

TM 9-2920-236-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

FIELD AND DEPOT MAINTENANCE MANUAL

(INCLUDING FIELD AND DEPOT
MAINTENANCE REPAIR PARTS)

FOR

STARTER, ENGINE, ELECTRICAL,
ASSEMBLY

(2920-852-5483)

(ELECTRIC AUTO-LITE MODEL MBD-4043UT)

END ITEM APPLICATION:

ENGINE, DIESEL (MULTI-FUEL):

6-CYLINDER, CONTINENTAL MODEL LDS-427-2 (TM 9-2815-204)

This copy is a reprint which includes current
pages from Change 2

HEADQUARTERS, DEPARTMENT OF THE ARMY

SEPTEMBER, 1963

CHANGE

No. 2

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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 10 November 1971

Direct Support, General Support
and Depot Maintenance Manual
(INCLUDING DIRECT SUPPORT, GENERAL SUPPORT,
AND DEPOT MAINTENANCE REPAIR PARTS LIST)
FOR
STARTER, ENGINE, ELECTRICAL
AUTO-LITE MODEL MBD-4044UT
(2920-763-2346)

TM 9-2920-236-35, 17 September 1963, is changed as follows:

Publication title, model number and FSN are changed as shown above.

*This change supersedes C 1, 23 December 1965.

Page 1, paragraph 1d, line 3 through 7. Sentence reading "Record any errors or SMOTA-FM" is changed to read as follows: "Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028, Recommended Changes to Publications, and forwarded direct to Commanding General, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MAP Warren, Mich. 48090".

Page 25, paragraph 32b; Page 26, paragraph 33a; and Page 27, paragraph 36. "grease, Specification MIL-G-3278" is changed to Lubricating Oil, Internal Combustion Engine OE/HDO-10, Specification MIL-L-2104.

Page 29, paragraph 40a. Reference letters "d

through k" and "m through p" are changed from (fig. 48 to fig. 49). Figure 48, reference letter "l", and pertinent data are deleted.

Page 29, paragraph 40b. Figure 49, reference letter "a", and pertinent data are deleted. Figure 50 and reference letter "a", are changed to Figures 24 and 26, reference letter "B".

Page 30, paragraph 1b, TM 9-2320-235-35P is changed to TM 9-2320-209-35P.

Page 30, paragraph 3a. TM 9-2320-235-10 and TM 9-2320-235-20 are changed to TM 9-2320-209-10 and TM 9-2320-209-20 respectively.

Page 30, paragraph 3b, lines 3 and 4. Delete in its entirety, reference to TM 9-2300-223-34P.

Page 32 through 41. APPENDIX II is superseded as follows:

APPENDIX II

REPAIR PARTS LIST

Section I. INTRODUCTION

1. Scope.

This appendix lists the repair parts required for the performance of direct support, general support, and depot maintenance of the electrical engine starter.

2. General.

The Repair Parts List is divided into the following sections:

a. *Repair Parts—Section II.* A list of repair parts authorized for the performance of maintenance at the direct support, general support, and depot level in figure and item number sequence.

b. *Special Tools, Test and Support Equipment.* Not applicable.

c. *Federal Stock Number and Reference Number Index—Section III.* A list of Federal stock numbers in ascending numerical sequence followed by a list of reference numbers in ascending alpha-numeric sequence, cross-referenced to the illustration figure number and item number.

3. Explanation of Columns.

The following provides an explanation of columns in the tabular lists in Sections II and III:

a. *Source, Maintenance, and Recoverability Codes (SMR) Column 1.*

(1) Source code, indicates the selection status and source for the listed item. Source codes are:

Code	Explanation
P	Repair Parts, Special Tools and Test Equipment supplied from the GSA/DSA, or Army supply system, and authorized for use at indicated maintenance categories.
P2	Repair Parts, Special Tools and Test Equipment which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.
P9	Assigned to items which are NSA design controlled: unique repair parts, special tools, test, measuring and diagnostic equipment, which are stocked and supplied by the Army COMSEC Logistic System and which are not subject to the provisions of AR 380-41.

Code	Explanation
P10	Assigned to items which are NSA design controlled: special tools, test, measuring and diagnostic equipment for COMSEC support, which are accountable under the provisions of AR 380-41, and which are stocked and supplied by the Army COMSEC Logistic System.
M	Repair Parts, Special Tools and Test Equipment which are not procured or stocked, as such, in the supply system but are to be manufactured at indicated maintenance levels.
A	Assemblies which are not procured or stocked as such, but are made up of two or more units. Such component units carry individual stock numbers and descriptions, are procured and stocked separately and can be assembled to form the required assembly at indicated maintenance categories.
X	Parts and assemblies that are not procured or stocked because the failure rate is normally below that of the applicable end item of component. The failure of such part or assembly should result in retirement of the end item from the supply system.
X1	Repair Parts which are not procured or stocked. The requirement for such items will be filled by the next higher assembly or component.
X2	Repair Parts, Special Tools, and Test Equipment which are not stocked and have no foreseen mortality. The indicated maintenance category requiring such repair parts will attempt to obtain the parts through cannibalization or salvage, if not obtainable through cannibalization or salvage, the item may be requisitioned with exception data, from the end item manager, for immediate use.
G	Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above the DS and GS level or returned to depot supply level.

NOTE

Cannibalization or salvage may be used as a source of supply for any items source coded above, except those coded X1.

(2) Maintenance code, indicates the lowest category of maintenance authorized to install the listed item. The maintenance level codes are:

Code	Explanation
C	Operator/crew maintenance
O	Organizational maintenance
F	Direct support maintenance
H	General support maintenance
D	Depot maintenance

(3) Recoverability code, indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are nonrecoverable. Recoverability codes are:

code	Explanation
R	Applied to repair parts, (assemblies and components) special tools and test equipment which are considered economically repairable at direct and general support maintenance levels. When the item is no longer economically repairable, it is normally disposed of at the GS level. When supply considerations dictate, some of these repair parts may be listed for automatic return to supply for depot level repair as set forth in AR 710-50. When so listed, they will be replaced by supply on an exchange basis.
S	Repair Parts, Special Tools, Test Equipment and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by a GSU to be uneconomically repairable, they will be evacuated to a depot for evaluation and analysis before final disposition.
T	Higher dollar value recoverable repair parts, special tools and test equipment which are subject to special handling and are issued on an exchange basis. Such items will be evacuated to the depot for overhaul or final disposition, Communications—Electronics and Missile Support Items will be repaired/overhauled only at depots.
U	Repair Parts, Special Tools and Test Equipment specifically selected for salvage by reclamation units because of precious metal content, critical materials, high dollar value or reusable casings or castings.

NOTE

When no code is indicated in the recoverability column, the part will be considered non-recoverable.

b. Federal Stock Number (FSN), Column 2. This column indicates the Federal Stock Number assigned to the item and will be used, for requisitioning purposes.

c. Description, Column 3. This column indicates the Federal item name and any additional description of the item required. A part number

or other reference number is followed by the applicable five-digit Federal supply code for manufacturers in parentheses. Repair Parts quantities included in the kits, sets and assemblies are shown in front of the repair part name.

d. Unit of Measure (U/M), Column 4. A 2-character alphabetic abbreviation indicating the amount or quantity of the item, upon which the allowances are based, e. g., ft., ea., pr., etc.

e. Quantity Incorporated in Unit, Column 5. This column indicates the quantity of the item used in the assembly group. A "V" appearing in this column in lieu of a quantity indicates that a definite quantity cannot be indicated.

f. 30-Day DS/GS Maintenance Authorization, Columns 6 and 7.

The Repair Parts List includes asterisk entries in separate columns—one for Direct Support (DS) and one for General Support (GS)—as appropriate to indicate the total range of repair parts authorized for use at that category or required to be removed or disassembled during the performance of authorized maintenance operations. They will be requisitioned initially on an "as required" basis. The repair parts authorized at the DS/GS levels will be those authorized for the maintenance mission at these levels. Requirements for repair part stockage and for distribution to supported units will be based on demand and determined in accordance with AR 711-16.

g. 1-Year Allowance Per 100 Equipments/Contingency Planning Purposes. Column 8. This column indicates opposite each item, the quantity required for distribution and contingency planning purposes. The range of items indicates total quantities of all authorized items required to provide for adequate support of 100 equipments for one year.

h. Depot Maintenance Allowance Per 100 Equipments, Column 9. This column indicates opposite each item, the quantity authorized for depot maintenance of 100 equipments,

i. Illustration, Column 10. This column is divided as follows:

(1) Figure number, column 10a. Indicates the figure number of the illustration in which the item is shown.

(2) Item number, column 10b. Indicates the callout number used to reference the item in the illustration.

4. Special Information.

- a. End item application: Engine, Diesel (Multi-fuel): 6-cylinder, Continental model LDS-427-2 (TM 9-2815-204).
- b. Repair parts mortality has been based on eight hours of operation per day.
- c. Parts which require manufacture or assembly at a category higher than that authorized for installation will indicate in the source column the higher category.

5. How to Locate Repair Parts.

- a. When Federal stock number or reference number is unknown:
 - (1) First. Find the illustration covering the repair part sought.
 - (2) Second. Identify the repair part on the illustration and note the illustration figure and item number of the repair part.
 - (3) Third. Using the repair parts listing, locate the illustration figure and item number noted on the illustration.
- b. When Federal stock number or reference number is known:

(1) *First.* Using the Index of Federal Stock Numbers and Reference Numbers find the pertinent Federal stock numbers or reference number. This index is in ascending FSN sequence, cross-referenced to the illustration figure number and item number.

(2) *Second.* Using the Repair List, find the illustration figure number and item number referenced in the Index of Federal stock numbers and reference numbers.

6. Abbreviations.

Not applicable.

7. Federal Supply Codes for Manufacturers.

Code	Manufacturer
19207	Army Tank Automotive Command Warren, Mich. 48090
19728	Prestolite Co. The Div. of Eltra Corp. 511 Hamilton St. Toledo, Ohio 43602
21450	Ordinance Corps Engineering Standards, Rock Island Arsenal Rock Island, Ill. 24617
96906	Military Standards Promulgated by Stan- dardization Division Directorate of Logis- tic Services, DSA

Section II. REPAIR PARTS LIST

(1) SMR Code	(2) Federal stock No.	(3) Description Reference Number & Mfr. Code Usable On Code	(4) Unit of meas	(5) Qty inc in unit	(6) 30-Day maint w. e			(7) Day maint wance			(8) 1-Yr. alw per 100 equip cntgcy	(9) Depot maint alw per 100 equip	(10) Illus- tration	
					(a)	(b)	(c)	(a)	(b)	(c)			(a)	(b)
					1- 20	1- 50	1- 100	1- 20	1- 50	1- 100			Fig No	tem No.
		GROUP 06—ELECTRICAL SYSTEM												
		0603—STARTING MOTOR												
P-O-R	2920-763-2346	STARTER, ENGINE, ELECTRICAL: Auto-lite model MBD-4044UT 10951134 (19207)	EA	1										
P-F	5310-823-8803	WASHER, FLAT: commutator end head MS15795-220 (96906)	EA	1	*	*	*	*	*	*	4	8	48	1
P-F	5330-530-8275	WASHER, NONMETALIC: commutator end shaft 5308275 (19207)	EA	1	*	*	*	*	*	*	6	10	48	2
P-F	5330-534-6760	WASHER, FLAT: commutator end shaft 5346760 (19207)	EA	1	*	*	*	*	*	*	4	8	48	3
P-F	2920-886-2989	GASKET: frame to pinion housing MBD446 (19728)	EA	1	*	*	*	*	*	*	10	100	48	4
P-F	5310-043-1680	WASHER, LOCK: switch to frame (4) head assembly to frame (8) 431680 (21450)	EA	12	*	*	*	*	*	*	6	120	48	5
P-F	5305-989-6265	SCREW, MACHINE: switch to frame MS35207-262 (96906)	EA	4	*	*	*	*	*	*	14	40	48	6
P-O	2920-322-9613	STARTER SWITCH ASSEMBLY: starter 8328134 (19207)	EA	1	*	*	*	*	*	*	14	50	48	7
X1		ASSEMBLY, FRAME AND FIELD: starter assembly MBD2435 (19728)		1									48	8
P-F	5330-197-9582	PACKING PREFORMED: commutator end head 546884 (21450)	EA	1	*	*	*	*	*	*	8	20	48	13

