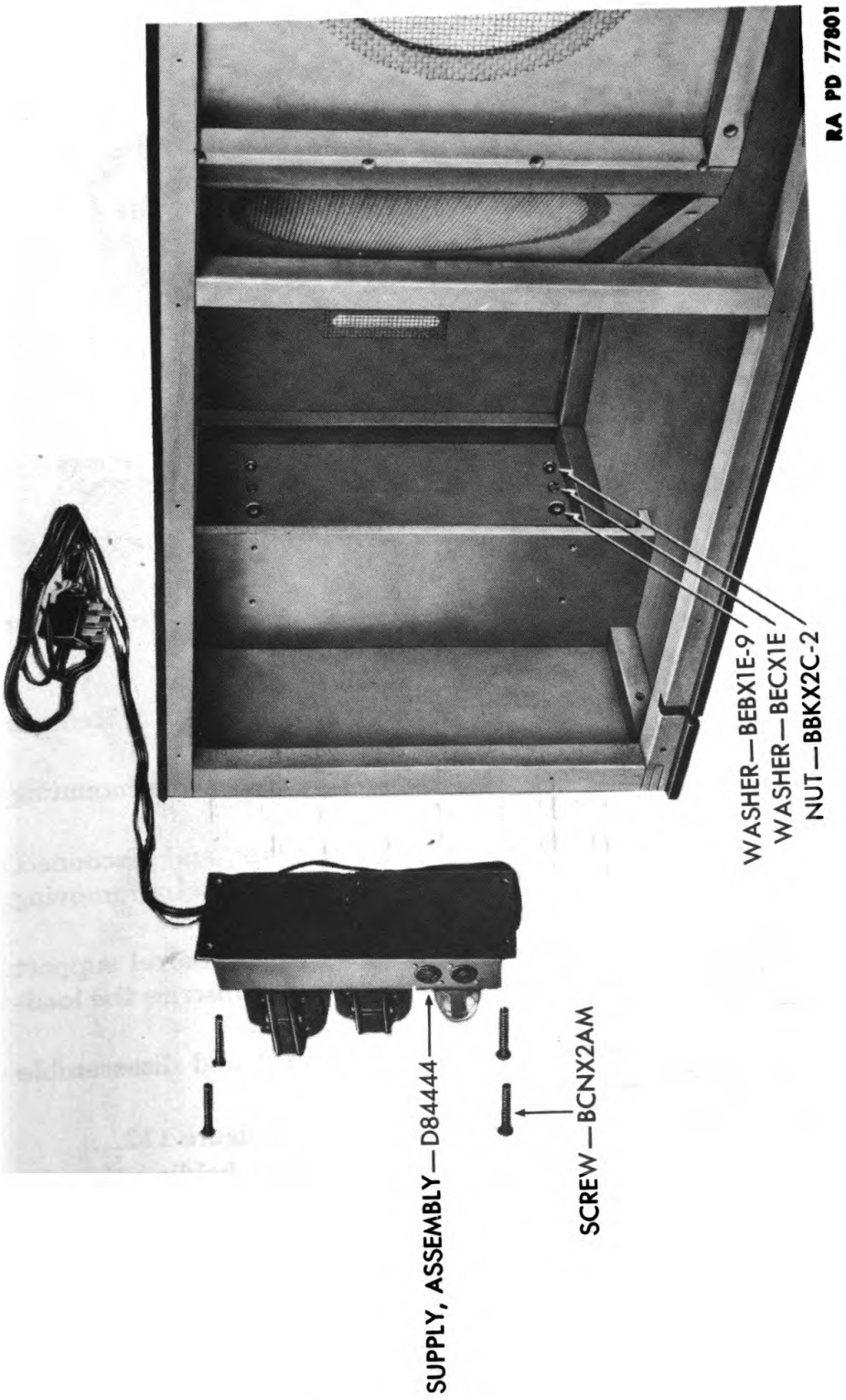


Figure 98 — Removal of Power Supply Assembly From Cabinet

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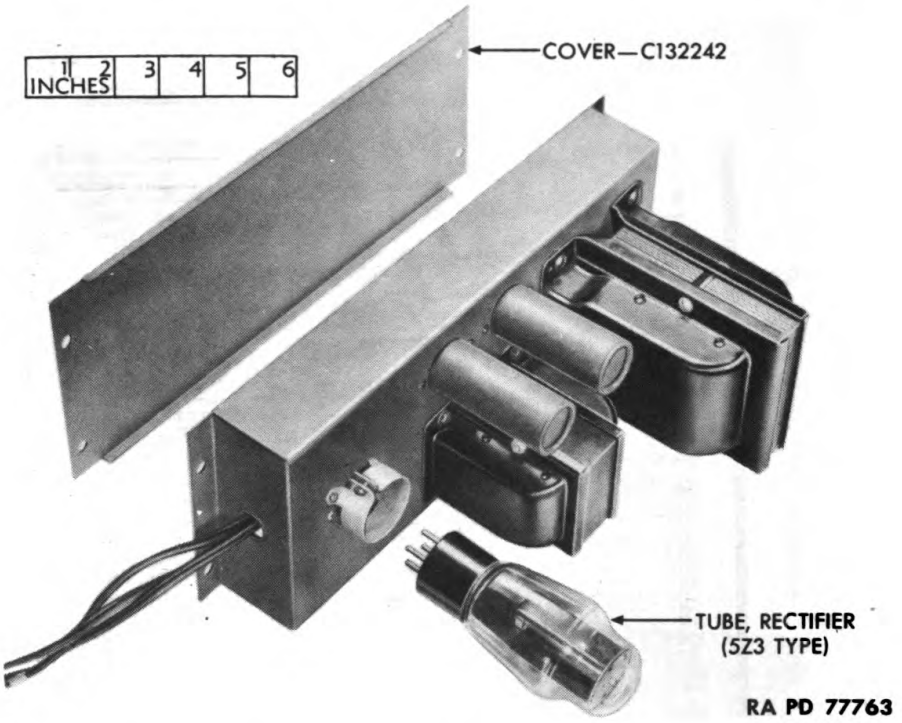


Figure 99 — Removal of Rectifier Tube and Chassis Cover From Power Pack

(2) Disconnect air hose and ultraviolet lamp from gun. Remove gun from tripod (fig. 108).

(3) Remove the gun from the cradle by removing the mounting bolts. Disconnect the yoke from cradle.

(4) Turn the cover fastener stud, lift the cover, and disconnect it. Remove the wires from the switch bracket assembly by removing the terminal screws on the contact strips (fig. 109).

(5) Remove the two screws and nuts holding the barrel support (fig. 110). Remove the eight water jacket screws. Unscrew the loading screw.

(6) Pull the water jacket forward to remove it and disassemble it as shown in figure 111.

(7) Remove the mounting bracket as shown in figure 112.

(8) Remove the four hexagonal-head cap screws holding the piston block (fig. 113) in the side plates. The complete unit can then be removed from the gun proper.

(9) Remove the connector holding the capillary in the piston block.

(10) Remove the four cap screws fastening the ball feed block to the piston block and remove the parts from the piston block.

(11) Remove connector holding capillary in loading block.

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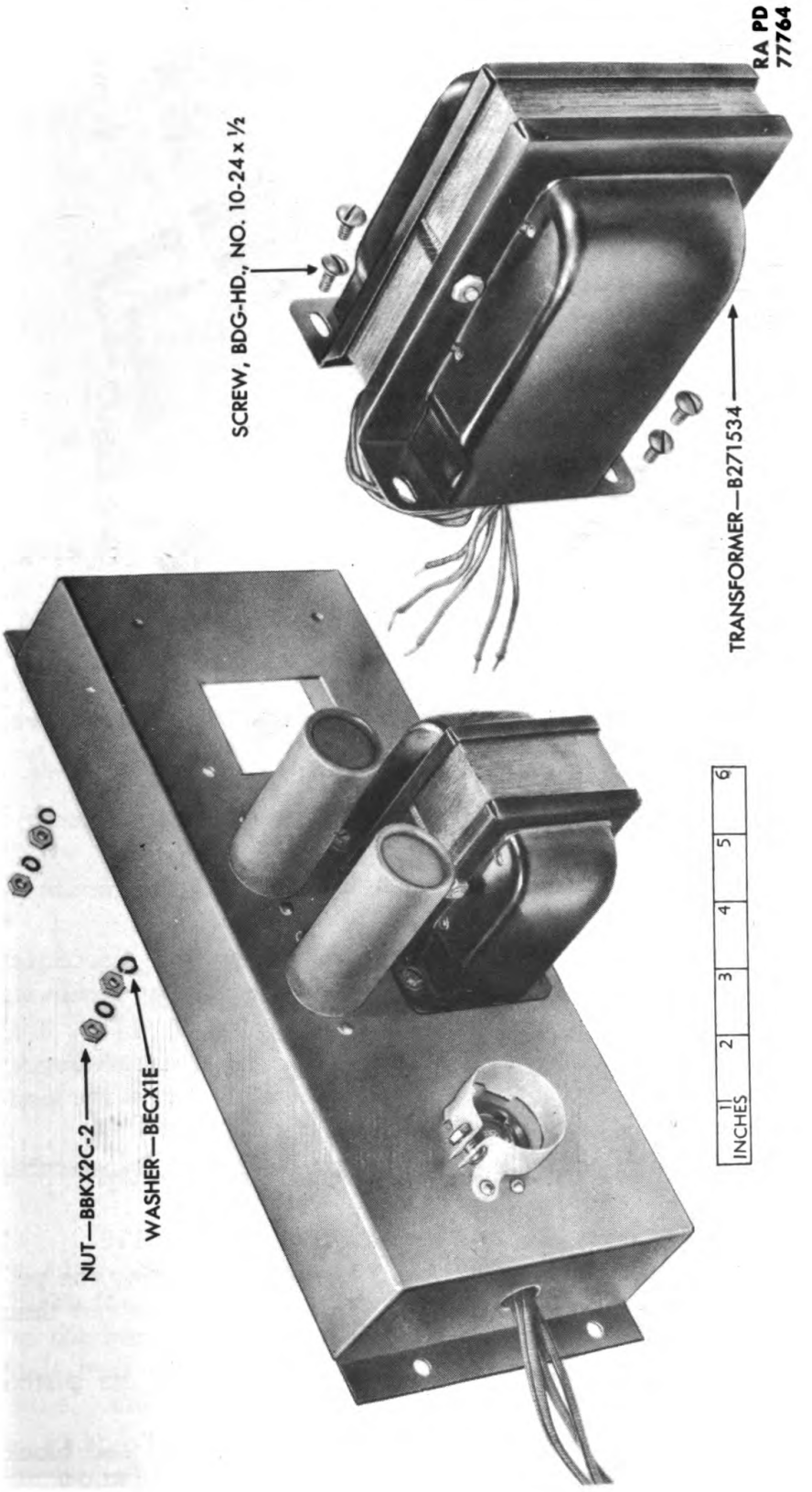


Figure 100 — Removal of Power Transformer From Power Supply Chassis

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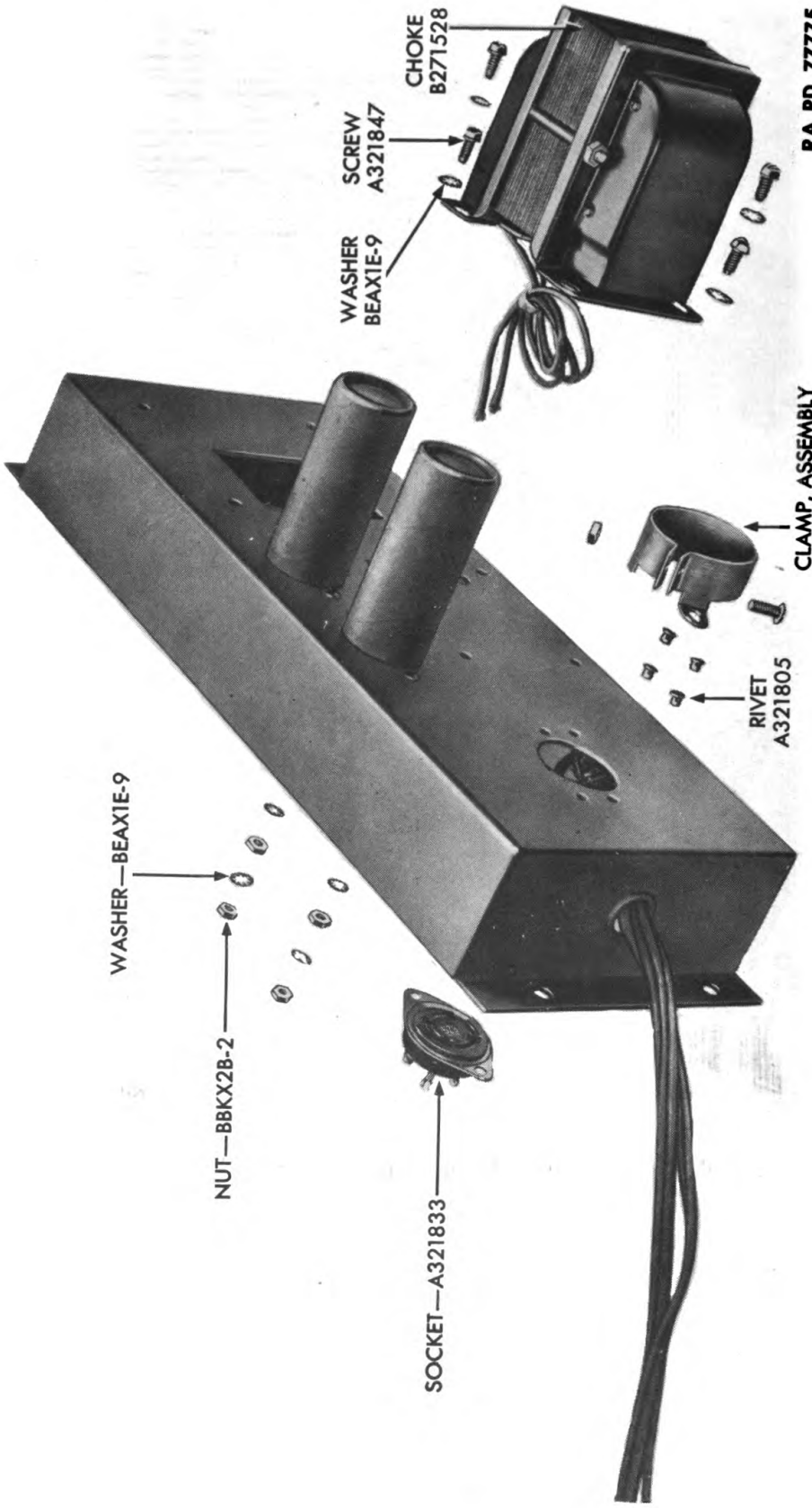


Figure 101 — Removal of Choke, Tube Socket, and Related Parts From Power Supply Chassis

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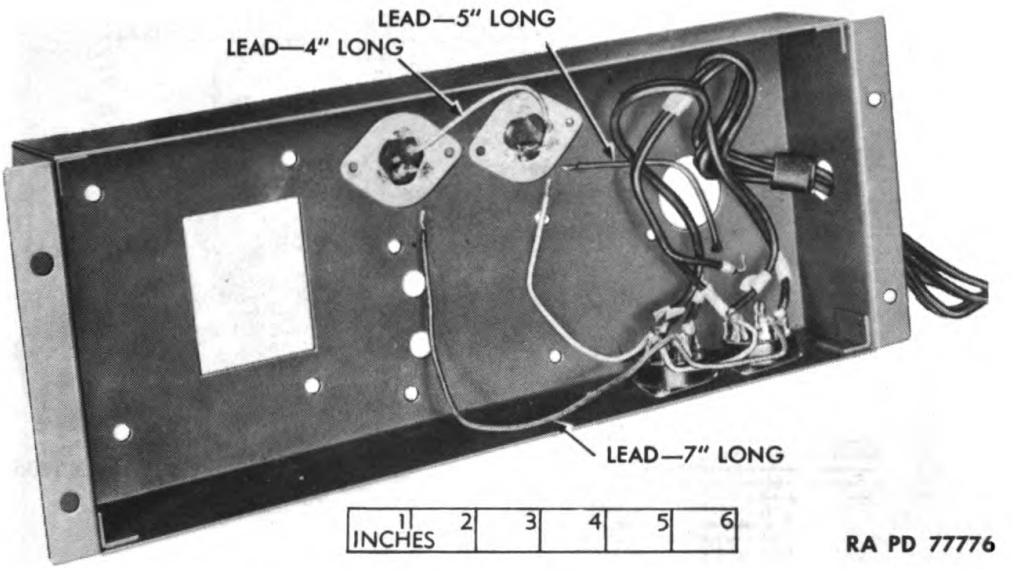


Figure 102 — Removal of Connecting Leads From Power Supply Chassis

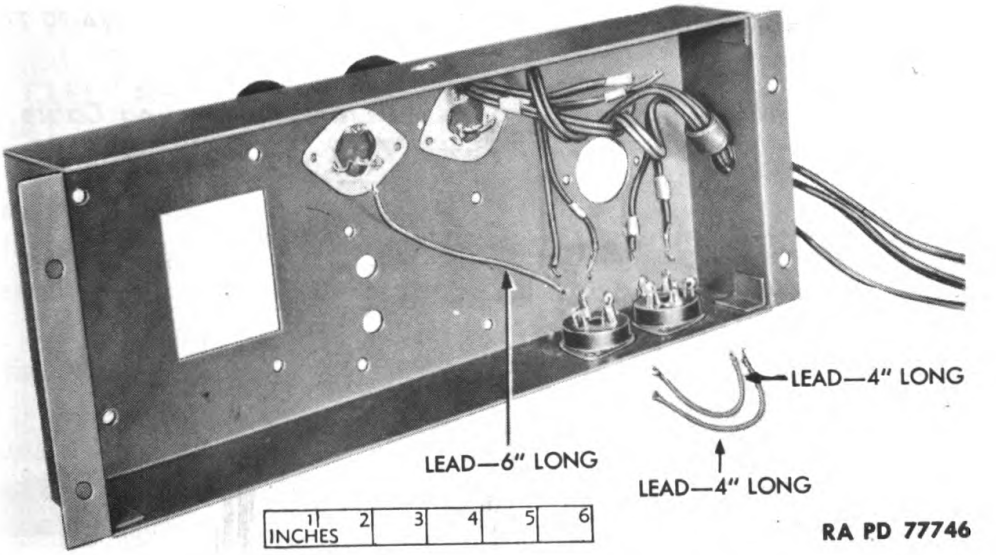


Figure 103 — Removal of Connecting Leads From Power Supply Chassis

(12) Scribe a mark on the barrel to relocate the barrel piston block for assembly, and remove the screw holding the piston block to the barrel and magazine tube. Pull the magazine tube from the ball feed block and unscrew the loading block from the magazine tube. The related parts are shown in figures 112 to 115.

(13) The air valve plunger unit is removed by unscrewing the hexagonal-head nut holding valve in the piston block. The air valve spring is also removed at this time (fig. 114).

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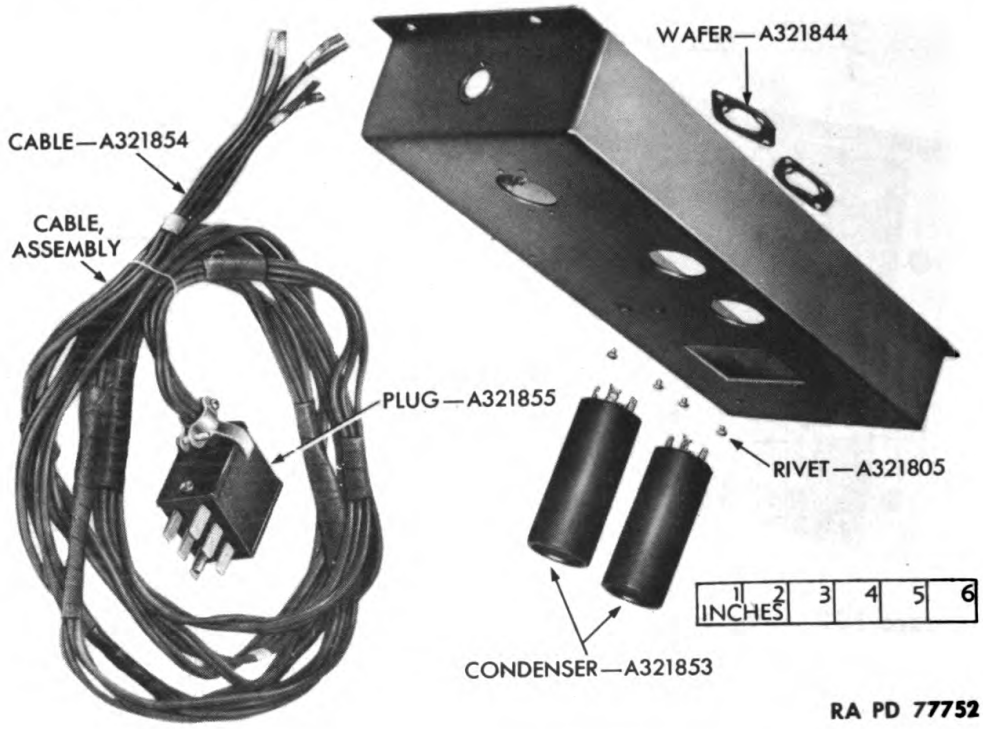


Figure 104 — Removal of Condensers and Connecting Cable From Power Pack

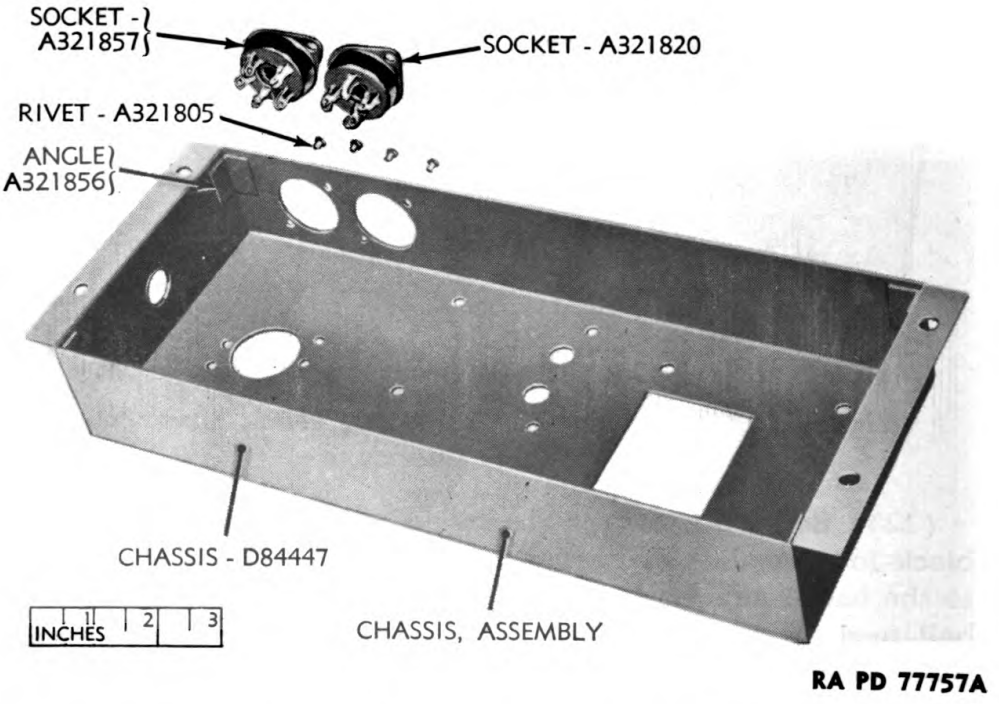


Figure 105 — Removal of Speaker Sockets and Clamp From Power Supply Chassis

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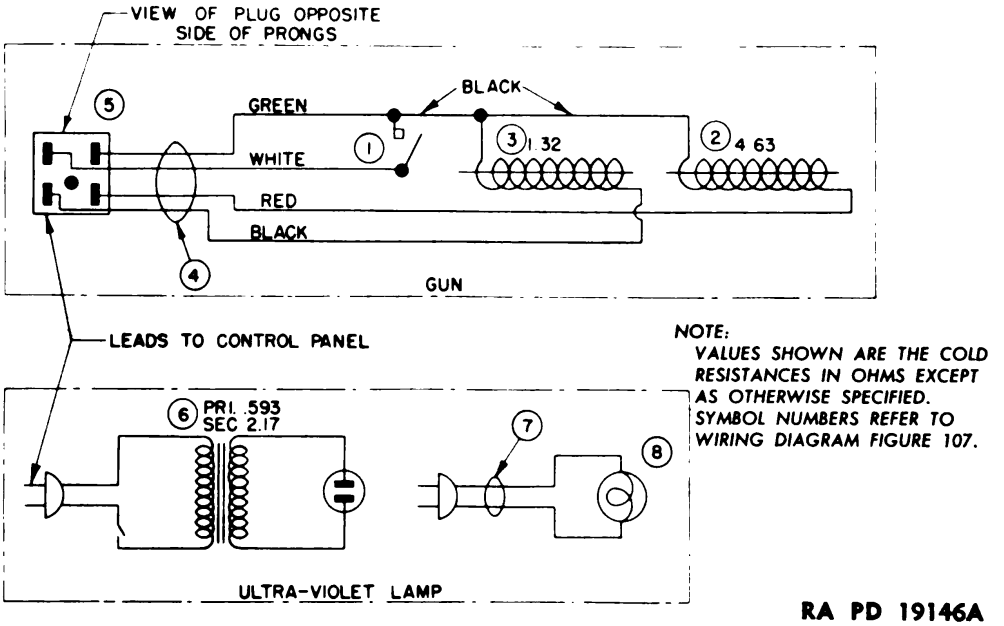


Figure 106 — Circuit Checking Diagram of Gun Including Ultraviolet Lamp

(14) Remove the stud and spring from the piston block (fig. 114).

(15) Pull the release blade forward until the stop pin is free in the slot in the release blade (fig. 114).

(16) Remove the release blade, stop pin, and release pin. The release pin is located above the release blade (fig. 114).

(17) Remove the stop plate by unscrewing the two holding screws (fig. 116).

(18) Remove the handle bracket assembly by removing the two nuts and pulling out the two screws at the rear of the recoil electromagnet (fig. 116). Do not lose the light recoil spring and return plunger.

(19) Remove the two screws holding the switch bracket assembly (fig. 117) in position. The switch bracket assembly may then be separated from the handle assembly. It is possible in some instances to remove the bracket assembly from the gun without removing the handle assembly, by pulling the switch bracket toward the rear of the gun after the holding screws have been removed.

(20) Pull the back plate assembly (fig. 117) out of the slots in the handle bracket to disassemble the gun handle assembly and expose the large recoil spring. Parts of brackets are shown in figure 118.

(21) Disconnect the two lead wires of the recoil electromagnet.

(22) Remove the nuts (fig. 119) and pull out the cap screws holding the recoil electromagnet in position.

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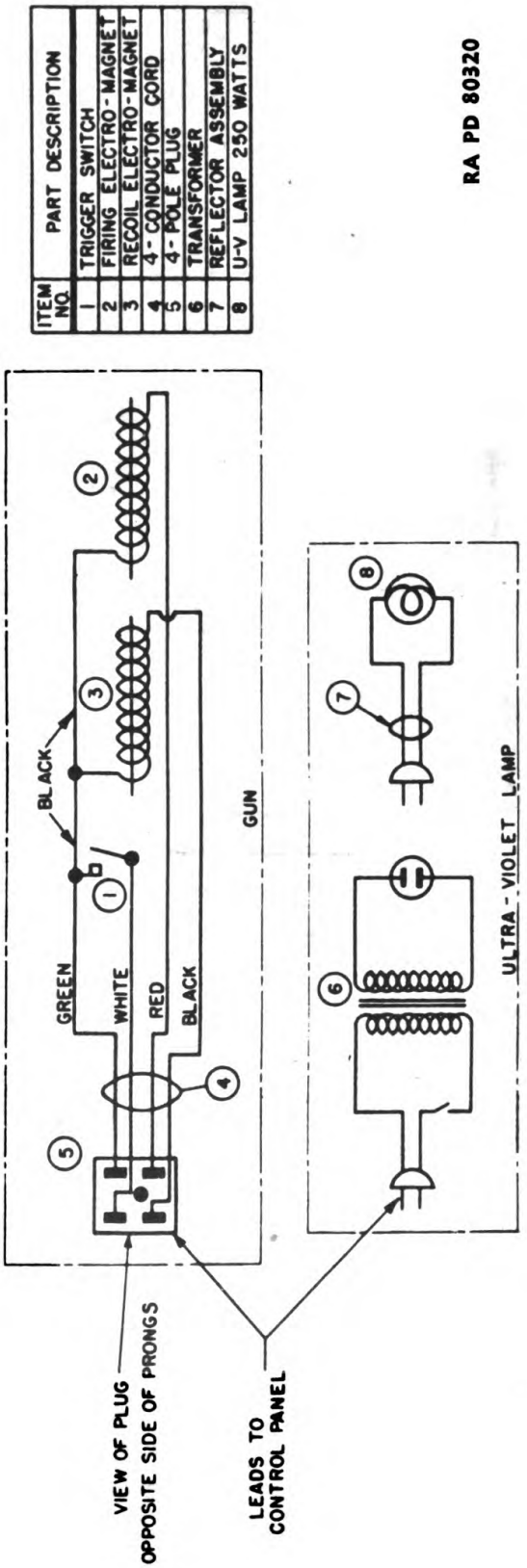


Figure 107 — Wiring Diagram of Gun Including Ultraviolet Lamp

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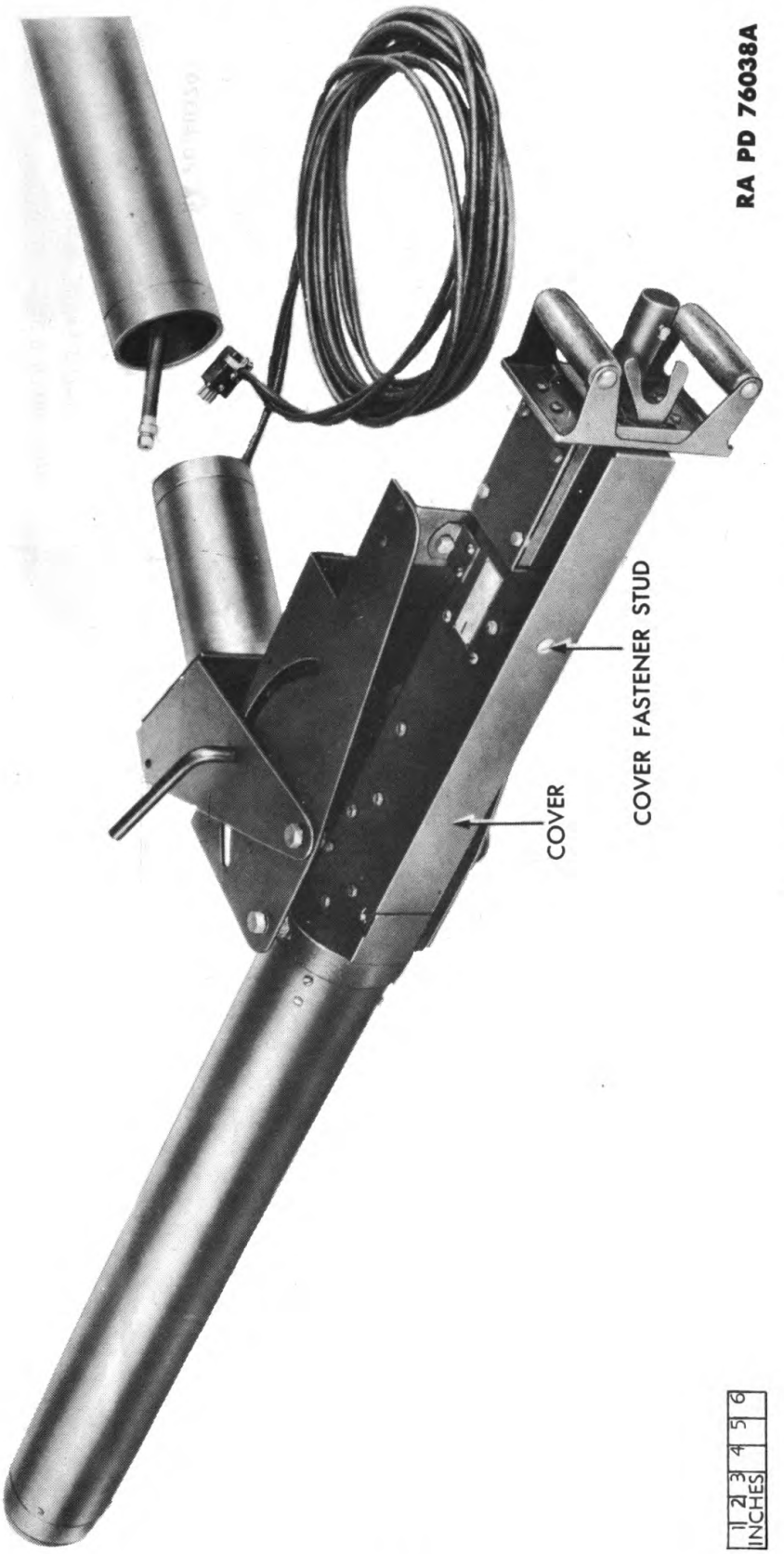


Figure 108 — Gun — Tripod and Air Hose Removed

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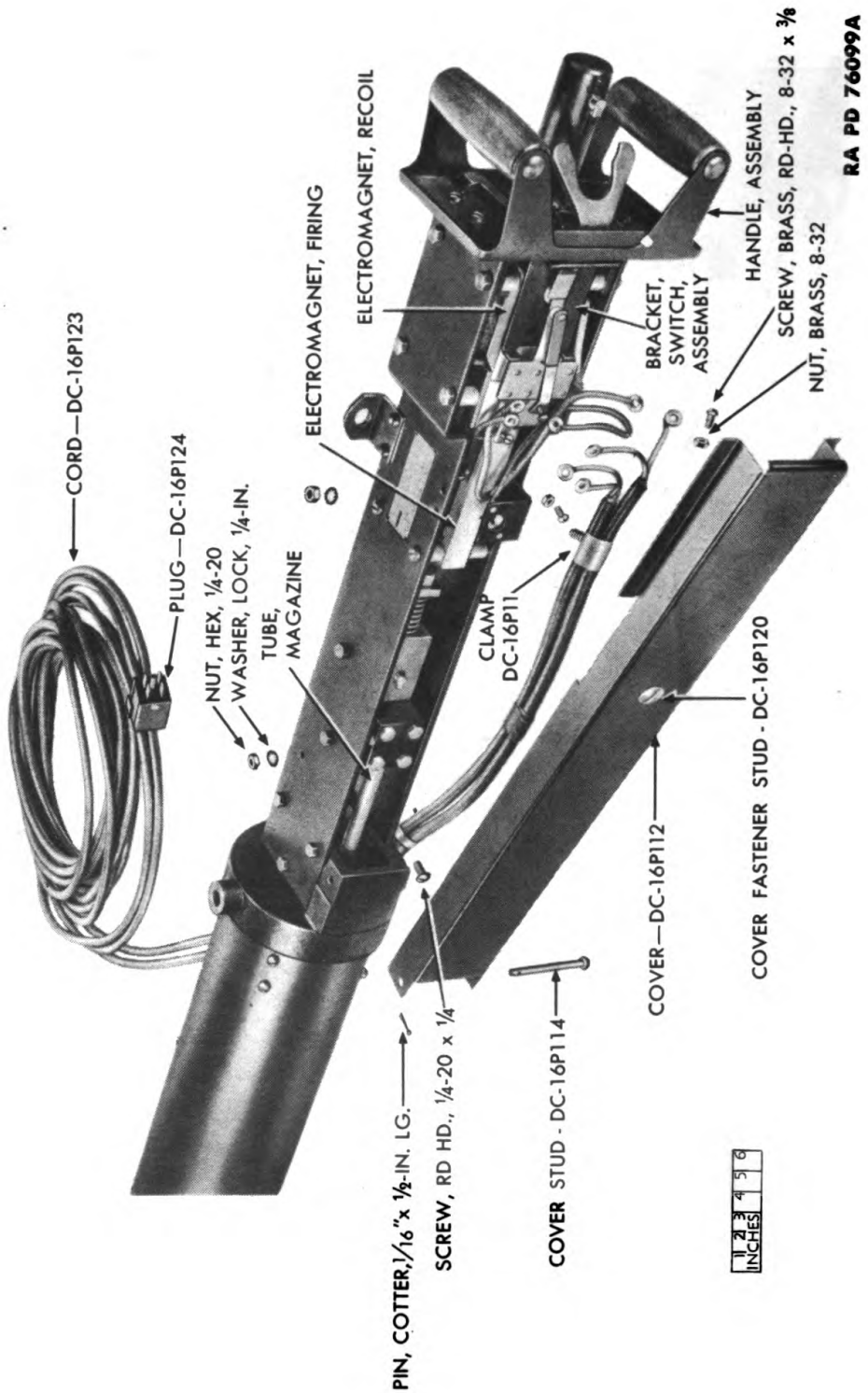


Figure 109 — Gun — Cover Removed and Cord Disconnected

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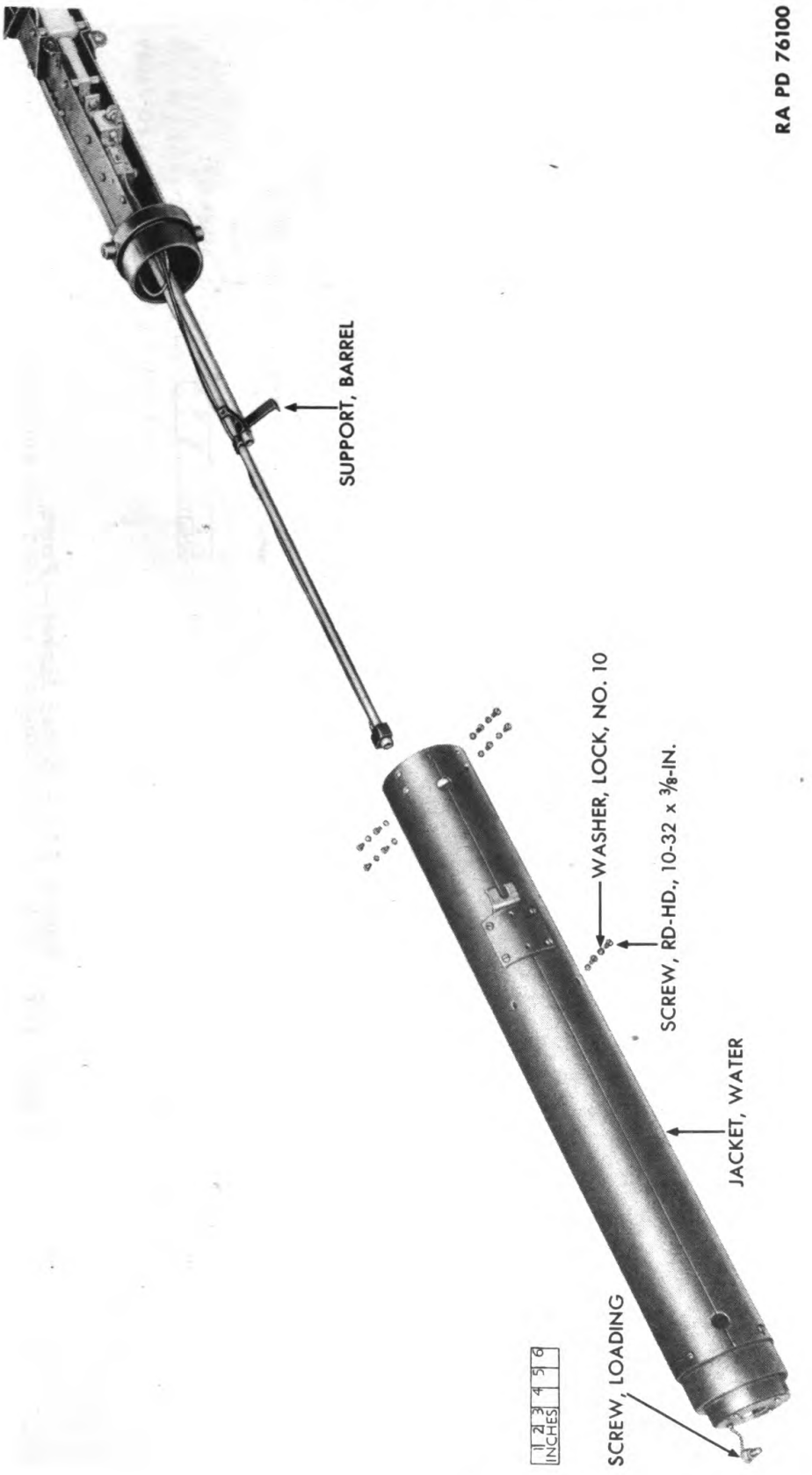


Figure 110—Water Jacket and Barrel Support

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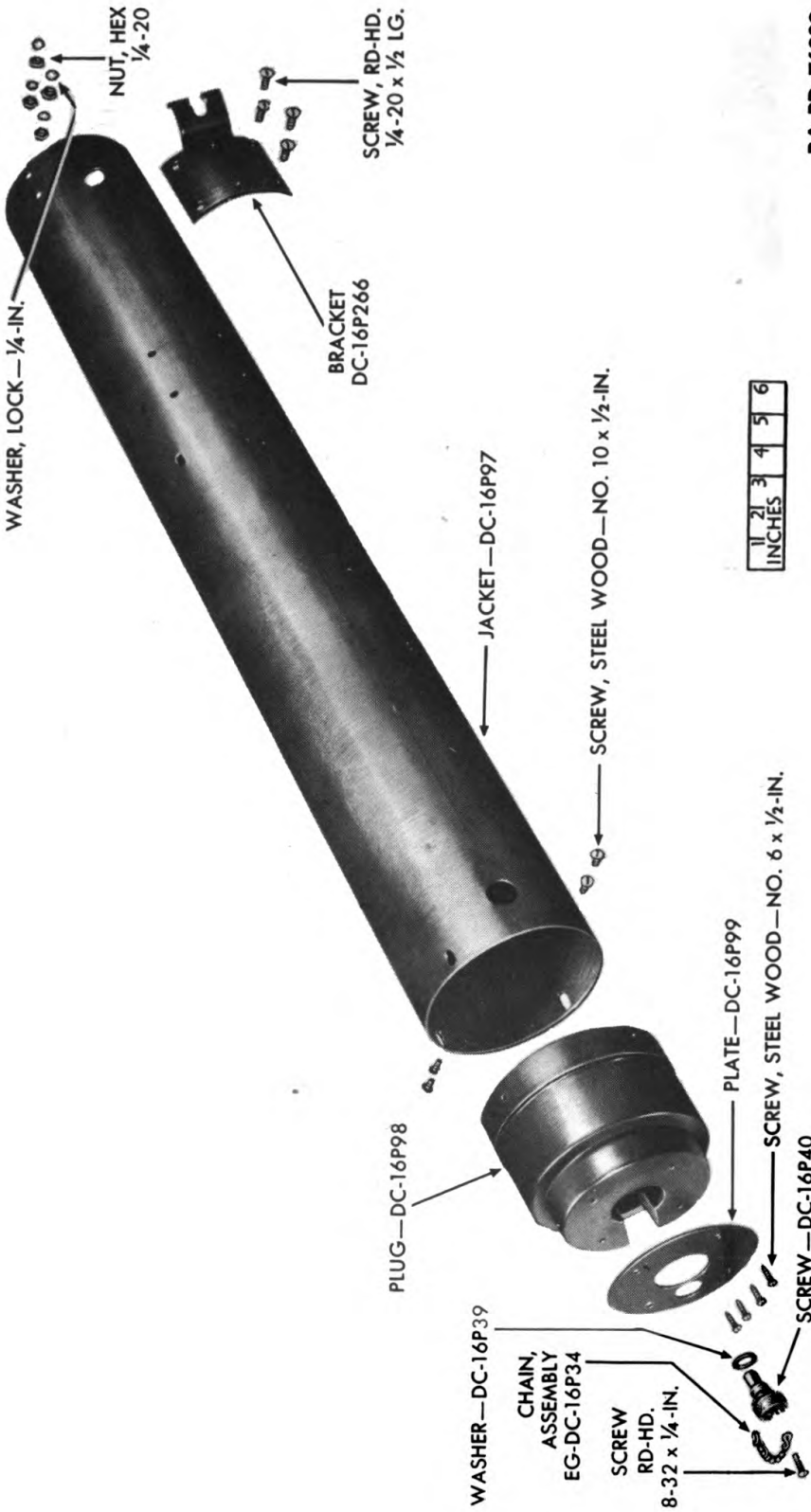