Section II. REPAIR PARTS LIST

(1) SMR Code	(2) Federal stock No.	(3) Description Reference Number & Mfr. Code Usable On Code		(4) Unit of meas	(5) Qty inc in unit	(6) 30-Day D a w i n t e n a n c e			(7) 30-Day G a l w a n c e			(8) 1-Yr. alw per 100 equip cntgcy	(9) Depot maint alw per 100 equip	(10) I l t r a t i o n	
						(a)	(b)	(c)	(a)	(b)	(c)			(a)	(b)
						1- 20	1- 50	1- 00	1- 20	1- 50	1- 00			Fig No	tem No.
		0603—STARTING MOTOR—Continued													
P-F	5977-353-7343	HOLDER ASSEMBLY, ELECTRICAL: brush MBD2079C (19728)		EA	1	*	*	*	*	*	*	8	20	48	14
P-F	5340-353-7357	CLIP, SPRING, TENSION: brush holder post MBD47A (19728)		EA	4	*	*	*	*	*	*	6	10	48	16
X2-F		HEAD AND BUSHING ASSEMBLY: switch assembly MBD1448 (19728)		EA	1	*	*	*	*	*	*			48	18
P-F	3120-293-5041	BEARING, SLEEVE: commutator end head GBF79 (19728)		EA	1	*	*	*	*	*	*	6	10	48	19
X2-F		HEAD: switch assembly MBD448 (19728)		EA	1	*	*	*	*	*	*			48	20
P-F	5305-614-0247	SCREW, MACHINE: head assembly to frame MS35266-64 (96906)		EA	8	*	*	*	*	*	*	6	10	48	21
X2-F		COVER: starter assembly MBD1447 (19728)		EA	1	*	*	*	*	*	*			48	22
X2-F		PLUG: frame X865A (19728)		EA	1	*	*	*	*	*	*			48	26
X2-F		PLATE DATA: frame MBD455 (19728)		EA	1	*	*	*	*	*	*			48	27
X2-F		SCREW: data plate to frame 19X435 (19728)		EA	4	*	*	*	*	*	*			48	28
P-O	5310-045-1817	NUT, PLAIN HEXAGON: frame terminal 451817 (21450)		EA	1	*	*	*	*	*	*	4	8	48	29
P-O	5310-043-2646	WASHER, LOCK: frame terminal 12X201 (19728)		EA	2	*	*	*	*	*	*	6	10	48	30

Section II. REPAIR PARTS LIST

(1) SMR Code	(2) Federal stock No.	(3) Description Reference Number & Mfr. Code Usable On Code	(4) Unit of meas	(5) Qty inc in unit	(6) Day maint allowance			(7) 30-Day GS maint allowance			(8) 1-Yr. allow per 100 equip cntgcy	(9) Depot maint allow per 100 equip	(10) Illus- tration	
					(a)	(b)	(c)	(a)	(b)	(c)			(a)	(b)
					1- 20	1- 10	1- 10	1- 20	1- 10	1- 10			1- 10	2- 10
		0603—STARTING MOTOR—Continued												
P-O	5310-013-4570	NUT, PLAIN HEXAGON: frame terminal 134570 (21450)	EA	1	*	*	*	*	*	*	4	8	18	11
X2-F		LEVER, SHIFTING: starter assembly MBD1452 (19728)	EA	1	*	*	*	*	*	*			19	1
P-F	5306-225-9091	BOLT, MACHINE: shift lever and shaft MS90726-36 (96906)	EA	1	*	*	*	*	*	*	4	6	19	2
P-F	5315-616-5514	KEY, WOODRUFF: shift lever shaft MS35756-6 (96906)	EA	1	*	*	*	*	*	*	3	5	19	3
P-F	5330-684-3420	PACKING, PREFORMED: shift lever shaft MS28784-13 (96906)	EA	1	*	*	*	*	*	*	6	20	19	4
P-F	2920-246-9993	YOKE, STARTER: drive assembly 10951129 (19207)	EA	1	*	*	*	*	*	*	4	6	19	6
P-F	5330-879-3011	GASKET: intermediate bearing to pinion housing 10917163 (19207)	EA	1	*	*	*	*	*	*	6	100	19	7
P-F	2920-442-5925	PLATE ASSEMBLY: armature shaft MBD1451 (19728)	EA	1	*	*	*	*	*	*	6	10	19	8
P-F	5330-820-1626	SEAL, PLAIN, ENCASED: armature shaft XA939 (19728)	EA	1	*	*	*	*	*	*	4	20	19	9
P-F	3120-287-9082	BEARING, SLEEVE: intermediate MZ333 (19728)	EA	1	*	*	*	*	*	*	4	10	19	10
P-F	5310-043-1680	WASHER, LOCK: bearing to pinion housing (4) pinion housing to field frame (8) 431680 (21450)	EA	12	*	*	*	*	*	*	6	12	19	11

Section II. REPAIR PARTS LIST

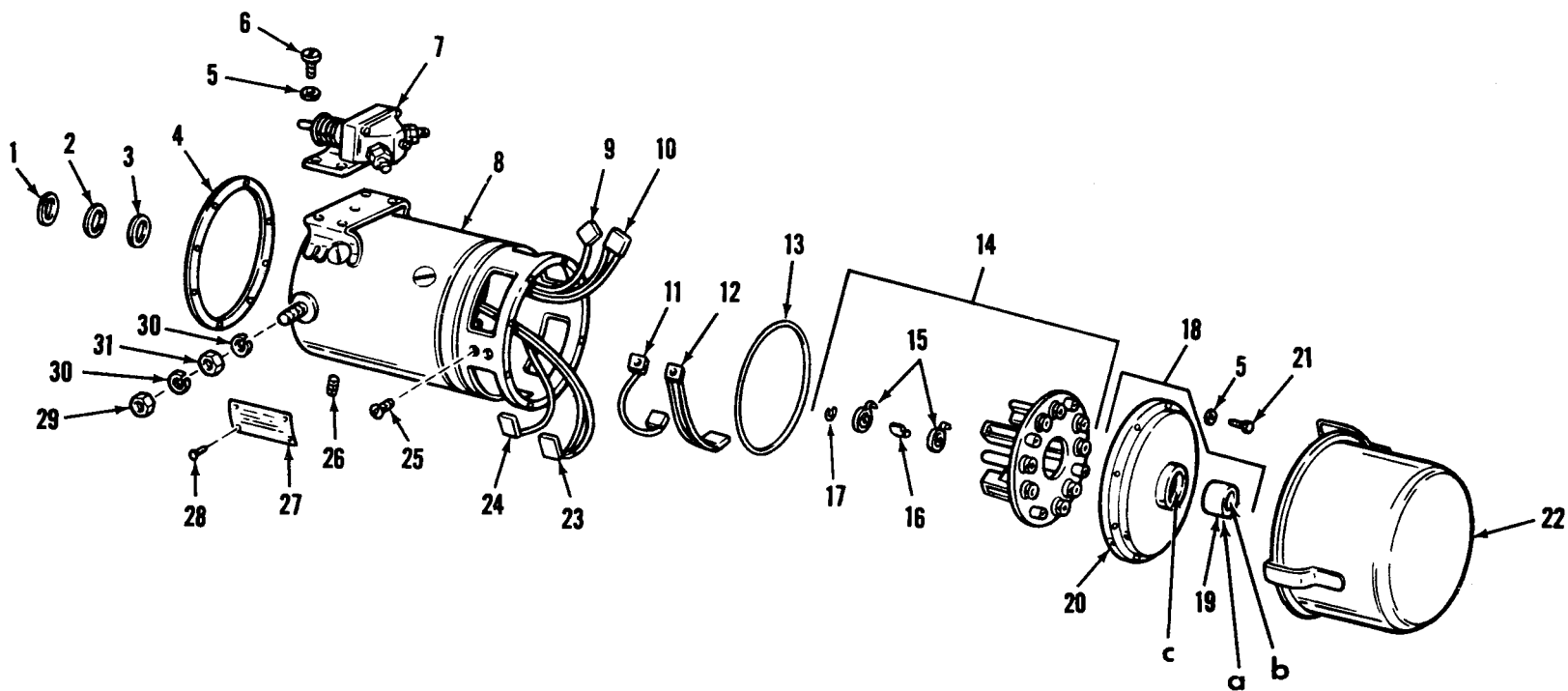
(1) SMR Code	(2) Federal stock No.	(3) Description Reference Number & Mfr. CodeUsable On Code	(4) Unit of neas	(5) Qty inc in unit	(6) 30-Day DS maint allowance			(7) 30-Day GS maint allowance			(8) 1-Yr. alw per 100 equip cntgcy	(9) Depot maint alw per 100 equip	(10) Illus- tration	
					(a)	(b)	(c)	(a)	(b)	(c)			(a)	(b)
					1- 20	1- 50	51- 100	1- 20	1- 50	1- 100			Fig N	Item No.
		0603—STARTING MOTOR—Continued												
P-F	5305-989-7434	SCREW, MACHINE: bearing to pinion housing MS35207-263 (96906)	EA	4	*	*	*	*	*	*	4	12	49	12
P-F	2920-763-2345	ARMATURE, MOTOR: starter assembly 10951128 (19207)	EA	1	*	*	*	*	*	*	0	0	49	13
P-F	5310-883-2237	WASHER, FLAT: armature shaft ML129 (19728)	EA	1	*	*	*	*	*	*	3	6	49	14
P-F	5310-255-5712	WASHER, FLAT: armature shaft 10951127 (19207)	EA	1	*	*	*	*	*	*	6	10	49	15
P-F	5306-878-8205	BOLT, MACHINE: end housing to field frame MBD254A (19728)	EA	8	*	*	*	*	*	*	1	3	49	16
X2F	2920-921-5042	HOUSING ASSEMBLY: starter assembly 1408 (19728)	EA	1	*	*	*	*	*	*			49	17
X2-F		HOUSING: starter assembly PS408 (19728)	EA	1	*	*	*	*	*	*			49	18
P-F	3120-886-2991	BEARING, SLEEVE: end housing MBD454 (19728)	EA	1	*	*	*	*	*	*	6	10	49	19
X2-F		PLATE: lever mounting to housing MBD445 (19728)	EA	1	*	*	*	*	*	*			49	20
P-F	5310-042-6678	WASHER, LOCK: mounting plate 426678 (21450)	EA	1	*	*	*	*	*	*	6	12	49	21

Section II. REPAIR PARTS LIST

(1) SMR Code	(2) Federal stock No.	(3) Description Reference Number & Mfr. Code Usable On Code	(4) Unit of meas	(5) Qty inc in unit	(6) 30-Day DS maint allowance			(7) 30-Day GS maint allowance			(8) 1-Yr. alw per 100 equip cntgcy	(9) Depot maint alw per 100 equip	(10) Illus- tration	
					(a)	(b)	(c)	(a)	(b)	(c)			(a)	(b)
					1- 20	1- 50	1- 90	1- 20	1- 50	1- 90			Fig No	tem No.
		0603—STARTING MOTOR—Continued												
P-F	5305-559-8145	SCREW, MACHINE: mounting plate MS35265-42 (96906)	EA	1	*	*	*	*	*	*	4	8	49	22
P-F	5310-982-4912	NUT, SELF-LOCKING: shift lever MS21045-5 (96906)	EA	1	*	*	*	*	*	*	4	8	49	23
P-F	2920-882-5941	PARTS KIT, ELECTRICAL: j702664 (19207) Consisting of:	EA	V	*	*	*	*	*	*	14	100		
X1		BRUSH, ELECTRICAL CONTACT: MBD12D (19728)		1									48	9
X1		BRUSH, ELECTRICAL CONTACT: MBD13D (19728)		1									48	10
X1		BRUSH, ELECTRICAL CONTACT: MBD12E (19728)		2									48	11
X1		BRUSH, ELECTRICAL CONTACT: MBD13F (19728)		2									48	12
P-F	5360-374-3737	SPRING, BRUSH: MBD19C (19728)	EA	8	*	*	*	*	*	*	0	0	48	15
P-F	5310-374-3706	WASHER: GG81B (19728)	EA	4	*	*	*	*	*	*	0	0	48	17
X-1		BRUSH, ELECTRICAL CONTACT: MBD13C (19728)		1									48	23
X-1		BRUSH, ELECTRICAL CONTACT: MBD12C (19728)		1									48	24
X1		SCREW, MACH, FL.HD: 19X66 (19728)		4									48	25
P-F	2920-060-7252	PARTS KIT, STARTER DRIVE: j702745 (19207) Consisting of:	EA	V	*	*	*	*	*	*	20	100		

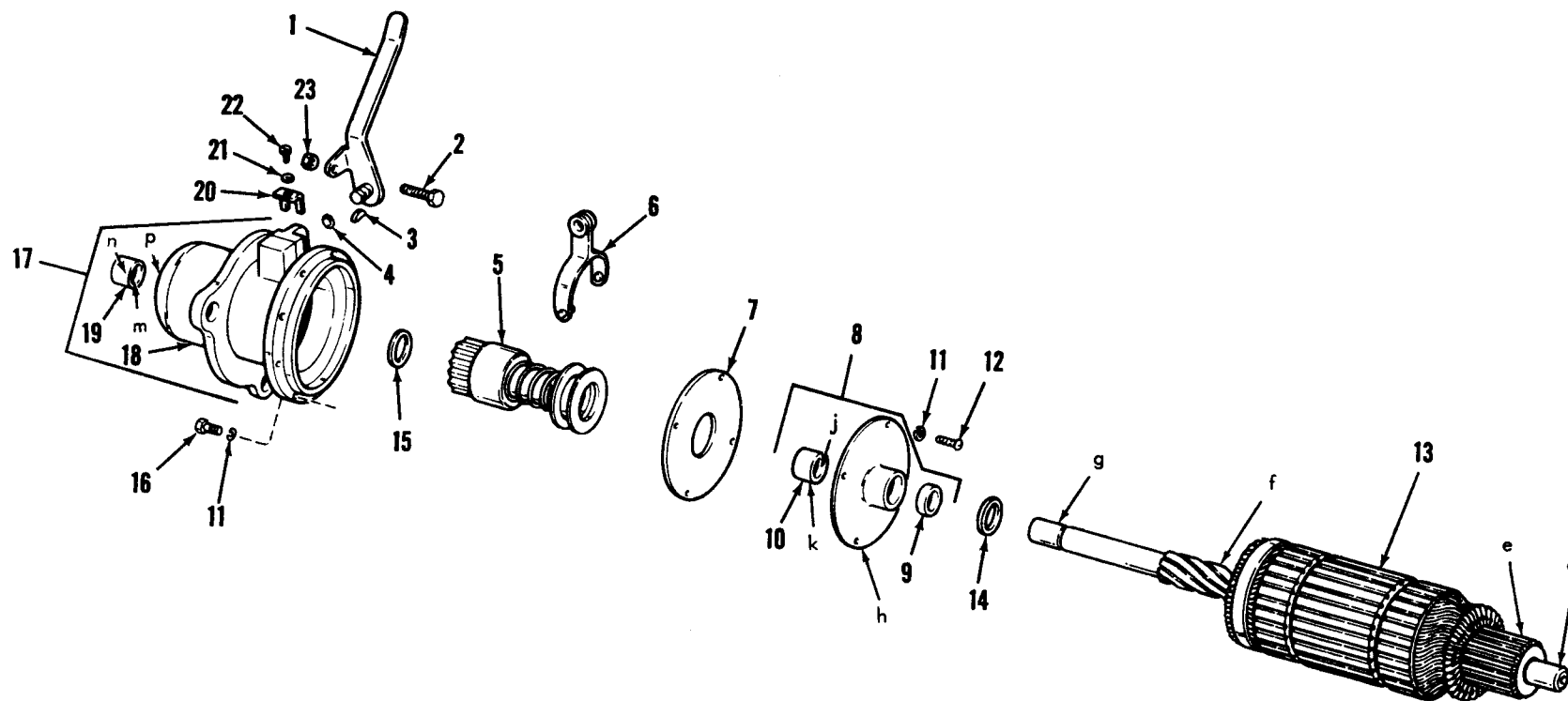
Section II. REPAIR PARTS LIST

[illegible]



AT 39066

FIGURE 48. END COVER, BRUSHES, FIELD FRAME, AND RELATED PARTS.



AT 39067

FIGURE 49. ARMATURE, HOUSING ASSEMBLY, DRIVE END, AND RELATED PARTS.

Section III. FEDERAL STOCK NUMBER AND REFERENCE
NUMBER CROSS-REFERENCE TO FIGURE AND ITEM NUMBER-Continued

<i>Stock Number</i>	<i>Figure No.</i>	<i>Item No.</i>	<i>Reference No.</i>	<i>Mfg Code</i>	<i>Fig No.</i>	<i>Item No.</i>
5330-197-9582	48	13				
5330-530-8275	48	2	10917163	19207	49	7
5330-534-6760	48	3	10951127	19207	49	15
5330-684-3420	49	4	10951128	19207	49	13
5330-820-1626	49	9	10951129	19207	49	6
5330-879-3011	49	7	10951134	19207	Starter Assembly	1
5340-353-7357	48	16				
5360-374-3737	48	15 (Kit)	11602684	19207	49	5 (Kit)
5977-353-7343	48	14	12X201	19728	48	30
			134570	21450	48	31
<i>Reference No.</i>	<i>Mfg Code</i>	<i>Fig No.</i>	<i>Item No.</i>			
GBF79	19728	48	19	1408	19728	17
GG81B	19728	48	17 (Kit)	426678	21450	21
MBD12C	19728	48	24 (Kit)	431680	21450	11
MBD12D	19728	48	9 (Kit)		48	5
MBD12E	19728	48	11 (Kit)	451817	21450	29
MBD13C	19728	48	23 (Kit)	5308275	19207	2
MBD13D	19728	48	10 (Kit)	5346760	19207	3
MBD13F	19728	48	12 (Kit)	546884	21450	13
MBD19C	19728	48	15 (Kit)	5702745	19207	Kit N.I.
MBD1447	19728	48	22	5702664	19207	Kit N.I.
MBD1448	19728	48	18	8328134	19207	48 7

Section IV. INDEX-FEDERAL STOCK NUMBER AND REFERENCE NUMBER
CROSS-REFERENCE TO FIGURE AND ITEM NUMBER

<i>Stock Number</i>	<i>Figure No.</i>	<i>Item No.</i>	<i>Reference No.</i>	<i>Mfg Code</i>	<i>Fig No.</i>	<i>Item No.</i>
2920-060-7252	KIT	N.I.				
2920-246-9993	48	6	MBD1451	19728	49	8
2920-322-9613	48	7	MBD1452	19728	49	1
2920-442-5925	49	8	MBD2079C	19728	48	14
2920-763-2345	49	13	MBD2435	19728	48	8
2920-763-2346	Starter Assembly	1	MBD254A	19728	49	16
2920-882-5941	KIT	N.I.	MBD445	19728	49	20
2920-886-2989	48	4	MBD446	19728	48	4
2920-921-5042	49	17	MBD448	19728	48	20
3120-287-9082	49	10	MBD454	19728	49	19
3120-293-5041	48	19	MBD455	19728	48	27
3120-886-2991	49	19	MBD47A	19728	48	16
5305-559-8145	49	22	ML129	19728	49	14
5305-614-0247	48	21	MS15795-220	96906	48	1
5305-989-6265	48	6	MS21045-5		49	23
5305-989-7434	49	12	MS28784-13	96906	49	4
5306-225-9091	49	2	MS35207-262	96906	48	6
5306-878-8205	49	16	MS35207-263	96906	49	12
5310-013-4570	48	31	MS35265-42	96906	49	22
5310-042-6678	49	21	MS35266-64	96906	48	21
5310-043-1680	49	11	MS35756-6	96906	49	3
	48	5	MS90726-36	96906	49	2
5310-043-2646	48	30	MZ333	19728	49	10
5310-045-1817	48	29	PS408	19728	49	18
5310-255-5712	49	15	XA939	19728	49	9
5310-374-3706	48	17 (KIT)	X865A	19728	48	26
5310-823-8803	48	1	19X66	19728	48	25 (Kit)
5310-883-2237	49	14	19X435	19728	48	28
5310-982-4912	49	23	10917157	19207	N.I.	(Kit)
5315-616-5514	49	3				

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

Official:

VERNE L. BOWERS,
Major General, United States Army,
The Adjutant General.

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To be distributed in accordance with DA Form 12-38, direct and general support maintenance requirements for Truck, 2 ½, Ton, 6x6; Chassis Truck: M44, M45 M46, Instrument Repair Shop, Truck Mounted: M185, Truck, Cargo: M35A1; Truck, Tank, Fuel Servicing, 1200 Gal: M49; Truck, Tank, Water, 1000 Gal: M50; Truck Tractor: M275; Truck, Van, Expansive: M29; Truck, Van, Shop: M109.

TECHNICAL MANUAL
No. 9-2920-236-35

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington 25, D.C., 17 September 1963

STARTER, ENGINE, ELECTRICAL,
ASSEMBLY
(2920-852-5483)
(ELECTRIC AUTO-LITE MODEL MBD-4043UT)

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*This manual supersedes TM 9-2920-236-35P, 1 January 1962, and TM 9-2920-236-35
1 February 1962.

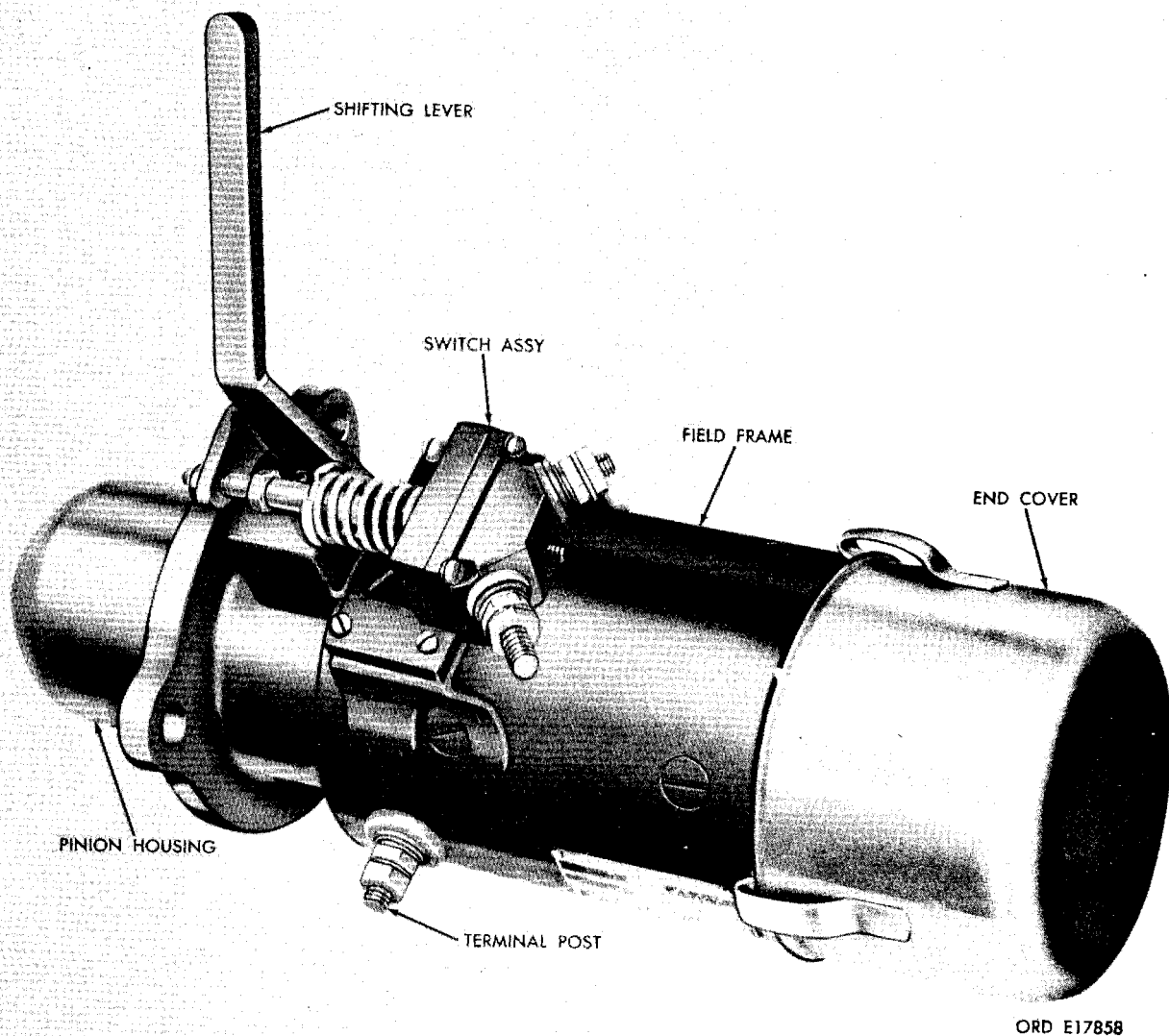


Figure 1. Starter assembly - assembled view.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

I. Scope

a. This technical manual contains instructions for field and depot maintenance of the electrical engine starter assembly (2920-852-5483) (fig. 1). It contains descriptions of, and procedures for, disassembly, inspection, repair, rebuild, and assembly of the starter.

b. Appendix I contains a list of current references, including supply manuals, forms, technical manuals, and other available publications applicable to this starter.

c. Appendix II contains an illustrated list of repair parts allocated to field and depot maintenance echelons.

d. This manual supersedes TM 9-2920-236-35 dated 27 February 1962 and TM 9-2920-236-35P dated 8 January 1962. Record any errors or omissions on DA Form 2028 and forward it to Commanding General, U.S. Army Tank Automotive Center, 28251 Van Dyke, Warren, Michigan, ATTN: SMOTA-FM. This manual differs as follows:

- (1) Revises information for the electrical engine starter used on LDS-427-2 engine.
- (2) Combines field and depot maintenance instructions and repair parts list in one manual.

e. TM 9-2320-235-10 contains operating instructions for the materiel, as well as all maintenance operations allocated to using organizations in performing maintenance work within their scope.

f. TM 9-2320-235-20 contains instructions for the maintenance of the materiel within the scope of organizational maintenance.