Figure 111 — Water Jacket — Parts

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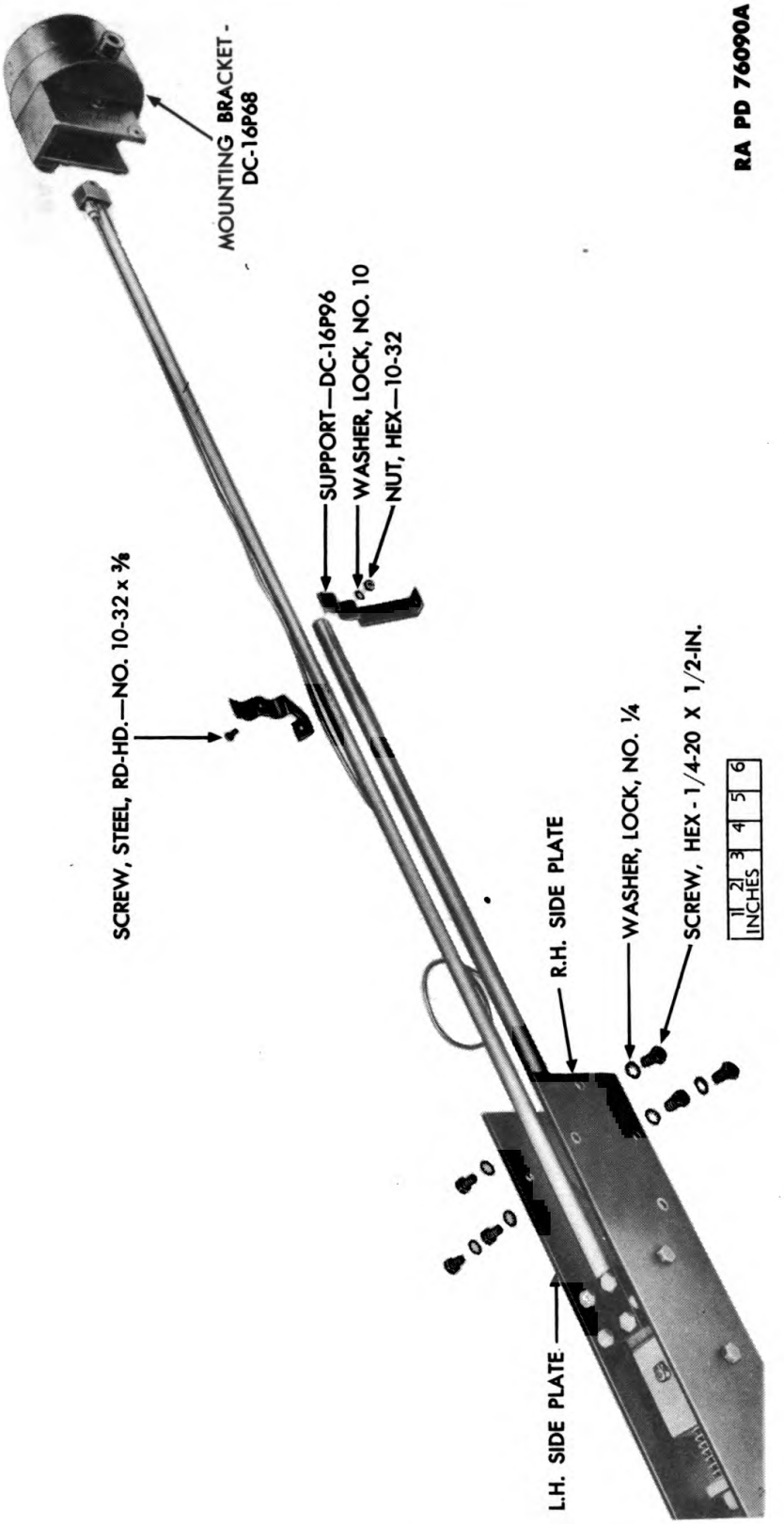


Figure 112 — Barrel Support and Mounting Bracket

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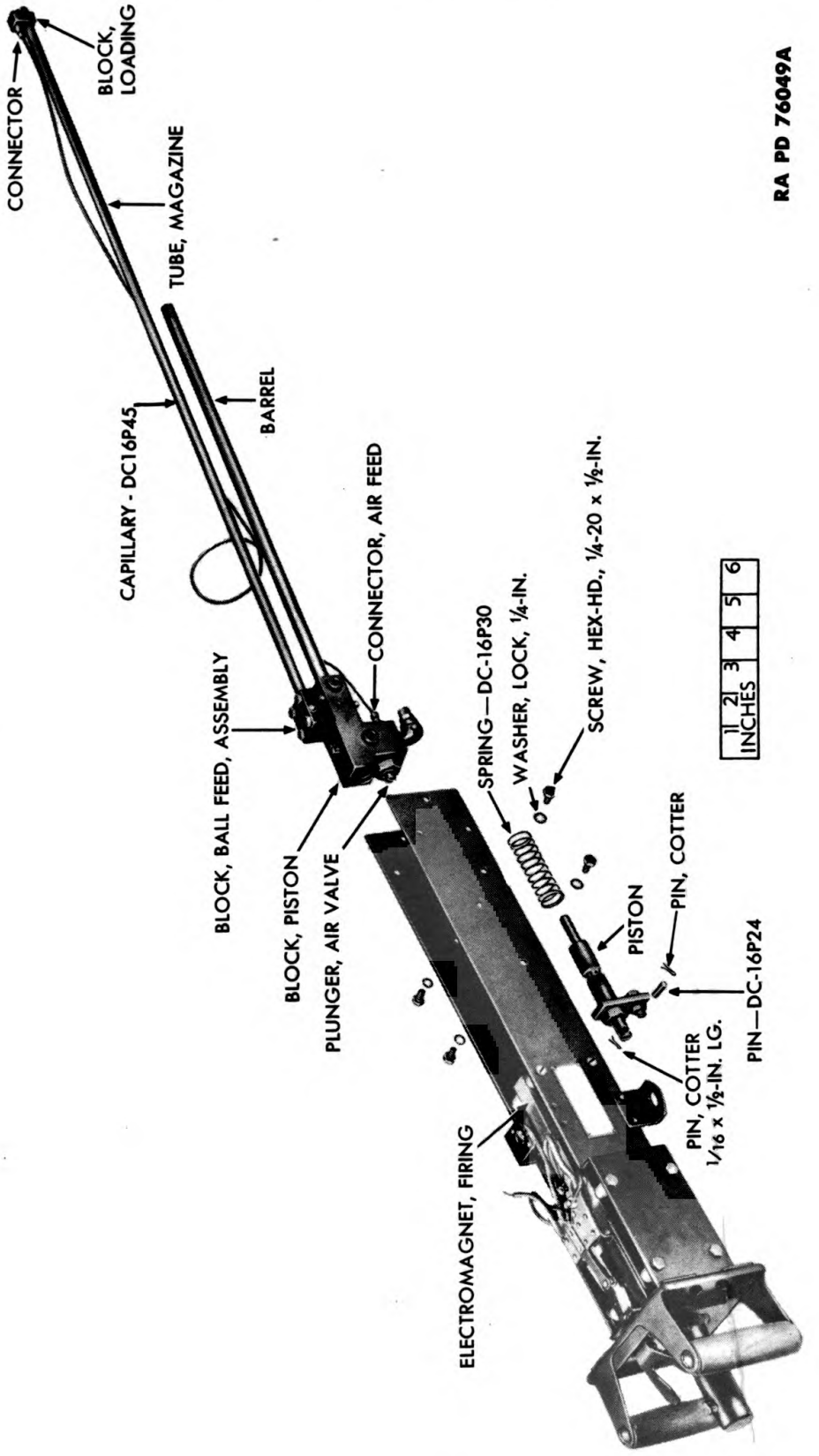


Figure 113 — Magazine Tube, Barrel, and Related Parts

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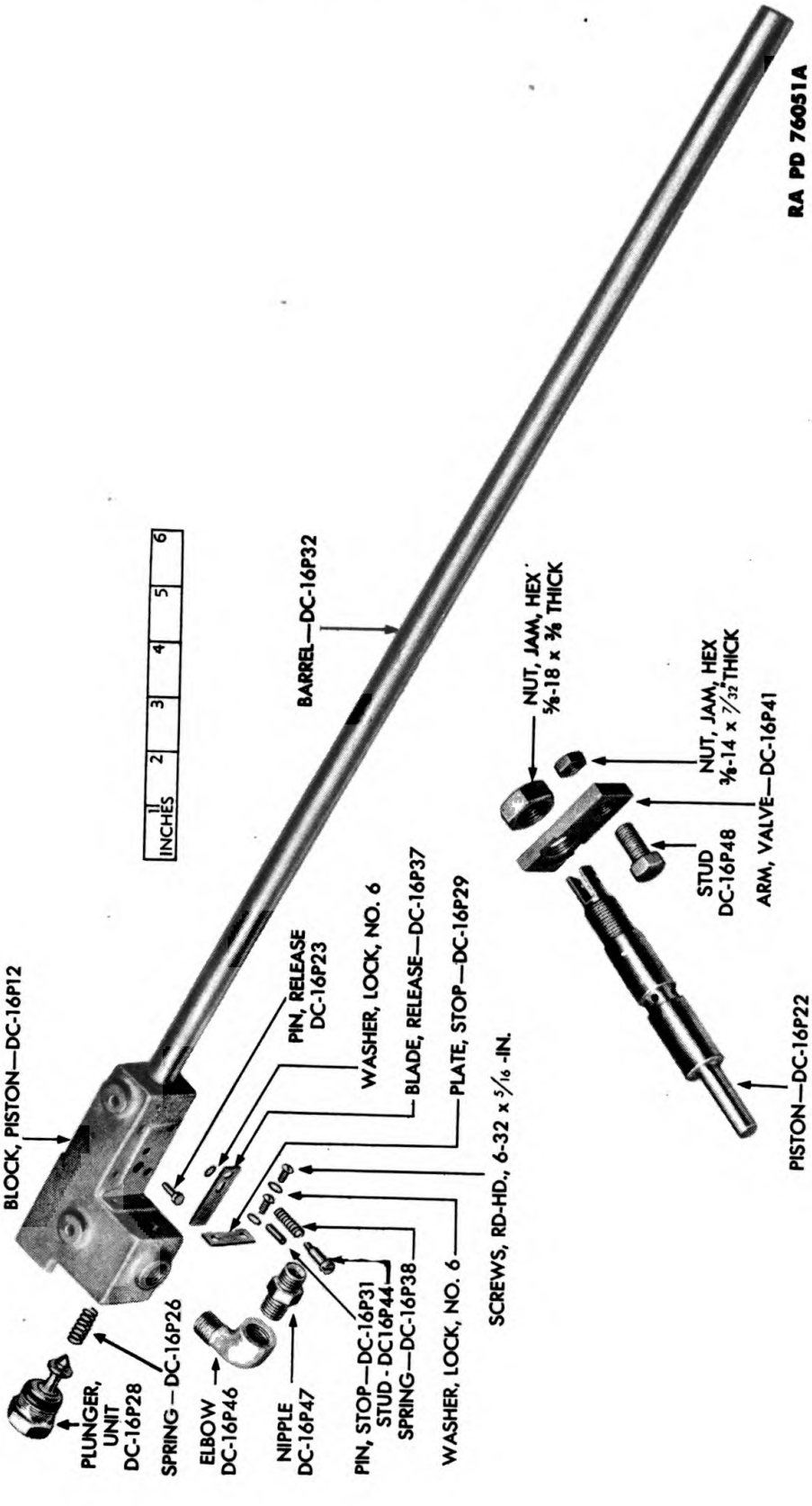


Figure 114 — Piston Block, Barrel, and Related Parts

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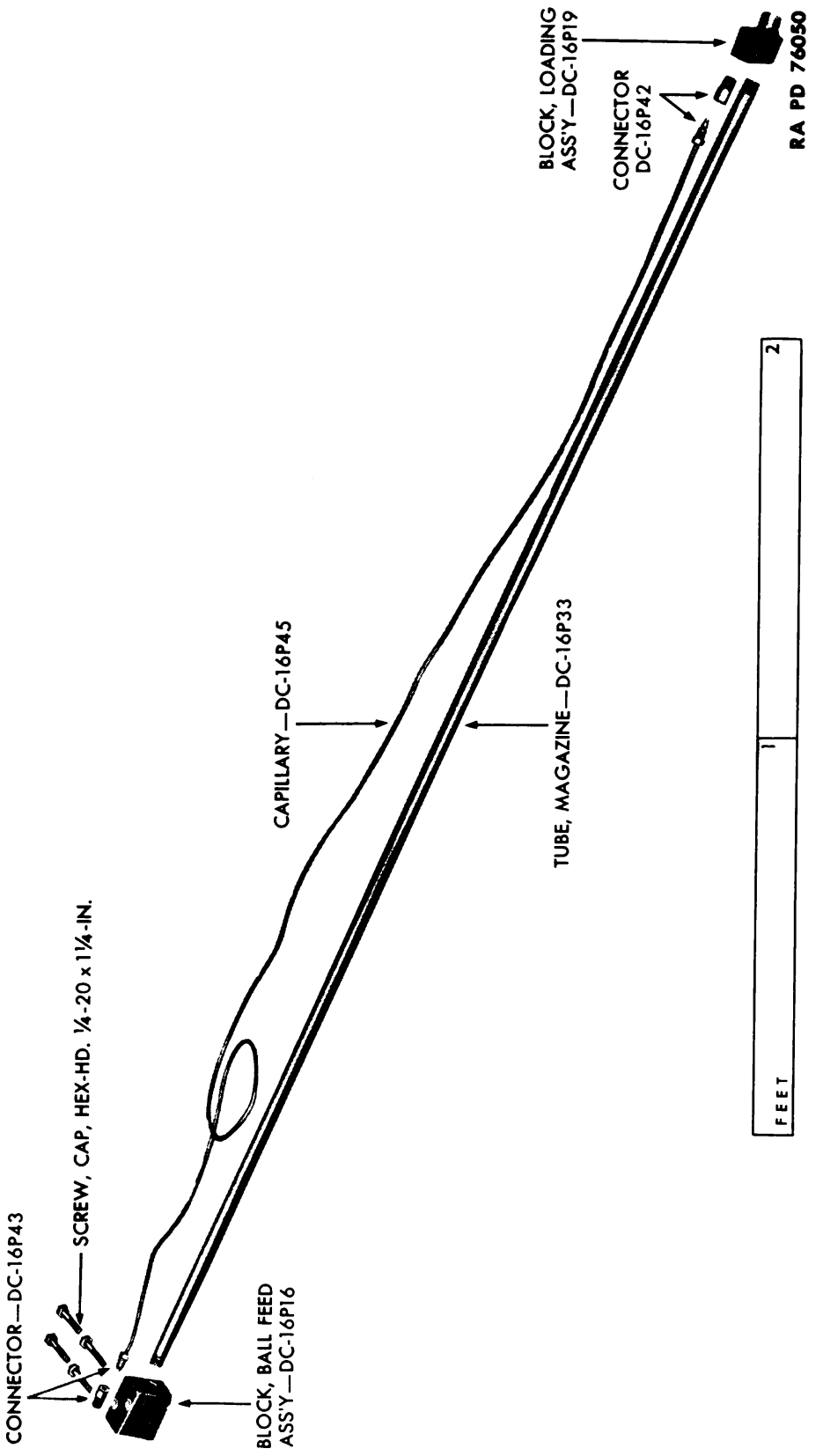


Figure 115 — Piston Block and Barrel — Parts

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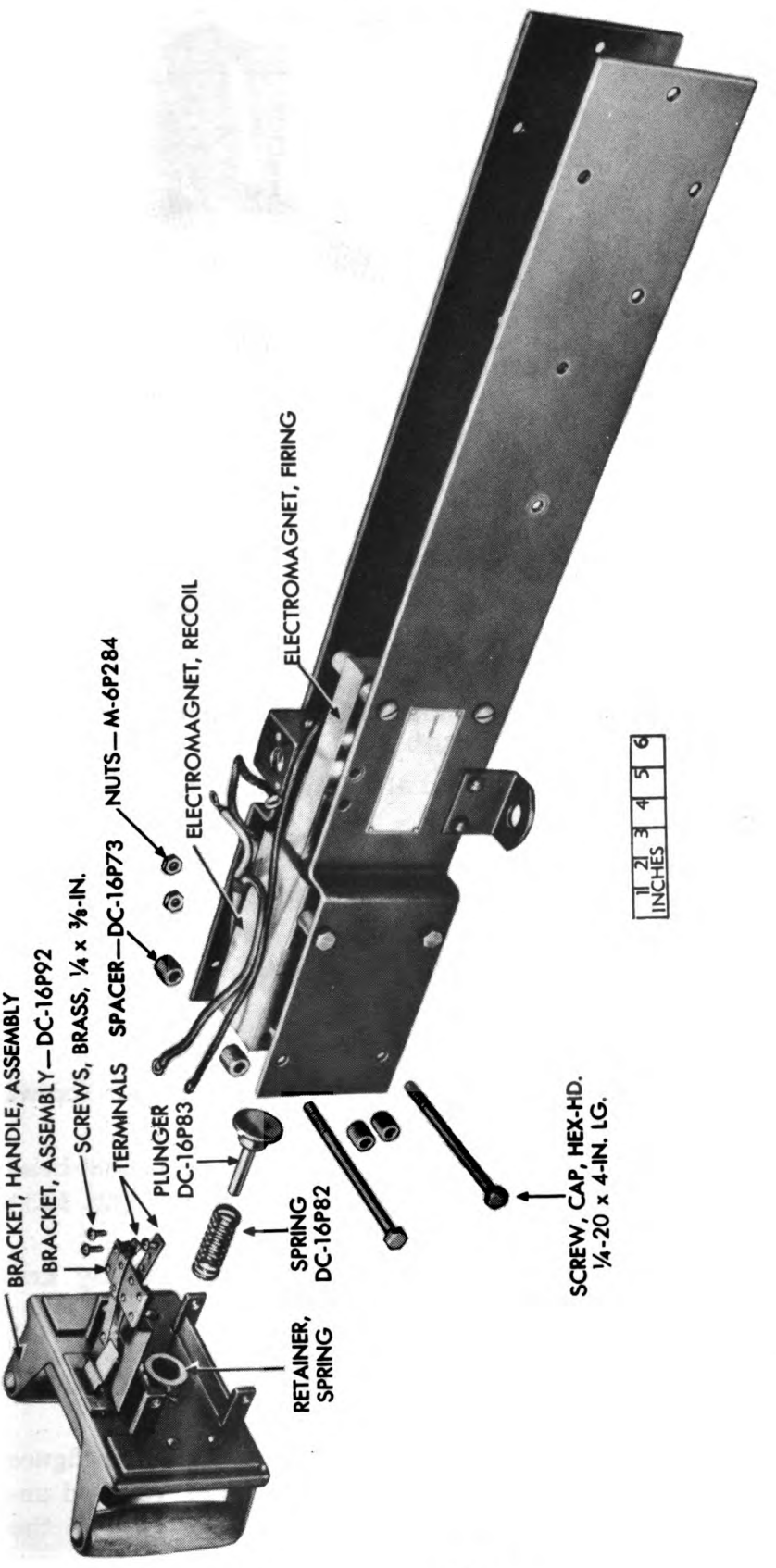


Figure 116—Handle Bracket and Related Parts

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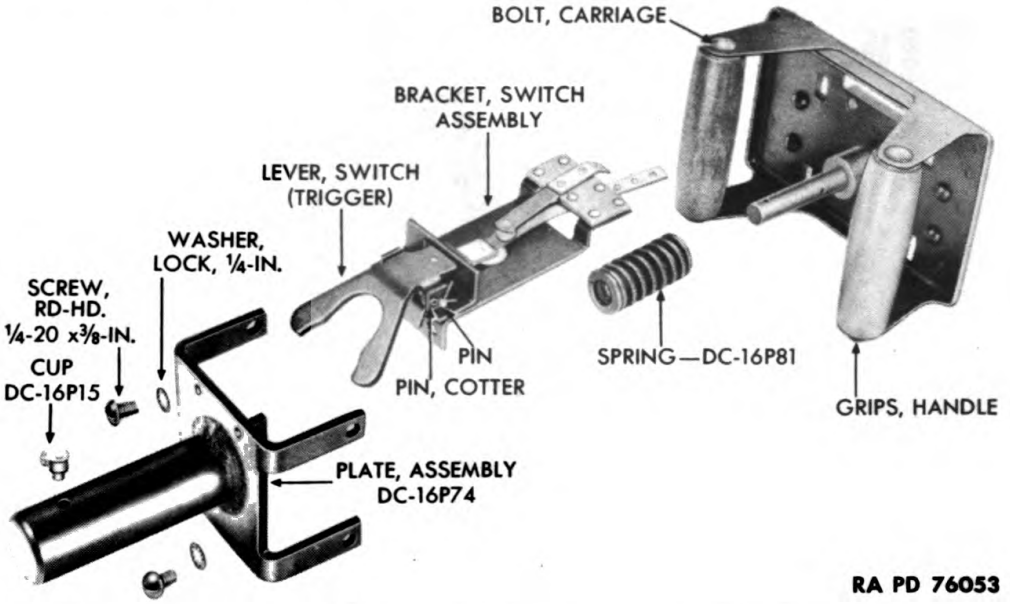


Figure 117 — Back Plate, Switch Bracket and Handle Bracket, Assemblies

(23) Remove the recoil electromagnet through the bottom of the space between the side plates (fig. 119).

(24) Remove the cotter key and the pin connecting the firing electromagnet to the piston (fig. 113).

(25) Remove the two nuts and the screws holding the firing electromagnet in position. Slide the electromagnet from between the side bracket, through the bottom.

(26) Unscrew the leg caps and the legs from the stand assembly to disassemble the tripod (fig. 120).

g. Air Compressor (fig. 121).

(1) Remove the guard (fig. 122) by removing the four screws fastening it to the compressor base.

(2) Disconnect the two pipes and remove the hexagonal-head cap screws and the lock washer fastening the air compressor (fig. 123) to its base.

(3) Disassemble the air filter as shown in figure 124 by first removing the bolt and pulling the components apart.

(4) Disconnect the air tube (fig. 125) and remove the cylinder head cap screws to separate the cylinder head and gasket from the cylinder.

(5) To disassemble the diaphragm unloader as shown in figure 126, remove the six screws to remove the cap and diaphragm, and unscrew the seat and body from the cylinder head. Do not lose the two springs.

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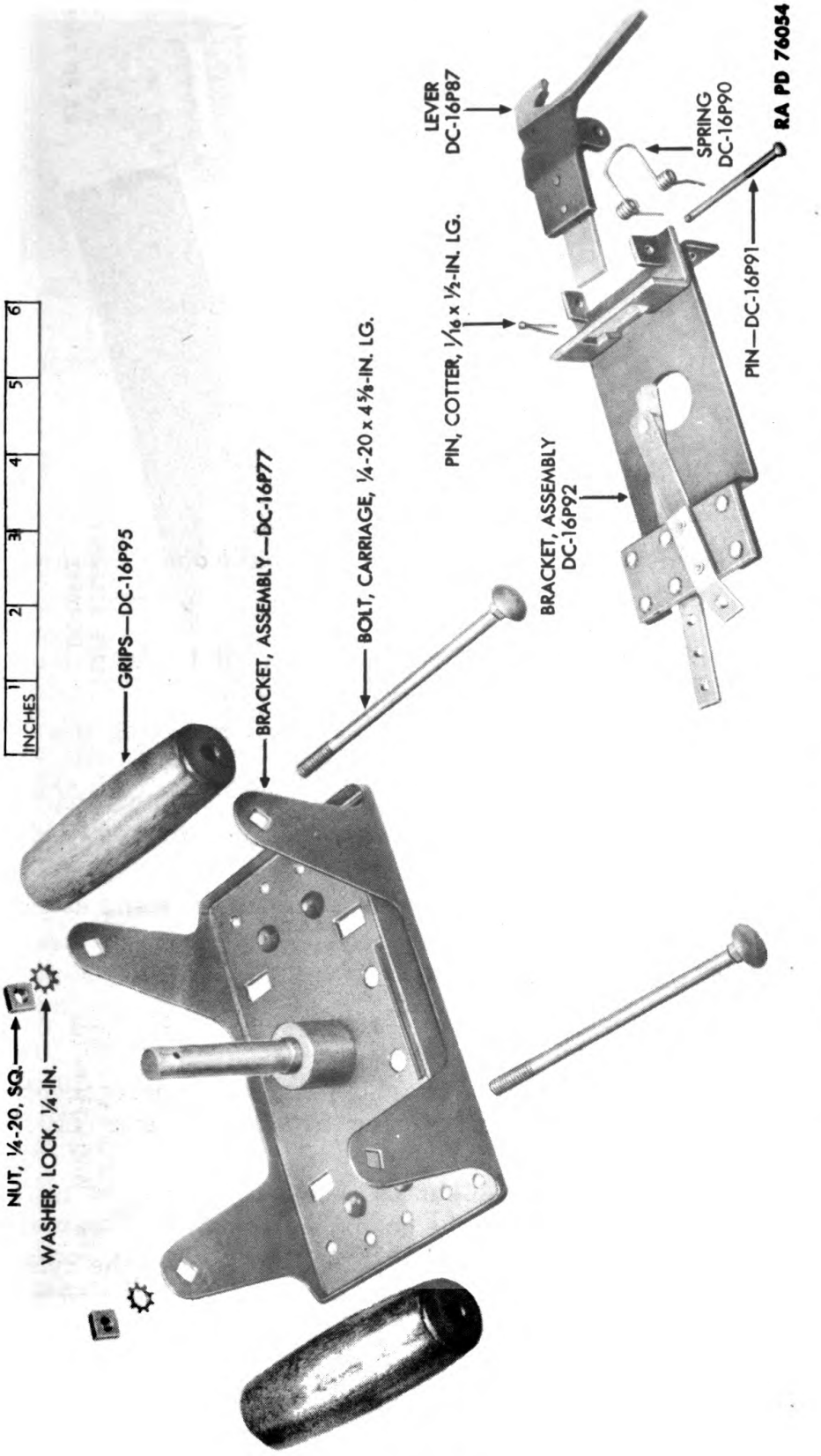


Figure 118 — Handle Bracket and Switch Bracket — Parts

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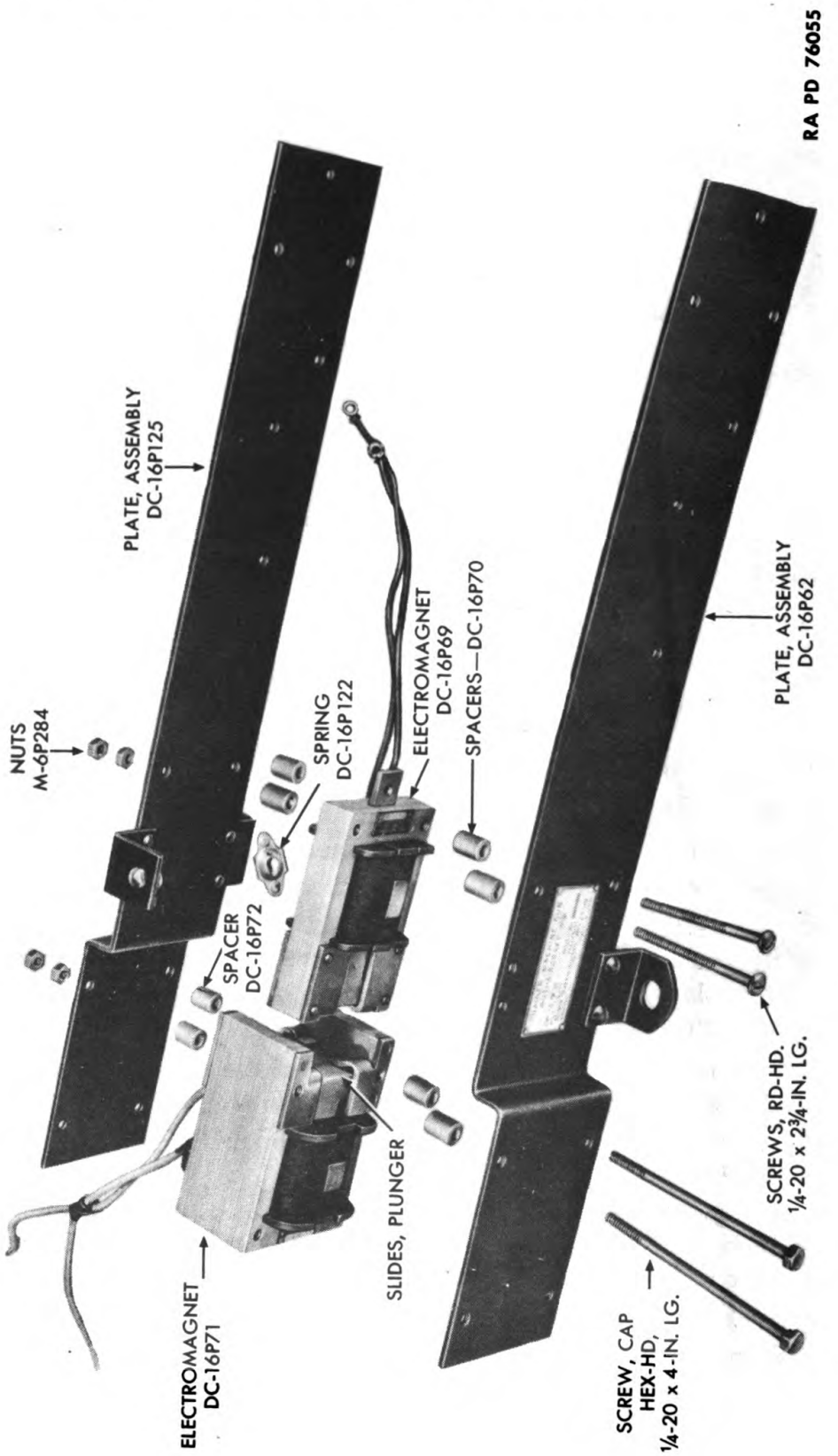


Figure 119 — Electromagnets and Side Plates

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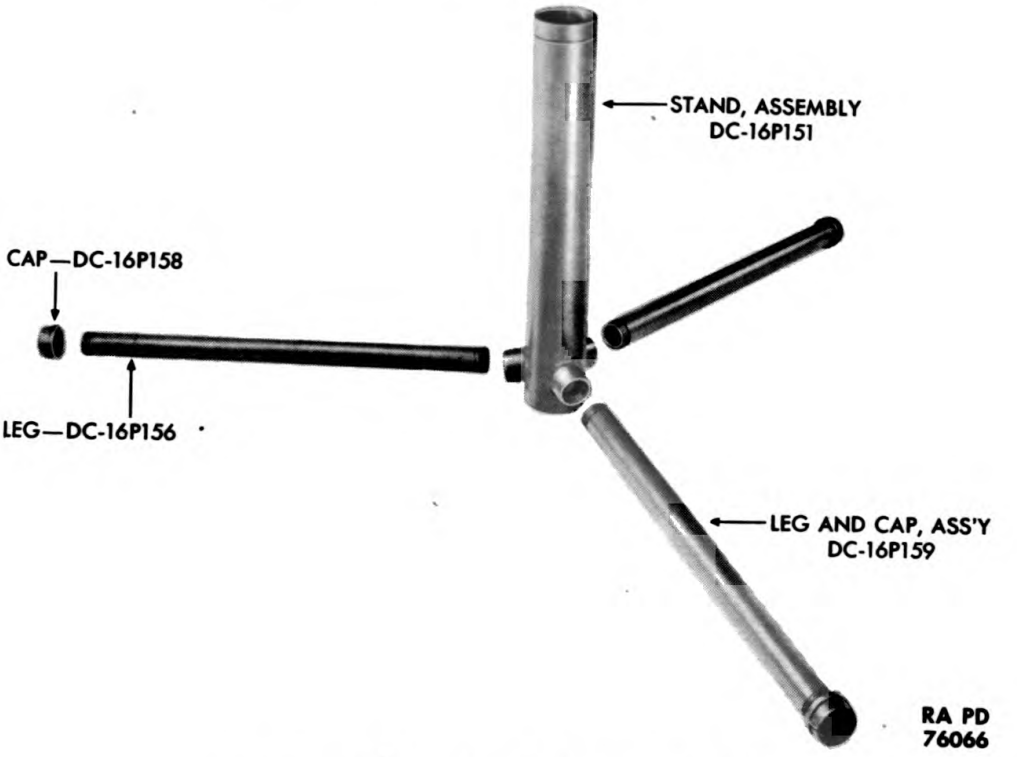


Figure 120 — Tripod — Disassembled

(6) Unscrew the cap and sleeve from the cylinder head to disassemble the discharge valve as shown in figure 127.

(7) The cylinder (fig. 128) is disconnected by removing the four cap screws which hold it to the base.

(8) Separate the inspection plate (fig. 129) from the crankcase by removing the four hexagonal-head cap screws. Reach through the inspection plate hole and unscrew the two connecting rod bolts. This will permit removal of the piston.

(9) The component parts of the piston and the connecting rod are shown disassembled in figure 130. Use care in slipping the piston rings from their grooves to avoid breaking them. It is necessary to expand them slightly to remove them.

(10) Remove the bearing adjustment plate and shims as shown in figure 131 by removing the four bearing carrier cap screws. This will expose the main bearing. Disassemble the 3-way valve as shown in figure 132.

(11) Remove the four bearing carrier screws that fasten the bearing carrier to the crank case (fig. 133). The crankshaft together with the bearing cones can be lifted from the crankcase. Do not misplace the oil ring.

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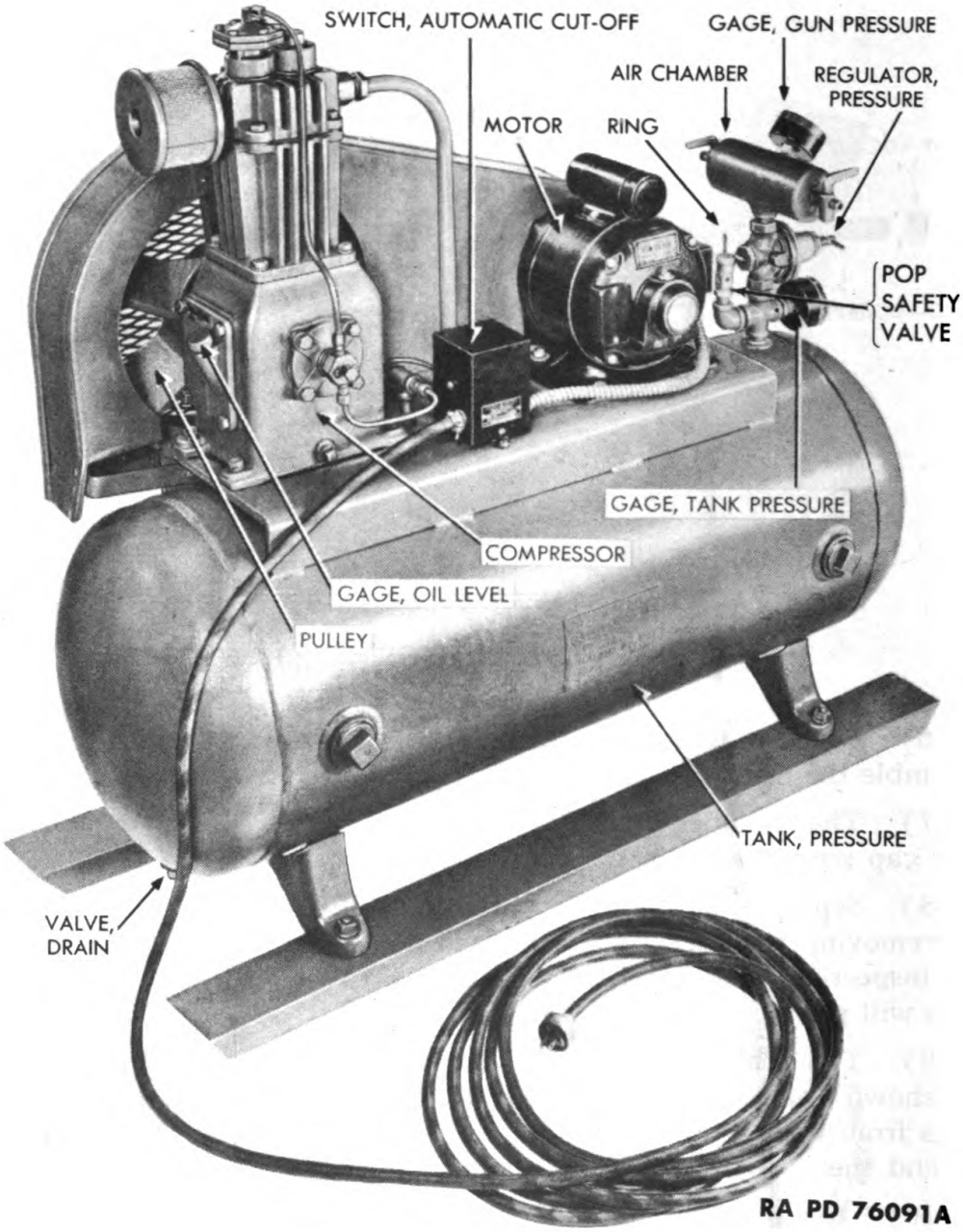


Figure 121 — Air Compressor Unit

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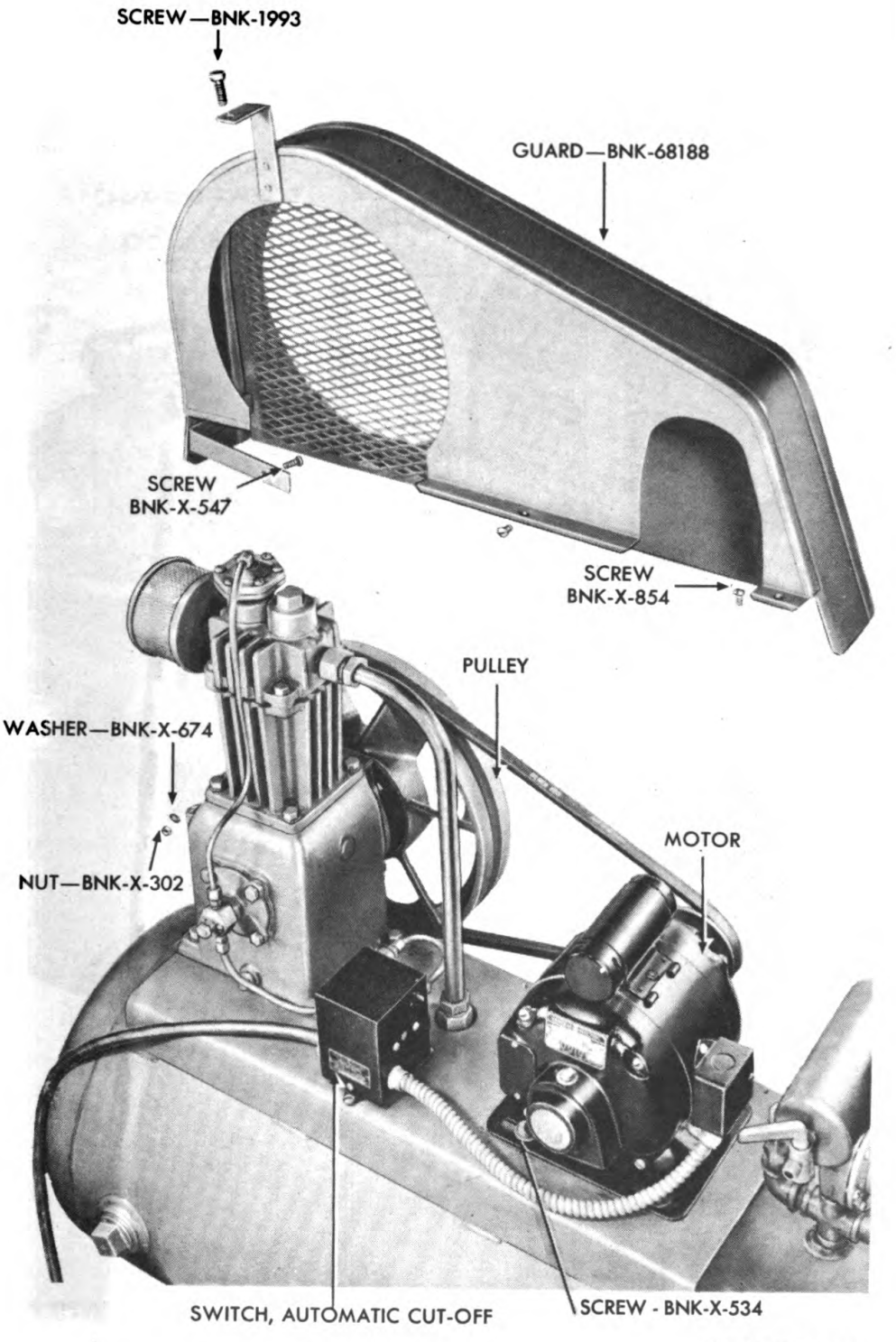


Figure 122 — Air Compressor — Belt Guard Removed

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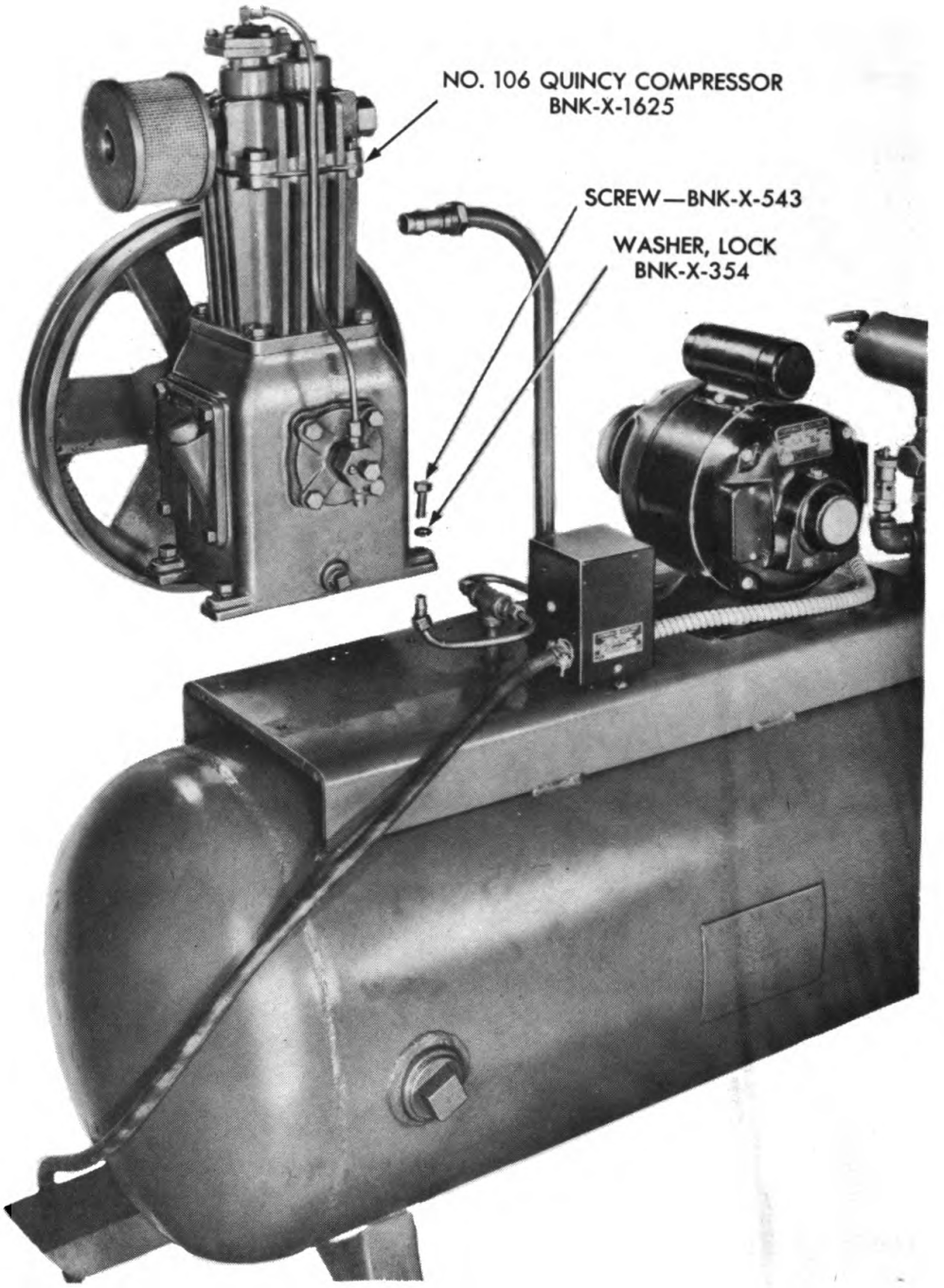