2. Field and Depot Maintenance Allocation

Refer to the maintenance allocation chart in TM 9-2320-235-20.

3. Forms, Records, and Reports

Refer to TM 9-2320-235-10, TM 9-2320-235-20, and TM 9-2815-204-35 for the applicable forms, records, and reports.

TM 38-750 contains instructions on use of forms for records and reports.

Section II. DESCRIPTION AND DATA

4. Description (fig. 2)

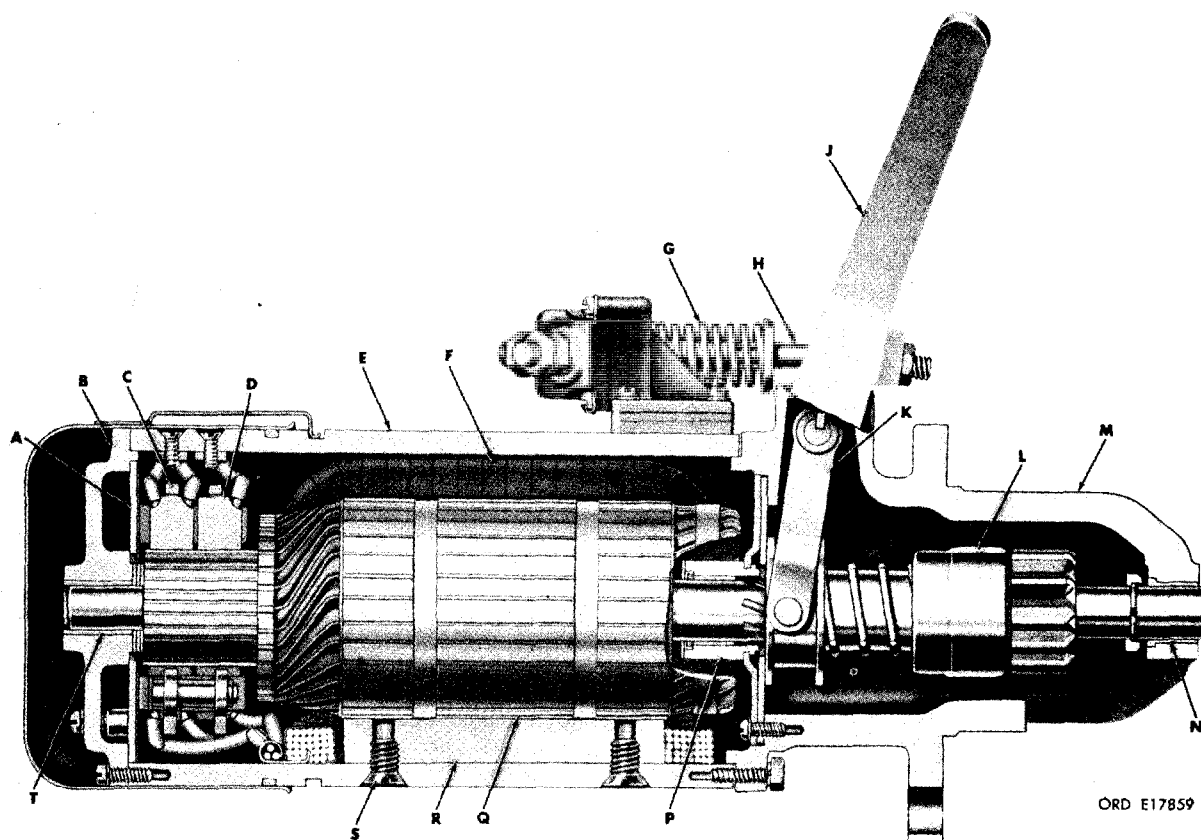
a. General. The main components of the starter assembly are the frame and field assembly, commutator end head assembly, pinion housing (M), positork drive assembly (L), brushes (D), switch assembly, and armature (Q).

b. Frame and Field Assembly. The frame and field assembly consists of the field coils (F), pole pieces (R), and terminal post all supported by a heavy steel field frame (E). The field coils are secured to the field frame by four pole pieces and eight pole piece screws (S). These field coils are also connected to the terminal post which is insulated from the

field frame.

c. Commutator End Head Assembly. The commutator end head assembly consists of the brush carrying plate (A) and commutator end head (B). The commutator end head serves as an enclosure for the field frame and a bearing support for the armature. The brush carrying plate supports the brushes and brush springs (C).

d. Pinion Housing. The pinion housing serves as a bearing support for the drive end of the armature shaft and as a housing for the positork drive assembly, yoke (K), and shifting lever (J). The pinion housing is flanged and provided with three holes for attachment to the engine.



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A - Brush carrying plate
B - Commutator end head
C - Brush spring
D - Brush
E - Field frame
F - Field coil
G - Return spring
H - Blade and plunger rod
J - Shifting lever

K - Yoke
L - Positork drive assembly
M - Pinion housing
N - Housing bushing-type bearing
P - Intermediate bearing
Q - Armature
R - Pole piece
S - Pole piece screw
T - Head bushing-type bearing

Figure 2. Starter assembly - sectional view.

e. Positork Drive Assembly. The positork drive assembly slides on the helical splined section of the armature shaft inside the pinion housing. It is engaged by the yoke. The drive gear operates like a ratchet when in use. It engages starter when rotated in a clockwise direction but rotates freely when engine flywheel speed exceeds speed of armature.

f. Brushes. The eight brushes function as the electrical contact to the commutator. Four of the brushes have leads which are connected to the field frame by screws and are thus grounded. The other four brushes have leads which are soldered to the field coils. The brushes ride in the brush carrying plate and are held against the commutator by eight brush springs.

g. Switch Assembly. The switch assembly consists of two terminals, a blade and plunger rod (H), return spring (G), and a housing which mounts to the bracket the field frame. The blade and plunger rod is connected to the shifting lever. When the shifting lever is activated, the contacts of the blade and plunger rod make contact with the two terminals. When the shifting lever is released, the return spring forces the blade and plunger rod to break contact with the two terminals and return to the original position.

h. Armature. The armature is made of copper and laminated steel assembled on a steel shaft. It is supported by two bushing-type bearings (N and T) on the ends and an intermediate bearing (P) in the center. The armature shaft has square-cut helical

splines which engage splines of positork drive assembly. At the opposite end is the commutator which is the electrical point of contact of the armature.

5. Operation (fig. 2)

a. Starter engagement is performed manually through the movement of the shifting lever (J). The shifting lever causes the yoke (K) to slide the positork drive assembly (L) to the engaged position. At the same time it acts against the blade and plunger rod (H) and closes the contacts of the electrical switch assembly.

b. Starter operation begins when the contacts are closed thereby completing the electrical circuit. Electrical current then flows to the starter through the terminal post (fig. 1), forming magnetic fields about the field coils (F) and armature (Q). The magnetic fields produced have the same polarity and torque results causing the armature to rotate. The commutator and brushes (D) act as a reversing switch and keep the magnetic field around the armature the same polarity as the magnetic field about the field coils. This effect results in continuous rotation of the armature.

c. This torque is transferred to the engine through the positork drive assem-

bly. After the engine starts, flywheel rotation speed is faster than that of the armature which causes the positork drive assembly drive gear to override.

d. When the pressure on the shifting lever is released, the return spring (G) retracts the shifting lever. This opens the contacts of the switch assembly and disengages the positork drive assembly.

6. Data

Voltage. 24 v dc
Current at rated load
 (rated max) 380 amps
Torque (rated) 21.0 ft-lbs
Pinion speed:
 No load at 20 v dc 5300 rpm
 Rated at 21 v dc and 380 amps . . 1625 rpm
Efficiency (rated). 63%
Pinion rotation (facing
 drive end) clockwise
Number of teeth on positork
 drive assembly (pinion) 12
Mounting data:
 Number of mounting holes 3
 Diameter of mounting holes . 0.6562-in.
 Mounting hole circle
 diameter 5.76-in.
Length 16.87-in.
Diameter 5-in.
Weight 48.5 lbs

CHAPTER 2

PARTS, SPECIAL TOOLS. AND EQUIPMENT FOR FIELD AND DEPOT MAINTENANCE

7. General

Tools, equipment, and maintenance parts over and above those available to the using organization are supplied to Army field maintenance units and depot shops for maintaining, repairing, and/or rebuilding the materiel.

8. Repair Parts

Repair parts for the starter assembly are listed in Appendix II which is the authority for requisitioning replacements.

9. Common Tools and Equipment

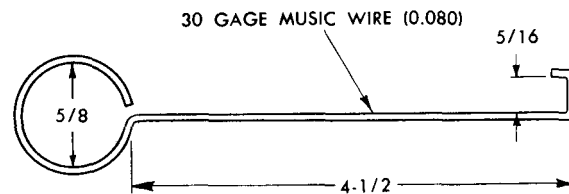
Standard and commonly used tools and equipment having general application to this materiel are listed in DA Supply Manuals SM 9-4-4910-A04 and -A38; SM 9-4-4910-A59 and -A69; SM 9-4-4910-A73 and -A74; SM 9-4-4910-J8-13; SM 9-4-4910-J9-1 and -8; SM 9-4-5180-A16 and -A24; SM 9-4-5180-A58; and are authorized for replacement by TA and TOE.

10. Special Tools and Equipment

There are no special tools or equipment required to perform repair and rebuild operations contained in this manual

11. Improvised Tools

The dimensional detail drawing of the improvised brush spring lifter (fig. 3) furnished herein applies only to field and depot shops to enable these maintenance organizations to fabricate the tools locally, if desired. This tool is of chief value to maintenance organizations engaged in rebuilding a large number of identical components: however, it is not essential for rebuild and is not available for issue.



NOTE. ALL DIMENSIONS SHOWN ARE IN INCHES

RA PD 395376

Figure 3. Improvised brush spring lifter.

CHAPTER 3

TROUBLESHOOTING

Section I. GENERAL

12. Purpose

Note. Information in this chapter is for use of Army maintenance personnel in conjunction with and as a supplement to the troubleshooting sections in the pertinent vehicle and engine technical manuals. It provides a continuation of the instructions where a remedy in either of these technical manuals refers to Army maintenance personnel for corrective action.

Operation of a deadlined vehicle without a preliminary examination can cause further damage to a disabled component and possible injury to personnel. By careful inspection and troubleshooting, such damage and injury can be avoided and, in addition, the causes of faulty operation of a vehicle or component can often be determined without extensive disassembly.

13. General Instructions and Procedures

This chapter contains inspection and troubleshooting procedures to be performed

after a component has the vehicle and/or engine.

a. Inspection after the component is removed from the vehicle and/or the engine is performed to verify any diagnosis made when the component was in the vehicle, to uncover further defects, or to determine malfunctions if the component alone is received by the maintenance activity. This inspection is particularly important in the last case because it is often the only means of determining the malfunction without completely disassembling the component.

b. Troubleshooting a disabled component after it has been removed from the vehicle and/or engine consists of subjecting it to tests on a suitable test stand. This chapter discusses those symptoms which can be diagnosed by using the testing equipment and interprets the results in terms of probable causes. Information pertaining to this testing is contained in paragraphs 35 through 38.

Section II. TROUBLESHOOTING PROCEDURES

14. General

After the starter has been received by the maintenance activity for preliminary inspection, or if performance of the starter has been unsatisfactory due to unknown causes, it must be inspected as described in this section. When the cause for failure has been found, the starter should be disassembled and repaired before proceeding with the tests. Additional operational tests performed on a damaged starter

would only increase the damage.