Figure 123 — Removal of Air Compressor

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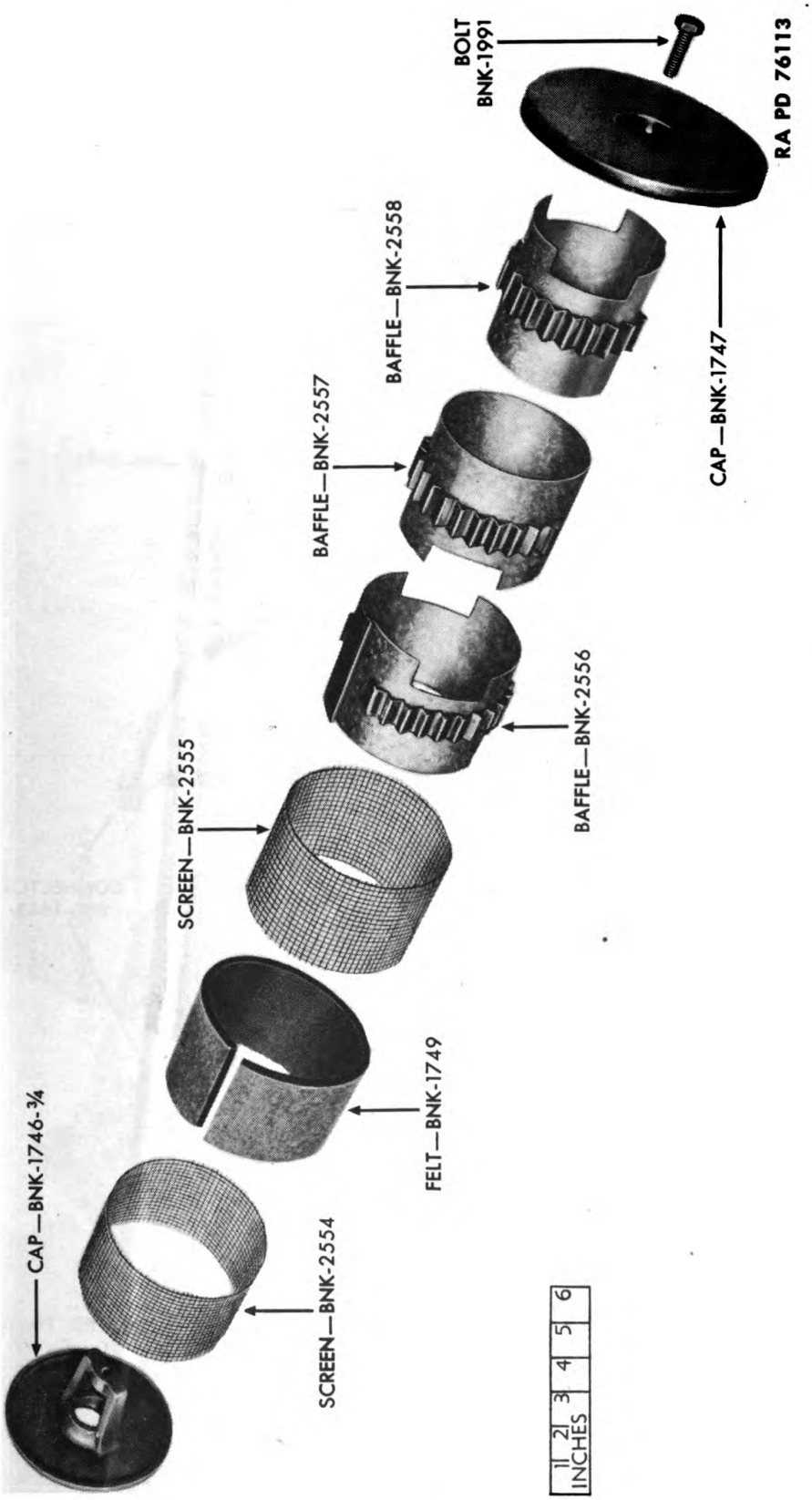


Figure 124 — Components of Air Filter for Air Compressor

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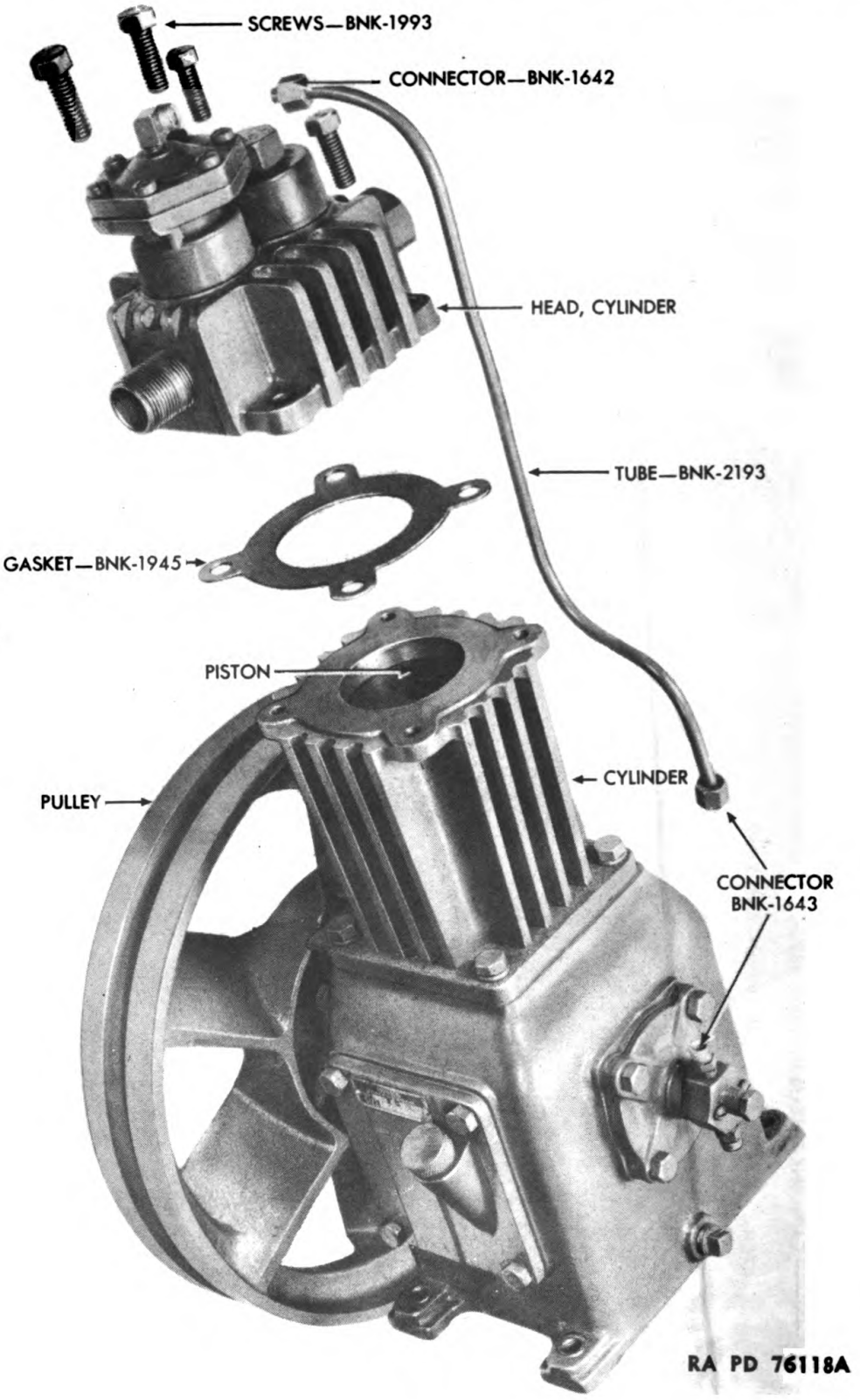


Figure 125 — Air Compressor — Cylinder Head and Tube Removed

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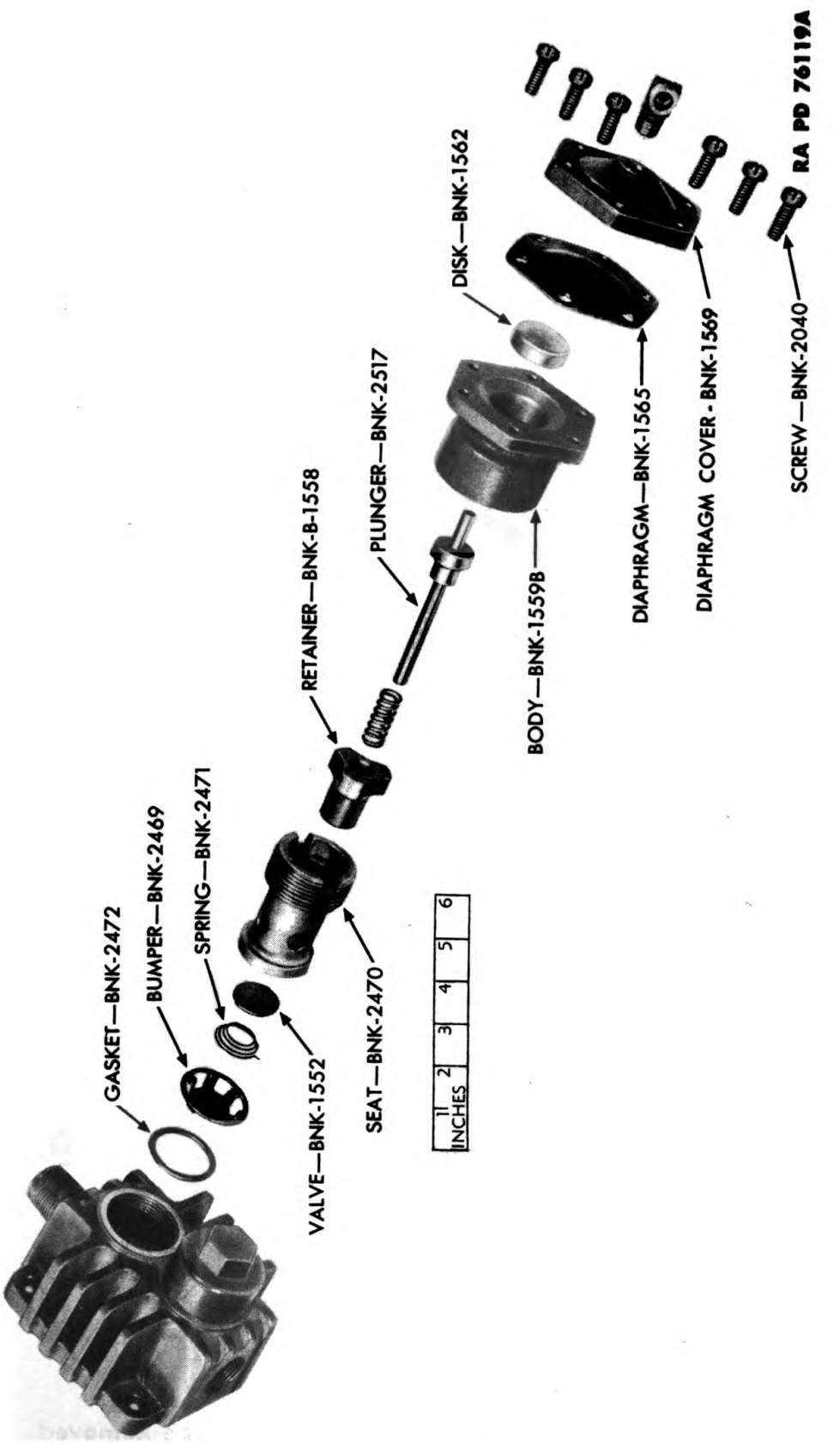


Figure 126 — Air Compressor Cylinder Head Showing Components of Diaphragm Unloader

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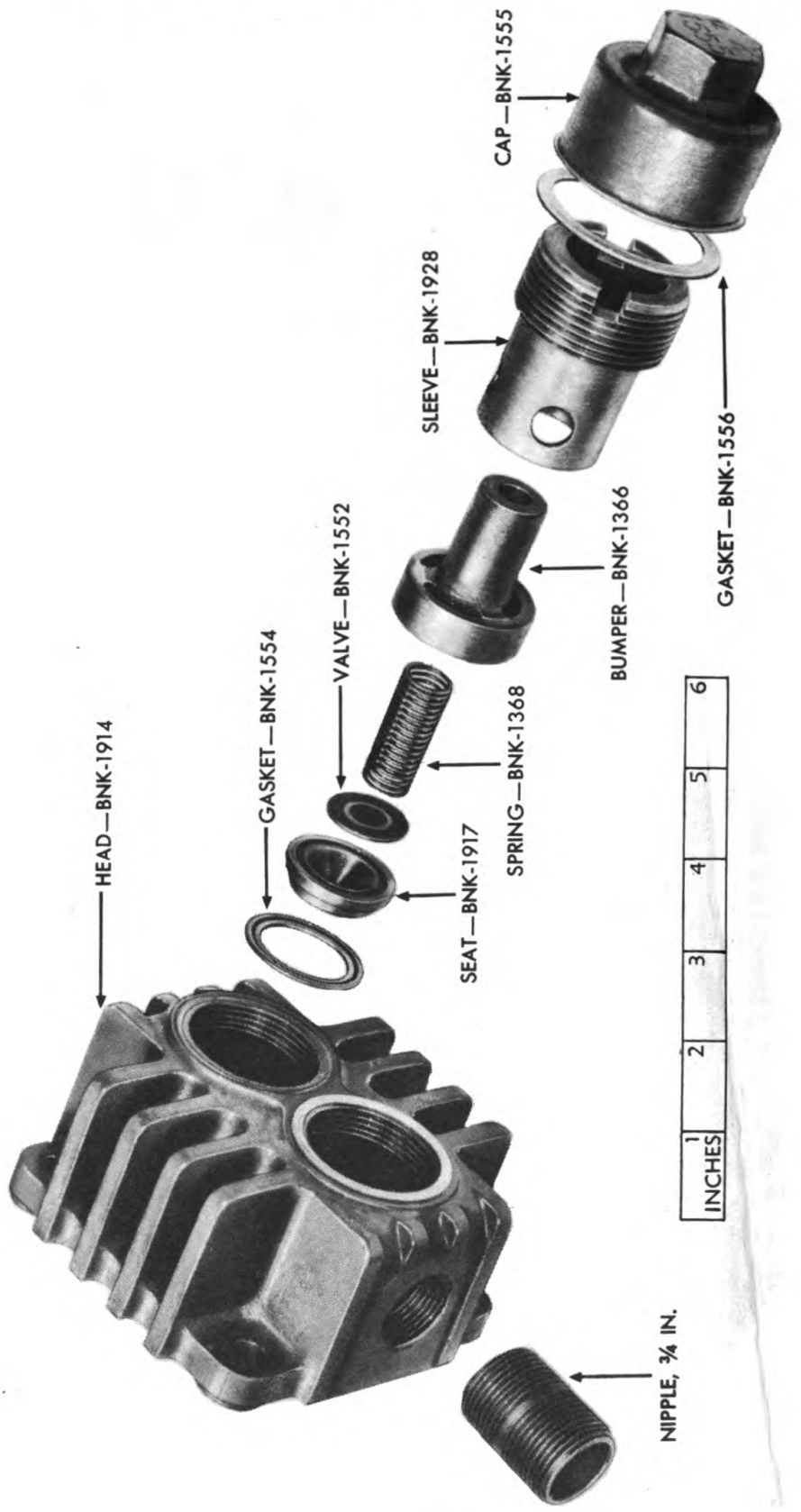


Figure 127 — Air Compressor Cylinder Head Showing Components of Discharge Valve

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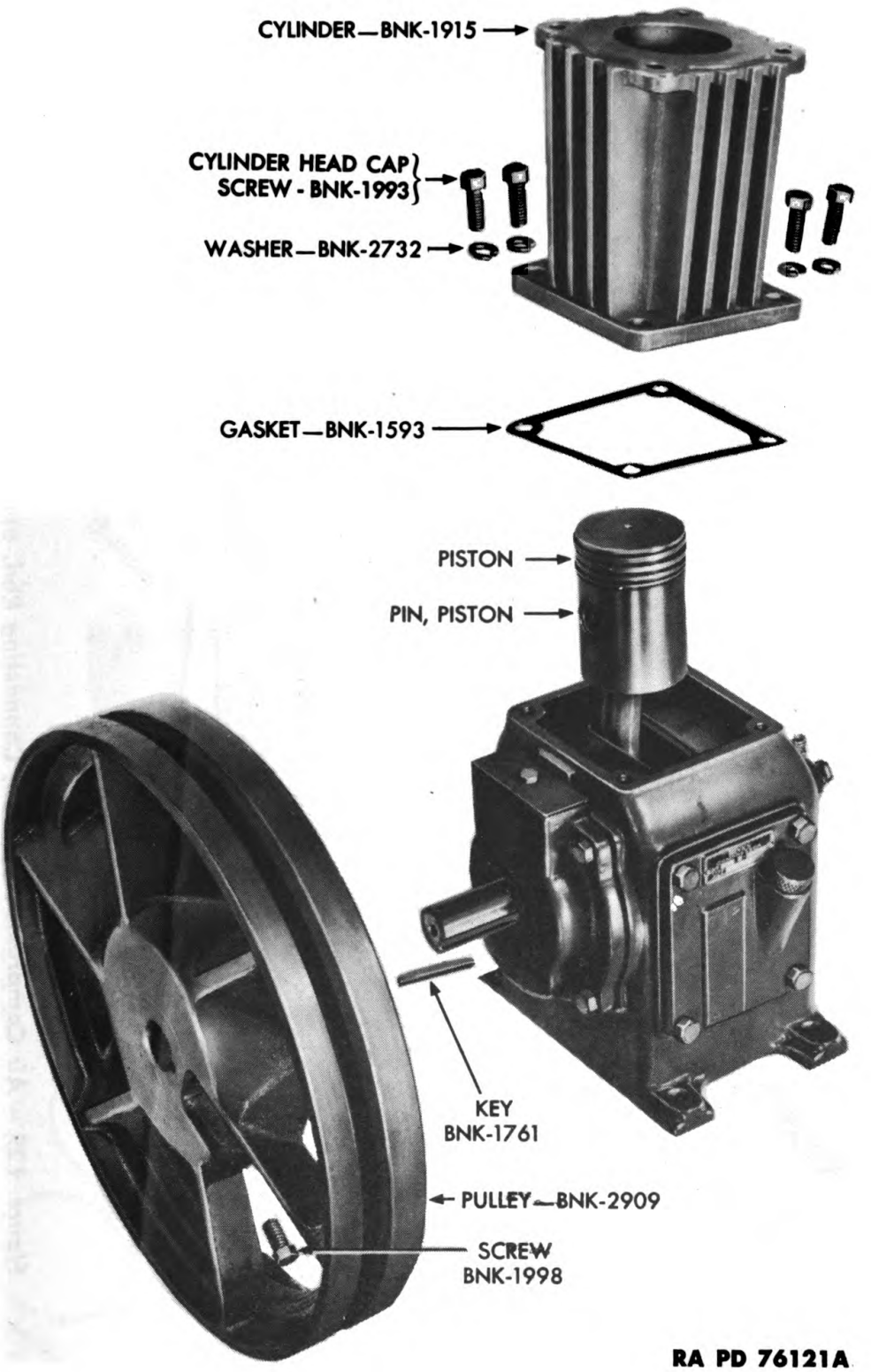


Figure 128 — Air Compressor — Cylinder and Pulley Removed

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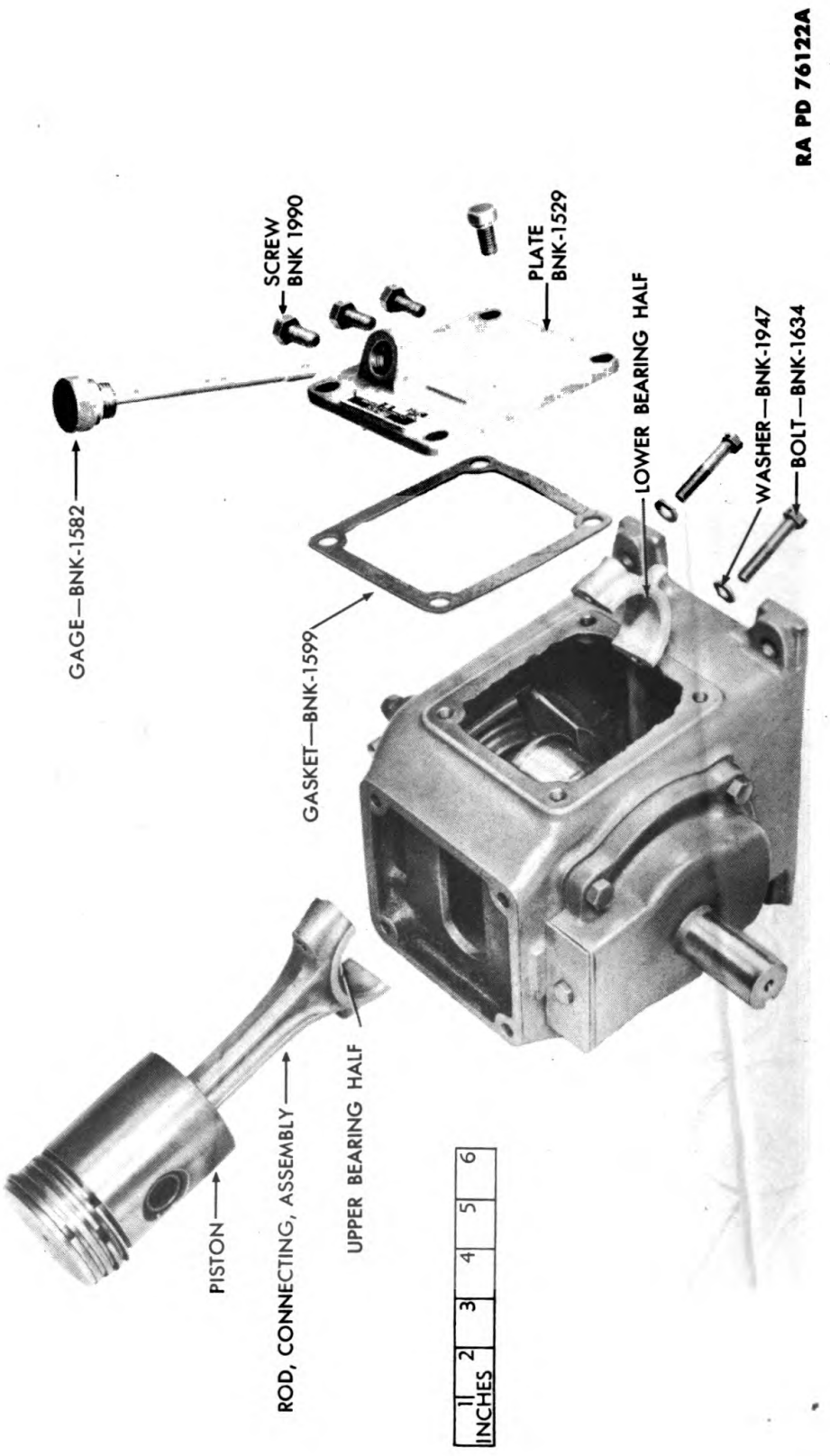


Figure 129 — Air Compressor — Piston, Connecting Rod, and Inspection Plate Removed

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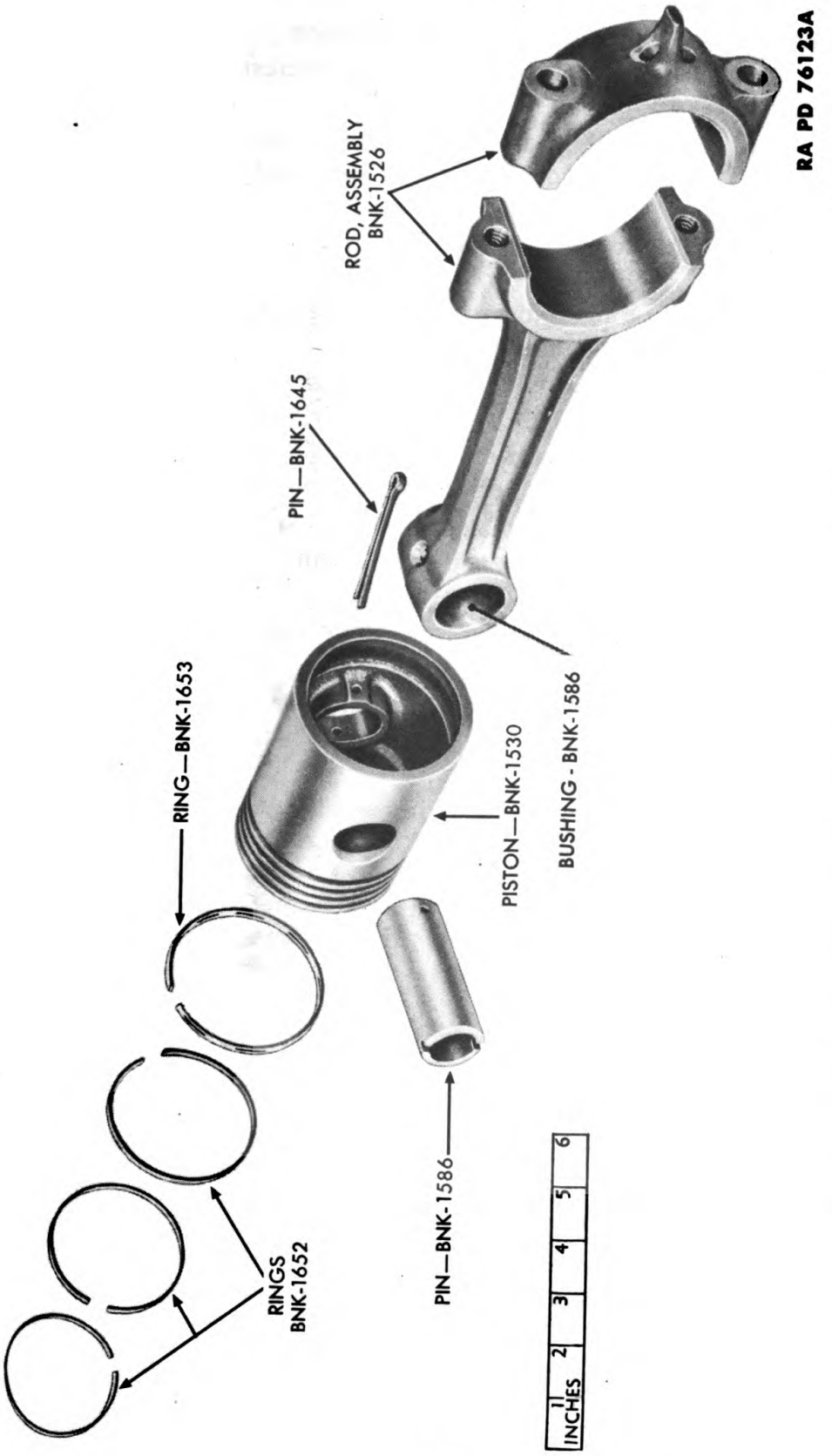


Figure 130 — Components of Piston and Connecting Rod for Air Compressor

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(12) Disassemble the bearing carrier as shown in figure 134. It will be necessary to force the cup from the plate.

(13) Slide the bearing cones from the crankshaft as shown in figure 135.

(14) The centrifugal governor is removed and disassembled as shown in figure 135. Remove the cotter pins and the springs from the pins.

(15) Drive out the pins BNK-1579 and then remove the pins BNK-1863.

(16) Push the plunger toward the crankshaft and pull out the bar to complete the disassembly.

(17) Remove the screw and lock washer to remove the automatic cut-off switch cover (fig. 136) from the switch.

(18) Disconnect the motor electrical leads from the switch. Remove the motor (fig. 137) by removing the four screws and washers.

(19) The thermotector in the motor can be removed after removing the end plate as shown in figure 138. Normally this is not recommended.

(20) The V-pulley is removed from the motor shaft by removing the set screw and the key (fig. 139).

(21) Disconnect the air tube connection to the cut-off switch. Remove the three screws to free the switch from the compressor tank base (fig. 140).

(22) The cut-off switch can be disassembled as shown in figures 141, 142, 143, and 144. Remove the hexagonal nut from the screw to free the block assembly, the rocker, and associated parts from the box. The rocker and block assembly are pivoted into the sides of the box. Remove the screen fastening the contacts to the holders and the movable contact holders to disassemble them as shown in figure 142.

(23) Remove the screws shown in figure 143 to disassemble the diaphragm, clamping plate, and spring assembly from the end plate.

(24) Remove the two screws and lock washers from the yoke and the spring assembly can be disassembled as shown in fig. 144.

(25) Unscrew the tubes (fig. 145) and connectors from the storage tank to disassemble the components.

(26) Unscrew the equalizing tank and related parts as shown in figure 146. The parts are further disassembled as shown in figures 147 and 148.

(27) The parts of the pressure regulator are shown disassembled in figure 149. The regulator can be completely disassembled by removing the plug from the body and by removing the hex-

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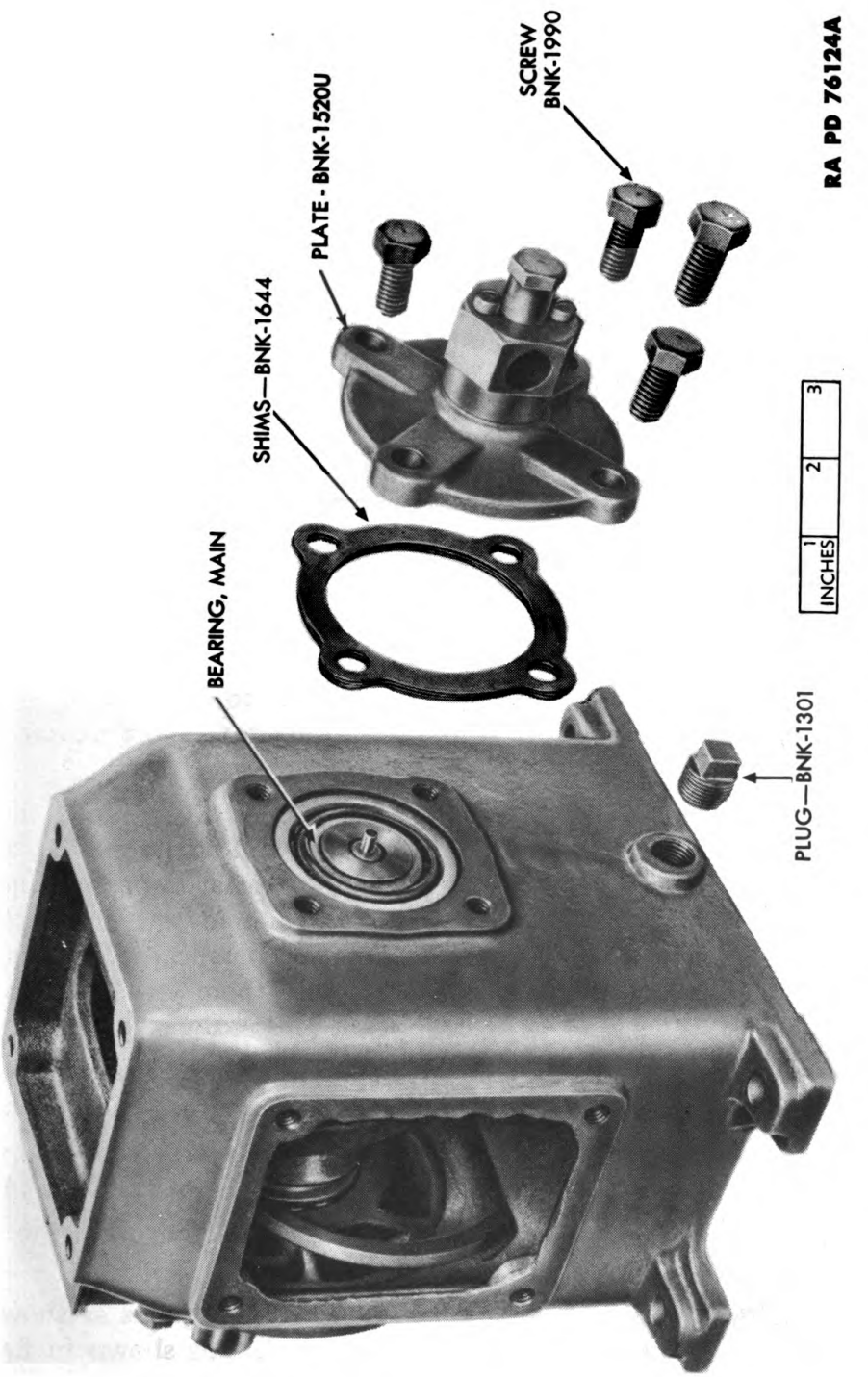


Figure 131 — Air Compressor — Adjustment Plate and Plug Removed

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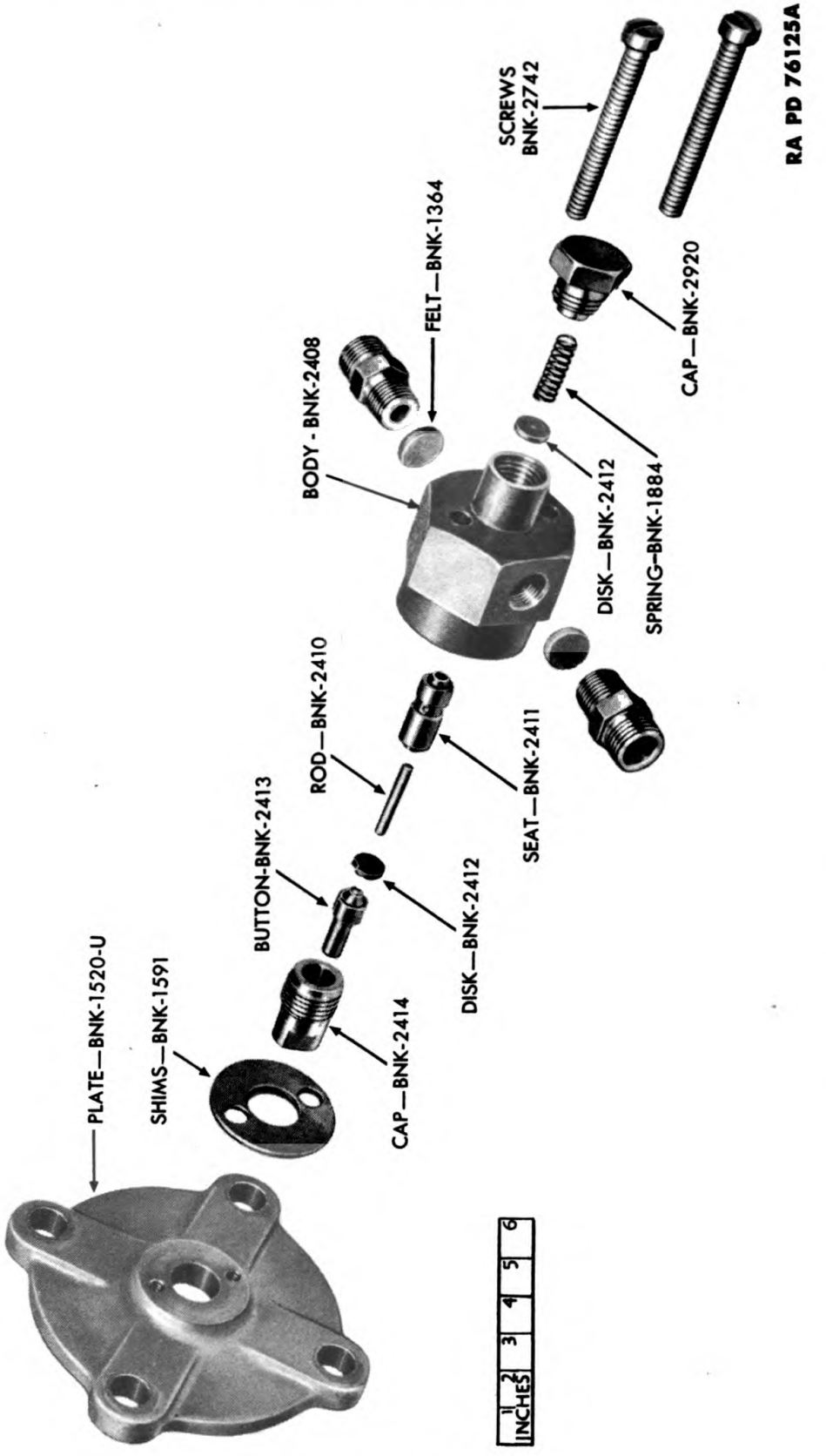


Figure 132 — Components of 3-way Valve for Air Compressor

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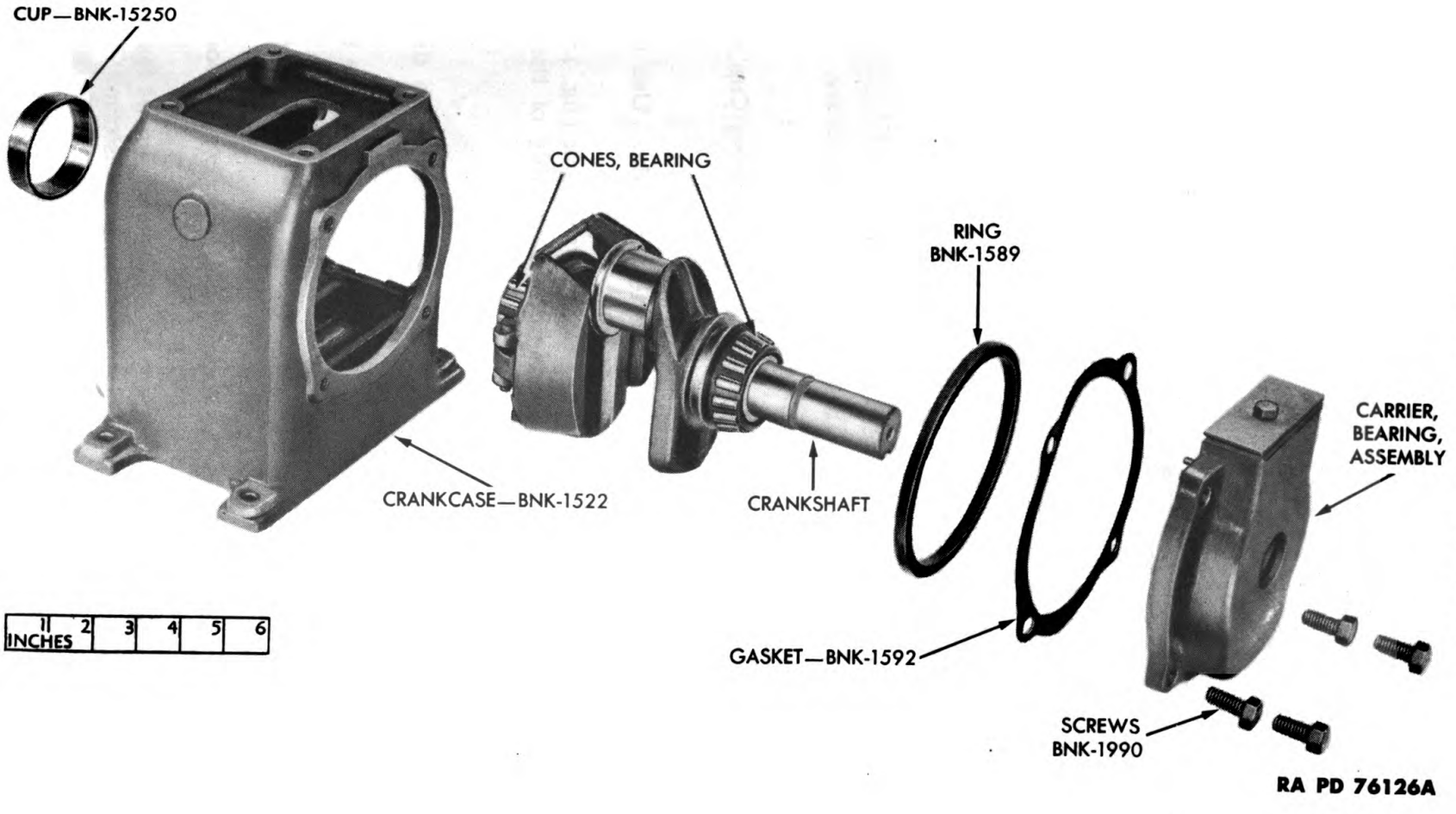


Figure 133 — Air Compressor — Bearing Carrier Assembly and Crankshaft Removed

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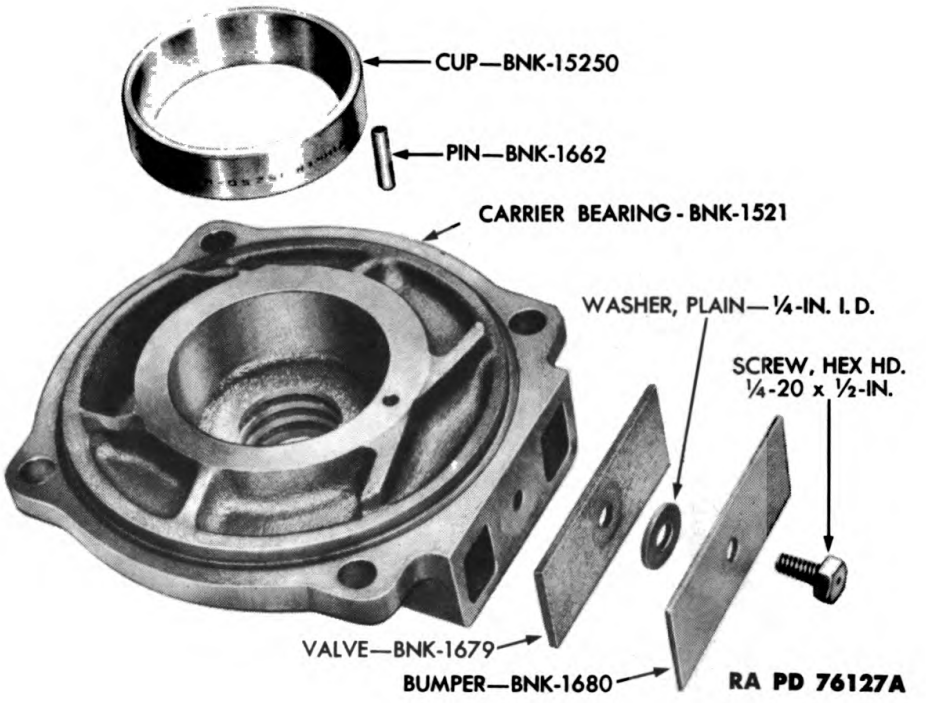


Figure 134 — Air Compressor Bearing Carrier With Bearing Cup and Breather Valve Removed

agonal nut and screws fastening the bonnet to the body. Use care not to damage the diaphragm set or the screen.