Note. Make certain that unusual noises are not produced by the test equipment used.

15. Troubleshooting

The following table lists the possible malfunctions that might be encountered, their probable causes, and the recommended corrective action.

Table I. Troubleshooting

Malfunction	Probable Cause	Corrective Action
1. Starter fails to crank	<p><u>a.</u> Current not reaching starter.</p> <p><u>b.</u> Worn brushes. This condition is usually indicated by a slight voltage drop at starter terminal.</p> <p><u>c.</u> Worn or pitted commutator. This condition may show a slight voltage drop when the starter is energized depending upon the extent of the damage.</p>	<p><u>a.</u> Connect a voltmeter between the starter terminal and ground. Energize the starter and observe the voltmeter. A reading of approximately 24 volts should be indicated. If no reading is noted, trace out the starter circuit and check battery condition. (Refer to pertinent operator's manual.)</p> <p><u>b.</u> Remove end cover (fig. 4), check brush spring tension (fig. 10), check brush condition (par. 26e), replace brushes (figs. 24 and 26), and install end cover (par. 34b).</p> <p><u>c.</u> Disassemble the starter (par. 21), resurface the commutator (par. 27e), and assemble the starter (par. 28).</p>
2. Low torque and low current	<p><u>a.</u> High internal resistance.</p> <p><u>b.</u> Poor brush contact.</p>	<p><u>a.</u> Remove end cover (fig. 4) and tighten brush leads. Install end cover (par. 34).</p> <p><u>b.</u> Remove end cover (fig. 4) and inspect commutator. If commutator is worn or dirty, disassemble starter (par. 21), resurface commutator (par. 27e), and assemble starter (par. 28). Check for worn brushes (1b, above).</p>
3. Low torque and high current	<p><u>a.</u> Faulty armature.</p> <p><u>b.</u> Armature drag.</p>	<p><u>a.</u> If armature shows excessive brush arcing, disassemble starter (par. 21), check armature for grounds (fig. 29), or shorts (fig. 30), repair armature (par. 27e), and assemble starter (par. 28).</p> <p><u>b.</u> Disassemble the starter (par. 21), inspect bearings (par. 26) and armature (par. 26g), repair armature (par. 27e), replace bearings, and assemble starter (par. 28).</p>

Table I. Troubleshooting - Continued

Malfunction	Probable Cause	Corrective Action
4. Starter produces excessive noise when operated	Worn bearings.	Disassemble the starter (par. 21), inspect bearings (par. 26), replace bearings, and assemble starter (par. 28).
5. Starter fails to operate or cranks very slowly	<u>a.</u> Short circuited or grounded armature. <u>b.</u> Worn, binding, or poorly seated brushes. <u>c.</u> Poor commutation due to dirty, rough, or pitted commutator. <u>d.</u> Eccentric commutator. <u>e.</u> Field coils grounded.	<u>a.</u> If armature shows excessive brush arcing, disassemble the starter (par. 21), check armature for grounds (fig. 29) or shorts (fig. 30), repair armature (par. 27e), and assemble the starter (par. 28). <u>b.</u> Remove end cover (fig. 4), check brush spring tension (fig. 10), check brush condition (par. 26e), replace brushes (figs. 24 and 26), and install end cover (par. 34). <u>c.</u> Disassemble the starter (par. 21), resurface the commutator (par. 27e), and assemble the starter (par. 28). <u>d.</u> Disassemble the starter (par. 21), check eccentricity (fig. 31), repair commutator (par. 27e), assemble starter (par. 28). <u>e.</u> Inspect the field coils (par. 26f). If field coils are grounded, disassemble starter (par. 21), repair field coils (par. 27f), and assemble starter (par. 28).
6. Excessive arcing of the brushes.	<u>a.</u> Worn, binding, or broken brushes. <u>b.</u> Scored, pitted, or dirty commutator.	<u>a.</u> Remove end cover (fig. 4), check brush spring tension (fig. 10), check brush condition (par. 26e), replace brushes (figs. 24 and 26), and install end cover (par. 34). <u>b.</u> Disassemble the starter (par. 21), resurface the commutator (par. 27e), and assemble (par. 28).

Table I. Troubleshooting - Continued

Malfunction	Probable Cause	Corrective Action
6. Excessive arcing of the brushes - Continued	<u>c.</u> Eccentric commutator.	<u>c.</u> Disassemble the starter (par. 21), check eccentricity (fig. 31), repair commutator (par. 27e), assemble starter (par. 28).
	<u>d.</u> Shorted or grounded field coils.	<u>d.</u> Inspect the field coils (par. 26f). If field coils are grounded, disassemble starter (par. 21), repair field coils (par. 27f), and assemble starter (par. 28).
	<u>e.</u> Shorted or grounded armature windings.	<u>e.</u> If armature shows excessive brush arcing, disassemble starter (par. 21), check armature for grounds (fig. 29) or shorts (fig. 30), repair armature (par. 27e), and assemble starter (par. 28).
	<u>f.</u> Poor brush contact.	<u>f.</u> Remove end cover (fig. 4), check brush spring tension (fig. 10), check brush condition (par. 26e), replace brushes (figs. 24 and 26), and install end cover (par. 34).
	<u>g.</u> Insufficient brush spring tension.	<u>g.</u> Remove end cover (fig. 4), check brush spring tension (fig. 10), disassemble starter (par. 21), replace springs (fig. 23), assemble the starter (par. 28).
7. Starter pinion fails to engage.	Drive binding on armature shaft.	Disassemble the starter (par. 21), inspect drive (par. 26c), repair drive (par. 27c), and assemble the starter (par. 28).
8. Starter vibrates during operation	Worn or damaged bearings.	Disassemble the starter (par. 21), inspect bearings (par. 26), replace bearings, and assemble starter (par. 28).
9. Starter operation is noisy	<u>a.</u> Worn or rough bearings.	<u>a.</u> Disassemble the starter (par. 21), inspect bearings (par. 26), replace bearings, and assemble starter (par. 28).
	<u>b.</u> Starter loose on the mounting flange.	<u>b.</u> Tighten the attaching parts.

Table I. Troubleshooting — Continued

Malfunction	Probable Cause	Corrective Action
10. Low speed and low current	<u>a.</u> High internal resistance.	<u>a.</u> Remove end cover (fig. 4) and tighten brush leads. Install end cover (par. 34).
	<u>b.</u> Poor brush contact.	<u>b.</u> Remove end cover (fig. 4), check brush spring tension (fig. 10), replace brushes (figs. 24 and 26), and install end cover (par. 34).
11. Low speed and high current	<u>a.</u> Faulty armature.	<u>a.</u> If armature shows excessive brush arcing, disassemble starter (par. 21), check the armature for grounds (fig. 29) or for shorts (fig. 30), repair armature (par. 27e), and assemble starter (par. 28).
	<u>b.</u> Armature drag.	<u>b.</u> Disassemble the starter (par. 21), inspect bearings (par. 26) and armature (par. 26g), replace bearings, repair armature (par. 27e), and assemble starter (par. 28).

CHAPTER 4
REPAIR AND REBUILD

Section I. GENERAL

16. Removal and Installation

Refer to TM 9-2815-204-35 for instructions covering the removal and installation of the starter.

17. Cleaning Before Disassembly

Before beginning disassembly, wash starter thoroughly with dry-cleaning solvent, Federal Specification P-S-661, or volatile-mineral-spirits paint thinner

and dry with compressed air (15 psi).

Warning: Particles blown by compressed air are hazardous. Make certain air stream is directed away from user and any other persons in area.

18. Parts Kits

Standard parts kits should always be used when repairing or rebuilding the starter assembly. Refer to Appendix II for description of parts kits.

Section II. DISASSEMBLY

19. General

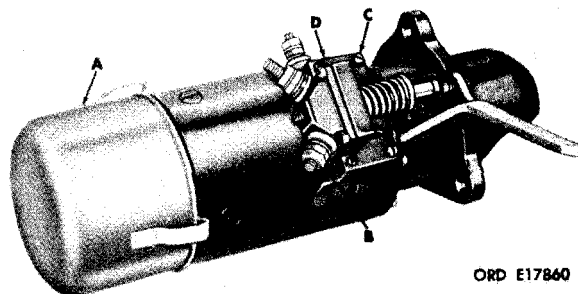
a. Disassembly of the starter will be performed in figure number sequence and the instructions provided with each illustration will, in turn, be performed in the order of their respective index letters. If no instructions are provided with these index letters, the procedures involved are relatively simple and the parts should be removed in the sequence indicated by the letters.

b. All packings and gaskets will be discarded during disassembly to insure their replacement by new parts during assembly.

20. Switch Assembly and End Cover

a. Refer to figure 4 for instructions covering removal of the switch assembly and end cover.

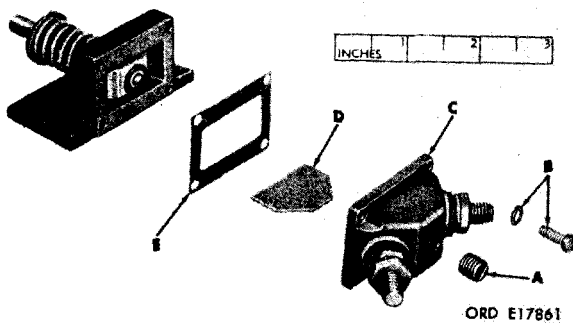
b. Refer to figures 5 through 8 for instructions covering disassembly of the switch assembly.



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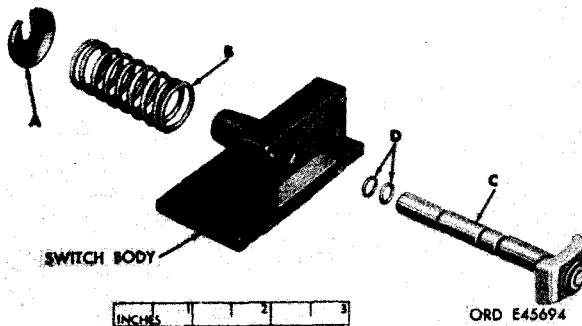
- A - Remove end cover.
- B - Remove nut and lock washer.
- C - Remove four screws and lock washers.
- D - Remove switch assembly.

Figure 4. Removing or installing switch assembly and end cover.



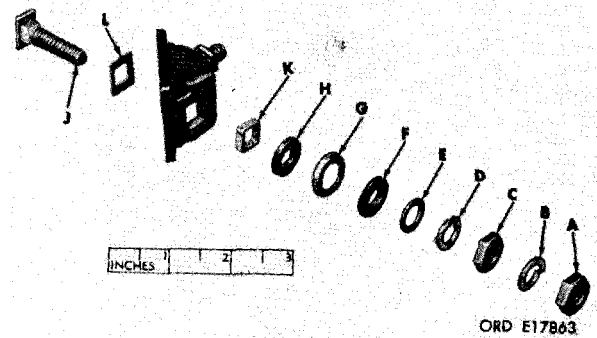
- A - Remove housing plug.
- B - Remove four screws and lock washers.
- C - Remove switch blade housing and associated parts.
- D - Remove two housing insulators.
- E - Remove and discard switch body gasket.

Figure 5. Removing or installing switch blade housing and associated parts.



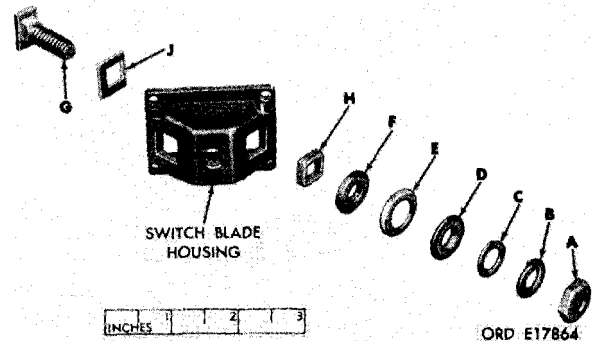
- A - Depress return spring and remove spring retainer.
- B - Remove return spring.
- C - Remove blade and plunger rod.
- D - Remove and discard plunger rod packings.

Figure 6. Removing or installing blade and plunger rod and associated parts.



- A - Hex nut
- B - Lock washer
- C - Hex nut
- D - Lock washer
- E - Terminal washer
- F - Terminal bushing
- G - Gasket retainer
- H - Terminal gasket
- J - Long contact terminal
- K - Insulating bushing
- L - Insulating washer.

Figure 7. Removing or installing long contact terminal and associated parts.