(28) Remove the bolts fastening the skids to the tank (fig. 150), and unscrew the drain valve to complete the disassembly of the air compressor.

h. Ultraviolet Lamp and Transformer.

(1) Consult figures 106 and 107 before proceeding with disassembly.

(2) Remove the screw assemblies (fig. 151) fastening the support assembly to the reflector assembly.

(3) The lens is removed by loosening the clamping ring part of the reflector assembly which holds the lens in position.

(4) Unscrew the bulb from the socket. Disassemble the socket by removing the two screws and hexagonal nuts.

(5) Remove the twenty self-tapping binding head screws fastening the housing (fig. 152) to the ultraviolet lamp transformer support assembly.

(6) Unsolder the electrical leads connecting the switch, receptacle, autotransformer, and cord as shown in figure 153. Remove

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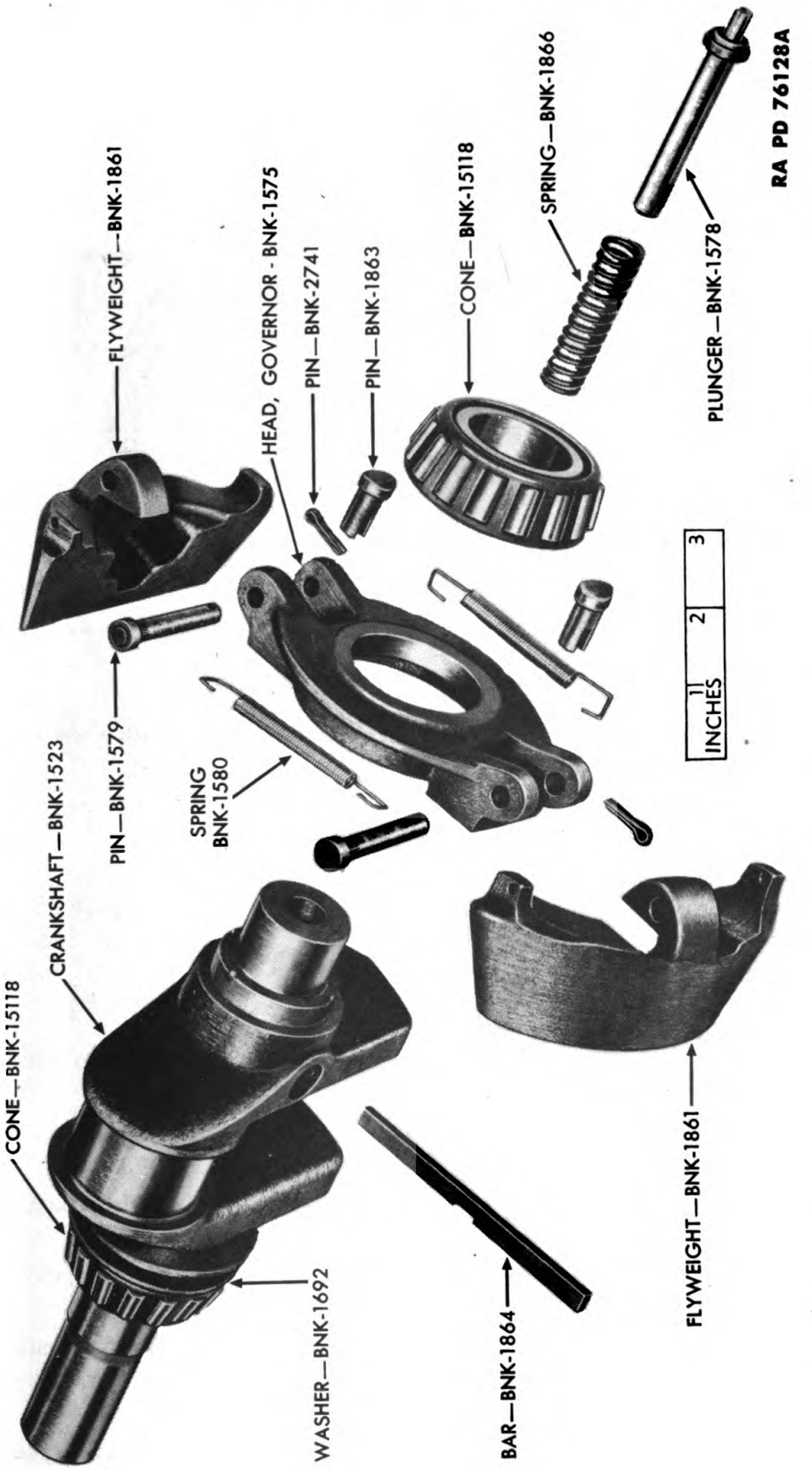


Figure 135 — Air Compressor Crankshaft With Bearing Cone and Centrifugal Governor Removed

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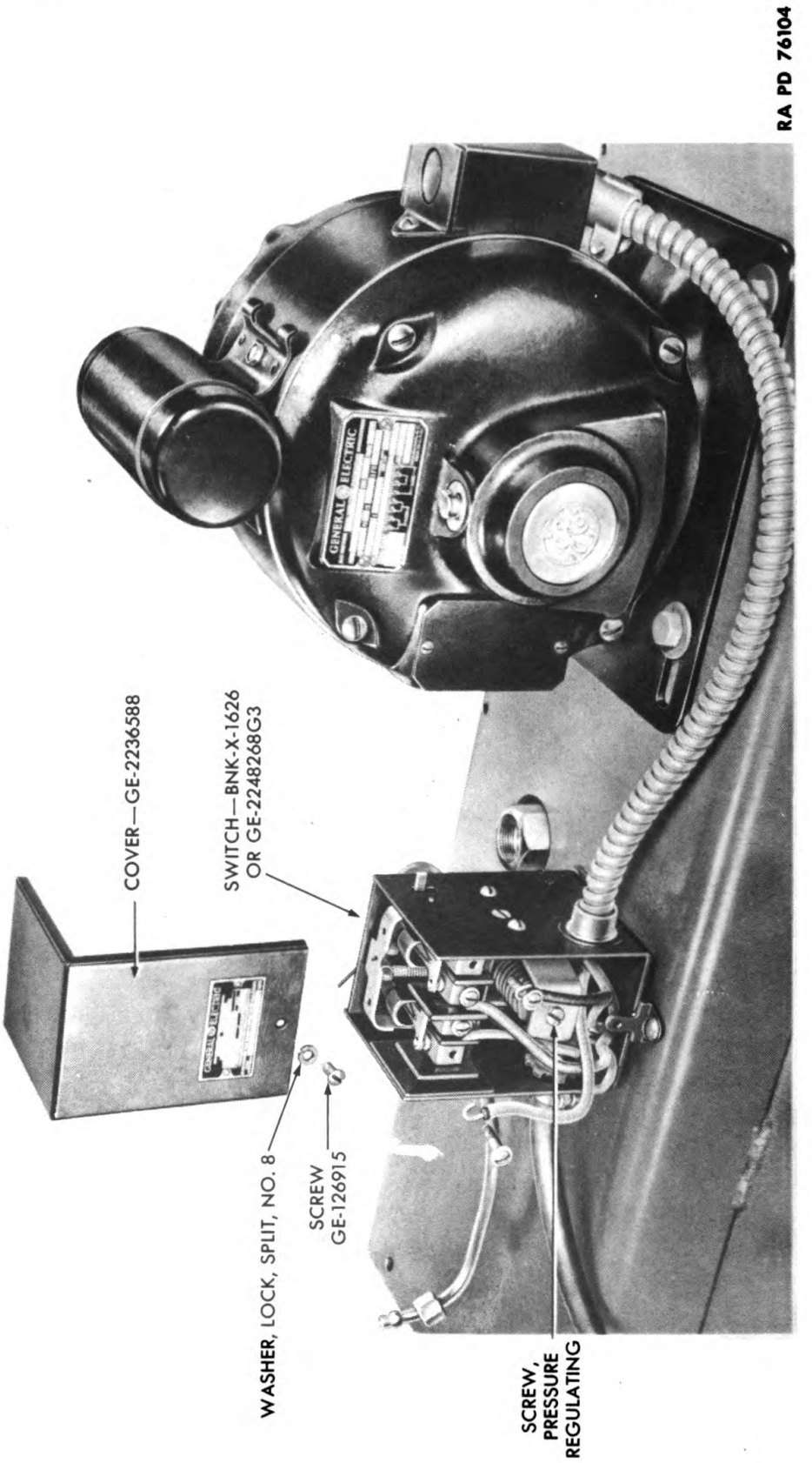


Figure 136 — Removal of Cover From Automatic Cut-off Switch of Air Compressor

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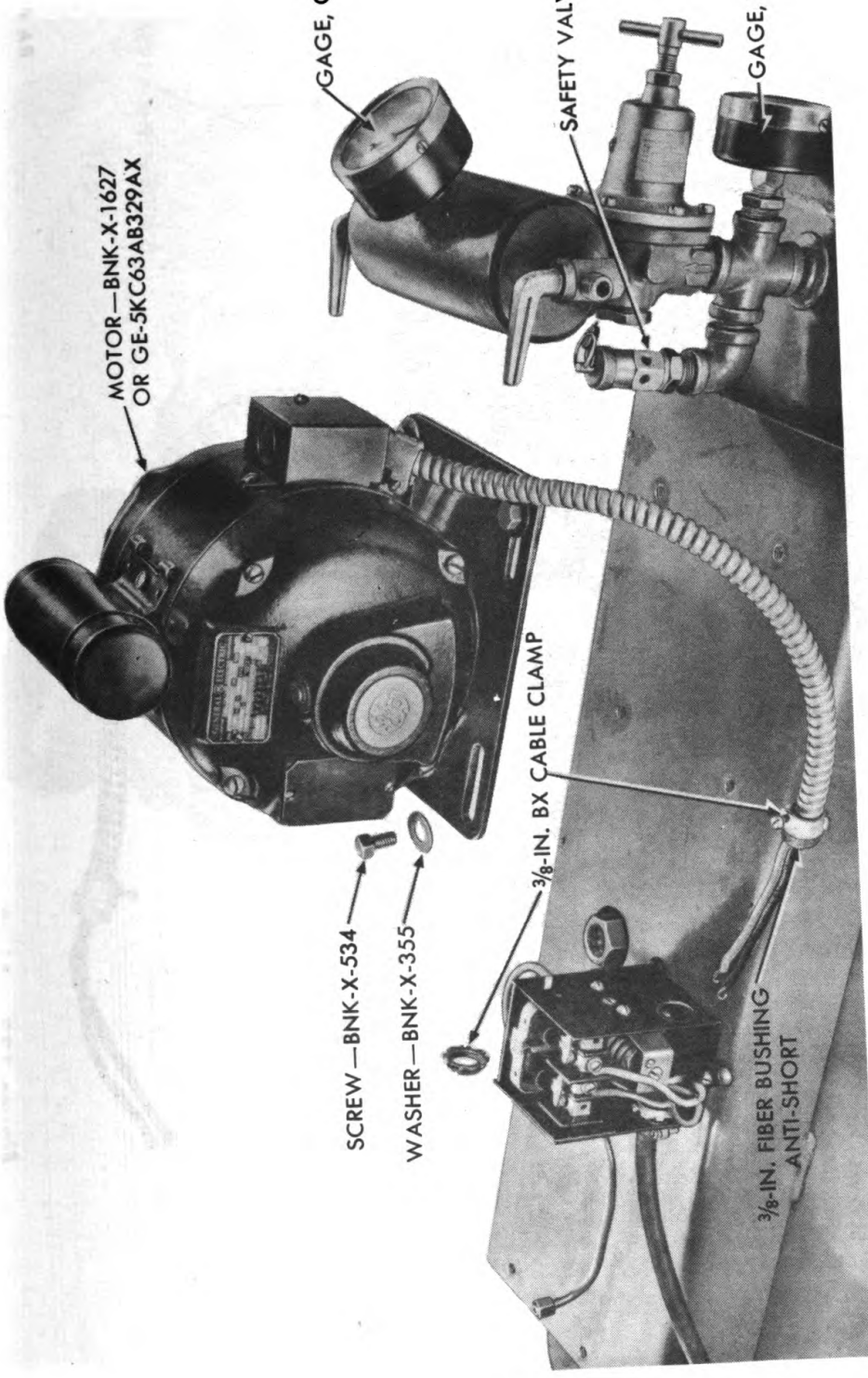


Figure 137 — Motor Removed From Air Compressor

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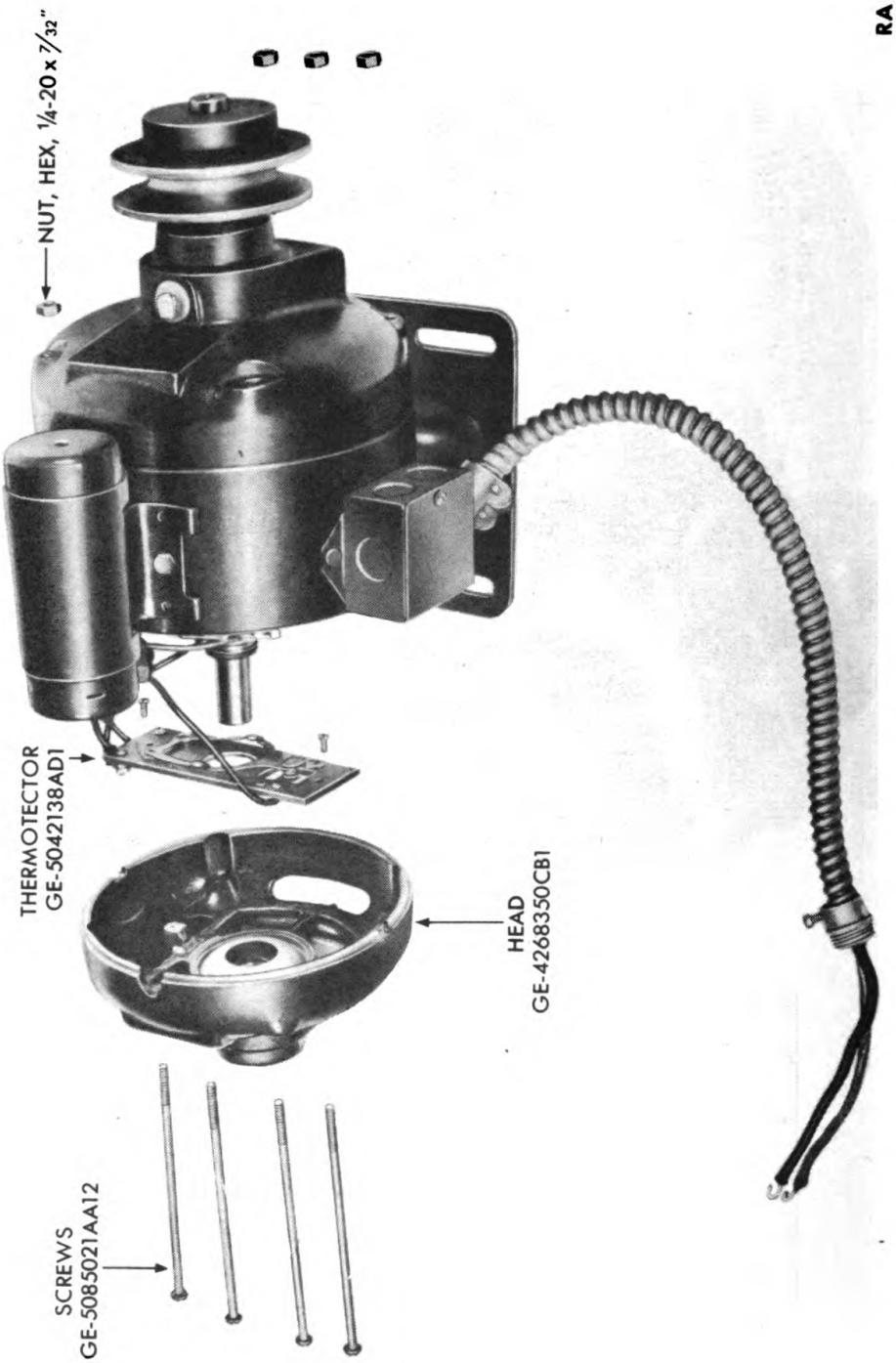


Figure 138 — Air Compressor Motor — End Plate and Thermotector Removed

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Figure 139 — Air Compressor Motor — Pulley and Connecting Wires Removed

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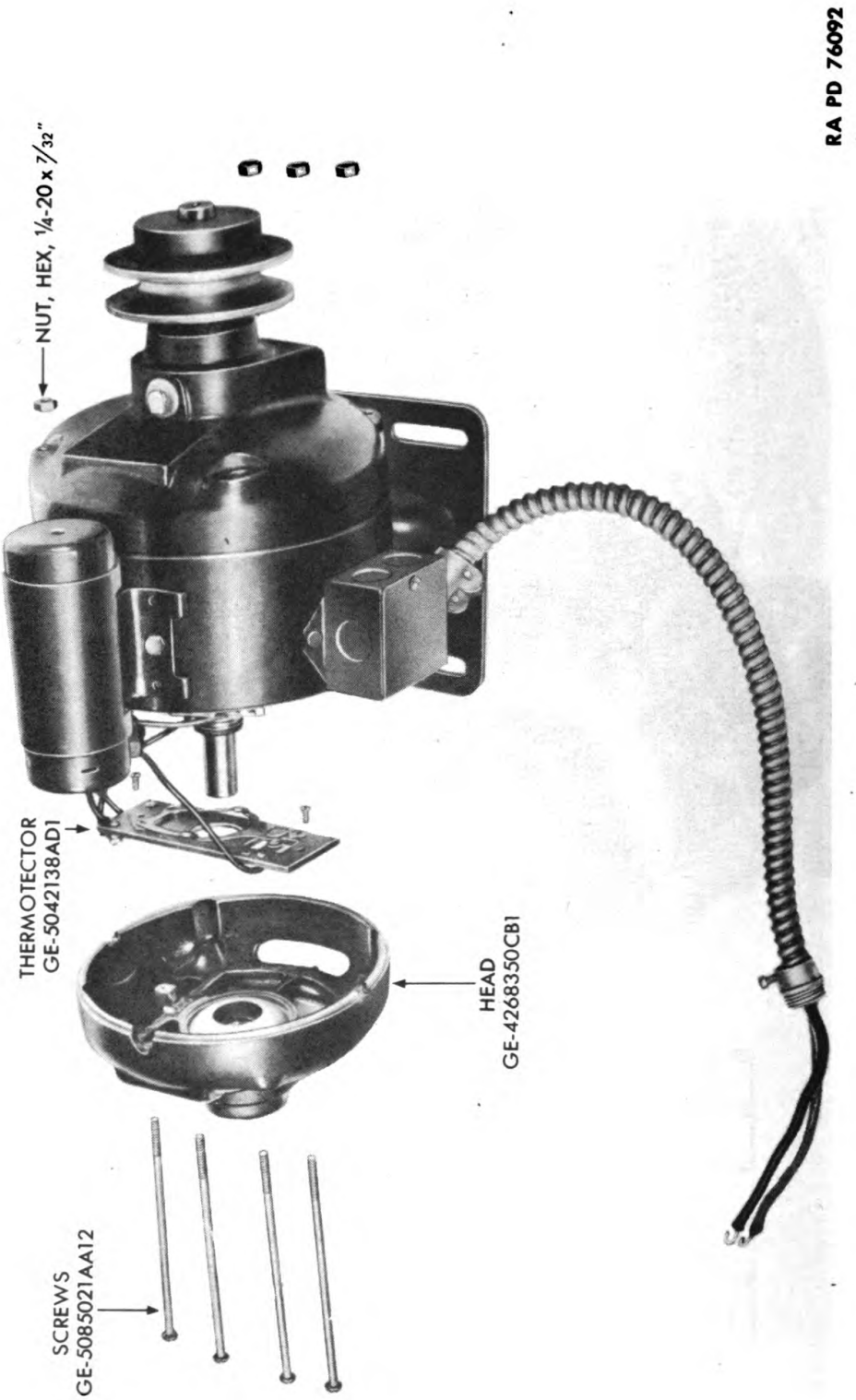


Figure 138 — Air Compressor Motor — End Plate and Thermotector Removed

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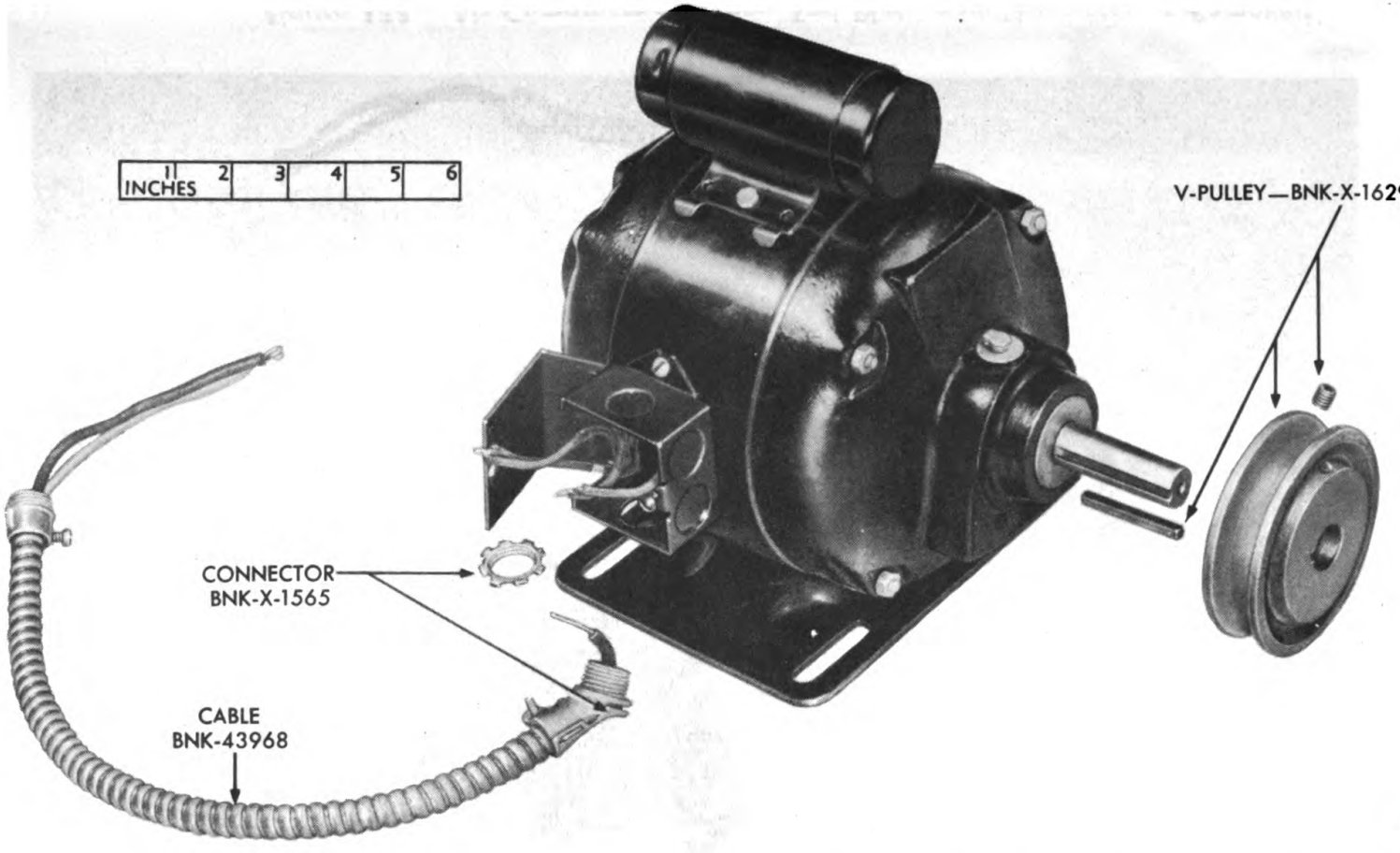


Figure 139 — Air Compressor Motor — Pulley and Connecting Wires Removed

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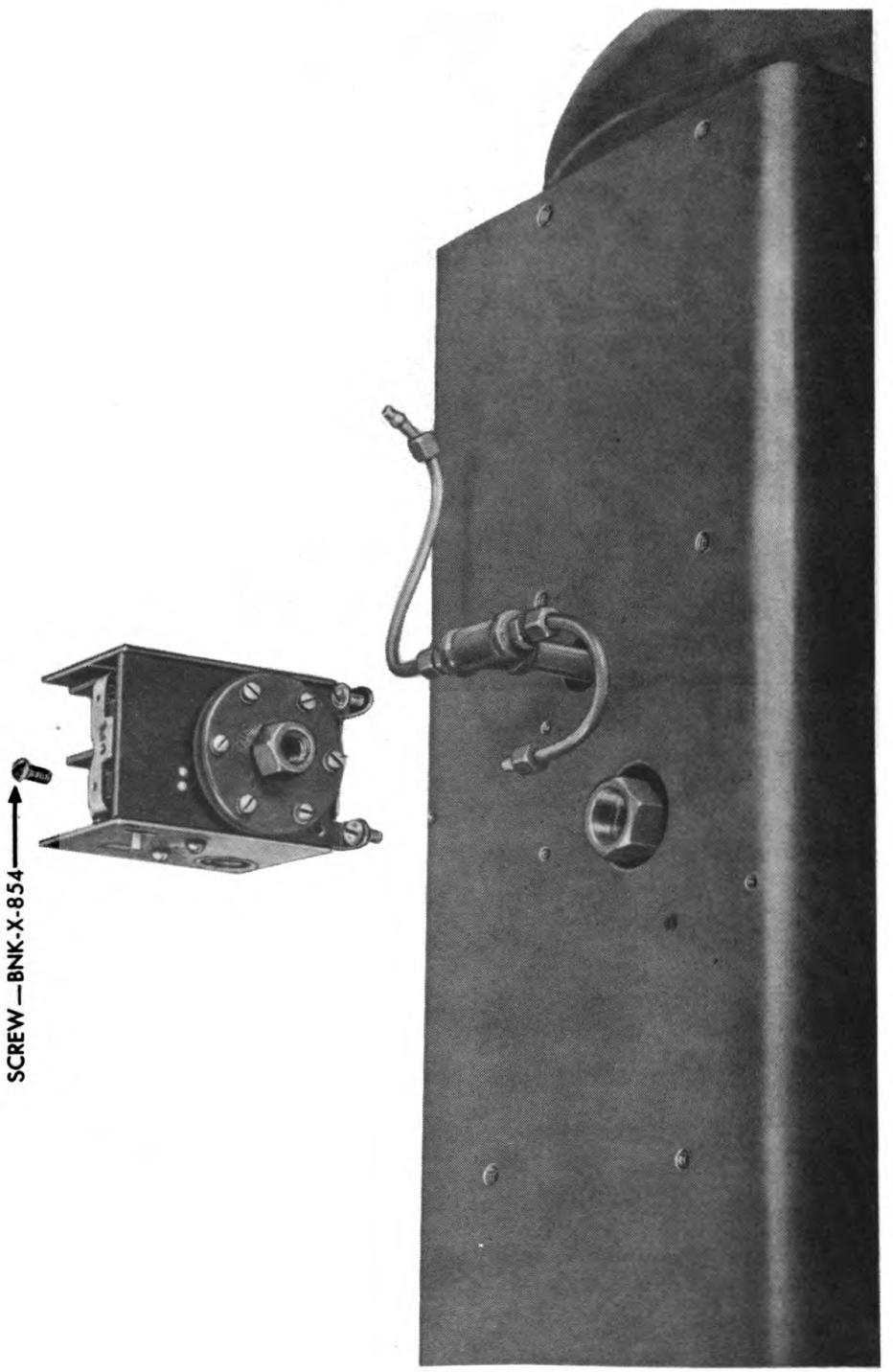


Figure 140 — Cut-off Switch Removed From Air Compressor Tank

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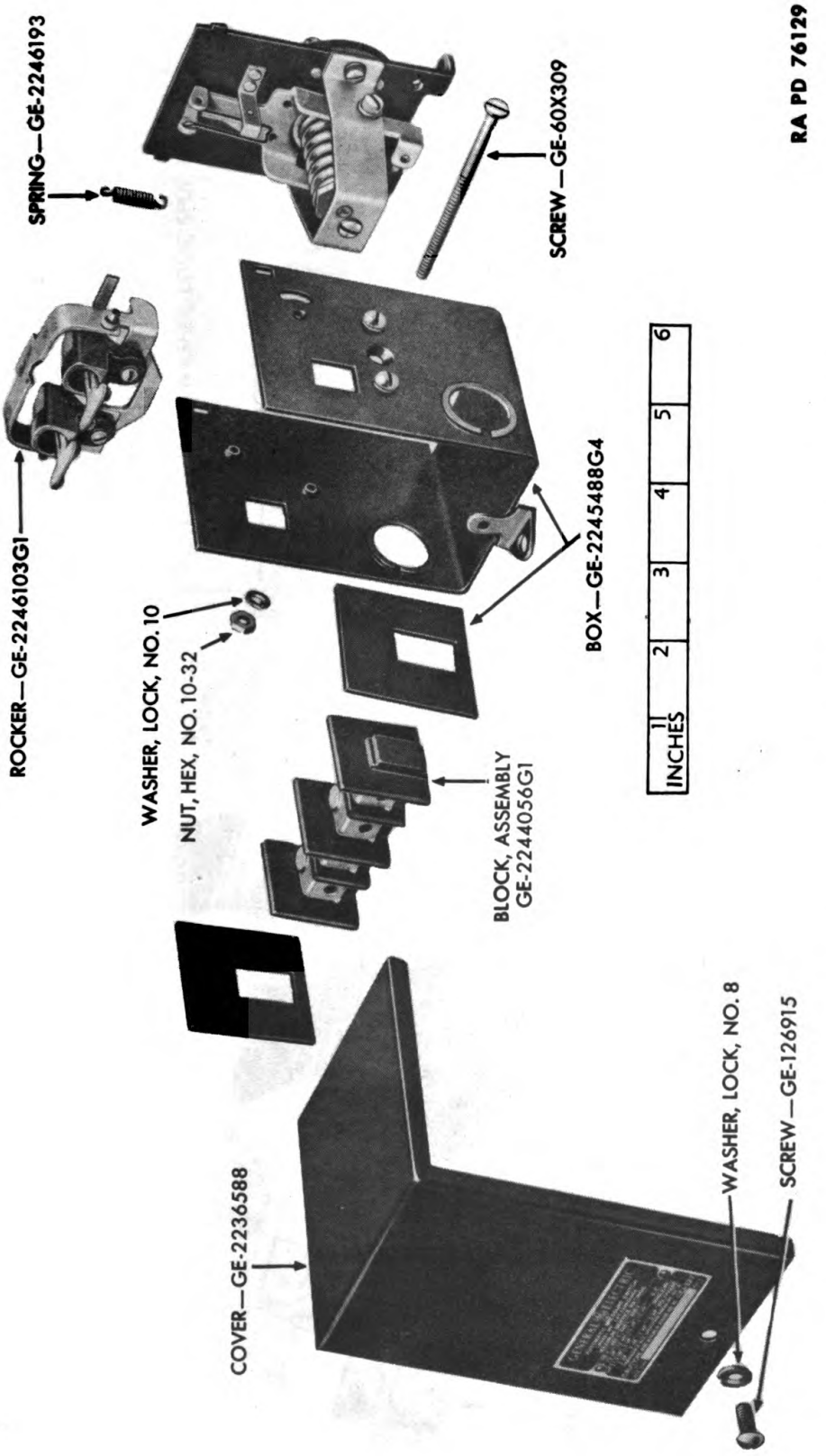


Figure 141 — Components of Cut-off Switch for Air Compressor

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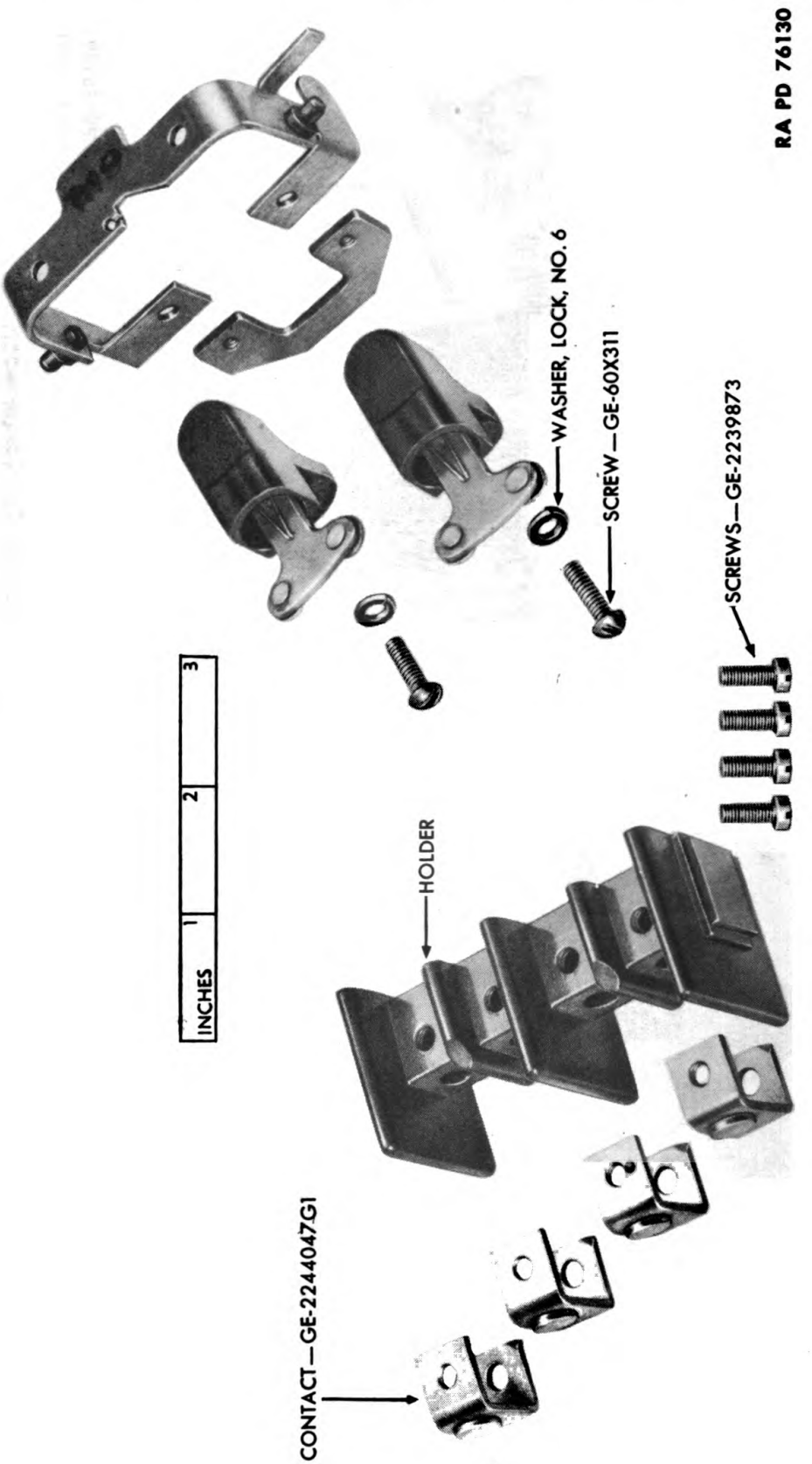


Figure 142 — Components of Cut-off Switch Contacts for Air Compressor

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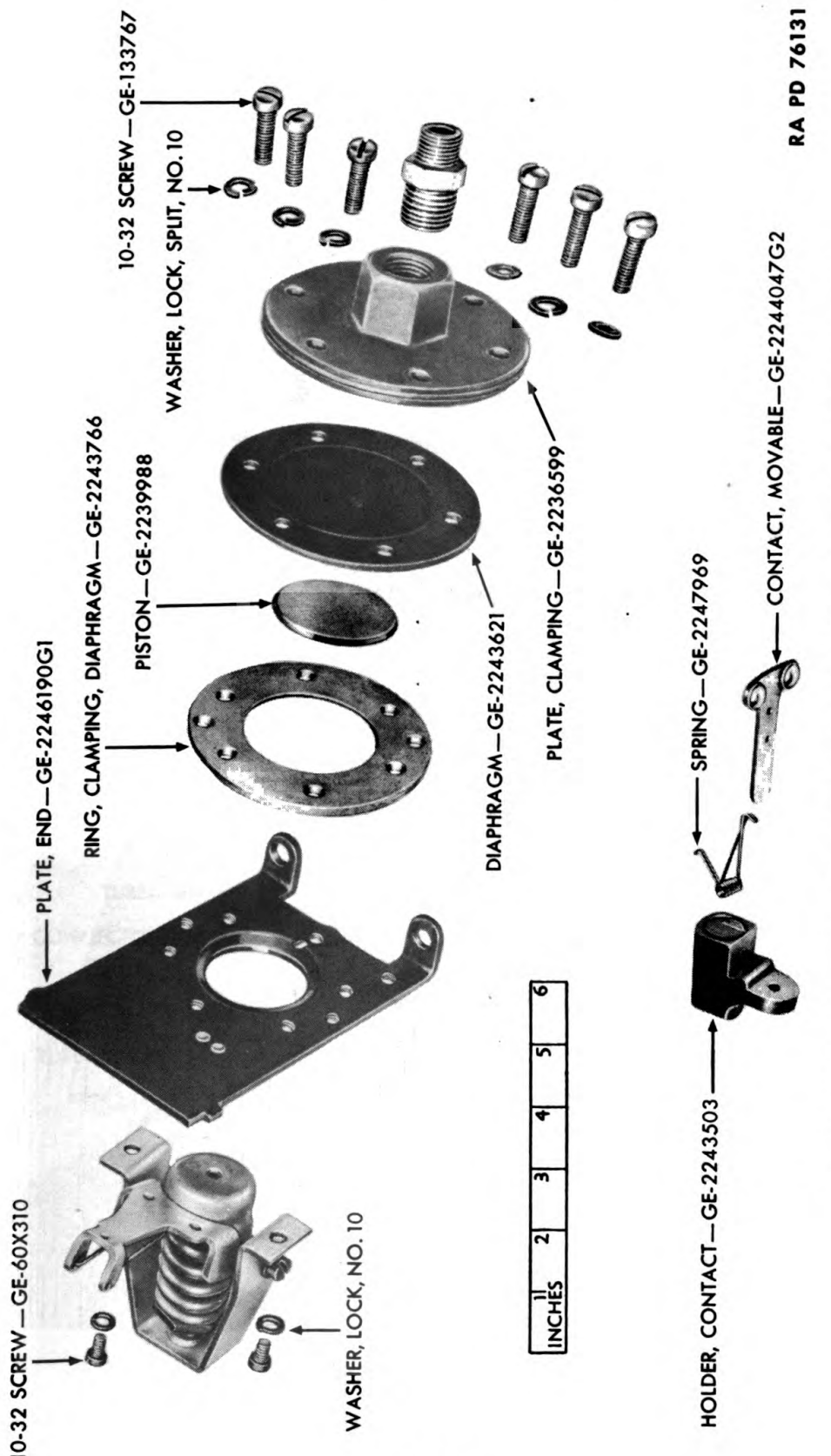


Figure 143 — Components of Cut-off Switch Diaphragm for Air Compressor

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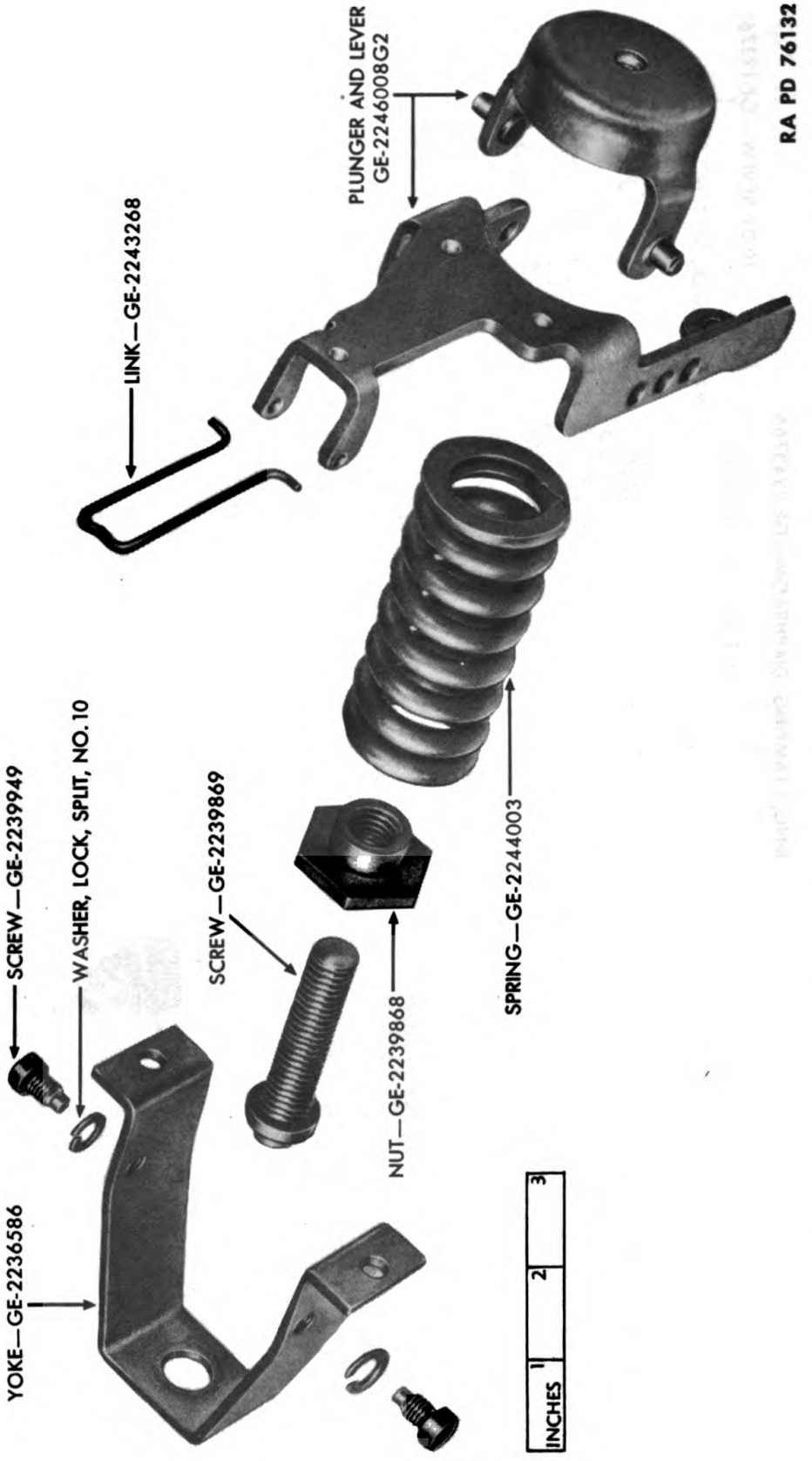


Figure 144 — Components of Spring Assembly for Cut-off Switch Diaphragm of Air Compressor