- A - Hex nut
- B - Lock washer
- C - Terminal washer
- D - Terminal bushing
- E - Gasket retainer
- F - Terminal gasket
- G - Short contact terminal
- H - Insulating bushing
- J - Insulating washer

Figure 8. Removing or installing short contact terminal and associated parts.

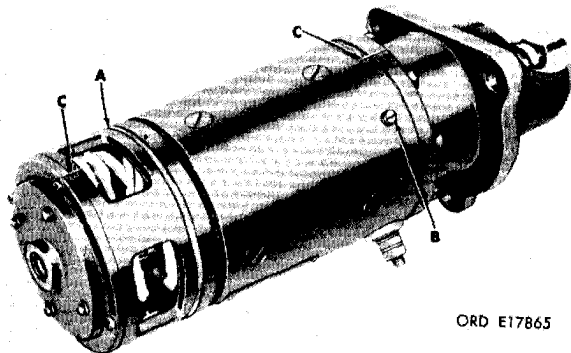
21. Pinion Housing

a. Refer to figure 9 for instructions covering the preparation necessary for removal of the pinion housing.

b. Check the brush spring tension as shown in figure 10. If the tension of any brush spring is not between 20 to 55 ounces, mark the spring for replacement.

c. Refer to figure 11 for instructions covering removal of the brushes.

d. Refer to figure 12 for instructions covering removal of the pinion housing.



A - Remove frame packing ("O" ring).

B - Remove frame plug.

C - Scribe alinement marks on starter to facilitate assembly,

Figure 9. Preparing for removal or installation of pinion housing.

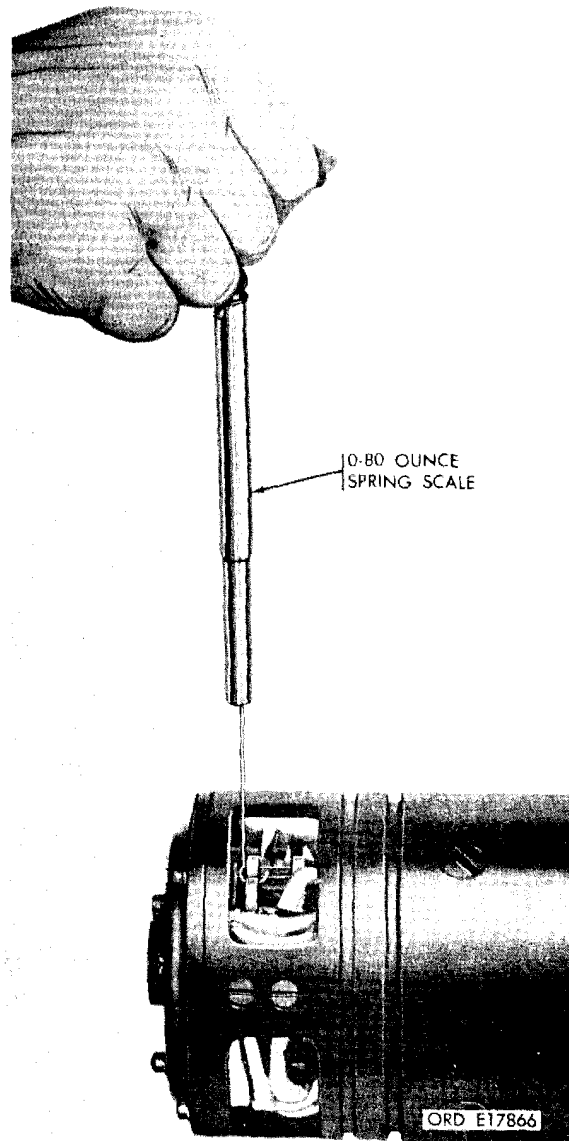


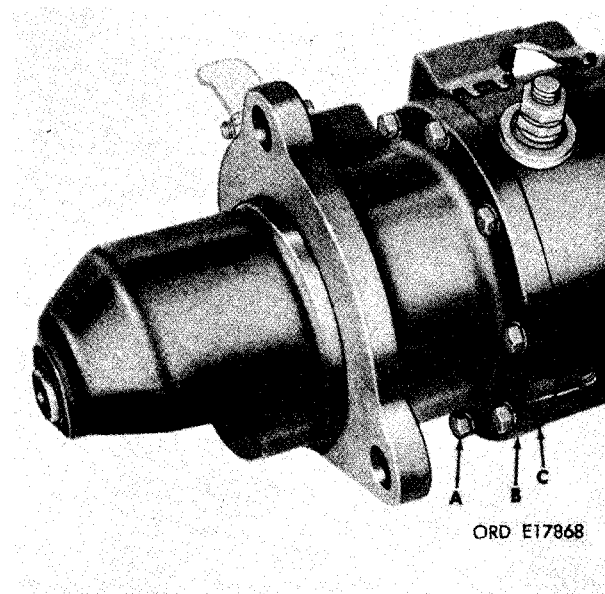
Figure 10. Measuring brush spring tension.



- A - Lift up on brush spring using improvised brush spring lifter (fig. 3).
- B - Remove brush from holder.
- c - Remove remaining seven brushes in the same manner.

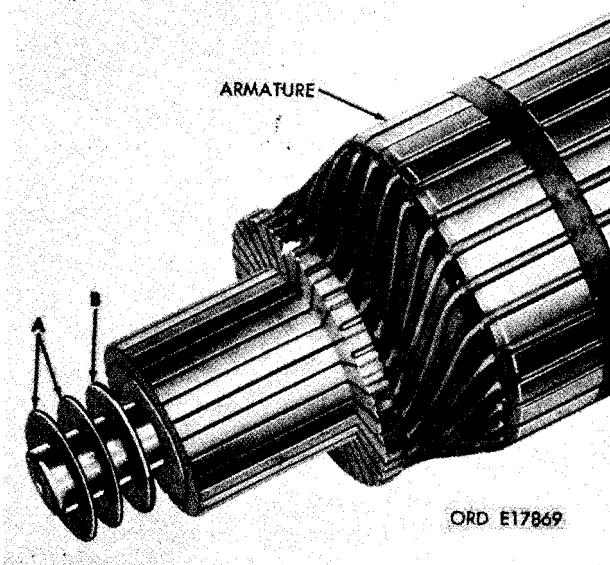
Figure 11. Removing or installing brushes using improvised brush spring lifter.

e. Refer to figures 13 through 17 for instructions covering disassembly of the pinion housing.



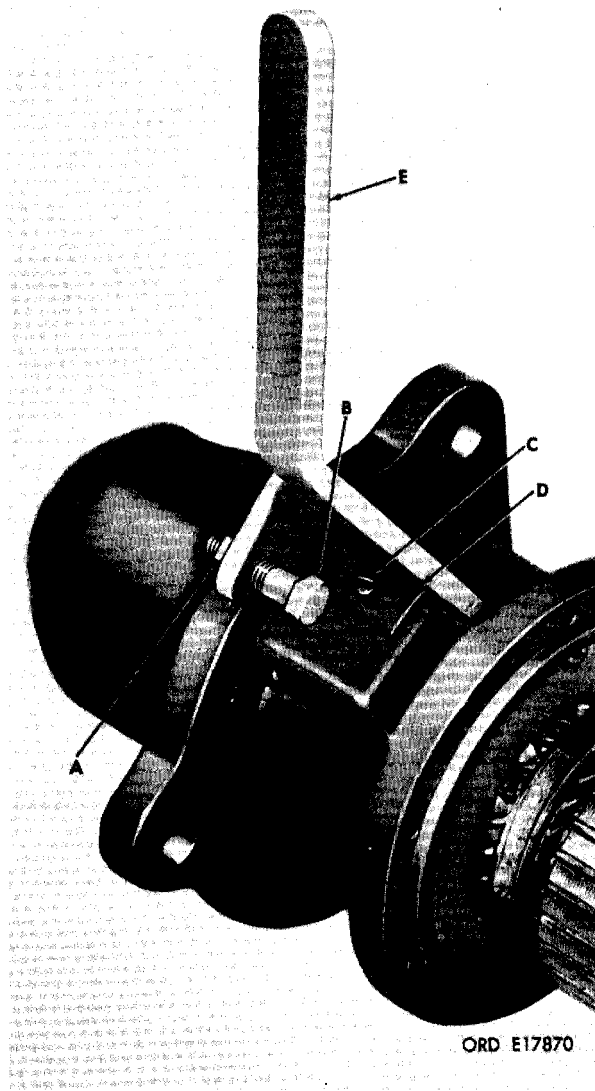
- A - Remove eight bolts and lock washers.
- B - Remove pinion housing and associated parts from the frame.
- c - Remove and discard pinion housing gasket.

Figure 12. Removing or installing pinion housing and associated parts.



- A - Remove two fiber washers.
- B - Remove thrust washer.

Figure 13. Removing or installing washers from armature.

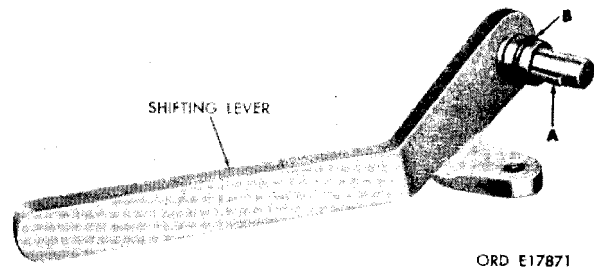


- A - Remove stop nut.
- B - Remove hex screw.
- C - Remove screw and lock washer.
- D - Lift off retainer plate.
- E - Remove lever and shaft assembly.

Figure 14. Removing or installing lever and shaft assembly.

22. Armature

a. Refer to figure 18 for instructions covering removal of the positork drive assembly from the armature.



- A - Remove Woodruff key.
- B - Remove shaft packing.

Figure 15. Disassembling or assembling lever and shaft assembly.

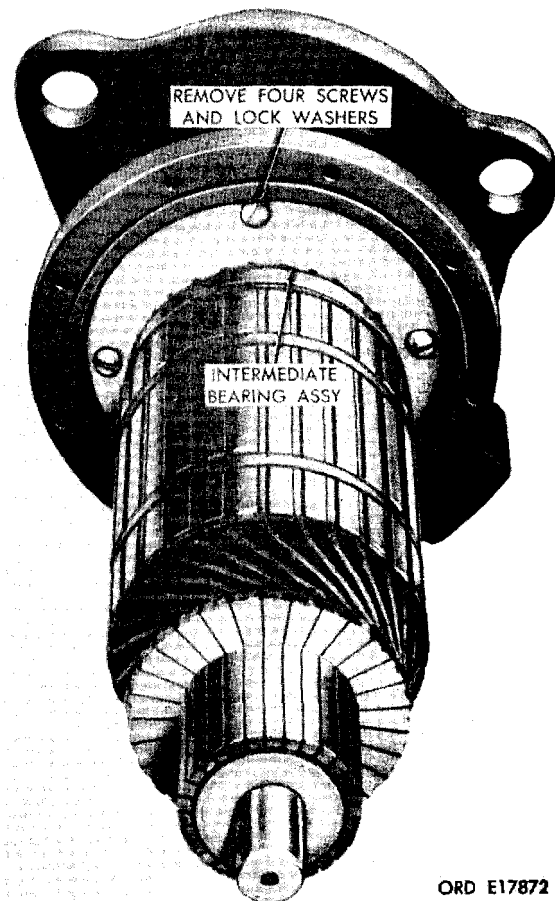
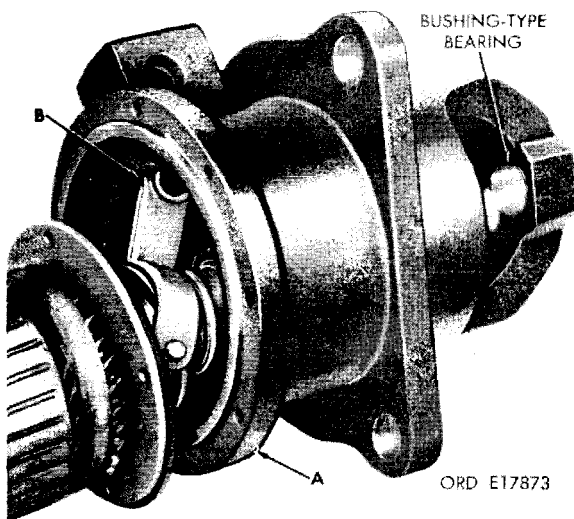


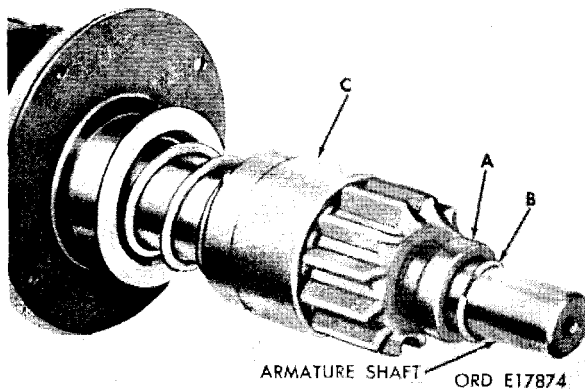
Figure 16. Removing or installing intermediate bearing assembly attaching parts.