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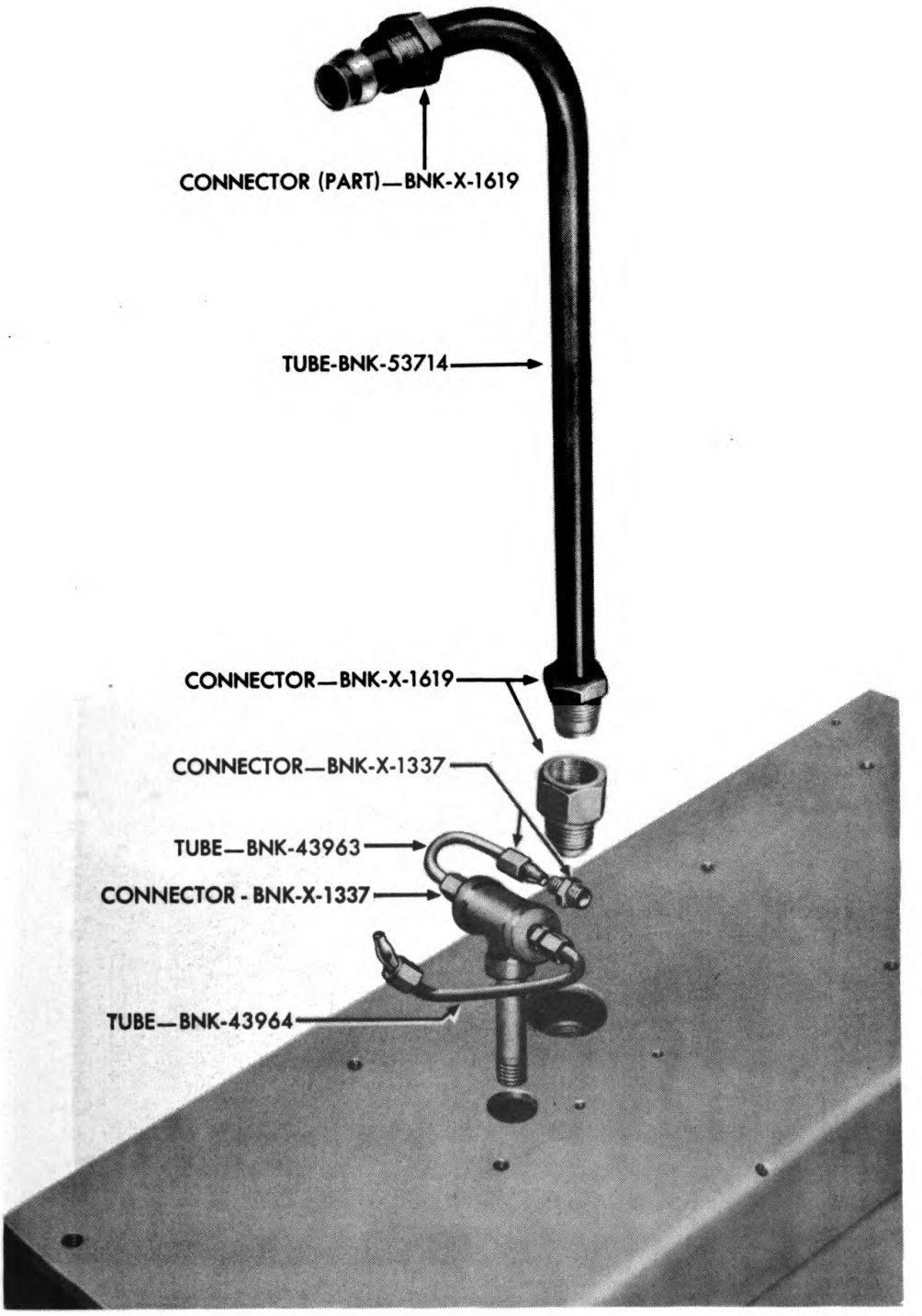
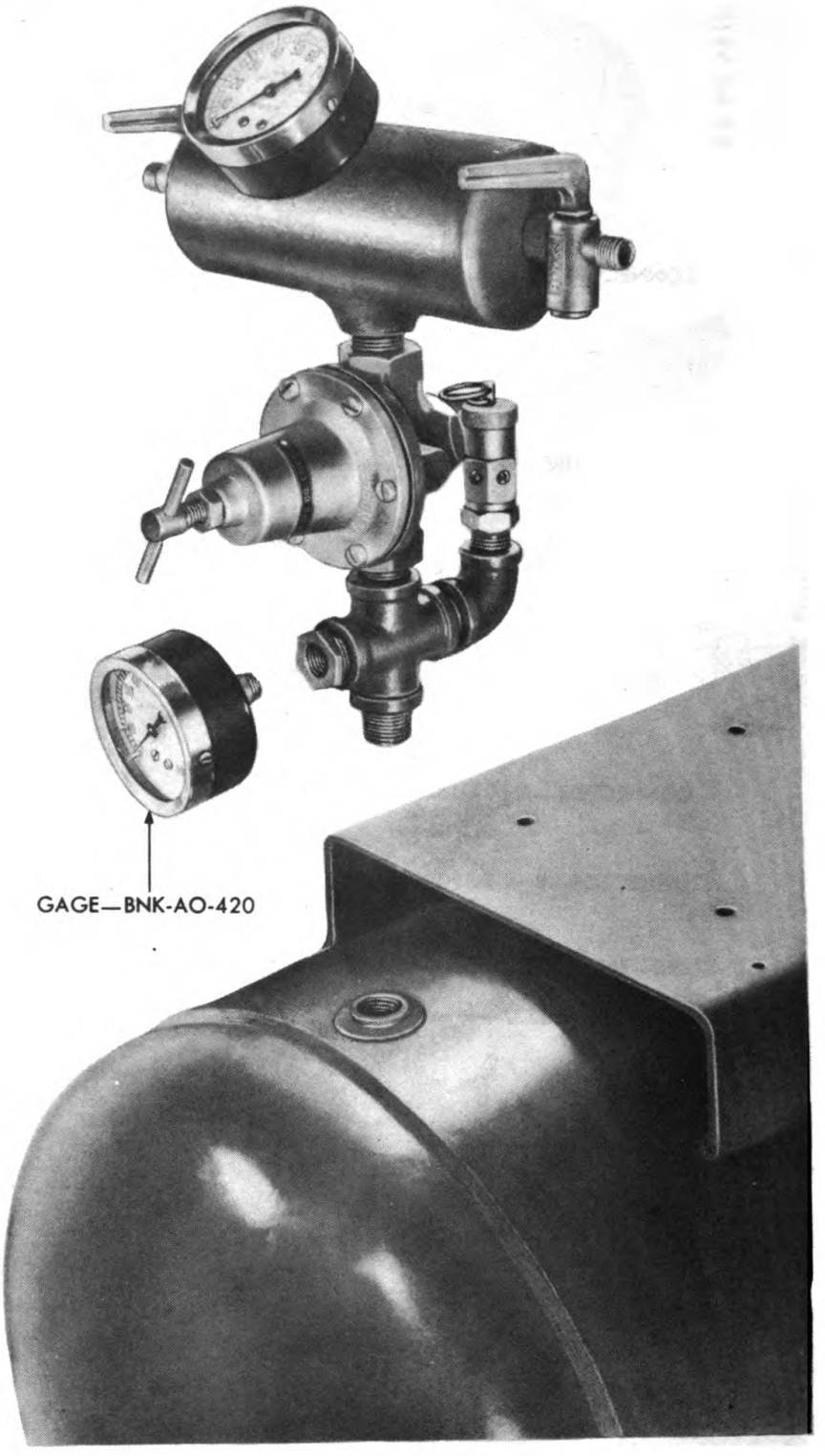


Figure 145 — Tubes, Connectors and Related Parts of Air Compressor Tank

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Figure 146 — Removal of Equalizing Tank and Related Parts From Air Compressor Tank

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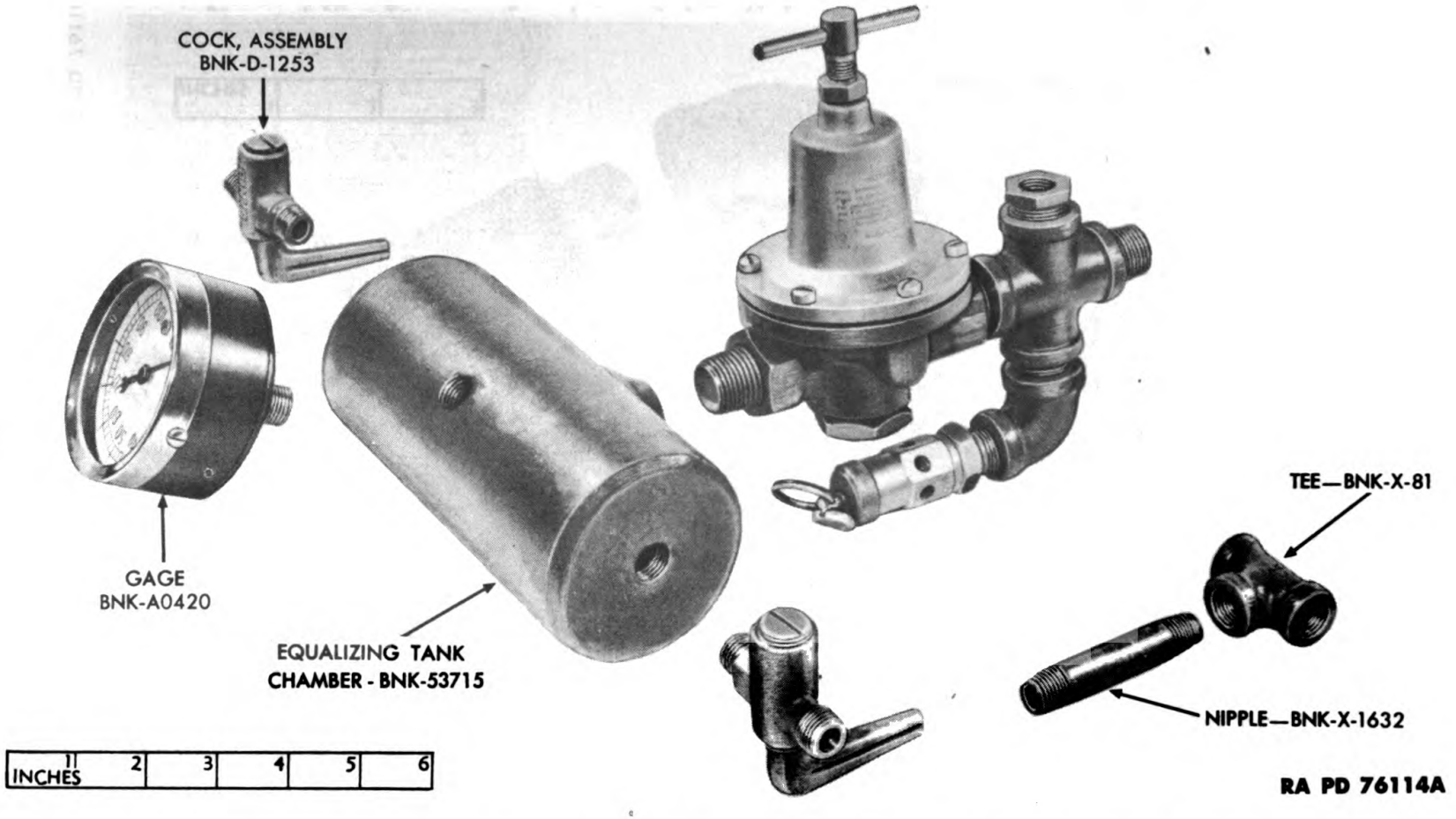


Figure 147 — Equalizing Tank Pressure Gage, Regulator, and Fittings for Air Compressor

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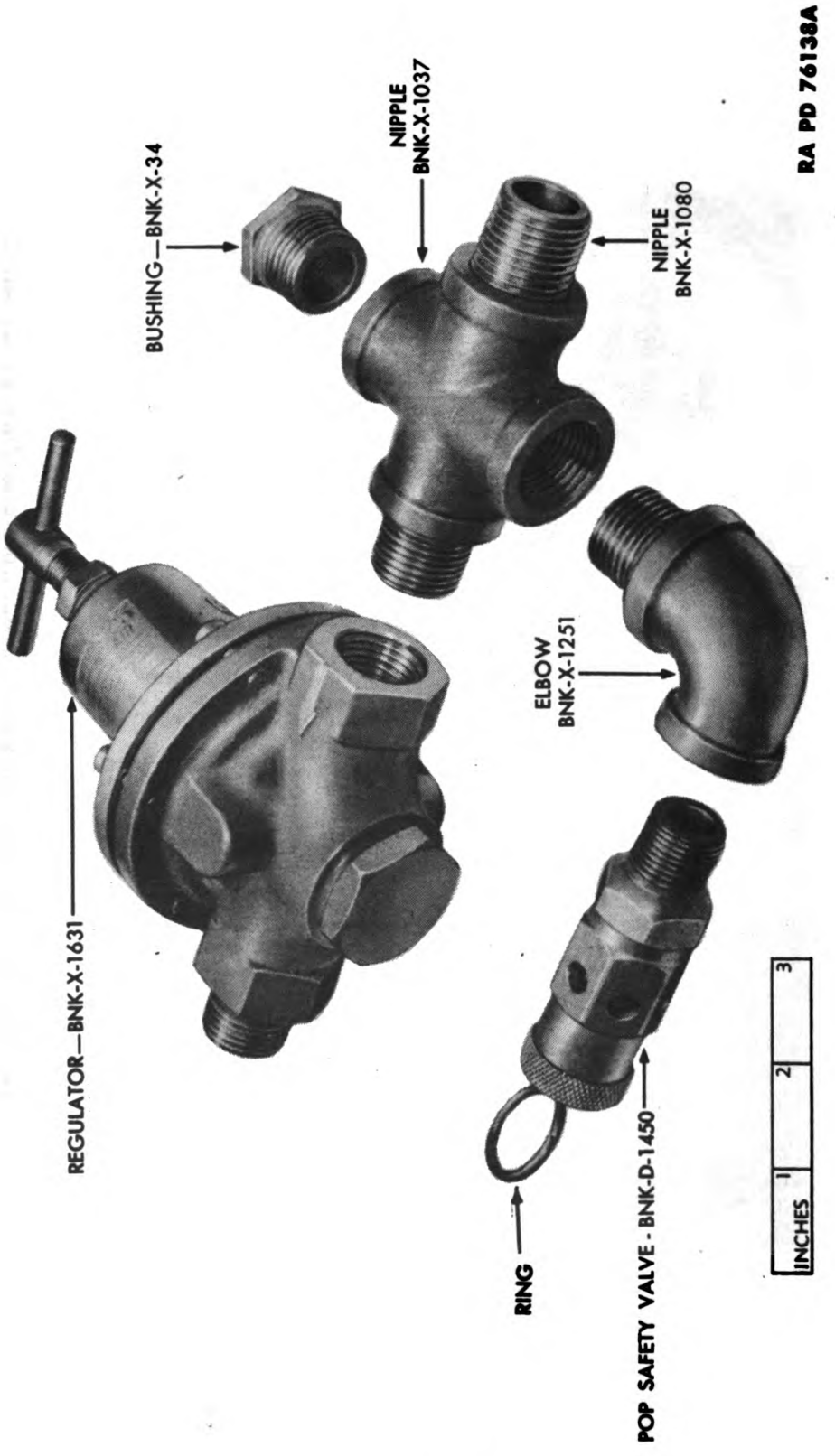


Figure 148 — Pressure Regulator, Safety Valve, and Fittings for Air Compressor

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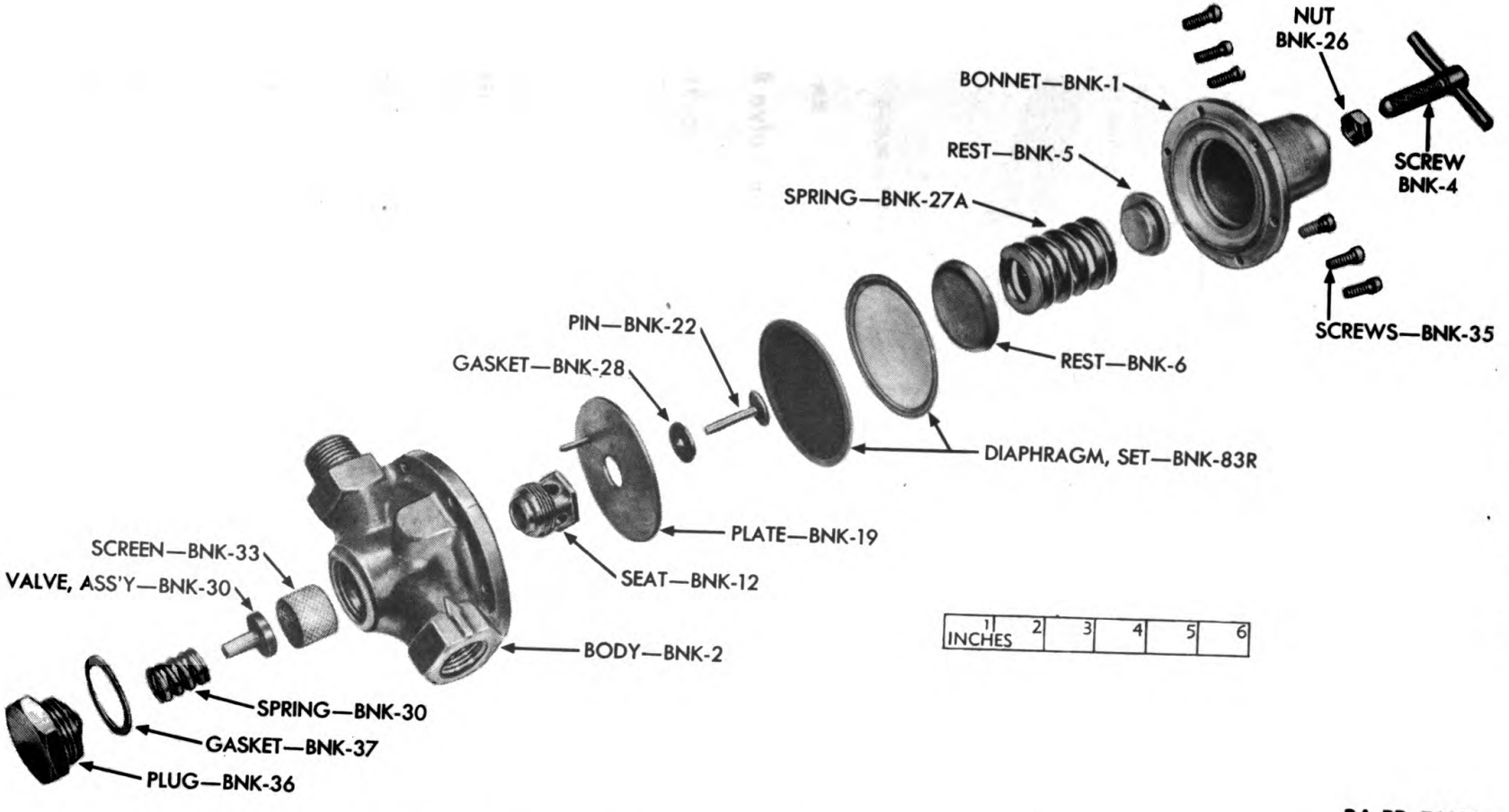


Figure 149 — Components of Pressure Regulator for Air Compressor

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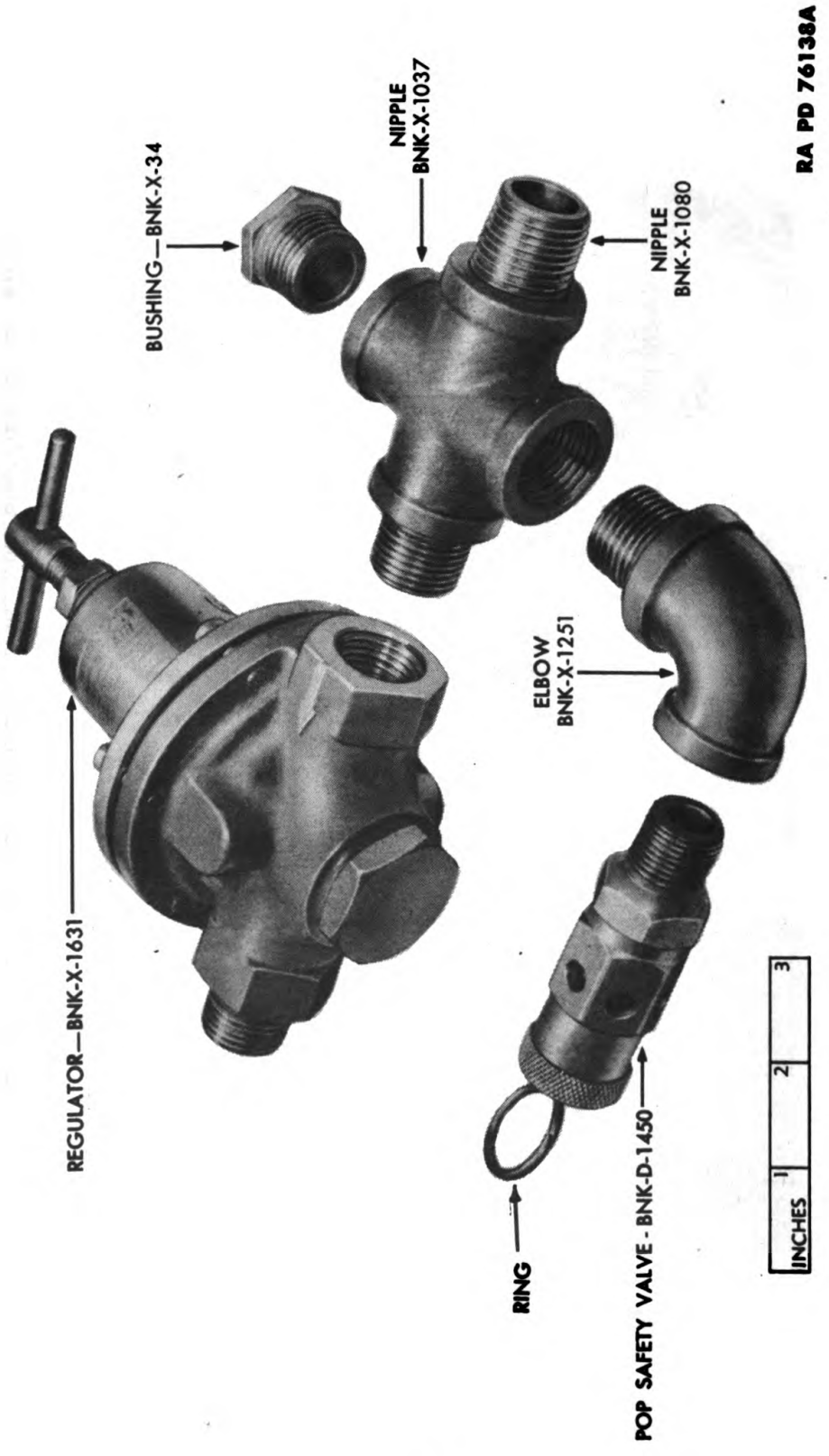


Figure 148 — Pressure Regulator, Safety Valve, and Fittings for Air Compressor

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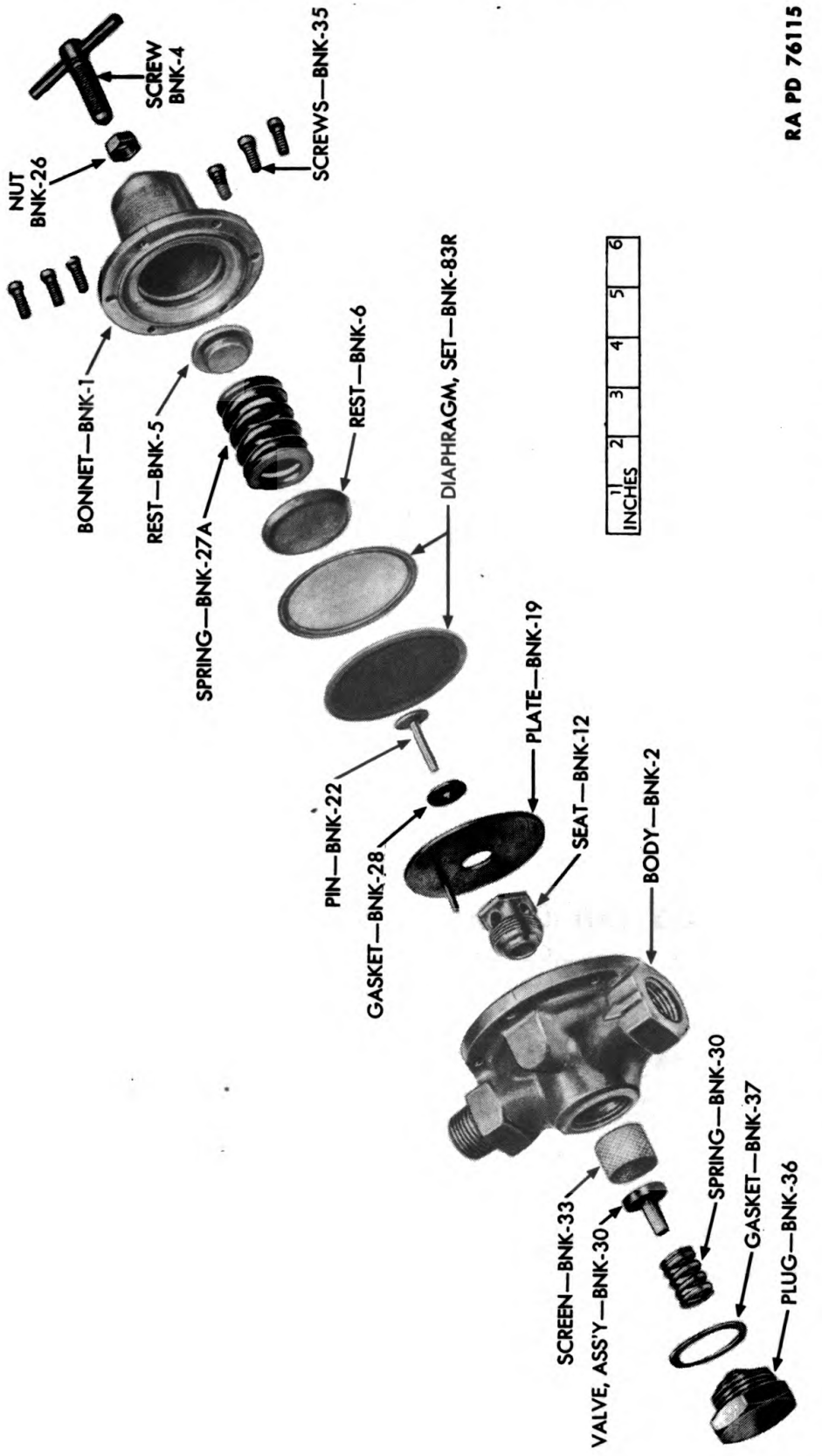


Figure 149 — Components of Pressure Regulator for Air Compressor

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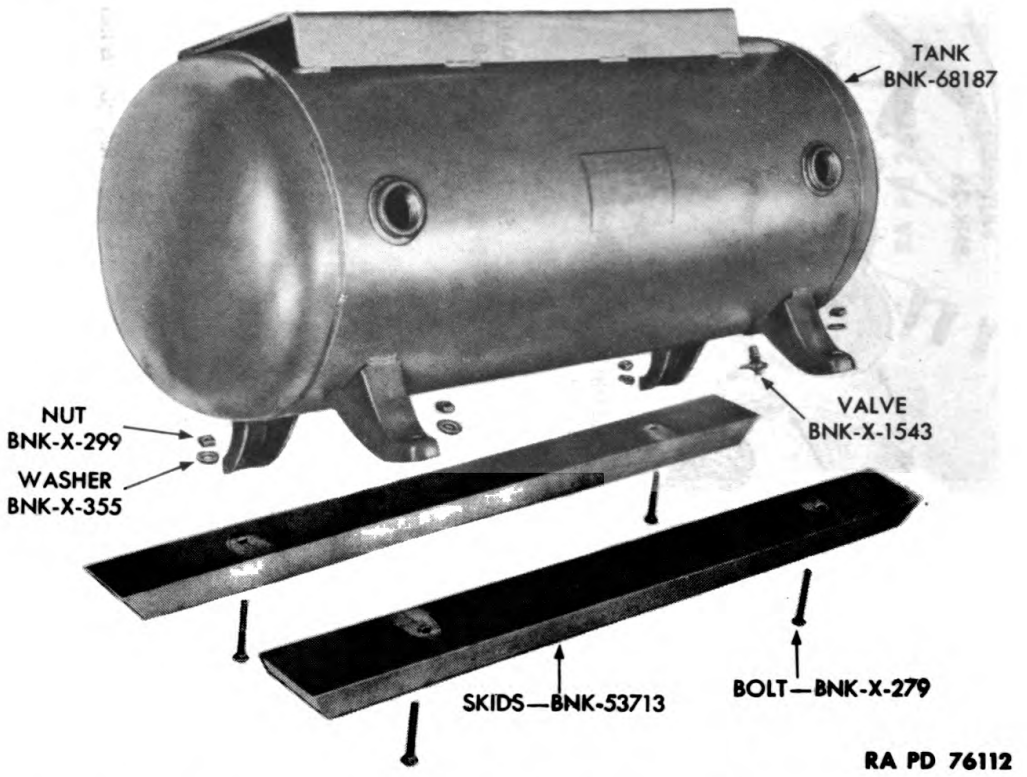


Figure 150 – Air Compressor Tank – Skids and Drain Valve Removed

the screws and nuts fastening the component parts to the transformer support assembly to complete the disassembly of the ultraviolet lamp transformer.

6. ASSEMBLY AND REPLACEMENT.

a. General. Assembly of any mechanism is largely the reverse of disassembly. In taking the appropriate steps, it is often necessary to include certain additional steps, such as the lubrication of the assembled parts, or special care in the fitting. In order that these operations may be more readily understood and followed, the various procedures of assembly are more fully explained in the following paragraphs.

b. Sound Equipment Record Changer (figs. 53 to 71).

(1) Position the shaft assembly, panel assembly, crank assembly, and the lead terminal as shown in figure 71.

(2) Insert the shaft assembly through the washer, the support, and into the crank assembly and aline taper pin hole. Tighten the set screw after the taper pin has been driven through its hole. Insert the upper pin into the hole in the shaft assembly.

(3) Fasten the lead terminal to the bracket using the two screws and lock washers.

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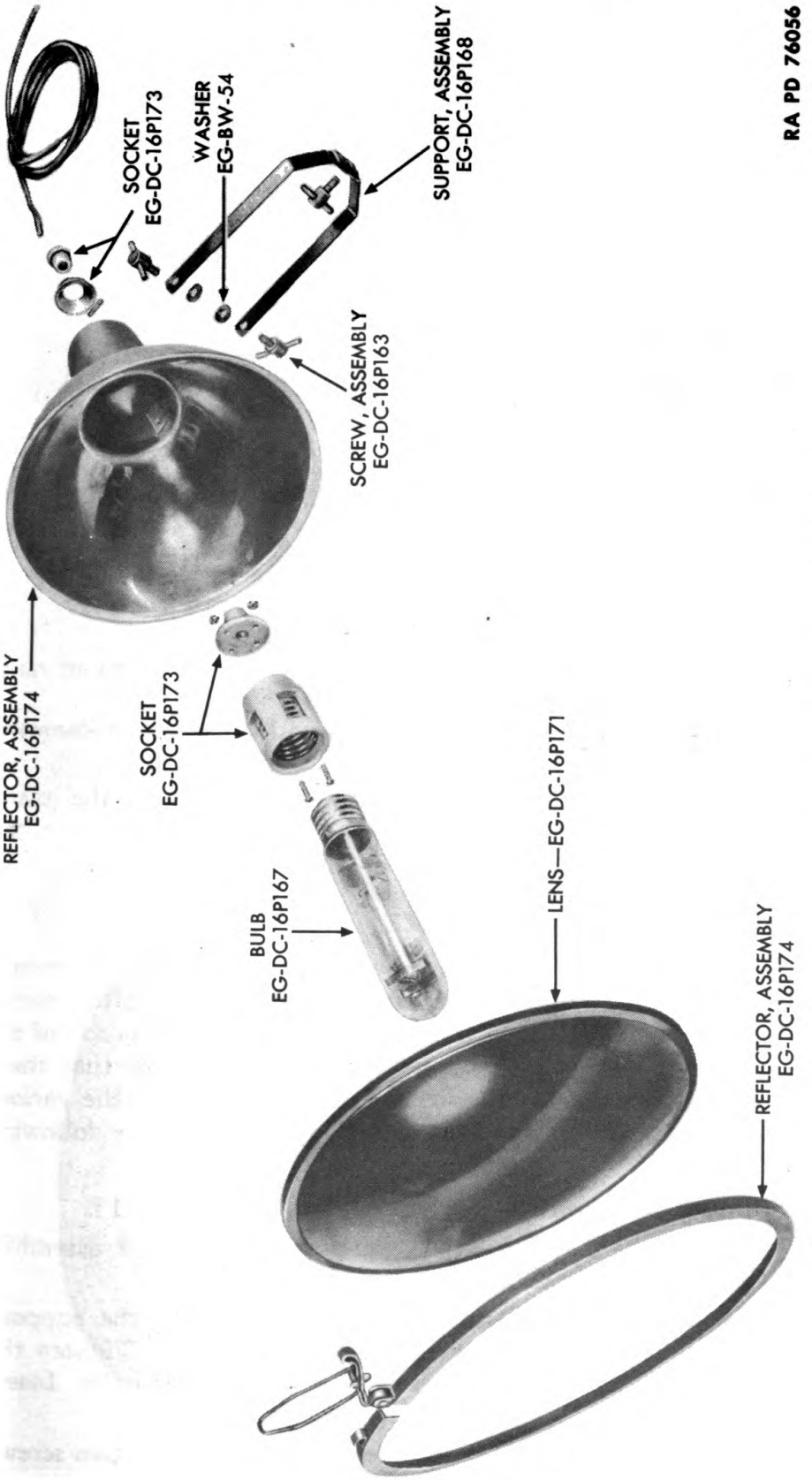


Figure 151 — Components of Ultraviolet Lamp

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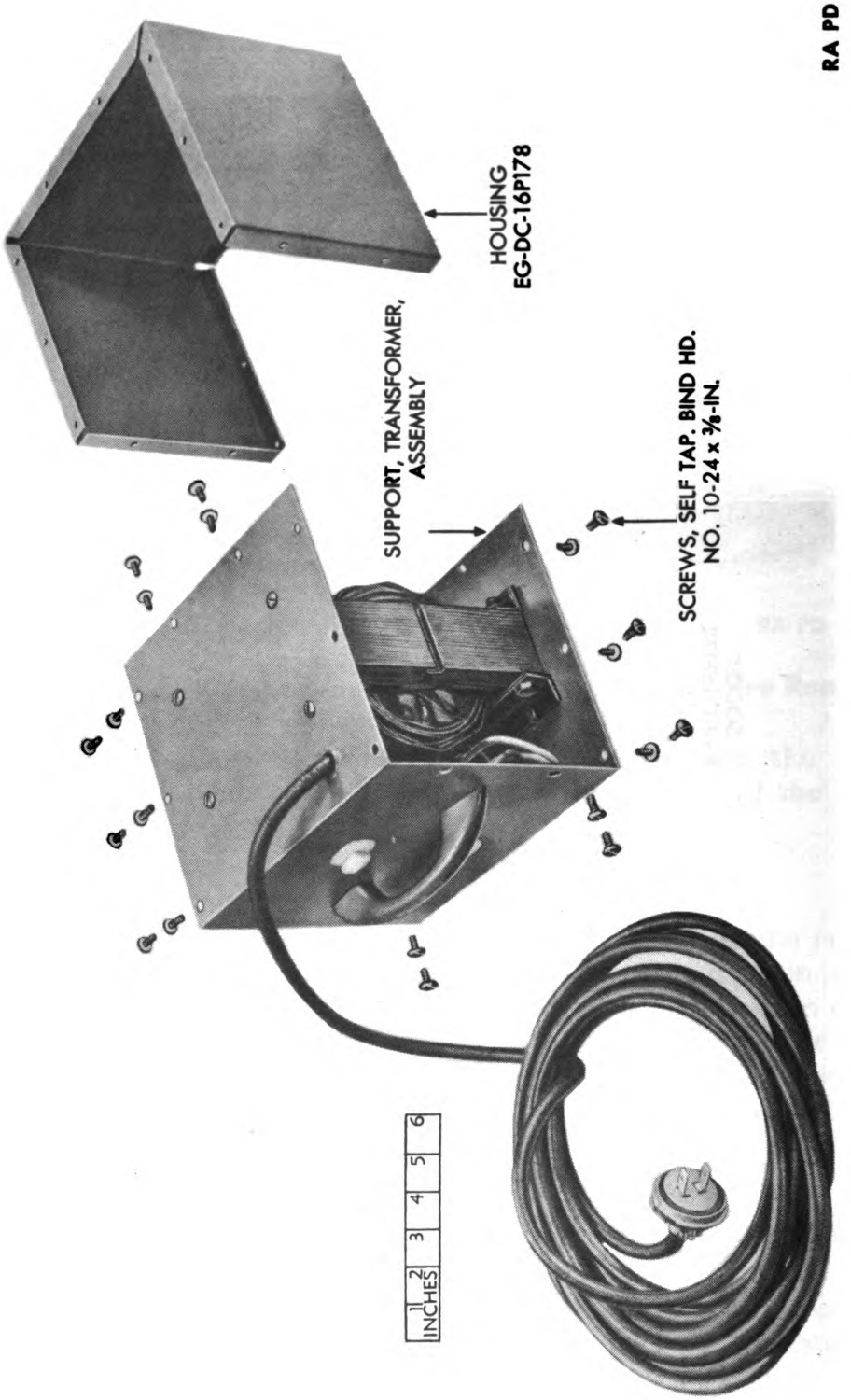


Figure 152 — Ultraviolet Lamp Transformer — Housing Removed

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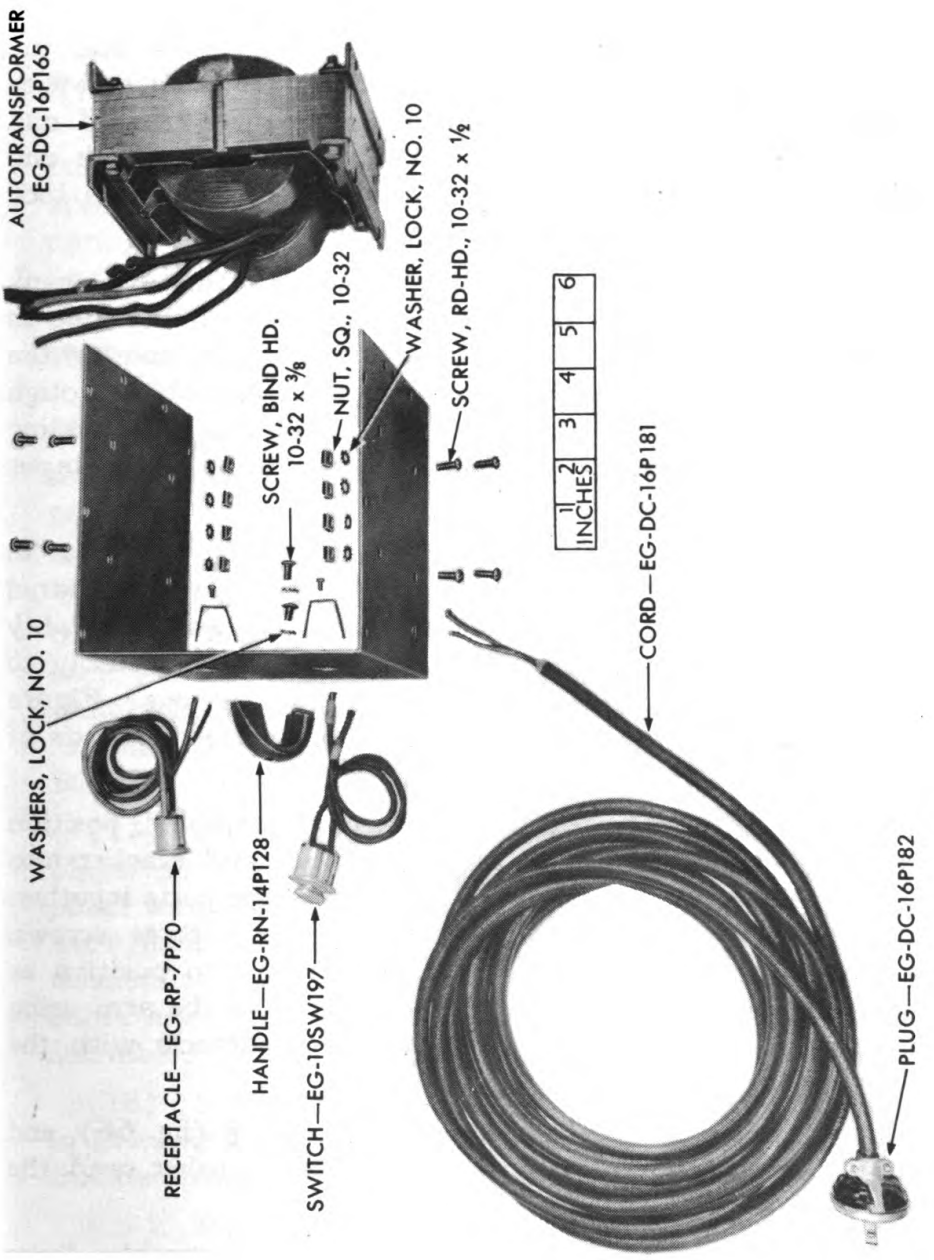


Figure 153 — Components of Ultraviolet Lamp Transformer

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(4) Position the reject lever, control lever, and link as shown in figure 70. Insert the small ear of the link into the slots in the ends of the control lever and reject lever. Place the levers with the large ends of the slots over the studs on the panel and slip them into position. Fasten in place with the screw and washer. Replace the spring if it has been disassembled. See figure 69 for the assembled view of the parts. Assemble the switch knob and escutcheon to the panel as shown in figure 70.

(5) Position the locator assembly, the lever, springs, and the switch as shown in figure 69. Fasten the lever to the panel with the U-shaped washer. Slip the locator assembly over its stud and fasten in position with the U-shaped washer. Attach the switch and plate assembly to the panel assembly with the two screws and lock washers. Attach the springs as shown in figure 68.

(6) Position the selector shaft assembly, washer, rod, and crank assembly as shown in figure 68. Slip the rod through the hole in the support and into the arm assembly. Aline the parts and tighten the set screw in the arm assembly. Insert the shaft assembly through the washer, through the support, and into the crank assembly. Aline the holes in the shaft and crank assembly and drive in the taper pin. Tighten the set screw.

(7) Position the lever, lever assembly, and spring as shown in figure 68. Place the large end of the slot in the lever over the panel stud and slide it into position. Fasten the lever and lever assembly together using the U-shaped washer. Attach the lever assembly to its stud using the U-shaped washer. Connect the springs. Figure 56 shows the proper position of the parts and the correct location of the springs.

(8) If the tone arm assembly has been disassembled, position the parts as shown in figure 67. Insert the shaft and bracket into the bracket assembly so that the hinge pin fastens the parts together. Attach the bracket assembly to the arm using the three screws, washers, sleeves, and grommets. Hook the spring into position as shown in figure 66. Attach the cartridge (fig. 67) to the arm using the two screws. Fasten the needle into the receptacle with the needle fastening screw.

(9) Insert the motor pulley shaft into its bearing (fig. 66), and fasten it in position using the felt washer, plain washer, and the cotter pin.

(10) Position the tone arm assembly, bearing assembly, lever assembly, and lift pin as shown in figure 65. Insert the tone arm shaft through its bearings, the support, and into the lever assembly. Fasten in position using the hexagonal-head cap screw as shown in figure 59. Lift the tone arm assembly to a vertical position and

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insert the lift pin into the support. It will be necessary to tape it in position until the drive gear assembly is attached to the panel.

(11) If the trip lever assembly (fig. 63) has been disassembled, reassemble the parts shown in figure 64.

(12) Insert the clutch engagement lever (fig. 64) into the brackets on the drive gear and fasten it in position with the pin.

(13) Attach the retard lever (fig. 63) to the drive gear using the screw A321940. Attach the ends of the spring to the stud on the panel assembly and on to the ear of the retard lever.

(14) Slip the small tube over the plain panel stud. Attach the trip lever assembly to the projection on the drive gear with the special screw and spring washer. Fasten one end of the trip lever spring to the escutcheon pin and drive the pin into the hole provided in the drive gear. Attach the other end of the spring to the hole in the trip lever assembly. Figure 60 shows an assembled view of the parts with the springs in proper position.

(15) Position the parts of the housing with spindle assembly as shown in figure 62. Insert the spindle assembly into the housing assembly and into the pinion gear. Secure it to the gear with the pin. Attach the link assembly and the shaft to the housing assembly as shown in figure 61.

(16) Position the drive gear assembly, link assembly, and housing with spindle assembly as shown in figure 61. Attach the parts to each other as shown in figure 60. The small roller on the link assembly B271509 (fig. 61) slips into the U-shaped slot of the link assembly B271487 (fig. 62). The small roller on link assembly B271487 rides in the heart-shaped cam groove as shown in figure 56.