- A - Remove pinion housing assembly.
- B - Lift off yoke.

Note. Do not remove bushing-type bearing unless inspection (par. 26b) shows need for replacement.

Figure 17. Removing or installing pinion housing assembly.



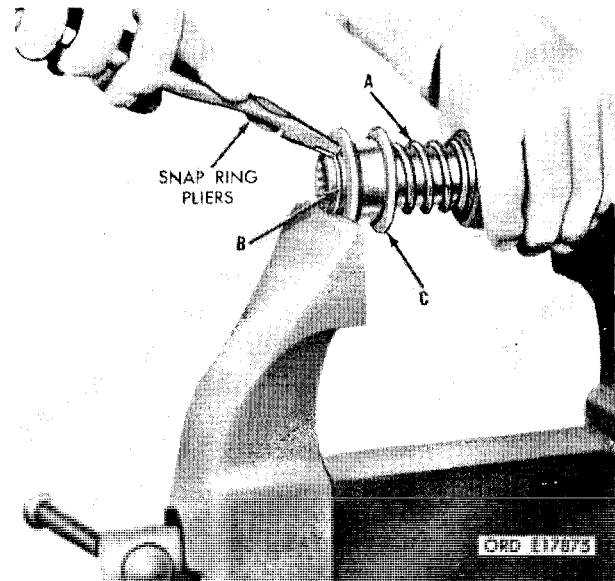
- A - Slide collar and pinion stop toward gear to gain access to snap ring.
- B - Remove snap ring and collar and pinion stop.

Note. Remove burs, if any, on armature shaft before removing collar and pinion stop.

- c - Remove positork drive assembly.

Figure 18. Removing or installing positork drive assembly.

b. Refer to figure 19 for instructions covering disassembly of the positork drive assembly.



- A - Compress drive spring.

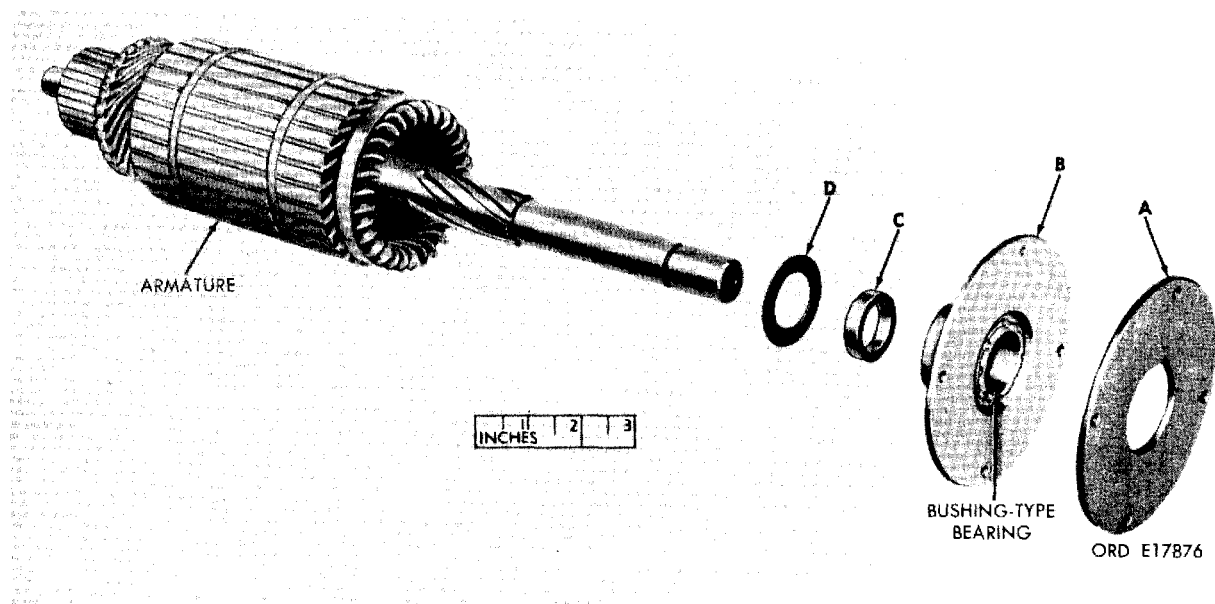
Warning: Exercise extreme care when compressing drive spring so parts will not fly off and harm anyone.

- B - Remove snap ring.

- c - Release tension on drive spring and remove drive collar and drive spring.

Figure 19. Disassembling or assembling positork drive assembly.

C. Refer to figure 20 for instructions covering removal of the intermediate bearing assembly from the armature shaft.



A - Remove fiber gasket.

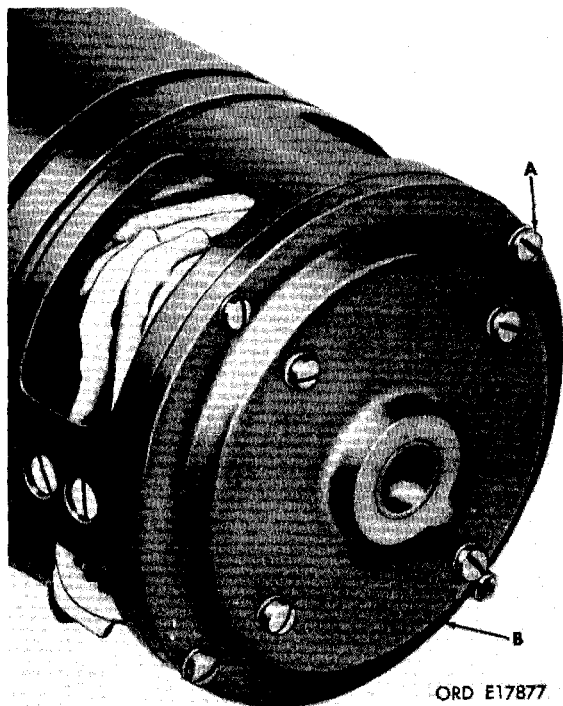
B - Remove intermediate bearing assembly.

C - Remove oil seal.

D - Remove armature flat fiber washer.

Note. Do not remove bushing-type bearing unless inspection (par. 26d) shows need for replacement.

Figure 20. Removing or installing intermediate bearing assembly and associated parts.



23. Commutator End Head Assembly

a. Refer to figure 21 for instructions covering removal of the commutator end head assembly.

b. Refer to figures 22 and 23 for instructions covering disassembly of the commutator end head assembly.

◀ Figure 21. Instructions.

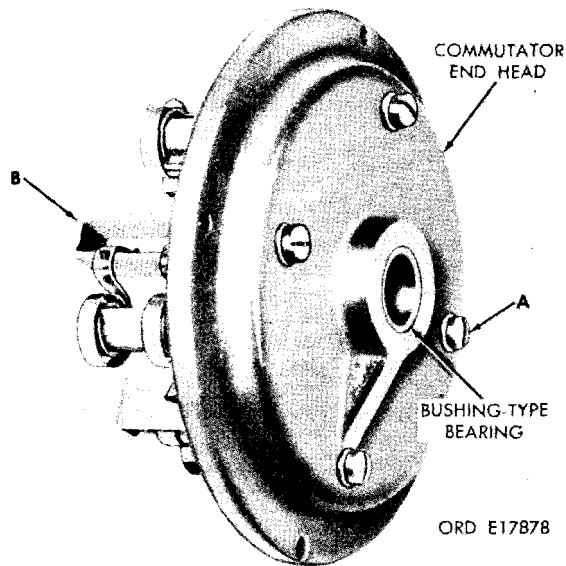
A - Remove four screws and lock washers.

B - Remove commutator end head assembly.

Figure 21. Removing or installing commutator end head assembly.

24. Brushes

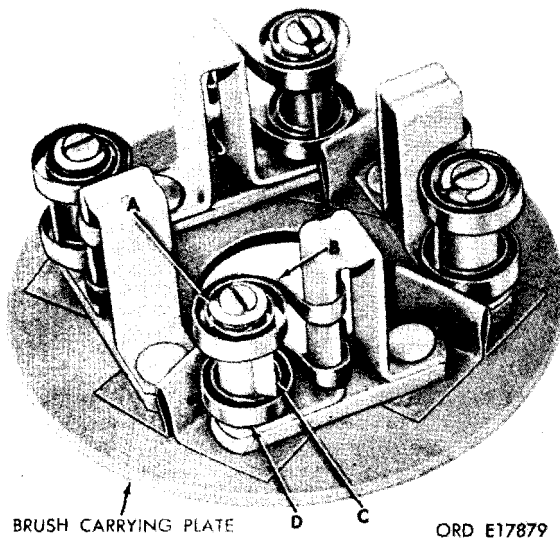
a. Refer to figure 24 for instructions covering removal of the four grounded brushes.



- A - Remove four screws and lock washers.
- B - Remove brush carrying plate assembly.

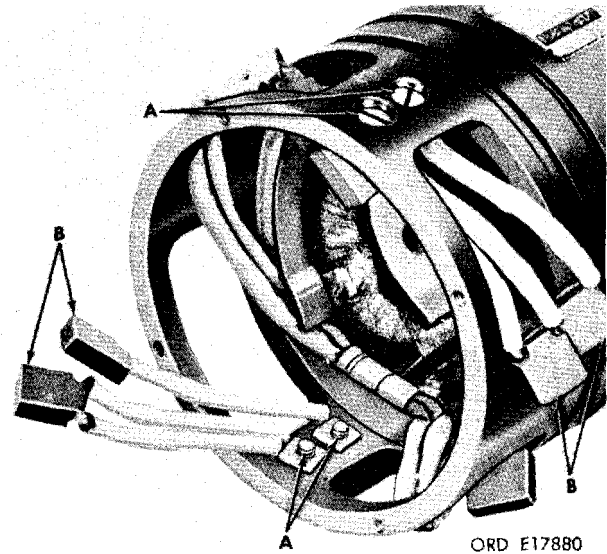
Note. Do not remove bushing-type bearing unless inspection (par. 26h) shows need for replacement.

Figure 22. Removing or installing brush carrying plate assembly.



- A - Remove four post clips.
- B - Remove four brush springs.
- C - Remove four spring spacers.
- D - Remove remaining four brush springs.

Figure 23. Removing or installing brush springs.



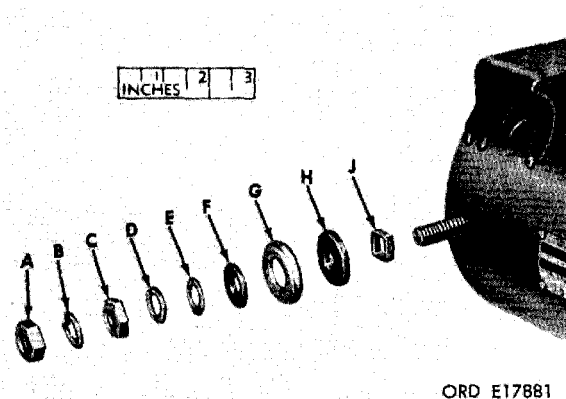
- A - Remove four screws.

- B - Remove four brushes.

Note. Do not remove the four brushes soldered to the field coils. They will be replaced if inspection (par. 26e) determines wear beyond limits specified.

Figure 24. Removing or installing four grounded brushes.

b. Refer to figure 25 for instructions covering removal of square bushing and associated parts.



- A - Hex nut
- B - Lock washer
- C - Hex nut
- D - Lock washer
- E - Flat washer
- F - Insulation washer
- G - Cup washer
- H - Rubber washer

Figure 25. Removing or installing square bushing.

Section III. CLEANING, INSPECTION, AND REPAIR

25. Cleaning

a. General. Wash all parts, except those detailed in paragraphs 25b through 25e, in dry-cleaning solvent, Specification P-S-661, or volatile-mineral-spirits paint thinner, and dry with compressed air.