(17) Position the gear assembly, link assembly, and record player panel as shown in figure 60. Fasten the gear assembly to the panel with the washer and hexagonal-head nut. Secure the housing with spindle assembly to the panel assembly with the two lock washers and screws. Secure the ends of the link assembly to the crank assemblies with the U-shaped washers. Figure 56 shows the assembled view, properly assembled.

(18) Solder the leads of the record player cord and the motor to the switch. Solder the leads of the tone arm lead wire and the shielded lead assembly to the lead terminal as shown in figure 56.

(19) Position the selector arms with their blades shown in figure 58 and fasten them together with the screws and lock washers.

(20) Slip the selector arm with blade assemblies (fig. 57) over their respective shafts and secure them to the shafts with the set screws and lock washers.

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(21) Lubricate the upper and lower bearing of the turntable spindle after assembly with a few drops of engine oil SAE 10. Do not overoil. Keep oil off motor idler pulley.

(22) Place the turntable (fig. 57) over the spindle and place it in position on the record changer panel so that the slot in the hub engages the pin in the spindle. Do not damage the motor idler pulley.

(23) Check the operation of the record changer and make the necessary adjustments described in paragraph 11.

(24) Set the assembled record changer in the control cabinet. Be sure the upper and lower mounting springs are in place. Note that the switch control knob is in the left-hand corner when the observer is looking at the control panel.

(25) Fasten the record changer in position by means of the lower mounting, springs, and clamping nuts (fig. 54). Pull nuts up firmly, but do not tighten more than enough to compress the lower mounting springs slightly.

(26) The record changer leads are connected to the control panel as described in paragraph 6 **d.**

c. Sound Equipment Record Repeater Mechanism (figs. 72 to 85).

(1) Position the rotor, clutch shifter shaft, frame casting, and related parts as shown in figure 84. Fasten the absorbing pad in the bottom of the frame casting with the spring. Insert the clutch shifter shaft into the frame casting and drive the clutch shifter arms into the holes provided in the shaft. Assemble the clutch fork, coupling, lower drive gear, and washer as shown in figure 82. Insert the rotor to engage the lower drive gear.

(2) Position the top plate and related parts as shown in figure 83. Assemble the two screws and hexagonal nuts to the speed regulator post. Insert the post into the hole provided in the top plate. Insert the turntable shaft into its bearing in the top plate. Attach the upper drive gear. Assemble the tension washer and collar to the shaft. Drive the pin into the hole provided in the turntable shaft. The assembled view is shown in figure 82.

(3) Position the top plate and assembled parts, the gasket, and the frame casting as shown in figure 82. Fasten the top plate in place using the three No. 8-32 screws.

(4) Attach the motor mounting brackets to the frame casting assembly by means of the four No. 10-32 screws. Be certain the rubber washers are in their correct positions to minimize vibration of the unit while operating. Attach the felt pad by means of the pad holder and screw. Place the metal support plate and rubber support plate over the turntable shaft. Place the spring and speed change

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post washer onto the speed change post and fasten in position using the drive pin.

(5) Assemble the speed regulator post and associated parts to the governor housing. Place the ball (fig. 80) into the hole in the housing before inserting the post.

(6) Position the coil shield assembly, field coil, governor, and governor housing and related parts as shown in figure 79. Attach the field coil to the frame casting by means of the two field coil mounting screws. Attach the coil shield with the two coil shield mounting screws. Screw the rotor end thrust screw and hexagonal nut in place. Slip the governor onto the rotor shaft and secure with set screw. Attach the governor housing.

(7) Temporarily attach clip leads from a source of 110-volt, 60-cycle current to the two motor leads. Note whether the governor weights strike the housing when the motor is operating. If the weights strike, disconnect the power and remove the housing. Move the governor toward the end of the shaft and retighten the set screw. Reassemble the housing and retest. Adjust the weights so they no longer strike the housing while operating. Do not pull the governor out on the shaft so far that it binds against the felt pad in the governor housing. During this testing, make certain the speed regulator post cam is not pressing the ball against the plate in the housing. Check the rotor for end play and tighten the rotor end thrust screw to eliminate end play. *Avoid binding.*

(8) Solder one lead of the motor to one lead of the power cable. Secure the motor leads to the frame casting with the clip and screw.

(9) Attach the motor and related parts to the motor mounting plate by means of the four 8-32 screws and hexagonal nuts (fig. 79).

(10) Position the parts of the repeater assembly as shown in figure 78. Insert the hinge bracket part of the arm assembly into the slot provided in the base plate assembly. Insert the worm gear dog into the slot in the side of the tubular section of the base plate assembly. Insert the worm gear and engage the dog into the spiral cuts in the worm gear. Fasten the parts together by means of the knob. Attach the trip arm assembly and the pick-up stop.

(11) Attach the assembled repeater assembly (fig. 77) to the motor mounting plate by means of the three No. 6-32 screws and hexagonal nuts. Attach the switch and lock in place with switch nut. Solder one lead of the motor to one switch terminal and one lead from the cable to the remaining switch terminal. Attach the speed regulator dial and pointer to the mounting plate and speed regulator shaft respectively.

(12) Position the related parts of the pick-up assembly as shown in figure 76. Attach the pivot spring, steel clamp, and pick-up spring

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to the arm support by means of the No. 6-32 screw. Hold the wire in the arm by means of the cable clamp. Insert the pivots into the holes provided in the die-cast arm. Attach the repeater trip arm and the pick-up cartridge.

(13) Fasten the assembled pick-up assembly (fig. 75) to the motor mounting plate by means of the hexagonal pal nut. Fasten the pick-up cartridge lead wire to the motor mounting plate with the cable clamp. Do not pull the wire taut. Leave sufficient slack between the clamp and the arm so that the pick-up assembly swings freely.

(14) Rivet the pick-up rest to the motor mounting plate.

(15) Lubricate the record repeater mechanism in accordance with instructions given in paragraph 20.

(16) Place the turntable on the turntable shaft.

(17) Adjust the speed regulator, repeater assembly, and governor in accordance with instructions given in paragraph 11.

(18) The record repeater mechanism is installed in the sound cabinet in the same manner as the record changer. Have the four upper mounting springs in place and use the four lower mounting springs and clamp nuts to hold the record repeater mechanism in position.

(19) The record repeater mechanism leads are connected to the control panel as described in subparagraph **d**, below.

d. Sound Equipment Control Panel (figs. 27 to 52).

(1) Insert the rubber grommets and mounts into their proper positions in the panel assembly (fig. 52).

(2) Position the switch, volume control, and shield as shown in figure 47. Insert the parts into the shield. Fasten the connector to the volume control lead. Solder the volume control leads to the receptacle.

(3) Mount the switch shield (fig. 51) on the panel assembly using the two binding head screws. The screws attach to the battle sound switch in the switch shield. Thread the volume control hexagonal nut onto the volume control shaft. Attach the knob with the set screw.

(4) Attach the cover (fig. 46) to the shield using the four binding head screws.

(5) Rivet the terminal strip (fig. 50) to the panel assembly. Attach the receptacle to the panel with the retaining ring.

(6) Insert the gun and speaker receptacles (fig. 49) into the holes provided in the panel assembly and secure with the four binding head screws, lock washers, and hexagonal-head nuts. Fasten the speaker cable to the bottom of the panel assembly with the clamp and binding head screw.

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(7) Assemble the parts of the pilot light and fuse holder (fig. 46) as shown in figure 48. Fasten the pilot light assembly to the front panel with the two binding head screws and hexagonal nuts. Screw the cap over the lamp. Attach the fuse holder to the panel by threading the hexagonal nut on to the holder. Do not secure too tightly to avoid damaging the plastic holder.

(8) Attach the switches to the panel (fig. 45) with the eight binding head screws.

(9) Position the gears, shafts, collars, rubber seals, plugs, and gear case as shown in figure 44. Insert the shafts through the bushings in the gear case and fasten the gears to their respective shafts with the taper pins. Locate the collars in proper position and fasten them to the shafts with the taper pins. Figure 43 shows the gears and shafts in their proper positions. Do not damage the oil seals (fig. 44) during this assembly. Turn the drive shaft by hand and be sure the plugs have not been driven into the case so far that the shafts bind.

(10) Screw the pipe plug into the gear case. Fill the gear case to level of pipe plug with engine oil SAE 10. Fasten the cover (fig. 43) to the gear case. Be sure the gasket has no tears or wrinkles in it.

(11) If the contact assemblies have been disassembled, position their component parts (fig. 42) and assemble them together as shown in figure 41.

(12) Attach the firing, recoil, and gun sound cams (fig. 41) to their respective shafts with the taper pins. Slip the contact assemblies over the cams and fasten them to the cams temporarily with the set screws. Do not attach the dust caps or clips until the contact assemblies have been properly adjusted.

(13) Assemble the contact breaker assembly (fig. 40) to the chassis base with the six round-head screws and lock washers.

(14) Assemble the 12 M.F.D. condenser (fig. 39) to the chassis base with the brackets and self-tapping screws. Assemble the 0.5 M.F.D. condenser (fig. 38) to the base using the two binding head screws Solder the leads of the resistor to the terminals of the 12 M.F.D. condenser.

(15) Slide the coupling (fig. 37) over the shaft of the motor. Assemble the motor (fig. 36) to the chassis base with the four round-head screws and lock washers. If a Bodine motor is used, the mounting block must be inserted between the motor and base. Aline the coupling with one half of the coupling on the motor shaft and the other half on the drive shaft of the contact breaker assembly. Be certain the fiber vibration stop section of the coupling is in proper position. Tighten the set screws in the coupling. Make sure the shafts are in line or the assembly will vibrate excessively. See figure 35 for the assembled view.

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(16) Position the control panel and timer as shown in figure 34. Make the necessary electrical connections to the motor, switches, condensers, and contact breaker assembly using the wiring diagrams (figs. 27 and 29) as a guide.

(17) Attach the timer to the control panel with the six round-head screws, washers, and hexagonal-head nuts. Do not tighten the nuts too much. The assembled view of the unit is shown in figure 32.

(18) After assembly, oil the motor bearings with a few drops of engine oil SAE 10.

(19) Adjust the gun sound, firing, and recoil contact assemblies (fig. 32) in accordance with the instructions given in paragraph 13. Reassemble the dust caps and clips (fig. 41).

(20) After the control panel and timer are operating satisfactorily, set the control panel in position for attachment to the control cabinet (fig. 30). Make sure the a-c input plug, speaker plug, and battle sound input plug are dropped through the holes provided in the shelf in the cabinet so they may be attached to the amplifier below.

(21) Connect the power input leads to the terminal strip (fig. 30).

(22) Push the record changer plug and tone arm lead assembly into their respective receptacles.

(23) Slide the control panel into position in the control cabinet and fasten it in place with seven wood screws.

e. Sound Equipment Amplifier (figs. 7 to 26).

(1) Attach the tube sockets (fig. 26) to the chassis assembly with eight rivets.

(2) Solder the leads and condensers shown in figures 23 and 25 to the potentiometers.

(3) Fasten the potentiometer assemblies (fig. 24) to the chassis assembly with the two washers and hexagonal nuts. Fasten the two receptacle assemblies to the chassis assembly with the two hexagonal nuts. Make certain the fiber washers are in position to prevent grounding the potentiometers on the chassis.

(4) Fasten the two condenser and resistor strip mounting screws, and bushings (figs. 23 and 24) with the two washers and hexagonal nuts. Rivet the two resistors shown in figure 23 to the chassis assembly. Use small lock washers between the resistors and chassis.

(5) Rivet the two wafers, the socket, and the resistor shown in figure 22 to the bottom of the chassis assembly. Twist the locking ends of the two condensers into their openings in the wafers.

(6) Fasten the power transformer (fig. 21) to the top of the chassis assembly with the two screws, lock washers, and hexagonal-head nuts.

(7) Rivet the tube shield assembly (fig. 20) to the chassis assembly. Fasten the side flanges with the four screws.

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(8) Rivet the speaker socket and power receptacle (fig. 19) to the chassis assembly. Attach the choke to the chassis assembly using the four screws, lock washers, and the hexagonal-head nuts.

(9) Attach the choke (fig. 18) to the bottom of the chassis assembly using the two screws, lock washers, and hexagonal-head nuts. Connect the resistor across the terminals of the rear condenser A321826 (fig. 22).

(10) If the condenser with resistor assembly (fig. 15) has been disassembled, solder the terminals of the component parts (figs. 16 and 17) in position on the mounting strip.

(11) Fasten the condenser with resistor assembly (fig. 15) to the mounting screws and bushings with the two lock washers and nuts.

(12) Attach the transformer to the under side of the chassis assembly with the four screws, lock washers, and nuts.

(13) Place the fuse (fig. 16) in the post and thread the extractor into the post. Insert the post into the hole in the front panel of the chassis assembly and fasten in position with the hexagonal nut.

(14) Attach the output transformer (fig. 14) to the bottom of the chassis with the four screws, lock washers, and hexagonal nuts.

(15) Make the proper electrical connections to the various components of the amplifier using the wiring diagram (fig. 7) as a guide.

(16) Insert the vacuum tubes (fig. 12) into their proper sockets. Note that the 6JSC7 tube and the 6J5 tube are similar in appearance but must be placed in their proper sockets to operate properly.

(17) Check the continuity of the complete circuit in the amplifier using the circuit checking diagram (fig. 8) and table I as a guide.

(18) If the circuit operates properly, fasten the grill (fig. 11) to the front of the chassis with the four thumb screws. Fasten the cover (fig. 13) to the chassis with the four binding head screws.

(19) Set the assembled amplifier into the cabinet.

(20) Push the a-c input plug and the speaker plug into their respective receptacles. Screw the battle sound input plug in place (fig. 11).

(21) Push the amplifier into the cabinet and fasten it into place with the seven wood screws.

f. Sound Equipment Speakers (figs. 86 to 105).

(1) Slip the inner bracket (fig. 95) over the voice coil of the battle sound speaker and glue the rear of the outer bracket to the gasket on the voice coil. Line up the screw holes.

(2) Position the speaker housing and related parts as shown in figure 94. Drive the bushings into the four holes provided in the housing. Attach the field coil pot, field coil, bucking coil, and plate assembly to the housing with the four bolts. Make certain the pin on the plate assembly is inserted in the hole provided in the housing.

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(3) Position the coil with cone assembly, gaskets, housing assembly, and the pot as shown in figure 93. Glue the inner gasket to the outer rim of the housing assembly. Glue the outer rim and the outer gasket of the coil with cone assembly to the periphery of the housing assembly. Be sure the notches in the gaskets are alined with the speaker mounting holes. Fasten the voice coil brackets to the cone assembly with the three screws, lock washers, and hexagonal nuts.

(4) Solder the eiectrical leads in position in accordance with the wiring diagram (fig. 86).

(5) Attach the pot to the cone housing assembly with the screw, washer, and spacer. Have the pot gasket in place.

(6) Position the component parts of the gun sound speaker as shown in figure 92. Rivet the sectors, and coil with cone assembly to the housing. Glue to strip to the sector. Attach the plate assembly to the housing with the three screws, washers, and hexagonal nuts. Fasten the voice coil assembly to the plate assembly using the three screws, lock washers, and hexagonal-head nuts. Attach the terminal strip (fig. 92) to the side of the housing with the two screws, lock washers, and hexagonal-head nuts as shown in figure 91.

(7) Position the field coil and housing, bucking coil and ring, as shown in figure 91. Connect the leads of the field coil, bucking coil to the terminal strip. Slip the retaining ring over the bucking coil and position it against the field coil. Attach the field coil and its housing to the cone housing with the four hexagonal-head screws and washers. Insert the grommet into the housing.

NOTE: Figure 91 showing the field coil and housing disassembled is not normal practice. Ordinarily the field coil is glued into the housing and any attempt to separate the two parts results in permanent damage to the field recoil. The figures are used to illustrate the component parts of the assembly.

(8) Attach the gun sound speaker (fig. 90) to the support with the seven screws and lock washers. Connect the electrical leads in accordance with the wiring diagram (fig. 86). Bring the leads of the cord assembly through the rubber grommet in the side of the support and fasten in position with the clip.

NOTE: Speaker 9065-1 is not provided with a pot cover for the field coil. A current limiting device (fig. 97) is attached to the cone housing. Attach the mounting plate by means of the two fillister-head drive screws. Attach the current limiting assembly and the insulator to the mounting plate with the three fillister-head drive screws. Reconnect the electrical leads and screw the bulb into its socket.

(9) Mount the gun sound and battle sound speakers to the speaker cabinet as shown in figure 87. Note that the gun sound speaker sup-

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port is fastened to a false front of the cabinet with the four round-head screws and washers shown in figure 88. The wood panel is then fastened to the speaker cabinet using the 10 wood screws. If the power supply unit is in position in the speaker cabinet, plug the two speaker plugs into the receptacles in the power supply chassis.

(10) Attach the top panels of the speaker cabinet by means of the 19 wood screws.

(11) Reset the speaker cabinet in position on the support posts and plug the speaker cord into the receptacle on the control panel.

(12) Rivet the speaker sockets (fig. 105) to the power supply chassis.

(13) Rivet the condenser wafers (fig. 104) to the bottom of the power supply chassis. Insert the condensers into the wafers and twist the connections in the slots provided in the wafers to lock the condenser in position.

(14) Pull the leads of the cable assembly through the rubber grommet in the side of the power supply chassis.

(15) Rivet the socket (fig. 101) and the tube clamp assembly to the power supply chassis. Mount the choke on the top of the chassis with the four screws, lock washers, and hexagonal nuts.

(16) Mount the power transformer (fig. 100) to the power supply chassis with the four binding head screws, lock washers, and hexagonal nuts.

(17) Connect the electrical leads of the choke and transformer and the leads shown in figures 102 and 103 in accordance with the wiring diagram (fig. 86).

(18) Insert the rectifier tube (fig. 99) into its socket. Clamp it in position. Spring the cover on to the bottom of the power supply chassis.

(19) Mount the power supply in the speaker cabinet (fig. 98) by means of the four screws, washers, lock washers, and hexagonal nuts.

(20) Plug the speaker plugs into their sockets in the power supply.

(21) Attach the top panels to the speaker cabinet with the 19 wood screws.

g. Gun (figs. 106 to 120).

(1) If the piston block and barrel assembly and the associated parts have been disassembled, the following paragraphs describe their reassembly.

(2) Insert the air valve spring into the tapped opening in piston block and thread the air valve plunger unit to the block. Tighten the hexagonal nut (fig. 113).

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(3) Place the ball feed block in position on the top of the piston block, insert the turned end of the magazine tube into the ball feed block, and fasten the unit into place with the four cap screws (fig. 113).

(4) Thread the loading block onto the threaded end of the magazine tube and tighten until the loading block is in a vertical position (fig. 113).

(5) Insert one end of the capillary into the loading block and the opposite end into the piston block and fasten the ends in place using the two connectors (fig. 113).

(6) Place the piston block and assembled parts in position between the side plates, and fasten the piston block to the side plates using the four hexagonal cap screws (fig. 113).

(7) Slip the mounting bracket over the magazine tube and barrel assembly, and fasten the unit to the side plates with the hexagonal-head cap screws. See figure 112 for identification and location of parts.

(8) Locate the bracket at the mark inscribed on the barrel during assembly. Fasten the barrel supports in place with the round-head screws and nuts (fig. 110).

(9) Slip the water jacket over the magazine tube and barrel assembly. Push the water jacket onto the mounting bracket; line up the holes in the water jacket with the mounting holes in the mounting bracket. Use care when assembling that the loading block is inserted into its proper position in the end plug of the water jacket. It may be necessary to loosen the four cap screws in the ball feed block so that the magazine tube will turn freely, and the loading block will be brought into proper position.

(10) Fasten the water jacket to the mounting bracket with the eight screws.

(11) Fasten the barrel jacket in place with the two screws shown in the disassembled position in figure 110.

(12) Retighten the four cap screws in the ball feed block if they were loosened during the assembly operation.

(13) Slip the return spring over the gun piston and insert the two parts into the piston block.

(14) Push the piston flush against the piston block, insert the firing electromagnet (fig. 113) between the side plates, and release the piston.

(15) Fasten the firing electromagnet in place using the four spacers and the two mounting bolts.

(16) Connect the electrical leads.

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(17) Join the firing electromagnet to the piston by means of the pin and cotter pin.

(18) The associated parts of this assembly are shown partially disassembled in figure 113.

(19) Fasten the stop plate to the piston block with the two screws.

(20) Place the lock washer and the release pin in position in the piston block.

(21) Place the release blade in position, pull it forward slightly, insert the stop pin into the slot in the release blade, and push the release blade back into the slot formed by the piston block and stop plate.

(22) Place the spring over the stud and screw into the piston block.

(23) The parts of this assembly are shown in the disassembled positions in figures 114 and 115.

(24) If the trigger switch assembly has been disassembled, place the trigger between the lugs on the switch bracket; insert the pin and spring and lock in place with the cotter pin (fig. 118).

(25) If the gun handle assembly has been disassembled, reassemble the associated parts shown in figure 117. The recoil spring must be lubricated with O.D. grease No. 00 before assembly.

(26) Place the recoil spring over the guide, place the four legs of the backplate through the four slots in the handle bracket assembly, insert the switch bracket assembly in the slot in the handle bracket assembly, and fasten the parts together with the two screws (figs. 116 and 117).

(27) Lubricate the light recoil spring and plunger (fig. 116) with O.D. grease No. 00 and insert the parts in the spring retainer.

(28) Set the four legs of the backplate assembly between the side plates and the recoil electromagnet, insert the four spacers, and fasten the units together by means of the two screws and nuts.

(29) Connect the electrical leads.

(30) Close the cover and lock in position by turning the cover fastener stud.

(31) Plug the gun cord into the receptacle on the control panel.

h. Air Compressor (figs. 121 to 150).

(1) Attach the skids to the air compressor tank (fig. 150) by means of the four bolts, washers, and hexagonal nuts. Screw the chain valve into the tank.

(2) Position the parts of the pressure regulator as shown in figure 149. Insert the screen, valve assembly, and spring into the bottom opening of the body. Thread the plug into the opening, using the

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gasket as a seal. Screw the valve seat into the body. Insert the plate gasket, pin, diaphragm set, bottom rest, spring, and top rest in proper sequence. Clamp the parts into position by fastening the bonnet to the body with the six screws. Thread the hexagonal nut onto the adjusting screw, and thread the screw into the top opening in the bonnet. Use care not to damage the diaphragm set during assembly.

(3) Position the parts of the air pressure regulating assembly as shown in figures 147 and 148. Connect the parts to form the complete assembly shown in figure 146.

(4) Screw the air pressure gage (fig. 146) and the pressure regulating assembly in the threaded opening in the air compressor tank.

(5) Connect the air tubes and related parts (fig. 145) to the tank.

(6) Position the component parts of the cut-off switch spring assembly. Thread the special nut on to the screw. Slip the spring over the screw. Fasten the plunger and lever together. Insert the link into the holes provided in the plunger and lever assembly. Press the parts into the yoke and secure the plunger and lever to the yoke with the two lock washers and special screws.

(7) Position the component parts of the cut-off switch diaphragm and the spring assembly as shown in figure 143. Fasten the parts together to form an assembly with the end plate.

(8) Position the cut-off switch contacts as shown in figure 142. If the movable contacts have been removed from their holders, replace them. Make certain the springs (fig. 143) are in position in the holders.

(9) Fasten the stationary contacts (fig. 142) to the holder with the four screws. Fasten the movable contact holders and related parts together to form the rocker shown in figure 141.

(10) Position the component parts of the cut-off switch as shown in figure 141. Insert the stationary contact block assembly into the box. Pivot the rocker in the box. Insert the end plate and spring assembly into the box so that the ears at the top of the end plate fit into the slots provided in the top of the box. Hold the parts together tightly; insert the screw through the side of the box and clamp the assembly together with the lock washer and hexagonal nut. Connect the spring between the link and the rocker, as shown in figure 136.

(11) Assemble the cut-off switch to the air compressor tank with the three screws (fig. 140).

(12) Assemble the V-pulley to the motor shaft (fig. 139). Insert the two leads of the cable through the connector and into the motor terminal box. Solder the leads to the motor leads. Tape the connections. Fasten the cover to the terminal box.

(13) Mount the motor (fig. 137) onto the compressor tank with the four screws and washers. Connect the motor cable leads into the

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cut-off switch. Fasten the cable with the connector. Figure 136 shows correct position of leads in cut-off switch.

(14) Assemble the component parts of the discharge valve (fig. 137) to the cylinder head. Thread the ¾-inch nipple into the head. Use care not to damage the valve seat or gasket when assembling the valve.

(15) Assemble the component parts of the diaphragm unloader (fig. 126) to the cylinder head. Do not damage the rubber diaphragm during assembly.

(16) Position the crankshaft, bearing cone, and the component parts of the centrifugal governor as shown in figure 135. Slide the governor head onto the crankshaft. Insert the spring and plunger into hole in the end of the crankshaft. Press the plunger in and secure by inserting the bar through the slot in the plunger. Insert the heel pins BNK-1863 through the governor head with the slotted ends over the bar. Attach the flyweights to the governor head with two flyweight pins and cotter pins. Attach the ends of the springs to the holes provided in the flyweights.

(17) Position the bearing cup and the breather valve parts with the end plate, as shown in figure 134. Drive the bearing cup into the recess in the end plate. Drive the pin into the recessed hole. Assemble the breather valve to the end plate with the hexagonal-head screw. Make certain the plain washer is between the bumper and the felt valve.

(18) Position the bearing cup, crankcase, crankshaft, splash ring, gasket, and bearing carrier, as shown in figure 133. Drive the bearing cup into the recess provided in the crankcase. Insert the crankshaft into the crankcase opening and position the inner bearing cone in the cup. Place the splash ring into its groove on the crankshaft. Attach the bearing carrier to the crankcase with the four hexagonal-head screws. Do not damage the gasket while fitting the carrier against the crankcase. The pin in the bearing carrier is directly above the splash ring and the bearing cone will fit snugly into its cup when correctly assembled.

(19) Position the bearing adjustment plate and the components of the 3-way valve, as shown in figure 132. Insert the seat, the rod, disk, and button into the bottom of the body and thread in the cap BNK-2414. Place the disk and small spring into the upper threaded hole in the body and thread in the cap BNK-2920. Insert the two felt disks in position in the side of the body and screw the connectors into the threaded openings. Attach the assembled 3-way valve to the adjustment plate with the shims separating the two parts.

(20) Insert the plug (fig. 131) into the threaded opening in the crankcase. Place the shims between the bearing adjustment plate and

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the crankcase. Fasten the adjustment plate to the crankcase by means of the four hexagonal-head cap screws. Grasp the opposite end of the crankshaft and note the amount of end play. Remove or add shims until there is no movement of the crankshaft endways. The crankshaft must turn freely by hand. Binding must be avoided.

(21) Position the piston, piston rings, connecting rod, and pin, as shown in figure 130. Slip the piston rings into the grooves of the piston. Make certain the slotted oil ring is in the bottom groove in the piston. If new rings are installed, the gap between the ends of the ring when compressed in its groove on the piston should be a minimum of 0.005 inch. File the ends of the ring if the gap is less than the above figure. Insert the connecting rod into the piston and fasten it to the piston by inserting the piston pin. Lock the piston pin in position by means of the cotter pin.

(22) With the inspection plate removed (fig. 129), fit the upper bearing half of the connecting rod assembly over the crankshaft and attach the lower bearing half by means of the two bolts and washers. Tap the lower bearing half lightly to seat it before tightening the bolts. Hold the piston up and determine if the connecting rod and piston will turn on the crankshaft under their combined weight. They should turn slowly on the crankshaft, if the bearing halves are fitted properly to the crankshaft. If the connecting rod binds on the crankshaft, remove the lower bearing half and add paper shims until the bearing halves are properly fit. If the bearing halves are too loose, remove the lower bearing half and file the end faces of the bearing. Keep the file flat so that the bearing half faces are on a flat plane.

(23) Assemble the inspection plate to the crankcase by means of the four hexagonal cap screws.

(24) Place the cylinder (fig. 128) in position on the crankcase. It will be necessary to compress the piston rings into their grooves in the piston so that the piston will enter the cylinder. Make certain the cylinder walls are free from dirt or grit before assembly. Do not tear or wrinkle the gasket during assembly. Tighten the studs down firmly. If a torque wrench is used, tighten to torque reading 60 (21 ft-lb).

(25) Place the gasket (fig. 125) on the cylinder. Fasten the cylinder head to the cylinder with the four screws. Tighten the screws evenly. If using a torque wrench, tighten to a reading 60 (21 ft-lb). Connect the copper tube between the 3-way valve and the cylinder head by means of the connectors.

(26) Assemble the components of the air filter (fig. 124) together by means of the hexagonal-head bolt. Thread the air filter onto the nipple attached to the cylinder head.

(27) Mount the assembled compressor (fig. 123) on the compres-

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sor tank by means of the four hexagonal-head cap screws and the lock washers. Connect the air tubes as shown in figure 122.

(28) Mount the pulley (fig. 128) on the crankshaft with the key in the slot. The arrow on the periphery of the pulley should be to the outside and pointing toward the motor. Tighten the hexagonal-head screw against the key temporarily.

(29) Loosen the motor mounting screws and slide the motor toward the compressor. Slip the V-belt into the grooves of the motor pulley and the mounting screw in the compressor pulley, and slide the pulleys on their respective shafts until the V-belt is alined. Tighten the set screw in the motor pulley. Tighten the hexagonal-head screw in the compressor pulley. If using a torque wrench, tighten to reading 195 (68 ft-lb).

(30) Grasp the motor and pull it away from the compressor until the V-belt is tight. Tighten the motor mounting screws.

(31) Attach the belt guard to the air compressor unit.

(32) Fill the crankcase to the "FULL" level mark on the oil gage. Use engine oil SAE 10 for temperatures above 32° F.

(33) Test the operation of the compressor in accordance with instruction given in paragraph 9. Make any adjustments needed in accordance with instruction given in paragraph 17.

i. Ultraviolet Lamp and Transformer Housing (figs. 151 to 153).

(1) Position the component parts of the ultraviolet lamp as shown in figure 151. Attach the support assembly to the reflector assembly with the screw assemblies and washers. Assemble the socket. Replace the bulb. Mount the lens in the reflector assembly and fasten in position with the clamping ring part of the reflector assembly.

(2) Attach the handle, receptacle, and switch to the transformer support assembly. Mount the autotransformer in the support. Make the electrical connections between the transformer, switch, power cord, and receptacle.

(3) Fasten the housing to the transformer support assembly.

Section III

INSPECTION

7. GENERAL.

a. Inspection is for the purpose of determining the condition of the trainer, whether repairs or adjustments are required, and the action necessary to place the trainer in serviceable condition. As a result of this inspection, proper disposition of the trainer can be made

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and necessary action taken or recommended. Inspection forms (O.O.F. 7228 and O.O.F. 7229) are provided for recording the results of the inspection. Instructions concerning the entries to be made are printed on the back of the forms.

b. Tolerances, or allowable errors, are specified where necessary, to indicate the degree of accuracy required in performing certain adjustments. In general, an instrument is considered unserviceable if the error in any part exceeds the specified tolerance; however, it must be realized that the specified tolerance is intended to serve mainly as a guide for the inspector. These tolerances do not necessarily infer that the instrument repairman should not attempt to reduce the errors to lower limits if time and conditions permit.

c. The following equipment is needed for inspection:

(1) Test equipment for radio tubes, resistors, condensers, and circuit continuity.

(2) Tools used for truck maintenance.

8. PERFORMANCE INSPECTION.

a. The simplest complete inspection for the Antiaircraft Machine Gun Trainer M9 is a performance test, with the entire system in operation. The complete inspection will then include a visual check of the trainer for completeness, appearance, mechanical condition, and illumination. In addition, the component parts will be checked as outlined in the following paragraphs.

b. Sound Equipment.

(1) RECORD CHANGER.

(a) Clearness of reproduction.

(b) Physical condition of the three battle sound records.

(c) Smoothness of operation of the turntable, the tone arm, and the pick-up assembly.

(2) CONTROL PANEL.

(a) Proper fusing.

(b) Mechanical and electrical operation of all switches and receptacles.

(3) TIMER.

(a) Tightness of set screws on the breaker assemblies.

(b) Condition of the contacts.

(c) Tendency of the contacts to arc excessively.

(d) Oil in the gear case.

(e) Condition of the motor insulation and the lubrication.

(4) AMPLIFIER.

(a) Proper fusing.

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(b) Clearness of the reproduction of the sound.
(c) Volume.
(d) Condition of the connections and the insulation on the wiring.

(5) SPEAKER CABINET.

(a) Mechanical condition of speaker units, power pack, and mountings for each speaker.
(b) Clearness of the reproduction.
(c) Condition of the power tube.
(d) Condition of the connections and of the insulation on the wiring.

c. Gun.

(1) FIRING QUALITY AND MECHANICAL WEAR ON THE MOVING PARTS AS FOLLOWS:

(a) Handle assembly.
(b) Recoil electromagnet.
(c) Firing electromagnet.
(d) Piston and piston block.
(e) Air valve plunger unit.
(f) Ball release pin mechanism.
(g) Loading screw.
(h) Barrel.

(2) MECHANICAL AND ELECTRICAL CONDITION OF THE TRIGGER SWITCH. Condition of the connections and the insulation on the wiring.

(3) SMOOTHNESS OF OPERATION.

(4) AIR LEAKS.

d. Air Compressor.

(1) SPEED OF THE COMPRESSOR.

(2) CUT-OFF POINT.

(3) MECHANICAL OPERATION OF THE SAFETY VALVE.

(4) LOSS OF PRESSURE.

(5) NOISY COMPRESSOR.

(a) Loose pulley.
(b) Dirt on top of the piston which strikes the head.
(c) Loose piston pin bearing.
(d) Loose connecting rod bearing.
(e) Loose main bearing.

e. Target.

(1) REEL ASSEMBLY.

(a) Smoothness of operation.
(b) Tightness of component parts.
(c) Mechanical wear on the moving parts.

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(2) AIRPLANES.

(a) Completeness.

(b) Finish.

(3) TROLLEY CARRIAGE.

(a) Smoothness of operation.

(b) Mechanical wear on the moving parts.

(4) TROLLEY WIRE.

(a) Straightness.

(b) Tightness.

(c) Condition of the wire.

(d) Condition of the end bumper springs.

f. Accessories.

(1) PHYSICAL CONDITION OF THE WHITE PELLETS.

(a) Color.

(b) Breaks.

(c) Wear.

(2) PHYSICAL CONDITION OF THE FLUORESCENT RED PELLETS.

(a) Color.

(b) Breaks.

(c) Wear.

(3) MECHANICAL CONDITION OF THE LOADING HOPPER.

(a) Smoothness of operation.

(b) Operation of the pellet catch.

(4) MECHANICAL CONDITION OF THE LOADING TUBE.

(a) Operation of the pellet catch.

(b) Operation of the loading bolt.

(5) APPEARANCE AND OPERATION OF THE ULTRAVIOLET LAMP EQUIPMENT.

9. DETAILED INSPECTION.

a. Sound Equipment.

(1) Connect the input lead of the control unit and the compressor to a source of 115-volt, 60-cycle current.

(2) Snap the main switch to "ON" noting the feel of switch in action. All switches on the control panel are of the mercury type.

(3) RECORD CHANGERS.

(a) Record Changer. Open the lift-top cover on the control cabinet over the record changer. Check the tone arm, selector arms, switch control knob, and turntable for smooth operation. Set the selector arms for 12-inch records. Place a record on the arms and move the switch to "REJECT" which is in the direction of "START." The turntable should rotate and the tone arm swing in position to

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contact the record. Assuming that the equipment is complete and correctly set up turn the "battle sound" switch to "ON." This should cause the sound to be clearly produced in the overhead speaker.

(b) Repeater Mechanism. Open the lift-top cover on the control cabinet over the record repeater. Check the turntable and pick-up assembly for smoothness of operation. Place a record on the turntable and snap the switch "ON." Set the speed regulator pointer on the speed regulator dial midway between "F" and "S" positions. Place the pick-up cartridge needle in the first groove of the record. Assuming the equipment is operating correctly, turn the battle sound to "ON." This should cause the sound to be clearly produced in the overhead speaker. After the record has been played, the pick-up assembly should be carried up on the repeater arm until it slides down to start the needle in the first groove of the record again.

(4) To check the timer, it must be first taken out of the cabinet. To do this, temporarily disconnect the input lead from the power source. Remove the screws that hold the control panel and amplifier in the cabinet. Slide the amplifier out far enough to disconnect the battle sound plug, a-c plug, and the speaker plug. Slide the amplifier back in place. Pull the control panel and timer out sufficiently to disconnect the shielded tone arm lead and the record changer power input plug. This will permit the unit to slide out further, and make possible the removal of the dust caps from over the breaker assemblies. Support the unit in this extended position. Reconnect the input leads to the power source; snap the main, firing, recoil, and gun sound switches to "ON"; and then depress the gun trigger. *Keep personnel out of the possible line of fire while operating the gun.* The timer should operate without excessive arcing of the breaker contents. The firing and recoil electromagnets, and the muzzle blast, should operate normally under these conditions.

(5) The amplifier operates in conjunction with the record changer and the battle sound speaker. The procedure described in subparagraph **a** (3), above, will indicate whether or not the amplifier is operating satisfactorily.

(6) The procedures for testing the record repeater and for testing the timer will have served to indicate whether or not the gun and the battle sound speakers are both working satisfactorily.

b. Gun.

(1) The handle assembly must be checked for completeness, stability of mounting, and finish.

(2) The recoil electromagnet is inspected by lifting the gun cover, at the same time that the timer is being checked, as described in subparagraph **a** (4), above. The electromagnet must be smooth and positive in action.

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(3) Inspection of the firing electromagnet is carried out in the same manner as the inspection of the recoil electromagnet. The firing electromagnet must operate with sufficient snap to open the air valve quickly. It must operate regularly and smoothly without noticeable hesitation.

(4) The piston and piston block must present a smoothly operating assembly. In testing these parts, follow the procedure of operating the gun with the cover opened, and with the air valve on the line from the air compressor opened. Look for sluggish operation and for sloppy fits due to wear. The piston must move freely, operating 120 times per minute, but must not allow an appreciable amount of air leakage at the piston entrance.

(5) The air valve plunger must operate freely without appreciable loss of air around the plunger. The procedure for inspection is the same as for the piston and piston block. If the air valve plunger is sluggish in action, it will tend to slow up the firing electromagnet.

(6) The ball release pin mechanism, must act to prevent the pellet waiting to be fired, from rolling out of the barrel when the muzzle of the gun is depressed below the horizontal. It must move downward easily when the firing piston advances.

(7) The loading screw on the end of the magazine tube must be easily fitted into and removed from the threads in the end of the magazine, without the use of tools. When tightened in place, it should prevent any noticeable loss of air.

(8) The barrel must be inspected to determine its general condition and the accuracy with which pellets can be fired from it. Aim the gun at a paper target made of wrapping paper approximately 36 inches square, and set 50 feet away from the gun muzzle. Lock the gun rigidly in position by the use of C-clamps, or their equivalent. Load the magazine with one loader full, or 50 pellets, and fire the 50 shots into the paper target. Seventy-five per cent of the pellets should hit within a 6-inch diameter circle.

(9) The trigger switch must be inspected for its mechanical and electrical condition. To do this, open the cover by twisting the cover fastener stud to the left and lifting the cover. Try the trigger to note whether or not it moves freely. Check the trigger spring for positive return to the "OFF" point. Note the condition of the contacts and wiring.

(10) Inspect the wiring system for cuts or tears in the sheath. Damage from cuts or tears is progressive so that even a slight cut or tear may eventually make the cable unserviceable. The system should be checked for continuity if any operation failure is indicated.

(11) Smoothness of operation is important. Operate the gun to fire pellets with 20 pounds of air pressure. In making this test, the

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recoil action should be included. Note the feel of the gun in operation. It must swing freely through a vertical and horizontal arc. Except for the normal recoil effect, the operation of the gun must be free of any tendency to jump or vibrate excessively.

(12) Small air leaks in the gun mechanism are normal. A small amount of air is continually bypassed around the air valve for use in forcing the pellets from the magazine tube into the barrel. As there is no valve in the bypass, the small amount of air passes out of the barrel continuously. Check the air hose and air fittings for leaks.

c. Compressor.

(1) The compressor pulley speed must be approximately 450 revolutions per minute. Measure the speed, using a tachometer. If the speed falls appreciably below this figure, it indicates that correction is necessary. Failure to make immediate correction may ruin the belt or other parts.

(2) Inspect the "cut-off" point. The automatic switch must cut off the power to the motor when the tank pressure gage on the storage tank registers a pressure of between 65 to 70 pounds. The "cut-off" must be positive, i.e. not intermittent.

(3) The safety valve requires inspection to insure its proper action. To do this, lift the plunger by means of the ring. When the compressor tank is full, a pull of 5 to 6 pounds, measured with a spring balance or the equivalent, must open the valve.

(4) Note any tendency for loss of pressure. When the reserve tank is full of air, and all valves shut off, note any loss of air. An appreciable loss will be quite noticeable. If the cut-off switch is at the normal 65- to 70-pound cut-off setting, the motor will turn on when the pressure drops below 50 pounds. Small leaks can be determined by the sound of escaping air, feeling the stream, or painting the suspected section with a heavy soap solution.

d. Target.

(1) The target reel assembly must be inspected for smoothness of operation, tightness, and wear on the component parts. For this inspection it will only be necessary to operate each target and reel through its normal cycle.

(2) The target airplanes must be inspected for their general condition including completeness and finish.

(3) The trolley carriage must be inspected for general condition including smoothness of operation of the hooks and rollers, and wear on the moving parts.

(4) The trolley wires must be straight, free from bumps and kinks, substantially supported, tight, and free of excessive corrosion.

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The end bumper springs must be securely fastened at the outer end to keep them located at the extremities of the trolley wires. The inner or free ends must move readily along the trolley wires.

e. Accessories.

(1) Inspection of the white pellets (fig. 161) should cover their general condition with respect to cleanliness, breaks, burs, and general surface condition. If difficulty has been encountered with the pellets in operation, they must be spot checked for appreciable changes in diameter. Workable diameters lie between 0.365 and 0.370 inch.

(2) Inspect the red pellets, (fig. 161), in a manner similar to that for white pellets. The red pellets must glow when exposed to an ultraviolet light beam in the dark.

(3) The loading hopper must operate smoothly and with reasonable speed. The general appearance and mechanical condition must be noted. Particular attention must be paid to the agitator bearing and the pellet catch. The bearing must be a sufficiently good fit around the shaft to promote easy turning. The pellet catch must keep the pellets in the hopper except when the loading tube is in position, for loading. When the loading tube is beneath the hopper in the loading position, the pellet catch must release the pellets freely.

(4) The loading tube must be inspected for general appearance, mechanical wear, and completeness (fig. 161). Particular attention must be paid to the pellet catch and the plunger. The catch must permit the free loading, and the transfer of the pellets from the hopper to the magazine tube. The loading bolt must move freely and project the pellets into the magazine sufficiently for easy quick loading without spillage of pellets during the operation.

(5) The ultraviolet lamp equipment must be inspected for general appearance and proper functioning. Particular attention must be paid to the positioning of the bulb in the base, the physical condition of the bulb, and the condition of the wiring.

Section IV

MAINTENANCE AND REPAIR

10. GENERAL.

a. Corrections for defects in the trainer are made by the adjustment of the parts, where adjustment is provided, or by the replacement of the worn or damaged parts. Individual adjustments and repairs are described in the following paragraphs of this section.

b. Facilities required for the detailed repair are as follows:

(1) A working knowledge of electrical testing and radio repairing.

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(2) Electrical and mechanical testing equipment as listed in the Ordnance Catalogs SNL G-91 and SNL G-92.

(3) Radio testing equipment described in TM 1-470, TM 11-455, and TM 9-1672.

11. MAINTENANCE AND REPAIR OF THE SOUND EQUIPMENT RECORD CHANGER.

a. No reproduction due to one or more causes is evidence that some correction is necessary. For failure of the electrical circuit, check the fuses. For faulty inter-connecting wire, check the continuity of the wiring circuit with the test lamp. Test the switch on the tone arm cable. Failure of the amplifier and failure of the record changer to operate may also be causes of no reproduction.

b. Record Changer.

(1) Poor reproduction is indicated by a poor tone, a background of noise and scratching, or howling. Howling indicates the record changer is contacting the cabinet at some point other than at the four corners where it rests on the four mounting springs (fig. 55). Examine the under side of the record changer and see that the four clamp nuts (fig. 54) are not drawn too tightly against the springs and that the record changer is not rubbing against the cabinet.

(2) Lack of smoothness in the operation of the turntable will be indicated by variation in the tone known as a "wow" or a speed variation. A wow or speed variation may be caused by binding of the turntable spindle (fig. 57). Remove the turntable and rotate the turntable spindle with the fingers to determine whether it tends to bind. If it binds, add not more than 2 drops engine oil, SAE 10 to the two spindle bushings (fig. 60). If the turntable spindle should be bent to such an extent that replacement is necessary, it is recommended that the entire spindle housing gear assembly be replaced. This assembly is precision-fitted at the factory, insuring proper clearances and smooth operation. Never allow oil to come in contact with the motor idler pulley (fig. 57).

(3) Lack of smoothness in tone arm operation will be the result of incorrect adjustment. Adjustments of the tone arm mechanism involve such items as the tone arm indexing, the tone arm height, the tone arm hinge, the booster spring settings, the minimum circle diameter trip and the tone arm retard lever adjustment. Proper setting of the tone arm indexing position is necessary for the proper performance of the record changer. The needle must contact the record approximately one-eighth inch from the outside edge of the record. The steps in making the adjustment are as follows:

(a) Remove the record changer from the sound cabinet and connect it to a source of a 115-volt, 60-cycle current. With the tone arm

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in the "REST" position, move the switch control knob to the "MANUAL" position and run the turntable until the tone arm drops down. Turn the main switch on the control panel to "OFF."

(b) Move the tone arm to the "REST" position manually.

(c) Loosen the hexagonal-head cap screw (fig. 154) on the under side of the record changer base panel.

(d) Line up the outer edge of the tone arm with the outer edge of the record changer base panel by eye. This is a preliminary adjustment to obtain approximately correct indexing.

(e) Place a 12-inch record on the turntable. Put the machine into automatic operation by moving the switch control knob to the "REJECT" position. In order to do this the main switch on the control panel must be in the "ON" position. Release the knob and note the point at which the needle *first* strikes the margin of the 12-inch record. The word *first* is used to indicate the fact that after the needle has touched the record, the booster spring will move the needle slightly toward the center of the record. The proper setting of the tone arm indexing position is only concerned with the point at which the needle first makes contact with the record. For this reason, it may be advisable to slow down the movement of the tone arm, by retarding the movement of the turntable by hand, so that the action may be more readily observed during the adjustment.

(4) If the needle does not strike the record initially approximately one-eighth inch in from the outside edge of the record, move the tone arm in a compensating direction. Do this by slipping the tone arm with reference to the tone arm lever which has been previously loosened by the loosening of the hexagonal-head cap screw.

(5) After the correct indexing of the tone arm on the 12-inch diameter record is obtained, check the indexing on a 10-inch diameter record. If correct, tighten the hexagonal-head cap screw (fig. 154) firmly. Incorrect action of the booster spring, or tone arm lever may may produce the effect of improper tone arm indexing. Never force the movement of the tone arm.

(6) The height of the tone arm in the playing position with no record on the turntable is adjusted by the tone arm height adjustment screw (fig. 155).

(7) The correct setting of this screw is that which, with no record on the turntable, allows the tone arm to descend until the needle is slightly below the level of the turntable surface.

(8) The tone arm adjustment screw must not be used to adjust the height to which the tone arm rises during a change cycle. This height is controlled solely by the length of the tone arm lift pin (fig. 155).

(9) The tone arm hinge must allow free vertical movement of

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the tone arm. If the spring is free, any other binding is evidence that the tone arm assembly (fig. 155) should be replaced. Binding may be due to the counterbalance spring (fig. 155) rubbing on the tone arm.

(10) The booster spring (fig. 69) must be adjusted so as to move the needle from the margin of the record into the first groove. The side pressure should be just sufficient to pull the needle into the groove. Do not increase the pressure of this spring to such a point that it tends to pull the needle across the first few record grooves. The adjustments are made as follows:

(a) With the record changer removed, and connected to a source of 115-volt, 60-cycle current, have the tone arm in the "REST" position, and the control knob turned to "OFF." Move the tone arm locator lever assembly out toward the outer edge of the record changer base panel.

(b) Adjust the pressure of the booster spring (fig. 69) with a pair of light pliers or with the fingers. The tension measured at the point of contact between the booster spring and the tone arm lever is set at the factory to be approximately 15 grams. The shielded tone arm lead wire (fig. 55) must have sufficient slack between the tone arm and the point where the lead wire enters the base panel to permit free sidewise movement of the tone arm. This lead must be checked before attempting any booster spring adjustment.

(11) The record changer mechanism must be inspected for jamming of the mechanism minimum circle diameter trip, failure to trip, repeated tripping, tone arm retard lever adjustment, and the ability to complete a change cycle. If the mechanism should jam for any reason, other than jamming of the selector arms with the records being changed, remove the records and attempt to free the mechanism by rotating the turntable (fig. 57) in a reverse direction, manually, through a quarter of a turn. If cleared by this action, the machine should be operated through several cycles automatically, but with no records on the turntable. If the jam is not cleared by rotating the turntable in the reverse direction, inspect the under side of the changer for damaged or missing parts (fig. 59).

(12) Inspect the meshing of the drive gear with the spindle drive gear (fig. 60). If the gears do not mesh, it is probably due to the clutch engagement lever being damaged or bent. The clutch engagement lever is intended so to contact one of the lower projections of the pinion gear (fig. 60) that the teeth of this pinion gear and the teeth of the main drive gear (fig. 60) are timed to fit together properly whenever the mechanism starts a change cycle. If the clutch engagement lever (fig. 59) is bent, it may be adjusted, until by trial the two gears mesh properly when the changer is tripped. It is advisable that the record changer mechanism be operated by hand to observe closely the

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timing of these gears. Run the turntable until the pin is disengaged. Turn off the control knob with the tone arm resting on the edge of the record. Lift the tone arm slightly and move it toward the spindle, using care not to scratch the record. When it is almost to the spindle, the clutch engagement lever will drop into position. Under these conditions, move the turntable by hand and observe the character of the pinion and gear engagement. If the engagement is incorrect, bend the clutch engagement lever to overcome the difficulty.

(13) The record changer incorporates a dual trip arrangement to insure positive cut-off of various types of records. The adjustments of the two cut-off devices are as follows:

(a) Remove the record changer from the control cabinet and connect it to a source of 115-volt, 60-cycle current. The tone arm should play in far enough on a record so that the distance from the needle to the center spindle is approximately 1⅞ inches. At this point the record changer will trip regardless of whether or not there is a "cut-off" or eccentric groove in the record. The mechanism may be adjusted for a larger or smaller diameter trip, by moving the position of the trip shoe (fig. 154) slightly. The trip shoe is locked in position by means of an adjusting screw (fig. 154) when the adjustment is satisfactory. This screw must be adjusted through the circular hole cut in the main drive gear, when the machine is not in a change cycle.

(b) For records provided with an eccentric "cut-off" groove at the center, a second tripping mechanism, or eccentric groove trip is provided. It operates due to any outward movement of the tone arm after it has played to within 2½ inches of the center spindle. The trip lever (fig. 154) is actuated by a small dog and rachet combination and is permanently adjusted at the factory.

(c) Failure of the record changer mechanism to trip may be due to binding of the clutch engagement lever (fig. 64).

(14) With the record changer removed from the sound cabinet, connect it to a source of 115-volt, 60-cycle current. Turn off the changer and operate the clutch engagement lever (fig. 64) by hand while the trip lever (fig. 154) is being held away to prevent the engagement lever from locking in the "UP" position. The lever must not bind. The clutch engagement lever can easily be inspected for binding when the main gear is stopped about three-quarters of the way through the change cycle. It is not advisable to lubricate the bearing point of the clutch engagement lever at any time. It is intended to be loose fit, run dry, and operate due to gravity. To correct binding of the clutch engagement lever, remove the retaining pin shown in figure 59 and remove the lever. Straighten the lever if necessary and remove any rough spots on the bearing surfaces.

(15) Excessive pressure on the trip lever spring (fig. 154) tends

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to make the needle jump out of the "cut-off" groove of a record and prevent tripping. Correction of serious jumping from this cause will require the replacement of the spring.

(16) Examine the shielded tone arm wire (fig. 55) to see that it has sufficient slack between the tone arm and the point where the wire enters the record changer base panel to permit free sidewise movement of the tone arm. The shielded tone arm wire must be slack at all times and should never be pulled taut or fastened in place.

(17) If the record changer exhibits repeated tripping during the change cycle, remove the record changer from the sound cabinet, and reconnect it to a source of 115-volt, 60-cycle current. Start the record changer by placing the switch control knob in the "REJECT" position, and release. Turn off the changer during a change cycle so that the clutch engagement lever may be moved up and down with the finger.

(18) The clutch engagement lever (fig. 59) must lock into the "UP" position due to its engagement with the trip lever (fig. 154) at the point 1 (fig. 154). If the engagement is not positive, inspect the bearing point of the trip lever for evidence of dirt or binding. A more positive engagement may be obtained by strengthening the trip lever spring (fig. 154). Excess spring tension will result in failure to trip.

(19) Repeated tripping may also be caused by failure of the switch control knob to return to the "AUTOMATIC" position when released. Examine the roller lever assembly (fig. 154) and its bearing. Check the tension of the set arm spring, and examine the control lever to see that there is no excessive friction or binding of the parts. Clean and loosen any part which appears to bind.

(20) The tone arm retard lever should provide a smooth motion of the tone arm as it moves from the outer panel in toward the edge of the record to be played, during an automatic change cycle. The tone arm retard lever spring (fig. 154) should be adjusted with a pair of pliers or the fingers until the tone arm moves smoothy. Insufficient pressure will give the effect of incorrect tone arm indexing. Excessive pressure will cause a rough jerky action of the tone arm as it moves toward the record from the "REST" position.

(21) If the changer mechanism does not have sufficient power to complete a cycle, remove the record changer from the sound cabinet and inspect the bearing of the main drive gear (fig. 154) for excessive friction or binding. Take such corrective measures as are indicated as necessary to correct the binding. Inspect the shaft bearings of the selector shaft assembly (fig. 154) for excessive friction or binding. Make necessary corrections such as cleaning bearings and lubricating them to remove the binding.

(22) Incorrect adjustment of the switch (fig. 154) may cause failure to produce sound. The switch must be adjusted so that it is

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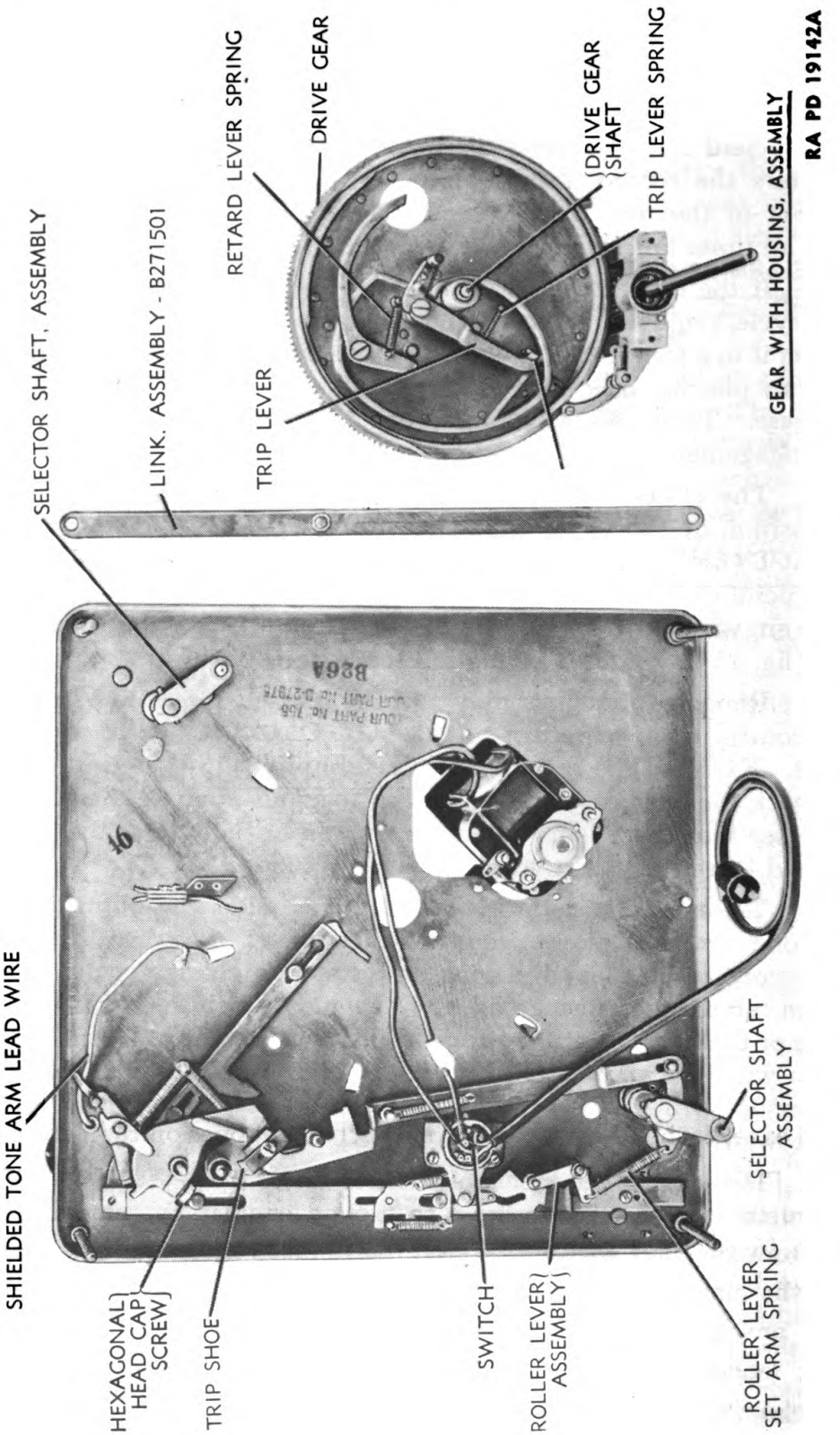


Figure 154 — Record Changer — Drive Gear, Spindle Housing, and Bushing Removed

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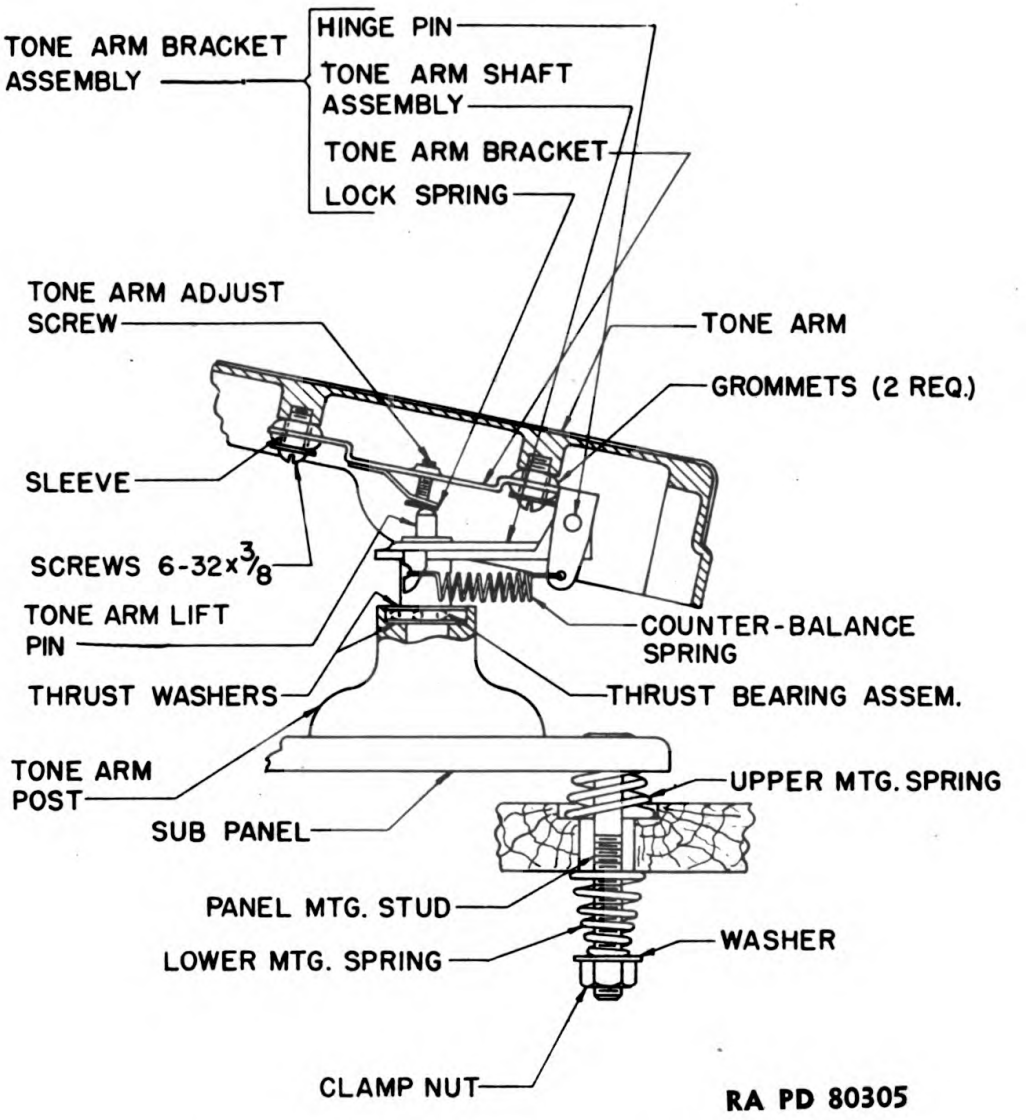


Figure 155 — Tone Arm — Mounting Assembly

closed except when held open by one of the two lobes on the periphery of the main gear. To check the adjustment of the switch springs, remove the record changer from the sound cabinet by removing the nuts from the four corner posts on the under side of the base panel. Turn the main gear by hand while watching the action of this switch. Make any indicated correction in the spring tension. Both switch spring leaves must have sufficient clearance to insure freedom of movement when the turntable is turned in either direction. In making spring adjustments, be sure to turn the turntable in both directions to be sure of free movement between the switch and the cam.

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c. Record Repeater Mechanism.

(1) Poor or no reproduction is evidence that some correction is necessary. One or more of the following may be the cause of the trouble:

(a) Electrical circuit failure (check fuses)

(b) Record repeater fails to operate.

(c) Failure of the amplifier.

(d) Faulty circuit wiring.

(2) Poor reproduction is indicated by a poor tone, background of noise and scratching, or howling. Poor tone can usually be remedied by changing the needle. Scratching and noise is the result of worn records. Howling indicates the record repeater is contacting the sound cabinet at some point other than at the four corners where it rests on the springs. Examine the under side of the record repeater and see that the four clamp nuts are not drawn too tightly against the cabinet.

(3) Lack of smoothness in the operation of the turntable may be caused by incorrect speed regulation or a binding governor.

(a) The turntable is normally set to operate at 78 revolutions per minute with the speed regulator pointer (fig. 156) set midway between the "F" and "S" positions on the dial. If the speed regulator is not correctly adjusted, pull the turntable from the turntable shaft. Loosen the nut holding the pointer to the speed regulator post. Turn the post one-quarter turn to the right. Replace the turntable, snap the switch "ON" and check the speed of the turntable. Repeat the adjustment until the correct speed is obtained; set the pointer midway between the "F" and "S" positions on the dial and retighten the nut fastening the pointer to the post.

(b) If the speed governor should be removed from the rotor shaft for repair or replacement, it will be necessary to see that it does not bind or that the weights do not strike the governor housing during operation. Turn the speed regulator pointer until the cam attached to the bottom of the speed regulator post (fig. 73) does not press the ball against the governor retainer cup inside the governor housing. Snap the main switch "ON" and note whether the governor weights strike the housing as indicated by a clicking sound. If they strike the housing, turn the switch "OFF." Remove the housing and loosen the set screw in the governor. Slip the governor toward the end of the rotor shaft slightly and retighten the screw. Reassemble the housing and check for the clicking sound. Repeat the adjustment until the weights no longer strike the housing. Do not pull the governor so far out on the shaft that it binds against the felt retainer. Binding would be indicated by a turntable speed of less than 85 revolutions per minute when the speed regulator cam is not pressing against the ball. In making these adjustments be certain the speed

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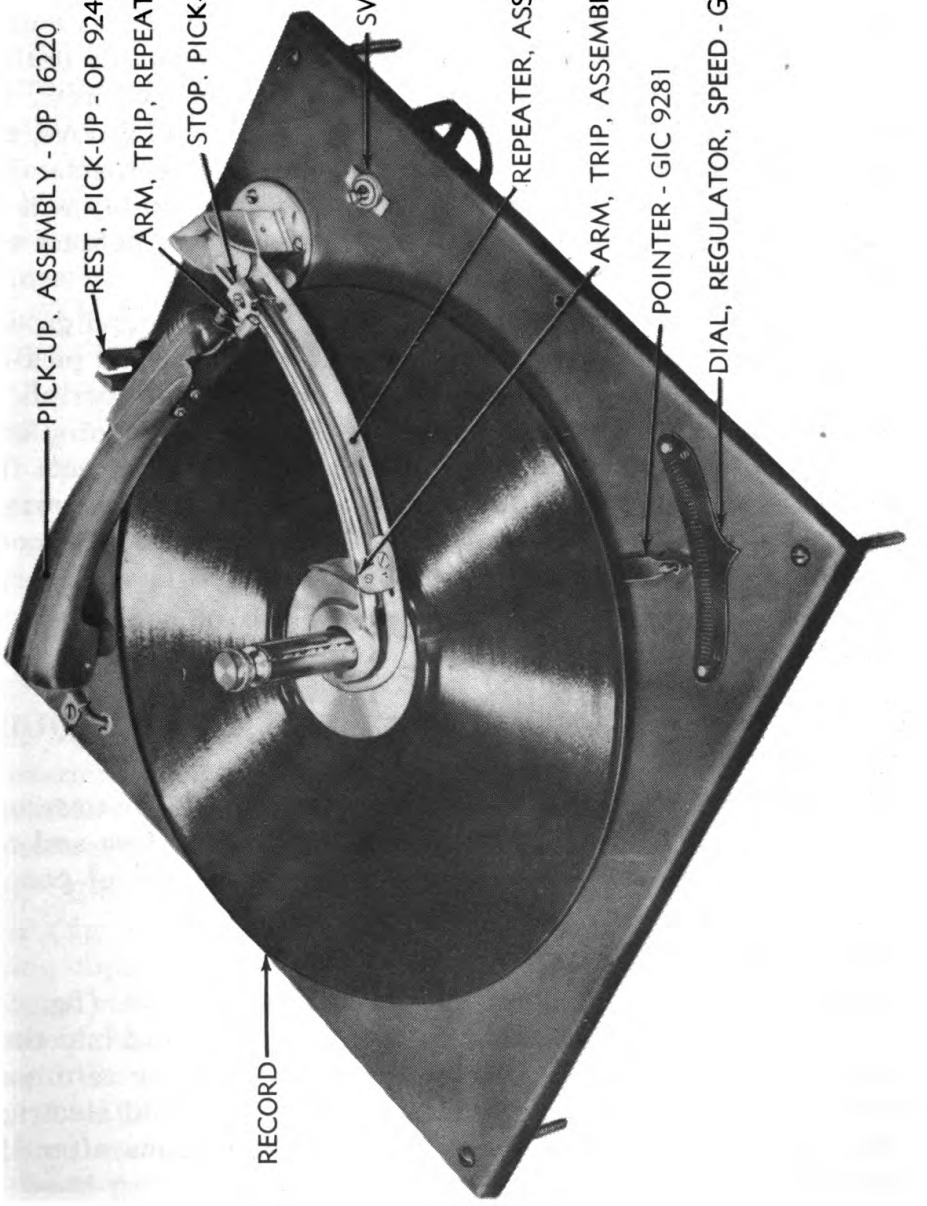


Figure 156 — Record Repeater Mechanism — Record in Playing Position

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change post assembly is locked in the fast speed notch cut in the frame. This is easily ascertained since the turntable will only revolve at 33 revolutions per minute in the slow position.

(c) Lack of smoothness or operating difficulties in the pick-up assembly will be the result of incorrect adjustment of the repeater assembly or binding of the pick-up assembly lead wire. Adjustments of the repeater assembly involve such items as the pick-up stop (fig. 156) and the trip arm assembly. The steps in making the adjustments are as follows:

1. Remove the record repeater from the sound cabinet and connect it to a source of 115-volt, 60-cycle current. Place a record on the turntable and set the pick-up cartridge needle approximately one-quarter inch from the last sound groove near the inner diameter of the record. Loosen the binding head screw in the trip arm assembly and slide the assembly in its groove in the base plate assembly until it contacts the roller on the repeater trip arm. Retighten the screw. As the pick-up assembly needle moves toward the last sound groove, the roller should push the trip arm assembly back until the arm assembly worm gear dog engages the worm gear. The pick-up assembly will be carried up on the arm assembly until it slides down to contact the first sound groove to replay the record.

2. The pick-up stop directs the needle into the first sound groove to replay a record. With a record on the turntable, place the pick-up assembly needle in the first sound groove located near the periphery of the record. Loosen the binding head screw in the pick-up stop and slide the stop on the arm assembly until its projection contacts the roller on the repeater trip arm. Tighten the screw. Snap the switch "ON," and operate the record repeater. Final adjustment can be made after a trial operation.

3. The pick-up assembly lead wire must have sufficient slack to permit free sidewise movement of the pick-up assembly.

12. MAINTENANCE AND REPAIR OF THE SOUND EQUIPMENT CONTROL PANEL.

a. Remove the center piece of the fuse post (fig. 31) by unscrewing the central thumb screw. Check the condition of the fuse and see that the rating is 3 amperes. Replace it with a new fuse of proper amperage if necessary.

b. Remove the timer from the control cabinet.

c. Place the timer on the top of the control cabinet (fig. 5). Insert the gun plug on the cord and speaker plug on the cord into their proper receptacles in the control panel. Connect the timer terminals (fig. 5) to a source of 115-volt, 60-cycle current. To avoid electrical shock, use care in handling exposed leads, or connections after the units are connected to the power source.

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d. With the units connected to a source of 115-volt, 60-cycle current, test each switch (fig. 32) on the control panel by placing the prods of a test lamp across the upper and lower terminals and snapping the switch to the "ON" and "OFF" position repeatedly. If the test lamp used is of the type shown as part of the equipment of the Tank Maintenance Truck M1, to be used in conjunction with a test panel power source, disconnect the timer unit terminals from the source of power. Under these conditions, it will be necessary to place a jumper across the input terminals. If the switches are defective, the lamp will fail to light when the circuit is closed in the switch. Replace defective switches with new switches of similar type. When replacing the battle sound switch (fig. 31), use the special switch designed for the purpose. The battle sound switch differs from the other switches on the control panel in that the mercury element is reversed within the switch; thus the switch is open when turned to "ON." All the control panel switches are mercury element type switches which operate more smoothly than mechanical type switches.

e. With the main switch in the "ON" position, check the continuity of the circuit for the ultraviolet lamp transformer receptacle and the circuit of the record changer motor plug outlet on the control panel, by inserting the prods of a test lamp into each of the sockets separately (fig. 31). The equipment must be disconnected from the power source during these tests and a jumper must be connected across the power input cord terminals (fig. 32), if the Tank Maintenance Truck M1 lamp and test panel are used.

f. If the test lamp does not light when the prods are inserted in either of the outlets, check the continuity of the circuit by placing the prods of the lamp across the input terminals of the outlets. Replace either of the outlets if they are defective.

13. MAINTENANCE AND REPAIR OF THE SOUND EQUIPMENT TIMER.

a. With the timer (fig. 32) removed from the cabinet, it is possible to examine the timer unit for tightness of set screws on the breaker assemblies, condition of the contacts, tendency of the contacts to arc excessively, oil in the breaker transmission, and condition of the motor.

b. Snap the main switch to the "OFF" position. Remove the dust caps (fig. 41) on the breaker contact assemblies by prying off the spring clips and pulling off the caps. Examine the set screws holding the gun sound, fire and recoil breaker contact assemblies in position on their respective cams (figs. 41 and 43). The screws must hold the assemblies in place tightly. Examine the condition of the contacts (fig. 41) for burning and pitting. Contacts should be cleaned by rubbing each contact with an ignition breakerpoint stone. Do not use sand paper or emery paper. The grains will become imbedded

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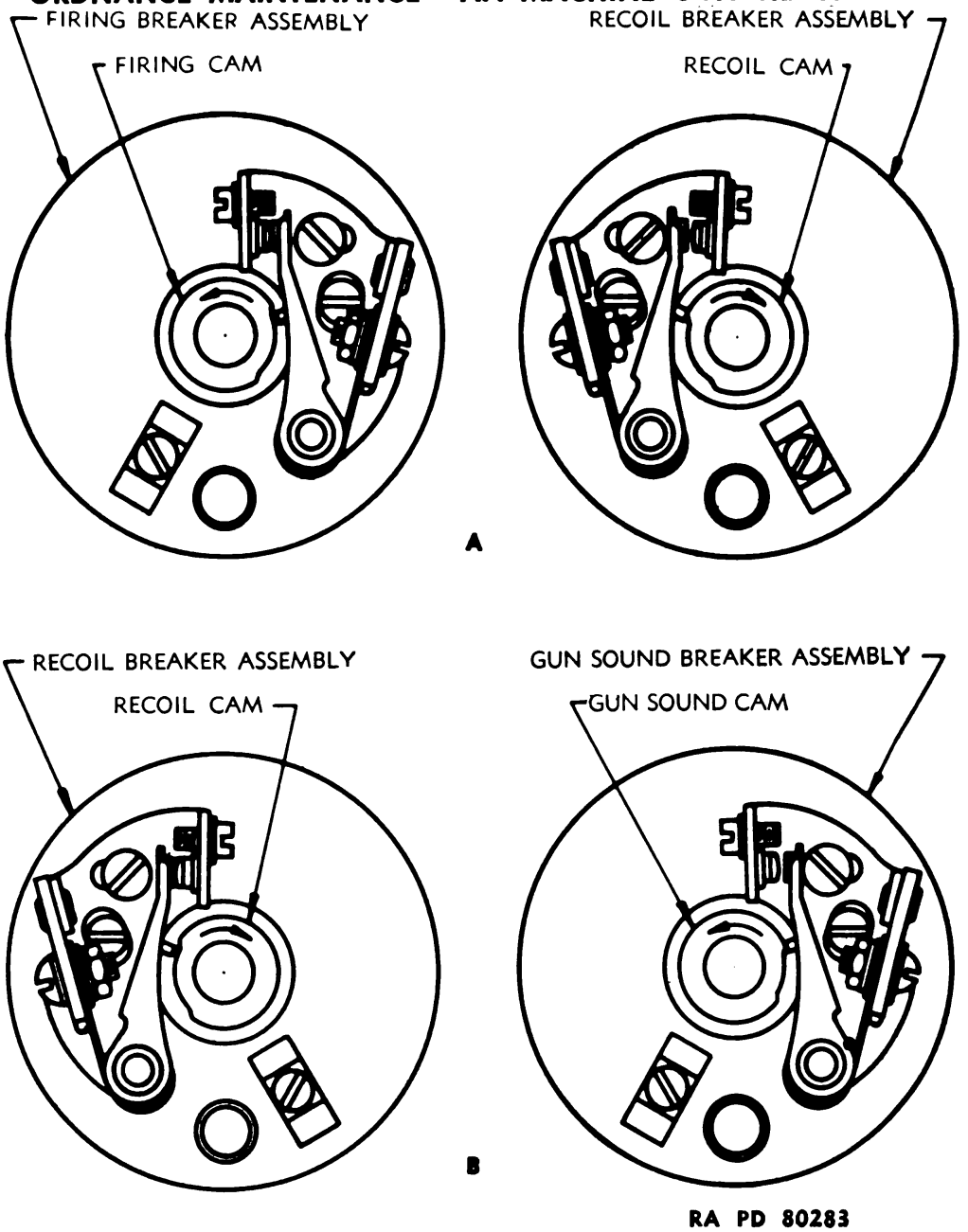


Figure 157 — Breaker Assembly Adjustment on Breaker Transmission

in the silver contacts and cause excessive arcing and burning of the contacts.

c. Reconnect the control panel power input lead terminals (fig. 32) to a source of 115-volt, 60-cycle current. Turn the main switch to the "ON" position. Inspect the operation of the breaker contacts individually while they are a part of an operating circuit. To do this it will be necessary to operate the trigger on the gun in the normal manner, but the test may be made without loading the gun with

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pellets. Turn the appropriate control panel switch to "ON" as the breaker for the firing, the recoil, or the gun sound are individually inspected.

d. Excessive arcing of the timer contacts can be corrected by adjusting the position of the contact assemblies. Poor adjustment may be the result of replacing a motor, or internal parts of the breaker transmission, or loosening of the set screw. All contact gaps must be 0.025 inch in the opened position. The approximate positions of the breaker assembly are shown in figure 157. The locations of the respective cam shafts are shown in figure 43.

e. To adjust the firing cam, loosen the set screws holding the firing breaker assembly (fig. 157). Rotate the firing breaker assembly slightly, forward or backward, while the motor is running and the gun is being operated, until a condition of minimum arcing is obtained. Tighten the set screws which hold the firing breaker assembly in place while holding it in the position of minimum arcing.

f. The recoil cam is adjusted by stopping the motor and turning the timer shaft manually until the firing cam contacts have just closed. After loosening the set screws on the recoil breaker assembly (fig. 157), rotate the recoil breaker assembly to a position where the recoil cam contacts are just about to close. Hold the recoil breaker assembly in this position and start the motor. Rotate the recoil breaker assembly slightly forward and backward, while the motor is running and the gun is being operated, until a condition of minimum arcing is obtained. Tighten the set screws which hold the recoil breaker assembly in place, while holding it in the position of minimum arcing.

g. Adjustment of the gun sound breaker assembly (fig. 157) is accomplished in a manner similar to the adjustment of the recoil breaker assembly. To make the adjustment, stop the motor and turn the timer shaft manually until the recoil cam contacts have just closed. After loosening the set screws on the gun sound breaker assembly (fig. 157), rotate the gun sound breaker assembly to a position where the gun sound breaker assembly contacts are about to close. Hold the gun sound breaker assembly in this position and start the motor. Rotate the gun sound breaker assembly slightly, forward and backward, while the motor is running and the gun is being operated, until maximum sound is produced. Some sparking will occur from this adjustment. Tighten the set screws which hold the gun sound breaker assembly in place, while holding it in position to produce maximum sound. After timing, check to be sure that the breaker contacts close in the sequence of firing, recoil, and sound.

h. Minimum arcing of the breaker assembly contacts also produces maximum effect in the case of the gun sound and the recoil. Thus the volume of gun sound and amount of recoil may be utilized

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as an indication of whether or not the breaker assemblies are properly adjusted. Remove the pipe plug on the end of the transmission box (fig. 32) and ascertain if oil will overflow, and the condition of the oil. The oil level must be maintained to the lower level of the pipe plug. To refill, remove the screws holding the transmission cover (fig. 32) and fill to the lower level of the plug with engine oil SAE 10 for temperatures above 0° F or special preservative lubricating oil for temperatures below 0° F. These lubricants have all the necessary characteristics to oil the transmissions satisfactorily, and will not cause the excessive drag experienced with heavier oil. Unauthorized heavy oil should be drained and replaced with oil of prescribed consistency. The use of heavy oil in the breaker transmission will result in burned out timer motors. If the oil is dirty, replace it with new oil. If the motor insulation becomes saturated with oil, the motor electrical circuit may be shorted. Replace the insulated leads to the motor if necessary. If the insulation is shorted within the motor, it will necessitate repair or replacement of the motor (fig. 32). A continuity check of the timer circuit may be made using the circuit checking diagram (fig. 27) and the wiring diagrams (figs. 28 and 29).

14. MAINTENANCE AND REPAIR OF THE SOUND EQUIPMENT AMPLIFIER.

a. The amplifier (fig. 11) should be inspected for proper fusing, condition of the connections and the insulation of the wire, clearness of reproduction of the sound, and the volume produced.

b. Remove the fuse mounted in the fuse knob (fig. 11) by unscrewing the thumb screw fuse knob and see that the rating is 3 amperes, and that the connecting strip is not burned out. If it is necessary to replace it, remove the fuse by pulling it from the clip holding it in position in the thumb screw knob. Replace the defective fuse with a 3-ampere fuse of similar type.

c. Symptoms of trouble evidenced by the amplifier may be the following:

(1) No reproduction of sound.
(2) Noisy or intermittent reproduction.
(3) Poor volume.
(4) Failure to operate.

d. Lack of clear reproduction of poor volume will require checking for the following sources of trouble:

(1) Defective tubes.
(2) Open or shorted condensers.
(3) Open or shorted chokes.
(4) Open or shorted resistors.

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(5) Open or shorted transformers.

(6) Loose connections.

(7) Speaker trouble.

e. First determine that the record player is operating and the battle sound switch is in the "ON" position with the speaker plug inserted in its proper receptacle on the control panel. Remove the grill (fig. 11) from the amplifier panel by removing the four thumb screws. Remove the tubes. Insert each tube in a tube tester and check for shorts, open connections, or poor emission, while hot. Replace any defective tubes with duplicate tubes. If the tubes are found to be satisfactory, a continuity check must be made on the entire circuit following the wiring diagram (fig. 7) to determine if any part of the circuit has broken or loose connections. A radio set analyzer or a Wiedenhoff No. 301 test bench as described in the tank maintenance truck catalog (SNL G-91) may be use for testing. Poorly insulated wire must be protected by a wrapping of tape, insulated sleeves, or by replacement with similar wiring. Check the resistors, condensers, and chokes for their cold ohm resistance, and the transformer for its cold ohm resistance and voltage output to determine if any of the parts are defective. The correct mean voltages and resistance readings for each part are contained in the table of resistance values (table I) and in the circuit checking and wiring diagrams (figs. 7 and 8). Replace the defective parts with new parts of similar characteristics.

15. MAINTENANCE AND REPAIR OF THE SOUND EQUIPMENT SPEAKER CABINET.

a. The dynamic speakers and the power pack (fig. 87) supplying the speakers must be inspected for the condition of the mountings, clearness of reproduction, condition of the tube in the power pack, continuity of the circuit, and the presence of broken or burned out speaker coils or voice coils, in the speakers.

b. Any looseness of bolts and wood screws in the cabinet and mountings must be corrected. If the wood screws no longer hold, replace the screws with slightly larger diameter screws.

c. Check the continuity of the circuit on either a radio set analyzer, or the Wiedenhoff test bench. The wiring diagram for the unit is shown in figure 86. Replace defective parts or wiring with similar parts or wiring. Any cuts or breaks in the insulation must be wrapped with rubber tape and friction tape.

d. Check the current limiting device attached to the battle sound speaker for a defective lamp bulb. Replace the bulb if defective.

e. The speaker field coils and voice coils (figs. 91, 92 and 93) must be checked for cold ohm resistance using the resistance tester on

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TABLE I — RESISTANCE VALUES, AMPLIFIER

Part Name and Number	Winding	Voltage Rating	Resistance Ohms	Inductance	Position of Tap	Current Rating	Choke Input	General Comments
Power Transformer Part No. 13688	Primary Secondary No. 1 Secondary No. 2 Secondary No. 3	165 V.A. 524-0-524 7.08 5.30	1.73 d-c		Center	4 amp 6 amp	0.20 amp	
Driver Transformer Part No. 5888	Primary Secondary		580 665	10,000 ohms 600/250 ohms				Turn ratio 1.75 to 1. Secondary Terminal No. 5 is in center of secondary
Output Transformer Part No. 9854	Primary Secondary		295 0.72	5,000 ohms 8/16 ohms				Turn ratio 1.76 to 1. Secondary tap not in center
Choke Part No. 5764			1,580	40 Henries		0.03 amp		
Choke Part No. 3799-A			83	5 Henries		0.22 amp		

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MAINTENANCE AND REPAIR

TABLE II – RESISTANCE VALUES, SPEAKER CABINET INCLUDING POWER SUPPLY

POWER TRANSFORMER
Part No. 6713

Pri.—135 V.A.—3.2 ohms d-c resistance
Sec. No. 1—340-0-340 volts—0.250 amp d-c
Sec. No. 2—5.45 volts 3.0 amperes

GUN SOUND SPEAKER
Part No. 11515

Voice coil d-c resistance—5.43 ohms
Hum bucking coil d-c resistance—0.18 ohms
Voice coil impedance at 330 cps—7.6 ohms
Field coil inductance for I(d-c)—0—122 Henries
Field coil inductance for I(d-c)—90 ma—96 Henries
Field coil resistance—3,000 ohms
Amperage rating of field coil—94 ma

BATTLE SOUND SPEAKER
Part No. 11517

Voice coil d-c resistance—6.10 ohms
Hum bucking coil d-c resistance—0.19 ohms
Voice coil impedance at 400 cps—8.0 ohms
Field coil inductance for I(d-c)—0—166 Henries
Field coil inductance for I(d-c)—90 ma—130 Henries
Field coil resistance—3,500 ohms
Amperage rating of field coil—85 ma

CHOKE
Part No. 3799-A

5 Henries—83 ohms—0.220 amperes

the Wiedenhoff test bench, and the values compared with the values given in the circuit checking diagram (fig. 85) and in table II. Replace any defective coils wtih coils of similar value. Disassembly information is given in section II.

16. MAINTENANCE AND REPAIR OF THE GUN.

a. The gun must be inspected for completeness, worn parts, condition of electrical parts, smoothness of operation, accuracy on firing, and air leaks. The detailed inspection must include each component part as described in the following paragraphs.

b. Inspect the handle bracket assembly (fig. 116) for broken parts, stability of mounting, and finish. The handle assembly is not attached

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to the main body of the gun, but returns the return plunger actuated by the recoil electromagnet to the starting position, after producing the recoil effect. A broken recoil spring (fig. 92) would cause instability of the handle assembly and should be replaced by a duplicate part. The nuts on the bolts, holding the wooden handle grips (fig. 117) in the handle assembly, must be kept tight.

c. The recoil electromagnet (fig. 119) has a free and positive action when the timer is operating properly. If the electromagnet is sluggish in action or sticks, add a few drops of engine oil SAE 10 to the plunger slides. *Do not overoil.* Excess oil may saturate the insulation of the wiring of the electromagnetic coil and permit shorting of the unit. If oiling does not correct the sluggish action, check the line voltage. The electromagnet is intended to operate on 115 volts, plus or minus 10 percent. The minimum line voltage should be 103 volts. If the line voltage is low, it may be due to the circuit lacking capacity. A new line of larger size run from the main feed box to the gun should correct the difficulty.

d. The firing electromagnet (fig. 119) must have a free and positive action with sufficient snap to open the air valve quickly. Failure to operate in such a manner can be corrected by following the directions given for the recoil electromagnet.

e. If the air valve spring (fig. 158) has broken, replace it with a new spring of similar type. If the air valve plunger is worn, replace the air valve plunger unit. The air valve plunger is removed by unscrewing the hexagonal-head nut holding the air valve unit in position.

f. To repair the ball release pin mechanism (fig. 158), the gun must be removed from the cradle. Remove the two holding screws, the stud, and the release spring. Examine the ball release pin for wear at the point where the piston contacts the end of the pin if badly worn. The pin must fit freely in the hole in the piston block. If dirt has accumulated in the hole, causing the pin to stick, clean the hole before reassembling. Examine the release spring and, if broken, replace with a similar spring. When reassembling, be certain that the ball release pin is in its correct position above the release blade. The stud which supports the release spring is tightened after assembly.

g. The loading screw must thread into the loading block easily and prevent appreciable loss of air. If the threads become damaged on either the screw or in the loading block, replace the defective piece with a duplicate part.

h. The barrel must be a press fit in the piston block. If the barrel becomes loose, bent, or otherwise damaged, replace the entire unit: piston, piston block, and barrel. The barrel is press fitted into the block at the factory, and no attempt should be made to separate the two component parts. If the accuracy of the gun on firing pellets

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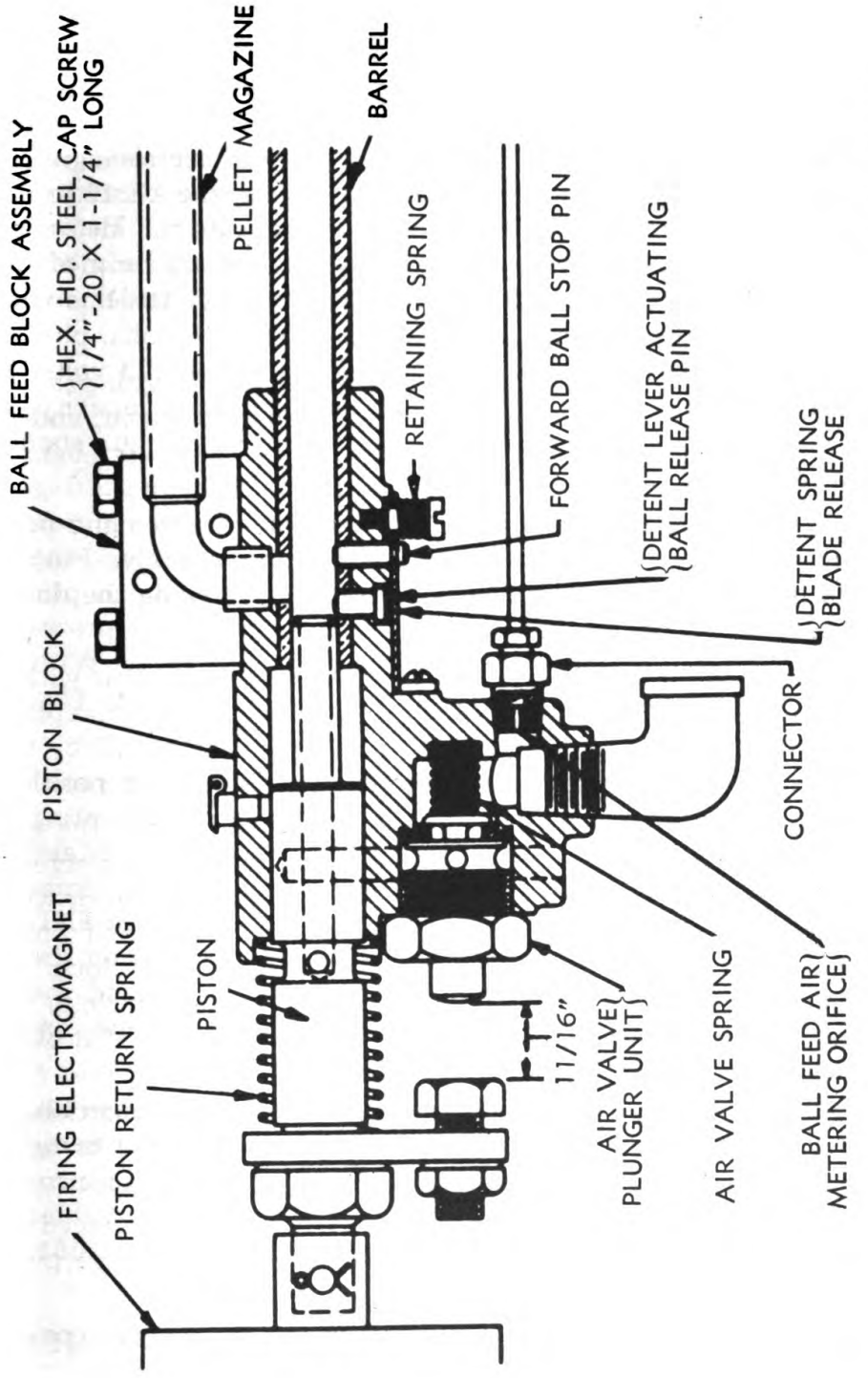


Figure 158 — Feed From Magazine to Barrel

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over a range of 50 feet is such that 75 percent of the pellets do not fall within a 6-inch circle when the gun is locked in fixed position, the barrel may be worn badly, or the piston block and barrel may be misalined. Misalinement may be caused by the water jacket (fig. 86) sagging slightly and straining the barrel assembly. To correct this difficulty, loosen the four bolts holding the piston block in place and permit the piston block and barrel assembly to assume a normal position. Retighten the bolts. Accuracy tests on the gun are seriously affected by the pressure of the air supplied the gun, the condition of the pellets, and the action of the firing electromagnet. Before concluding that the barrel is at fault, the firing test should be made with new pellets and with the gun operating smoothly, under the correct air pressure of 20 pounds.

i The trigger switch lever (fig. 117) must move freely with positive spring action. The contacts should be kept smooth, clean, and free from pits. To repair the trigger switch lever, open the cover (figs. 108 and 109) by turning the cover fastener stud (fig. 108) and lifting the cover upward on its hinges. Clean the contacts with an ignition breaker-point stone. If the spring action is not positive, replace the return spring (fig. 118) by removing the cotter pin and hinge pin. If difficulty is experienced in replacing the return spring by the procedure outlined, remove the switch bracket assembly (fig. 117). With the switch bracket assembly removed, replace the return spring (fig. 118). Reassemble the switch bracket assembly to the gun.

j. If the gun fails to operate when the trigger, firing, and recoil switches are "ON," and the timer unit in the sound cabinet is operating properly, a continuity check must be made on the wiring system. Make the continuity test by removing the gun cord plug (fig. 108) from the control panel gun outlet and using a test lamp, described in SNL G-91 on the Tank Maintenance Truck M1. The connections on the gun cord (fig. 108) must be tight at both the trigger switch and the plug. Check the wiring by using the circuit checking and wiring diagrams as a guide (figs. 106 and 107).

k. If the continuity test shows the wiring to be in good condition, the trouble may be located in the recoil electromagnet or the firing electromagnet. The cold ohm resistance of the firing and recoil electromagnets must then be measured with an ohmmeter and the values compared with those given in the circuit checking diagram (fig. 106). Replace the faulty electromagnet.

l. If the gun vibrates excessively when in use, tighten all the connecting bolts in the side plate assemblies (fig. 108) in the cradle and in the yoke assembly.

m. The air hose connections (fig. 159), air valve assembly (fig. 158), and the loading screw (fig. 110) must be tight to prevent ex-

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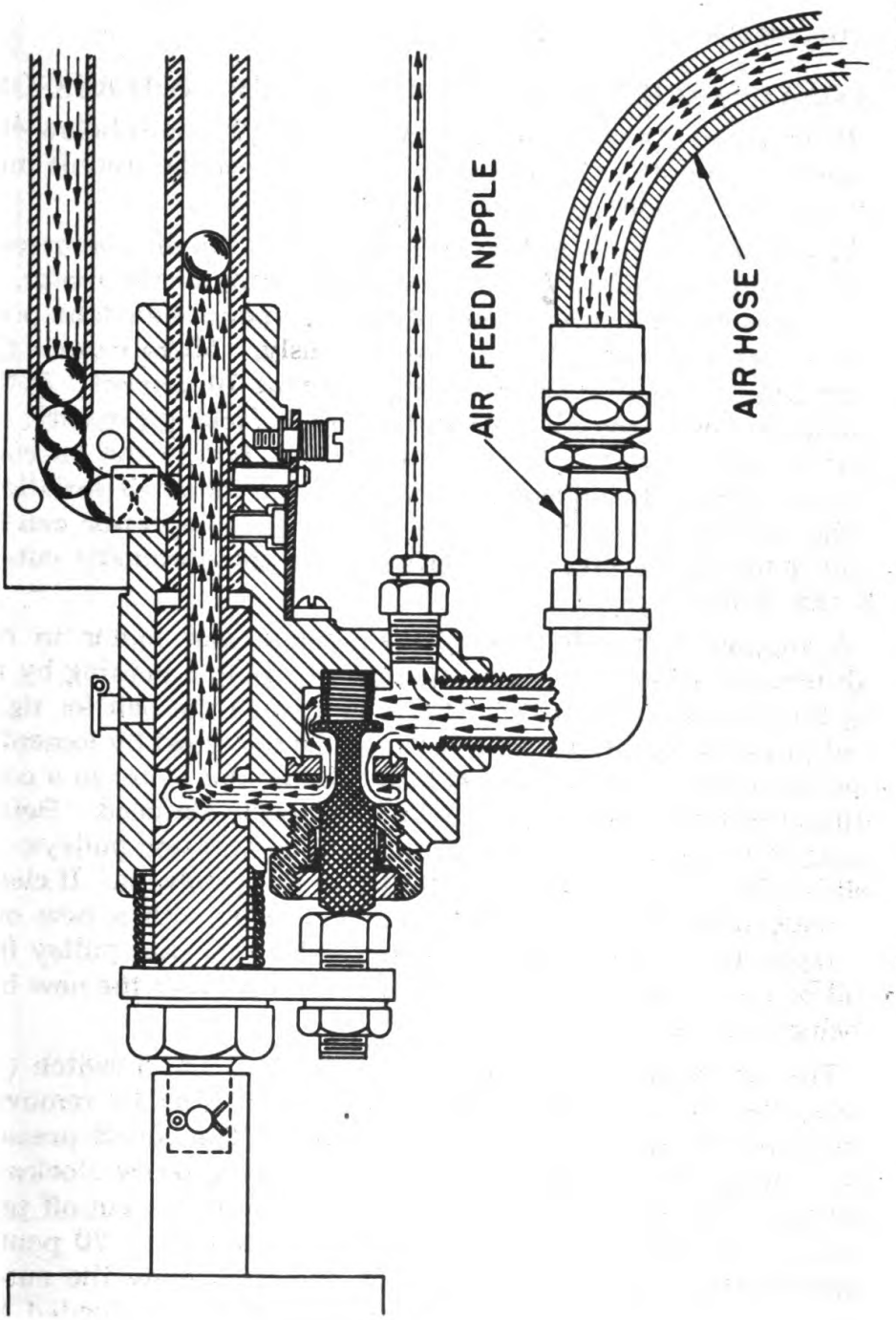


Figure 159 — Air Stream Diagram

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cessive air leakage. The loading screw is designed to be tightened with the fingers. Make certain the sealing gasket is in place on the loading screw. If the piston leaks air, replace it. If the air valve plunger unit leaks, replace it. A small amount of air will leak through the pellet magazine pressure orifice. Small leaks at this point will not impair the efficiency of the gun.

17. MAINTENANCE AND REPAIR OF THE AIR COMPRESSOR.

a. If the speed of the compressor pulley (fig. 122) falls below 400 revolutions per minute as measured by a tachometer, the trouble may be due to slow line voltage, or to a slipping belt.

b. Low line voltage is indicated by failure of the air compressor motor to attain the proper speed, excessive heating of the motor, or when it approaches the cut-off point of 60 to 70 pounds air tank pressure, the motor will stop and start continuously. Make certain the minimum line voltage is 115 volts plus or minus 10 percent. If the line voltage is low, it may be due to the circuit lacking capacity. A new line of larger size run from the main feed box to the air compressor may correct the difficulty. Compensation for small variations below the minimum required voltage for the air compressor can be made by reducing the pressure adjustment on the automatic cut-off switch (fig. 136).

c. A slipping belt will cause the air compressor motor to run through unusually long intervals. Remove the pulley housing by removing the screws and bolts (fig. 122). Examine the belt for tightness and physical condition. The belt may be tightened by loosening the four motor base screws (fig. 122) and sliding the motor in a compensating direction until the proper belt tension is obtained. Before tightening the screws, realine the motor and compressor pulleys. If the belt is oily or greasy, clean it with dry-cleaning solvent. If cleaning is inadequate, remove the belt and replace it with a new one. Before replacing the belt, wipe the motor and compressor pulley free from oil or grease using dry-cleaning solvent to prevent the new belt from being injured.

d. The cut-off pressure point of the automatic cut-off switch (fig. 122) may be adjusted. Take off the cover (fig. 136) by removing the screw and lifting the cover from the frame. The cut-off pressure point is reduced by turning the pressure regulating screw clockwise. A slight turn will result in a substantial reduction in the cut-off pressure point. The cut-off pressure should not exceed 65 to 70 pounds as shown on the tank gage (fig. 121). Do not increase the cut-off pressure above the 70 pounds, as the motor will be overloaded and may overheat while maintaining substantially higher pressures.

e. The pop safety valve requires inspection to insure its safe action. To do this, lift the plunger by means of a spring balance, or the

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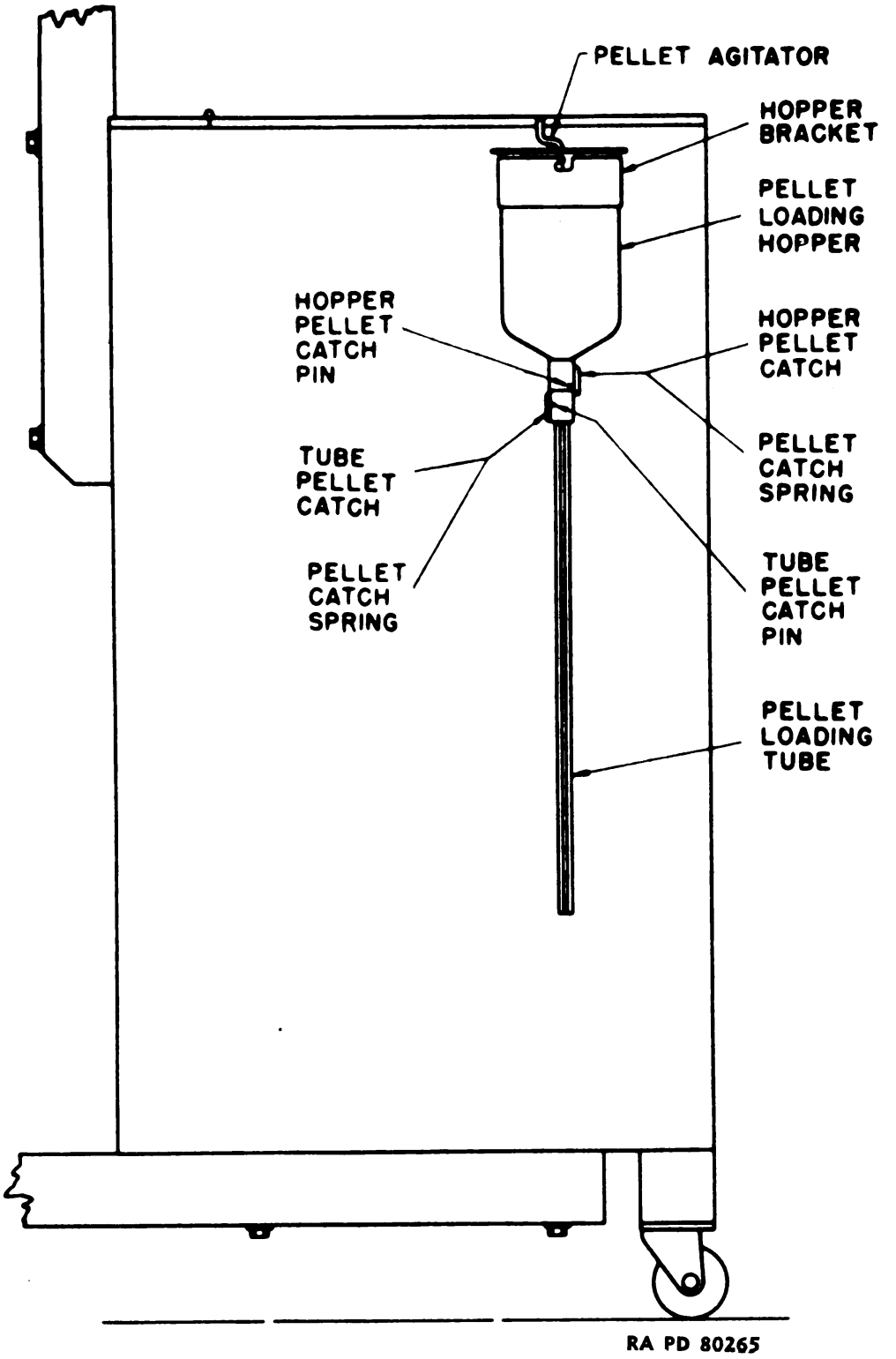


Figure 160 — Loading Tube Under Pellet Loading Hopper

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equivalent, hooked through the ring (figs. 121 and 148) when the compressor tank is full, as shown by a gage pressure of 65 to 70 pounds on the air storage tank gage (fig. 121). The valve must open with a vertical pull of 5 to 6 pounds. If defective, replace the valve with a new part. Remove the valve from the fitting by unscrewing the hexagonal nut with a wrench.

f. All air connections must be kept tight to prevent excessive leakage of air which would cause the motor and the pump to operate too frequently. If necessary, paint the threaded portion of the fittings before assembly.

g. A noisy compressor may be due to one of the following causes: a loose pulley, dirt on top of the piston striking the cylinder head, a loose piston pin bearing, a loose connecting rod bearing, worn piston rings, or loose main bearings. The procedure for the repair of the component parts of the air compressor is similar to that commonly used for the repair of like units such as pumps and gasoline engines; therefore it will not be described in detail.

h. If the pulley (fig. 128) is loose, tighten the set screw with the key in place.

i. To remove dirt from the top of the piston (fig. 125), remove the four cylinder head screws connecting the cylinder head to the cylinder, and remove the connectors on the copper tubes. Lift the cylinder head assembly from the cylinder and wipe the piston head clean. Rotate the pulley and remove accumulations of dirt or grease from the cylinder walls. Reverse the disassembly procedure when assembling the cylinder head to the cylinder, being sure that the cylinder gasket is in place. Use mica-base, anti-seize, compound on the gasket before assembly.

j. The piston pin (fig. 130) or the piston pin bushing must be replaced if badly worn.

k. If the compressor knocks, the connecting rod bearings may be badly worn. Disassemble the connecting rod bearing halves (fig. 129). Examine the babbitt metal bearing surfaces of the two bearing halves. If badly worn or scored, rebabbitt the bearing or replace the connecting rod. If the bearing halves appear to be in good condition, note whether any shims separate the bearing halves. Remove shims until by repeated trials all bearing looseness has been eliminated. If no shims are present, file the mounting faces of the lower bearing half until on assembly the proper fit is obtained. The connecting rod must not bind on the crankshaft. When correctly fit, the combined weight of the piston and the connecting rod will turn on the crankshaft *slowly*. In making this test, the cylinder must have been removed so that the piston is free to move.

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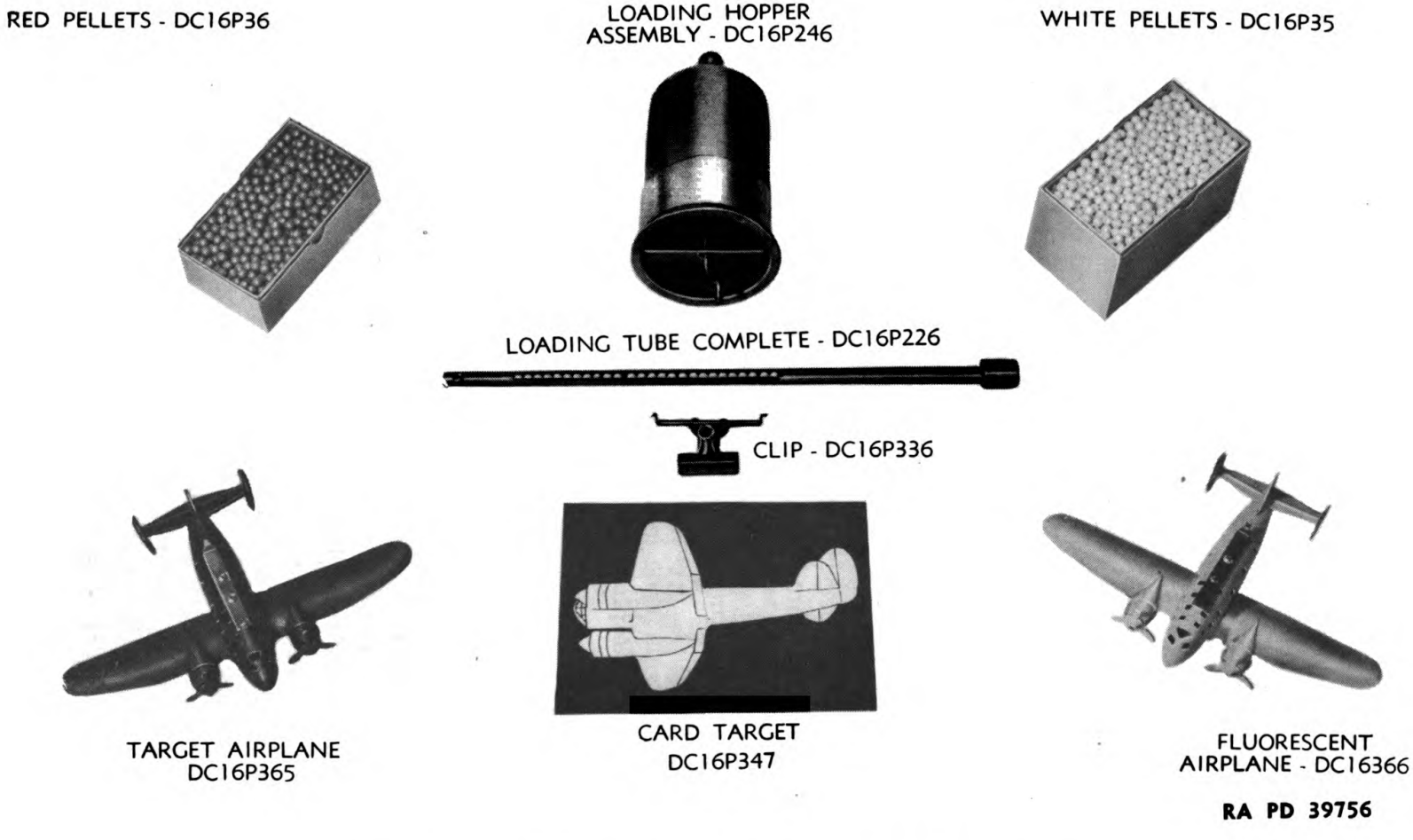


Figure 161 — Accessories for Antiaircraft Machine Gun Trainer

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l. Damaged main bearings (fig. 131) must be replaced. Excess end play can be corrected by removing the bearing adjustment plate (fig. 131) and removing bearing adjustment shims. Binding must be avoided.

18. MAINTENANCE AND REPAIR OF THE ACCESSORIES.

a. The agitator (figs. 160 and 161) and the pellet catch on the loading hopper must operate smoothly. Failure of the pellet catch to operate may be due to binding or to a broken spring. If broken, replace the spring. In order to make the replacement, drive out the retaining pin. Binding may also be caused by corrosion. To relieve binding due to corrosion, disassemble, clean, and oil, using engine oil SAE 10.

b. The only source of maintenance on the catch in the loading tube will be binding or the replacement of the spring. If the plunger pin in the loading tube becomes bent, either straighten it with pliers or replace it with a new part, after driving out the defective pin.

c. If the ultraviolet lamp fails to operate, check the line voltage with a voltmeter. Check the lamp outlet on the transformer for continuity, using a test lamp to determine if the circuit, the transformer, or the lamp is at fault.

d. If the transformer is the source of trouble, remove the housing (figs. 152 and 153). Check the cold ohm resistance of the primary and secondary coils using an ohmmeter and the circuit checking diagram (fig. 106). Replace the coils if defective.

19. CLEANING.

a. Cleaning External Surfaces.

(1) Remove dust from the external surfaces with cotton wiping cloth.

(2) In removing dust from the surface of the battle sound records, move the cloth in a light circular motion. Even a fine film of dust may cause rapid wear of recorded sound.

(3) If oil and grease accumulate on the various mechanisms, remove the accumulations with a cloth wet with dry-cleaning solvent.

(4) Any accumulation of oil and dirt on the external portions of the air compressor must be removed as it accumulates. The accumulations will not only lead to a bad appearance, but will tend to cause difficulty with specific parts such as the belt. Grease will tend to destroy the material from which the belt is made, and also cause it to slip.

(5) Except for the occasional removal of accumulated dirt and excess oil, the target will require little attention in the way of cleaning.

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The trolley wires should be wiped regularly with an oiled cloth wet with engine oil SAE 10, to keep them from corroding. The intervals of such wiping will depend largely on the atmosphere in which the target is operated. In dry climates, the interval can be considerably longer than on installations where moisture is prevalent.

b. Cleaning Internal Surfaces.

(1) In general, the procedures followed for external surfaces will be satisfactory.

(2) An effort must be made to prevent the coils of the electromagnets and other electrical parts from becoming oil-soaked. Oil is detrimental to the insulation.

(3) In the event that dirt is permitted to enter the magazine or the firing chamber, remove it by either tilting the gun muzzle downward or blowing out the barrel with high-pressure air. Small particles of dirt in the magazine may fall out if the plug at the muzzle end is removed and the barrel tipped downward. If this method is not successful, it may be helpful to blow out the magaine with 60 to 70 pounds of air pressure, by holding an air hose against the magazine intake after the plug has been removed. This will carry any loose particles through the magazine into the firing chamber and out the barrel.

CAUTION: Before attempting such an operation, make certain there are no pellets in either the magazine, the firing chamber, or the gun barrel. In blowing out the magazine, the operator must stand aside so that the air exhausted from the gun muzzle does not strike him. This is important, as small particles being blown with high-pressure air, may do considerable damage.

(4) The lubricating oil in the crank case of the compressor should be drained and refilled every 50 hours of operation with engine oil SAE 10. Drain only when oil is hot.

20. LUBRICATION.

a. Sound Equipment Record Changer.

(1) With the exception of the record changer and the turntable equipment, no lubrication is required on the sound equipment. The record changer motor is equipped with oilless bearings and, therefore, requires no lubrication.

(2) The turntable spindle bearings are lubricated at the factory and do not require any lubrication for one year. After one year, they should be oiled with 1 or 2 drops of engine oil SAE 10. *Do not overoil.* Oil the top bearing by lifting off the turntable. Make sure, when replacing the turntable, that the pin in the turntable spindle slips into the slot on the bottom surface of the turntable hub. Care should be taken not to damage the motor idler pulley. Never, under any circumstances, allow oil to come in contact with the motor idler pulley.

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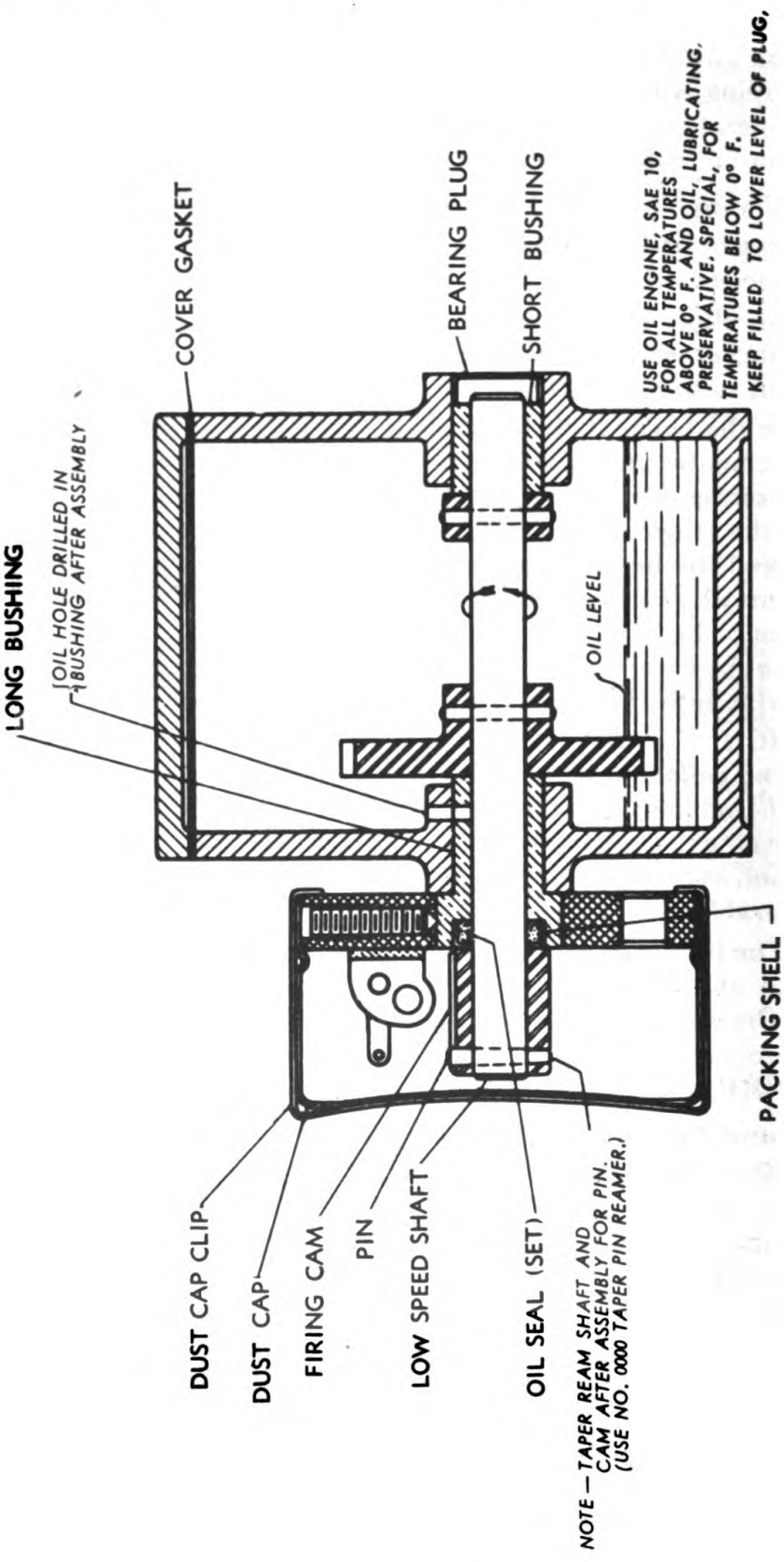
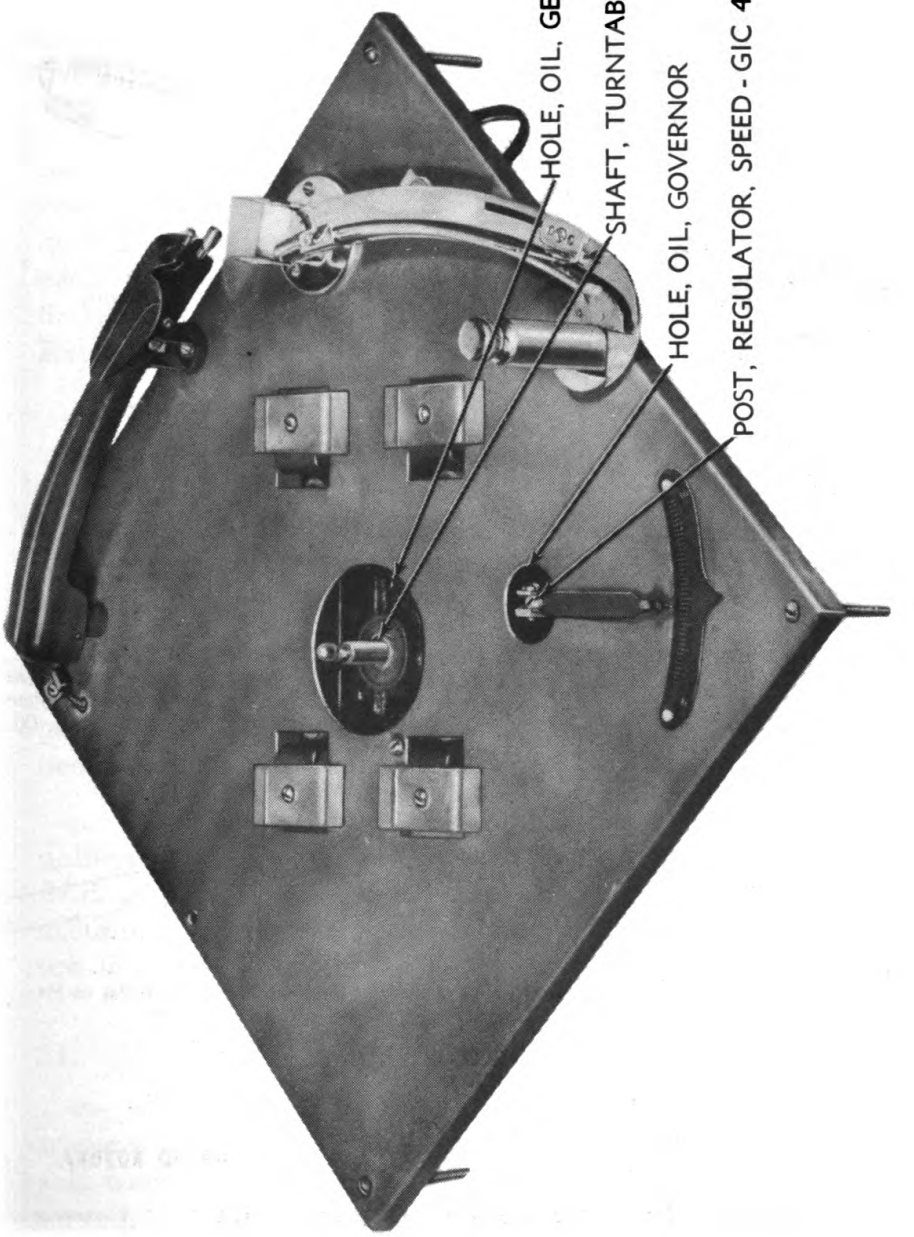


Figure 162 — Breaker Transmission — Sectional View

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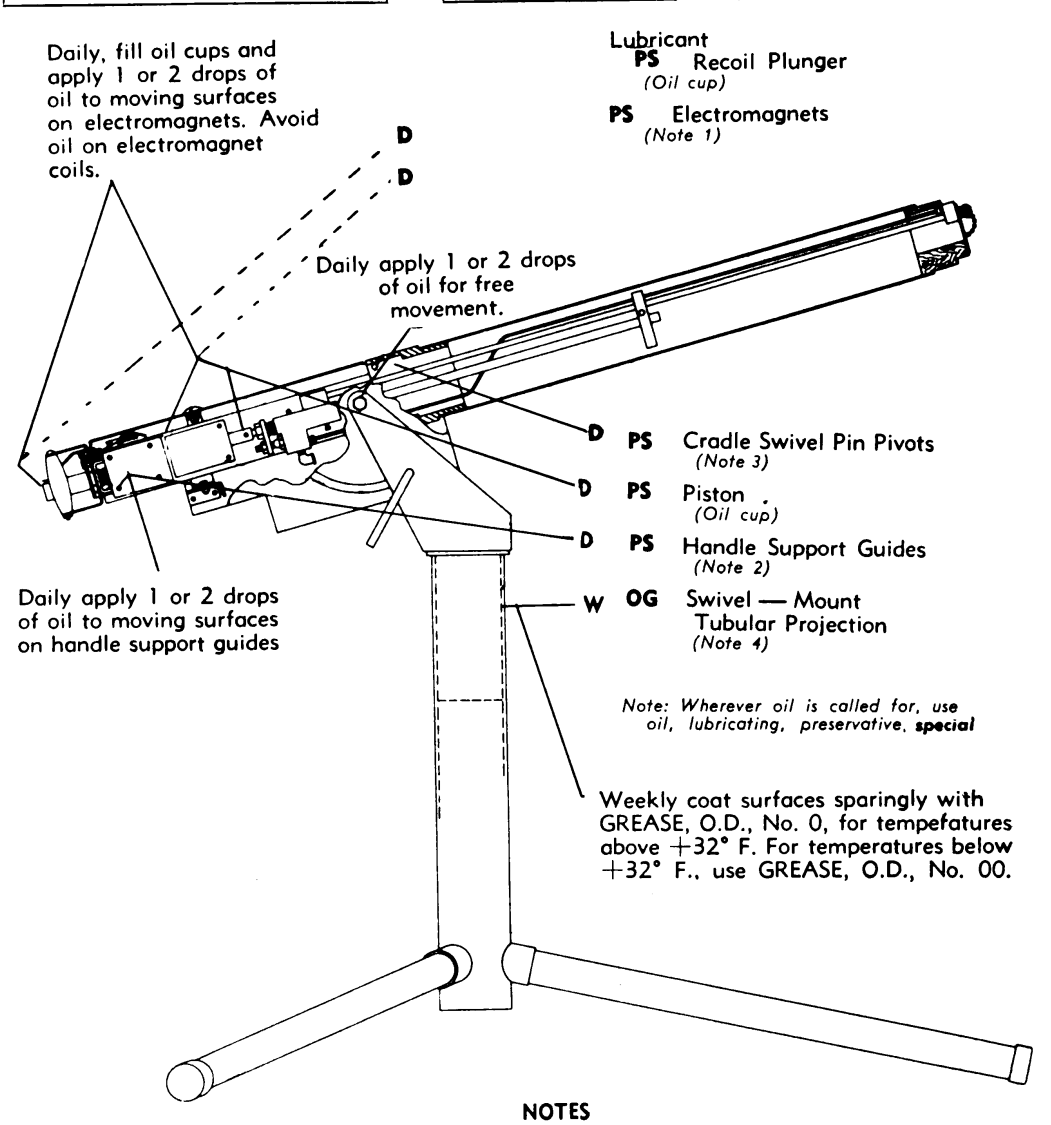
Figure 163 — Record Repeater Mechanism — Turntable Removed

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ORDNANCE MAINTENANCE — AA MACHINE GUN TRAINER M9

KEY

Lubricants	Intervals
OG — GREASE, O.D. No. 0 (above +32° F.) No. 00 (below +32° F.)	**D** — Daily
PS - OIL, lubricating, preservative, special	**W** — Weekly



NOTES

1. *Daily apply 1 or 2 drops of PL to each moving surface of the slides on the electromagnets and recoil mechanism. Avoid any excess oil on electromagnet coils.*
2. *Daily apply 6 or 8 drops of PL to moving surfaces.*
3. *Daily apply 1 or 2 drops to pivot points to allow free movement of gun in cradle.*
4. *Weekly coat surfaces sparingly with OG.*

RA PD 80308A

Figure 164 — Lubrication Diagram of Gun

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(3) The motor bearings on the timing and sound equipment should be oiled once in every 6 months with a few drops of engine oil SAE 10 for all temperatures above 0°F, or special preservative lubricating oil for temperatures below 0°F.

(4) Maintain the level of clean engine oil SAE 10 in the breaker transmission as shown on figure 162.

b. Sound Equipment Repeater Mechanism. Each week add a few drops of oil to the side of the turntable shaft on the record repeater below the rubber washer so that it will run into the bearing. *Do not allow oil to remain on the rubber washer.* Every 300 hours or every 3 months, add a few drops of oil to the holes provided on the top plate of the frame casting, and on the governor housing. Add 2 or 3 drops of oil to the motor bearings and to the governor felt. See figures 156 and 163 for lubrication points. Use engine oil SAE 10.

c. Gun. It is necessary to lubricate and oil points in the gun daily with engine oil SAE 10; however, where an excess of oil is indicated, remove it and omit the addition of oil until such time as it is required (see gun lubrication diagram fig. 164). Place a drop of oil on each surface of the slides on the electromagnets and recoil mechanism, daily; avoid excess oil, as oil will tend to ruin the insulation on the coils. Remove any excess oil with a cloth.

d. Air Compressor.

(1) The air compressor is delivered without oil in the crank case. The crank case must be filled to the "FULL" level marked on the oil gage, and additional oil must be added, whenever the oil falls below the "LOW" mark. Unless the compressor is to be operated at temperatures below 0°F, use engine oil SAE 10.

(2) Before starting, add oil in the reservoirs on both ends of the motor, using engine oil SAE 10, for temperatures above 0°F, or special preservative lubricating oil for temperatures below 0°F. Add oil as needed for maintaining proper level.

e. Targets. It is important to keep the bearings of the various pulleys and reels on the targets lubricated. A few drops of engine oil SAE 10 will be adequate. Remove any excess oil which may have accumulated on the brackets and supports to avoid saturating the tow-lines and airplanes.

21. MAINTENANCE UNDER UNUSUAL CONDITIONS.

a. General. When operating under unusual conditions such as tropical or arctic climates, severe dust or sand conditions, and near salt water, the precautions listed below should be scrupulously observed.

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b. Care in Arctic Climates.

(1) In temperatures below freezing, and particularly in arctic climates, it is essential that all moving parts be kept absolutely free of moisture. It has also been found that excess oil on the working parts will solidify to such an extent as to cause sluggish operation or even complete failure.

(2) When preparing the gun for use in arctic climate, all heavy lubricants must be removed and the piston, recoil spring, and other parts cleaned by dry-cleaning solvent before applying lighter lubricants. The oil in the breaker transmission and motor should be changed to special preservative lubricating oil.

c. Care in Tropical Climates.

(1) In tropical climates where temperature and humidity are high, or where salt air is present, and during rainy seasons, the materiel should be inspected at frequent intervals and kept lightly oiled when not in use. Groups should be removed at regular intervals and, if necessary, disassembled sufficiently to enable the drying and oiling of parts.

(2) Care should be exercised to see that exposed parts and surfaces are kept clean and oiled.

(3) In hot, dry climates where sand and dust are apt to get into the materiel, the materiel should be wiped clean daily or more often, if necessary. Oiling should be kept to a minimum, as oil will collect dust which will act as an abrasive on the working parts and foul the bore and interior. In dusty climates, the muzzle end should be kept covered.

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Section V

REFERENCES

22. PUBLICATIONS INDEXES.

The following publications indexes should be consulted frequently for latest changes or revisions of references given in this section and for new publications relating to materiel covered in this manual:

a.	Introduction to Ordnance Catalog (explaining SNL system)	ASF Cat. ORD 1 IOC
b.	Ordnance Publications for Supply Index (index to SNL's)	ASF Cat. ORD 2 OPSI
c.	Index to Ordnance Publications (listing FM's, TM's, TC's, and TB's of interest to Ordnance personnel, OPSR, FSMWO's, BSD, S of SR's, OSSC's, and OFSB's; and includes alphabetical listing of Ordnance major items with publications pertaining thereto)	OFSB 1-1
d.	List of Publications for Training (listing MR's, MTP's, T/BA's, T/A's FM's, TM's, TR's, TB's, SB's, MWO's, WDLO's, and Firing Tables)	FM 21-6
e.	List of Training Films, Film Strips, and Film Bulletins (listing TF's, FS's, and FB's by serial number and subject)	FM 21-7
f.	Military Training Aids (listing graphic training aids, models, devices, and displays)	FM 21-8

23. STANDARD NOMENCLATURE LISTS.

a.	Cleaning, preserving and lubricating materials; recoil fluids, special oils, and miscellanous related items	SNL K-1 ASF Cat. ORD 5
b.	Soldering, brazing and welding material, gases and related items	SNL K-2
c.	Tools, maintenance, for repair and overhaul of fire control and sighting equipment	SNL F-272
d.	Trainer, director, M8	SNL F-250
e.	Truck, instrument repair, M1	SNL G-92
f.	Truck, tank maintenance, M1	SNL G-91

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24. EXPLANATORY PUBLICATIONS.

a.	Aircraft radio shop practice	TM 1-470
b.	Antiaircraft machine gun trainer M9	TM 9-221
c.	Cleaning, preserving, lubricating, and welding materials and similar items issued by the Ordnance Department	TM 9-850
d.	Decontamination	TM 3-220
e.	Defense against chemical attack	FM 21-40
f.	Electrical testing apparatus for fire control equipment	TM 9-1672
g.	Instrument repairman	TM 9-2602
h.	Radio fundamentals	TM 11-455
i.	Shop work	TM 11-453

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