Warning: Particles blown by compressed air are hazardous. Make certain air stream is directed away from user and any persons in area.

b. Field Coils. Clean field coils and frame thoroughly with a cloth dampened with dry-cleaning solvent or volatile-mineral-spirits paint thinner. Be careful not to damage protective insulation coating. Dry thoroughly with compressed air (15 psi max.).

c. Armature. Remove loose particles from the armature and wipe with a clean cloth dampened with dry-cleaning solvent or volatile-mineral-spirits paint thinner. Clean commutator lightly with 00 sandpaper and remove all dust with compressed air.

d. Brush Carrying Plate. Clean the brush carrying plate with a brush and dry-cleaning solvent or volatile-mineral-spirits paint thinner and dry with compressed air.

e. Brushes. Clean brushes with a clean, dry cloth only. Extreme care must

be taken to prevent dry-cleaning solvent from contacting the brushes.

26. Inspection

a. General. Inspect all screws, bolts, nuts, threaded holes, and plugs for worn or damaged threads. Replace all worn or damaged parts. Inspect remaining hardware items and replace damaged parts.

Note. Figures 29, 30, 31, 34, and 36 do not depict the armature used in the starter assembly; however, the procedures for testing and repairing the armature are the same.

b. Pinion Housing.

- (1) Inspect the pinion housing for cracks, distortion, and burs. Replace if damaged.
- (2) Inspect the housing bushing-type bearing for score marks and wear patterns. Check bearing against limits specified in repair and rebuild standards (par. 40) and replace using a 0.87-inch diameter arbor if worn beyond limits.
- (3) If the housing bushing-type is removed, check the diameter of the bearing bore in the pinion housing against the limits specified in the repair and rebuild standards (par. 40)

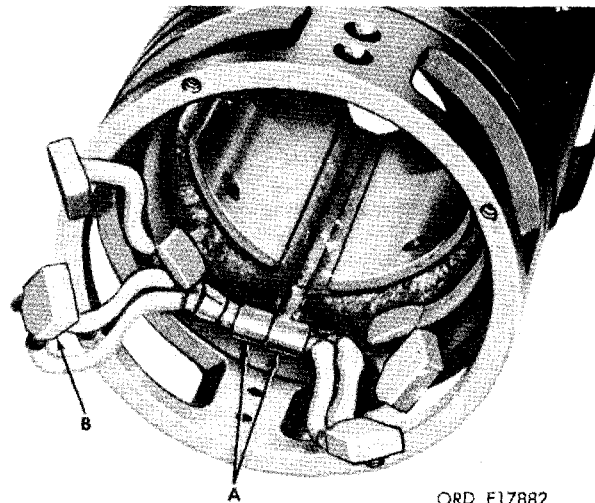
and replace the housing if worn beyond limits.

c. Positork Drive Assembly.

- (1) Inspect bearing surface and internal splines of the positork drive for score marks and wear patterns. Check snap ring groove for damage. Replace drive if damaged.
- (2) Check the drive spring against limits specified in repair and rebuild standards (par. 40) and replace the spring if it is not within these limits.
- (3) Inspect the drive collar for signs of wear and distortion and replace it if either condition exists.
- (4) Inspect the gear teeth for wear pattern and replace the positork drive assembly if wear is excessive.

d. Intermediate Bearing.

- (1) Inspect the intermediate bearing for cracks, distortion, and burs. Replace if damaged.



A - Melt solder and bend back leads.

B - Remove four brushes.

Figure 26. Removing or installing four brushes.

- (2) Inspect the intermediate bushing-type bearing for score marks and wear patterns. Check bearing against limits specified in

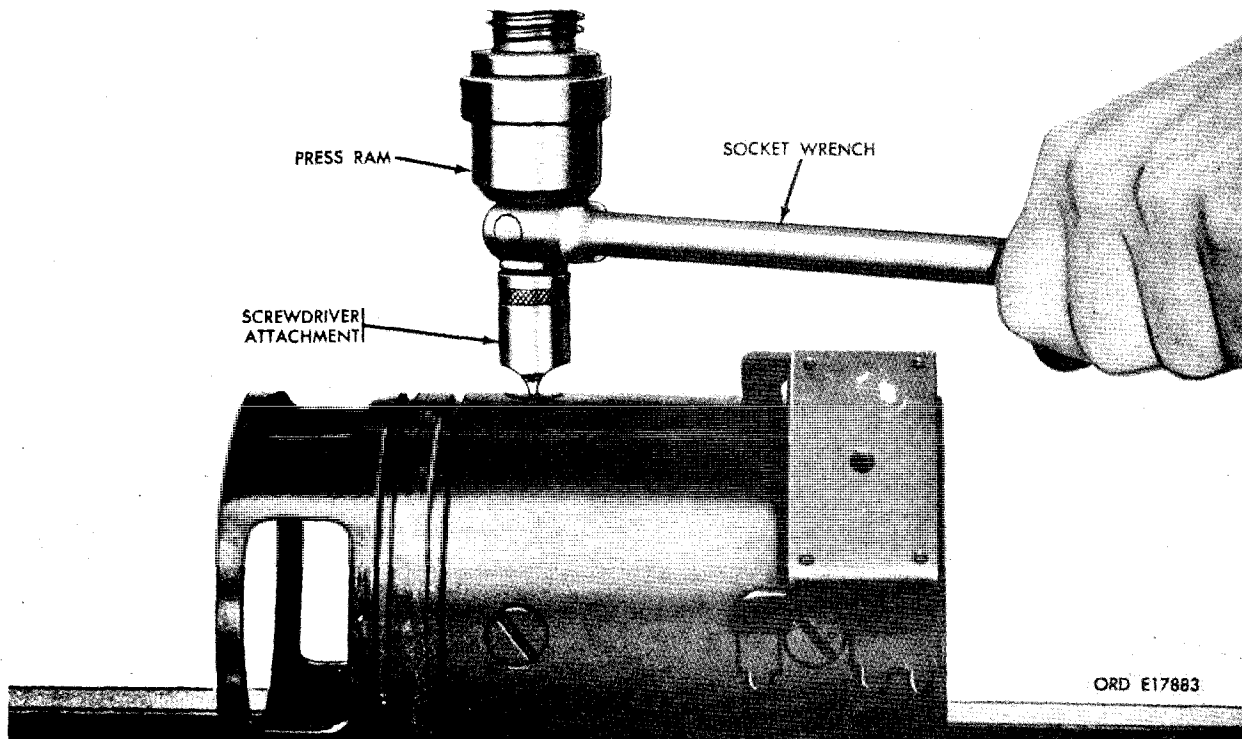


Figure 27. Loosening or tightening pole piece screws.

repair and rebuild standards (par. 40) and replace using a 0.99-inch diameter arbor if worn beyond limits.

- (3) If the intermediate bushing-type bearing is removed, check the diameter of the bearing bore in the intermediate bearing retainer against limits specified in the repair and rebuild standards (par. 40) and replace the intermediate bearing retainer if worn beyond limits.

e. Brush Carrying Plate Assembly and Brushes.

- (1) Inspect the brush carrying plate for any visible damage. Replace if damaged. Replace any brush springs that were marked for replacement during disassembly.
- (2) Inspect the brushes for chips, cracks, loose terminal leads, and grease spots. Check the length of the brushes against the limits specified in the repair and rebuild standards (par. 40). Replace the brushes if worn beyond these limits. In the event that any of the brushes

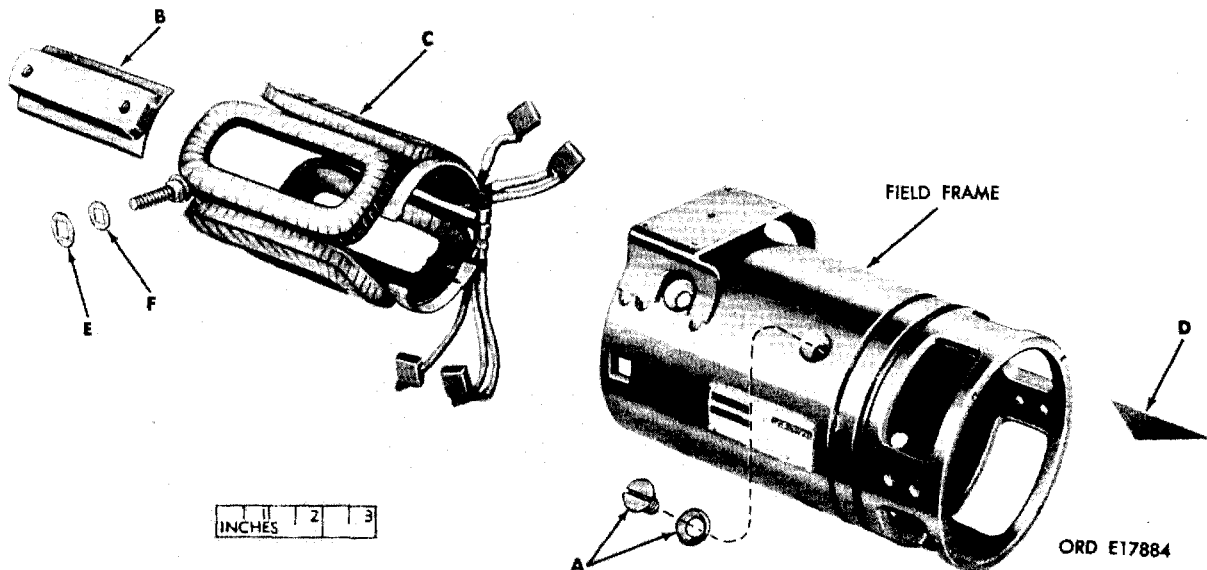
that are soldered to the field coils require replacement, remove them as shown in figure 26. Install a new set of brushes by referring to figure 26 and reversing disassembly procedure.

f. Field Coils and Frame.

- (1) Check field coils for insulation breakdown with an ohmmeter. Attach one probe of the ohmmeter to the brush lead and the other probe to the terminal post. The minimum reading should not be less than one megohm. If the field coils are damaged, remove them as shown in figures 27 and 28. Install a new field coil assembly by referring to figures 28 and 27 and reversing the disassembly procedures.
- (2) Inspect field frame for cracks and burrs. Inspect if cracked.

g. Armature.

- (1) Inspect the commutator contact surface of the armature. A satisfactory condition is indicated by an even, highly burnished, dark-copper color. If the



- A - Remove eight pole piece screws and gaskets.
- B - Remove four pole pieces.
- C - Remove field coils.
- D - Remove lead insulation.
- E - Remove insulation washer.
- F - Remove metal washer.

Figure 28. Removing or installing field coils and associated parts.

contact surface is rough, pitted, scored, burned, or coated with hard carbon or oil, the commutator must be resurfaced provided it is in good electrical and mechanical condition as a result of the following inspection. Check armature against limits specified in repair and rebuild standards (par. 40) and replace the armature if it is not within these limits. Inspect splines of armature shaft for wear or damage and replace the armature if either condition exists.

- (2) Inspect the armature for grounds with a test light by touching one probe to commutator bar riser and the other to armature core (fig. 29). Test all commutator bars in this manner. If test light glows, the armature is grounded and must be replaced.
- (3) Inspect armature for short circuits with a growler. Place the armature in the growler and hold a thin strip of steel, such as a hacksaw blade, about 1/32 to 1/16 inch away from the armature core as shown in figure 30.

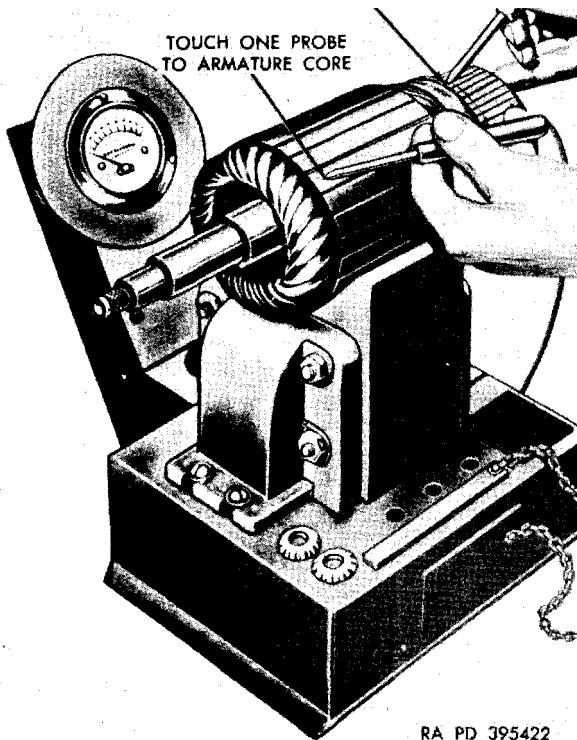


Figure 29. Testing armature for grounds.

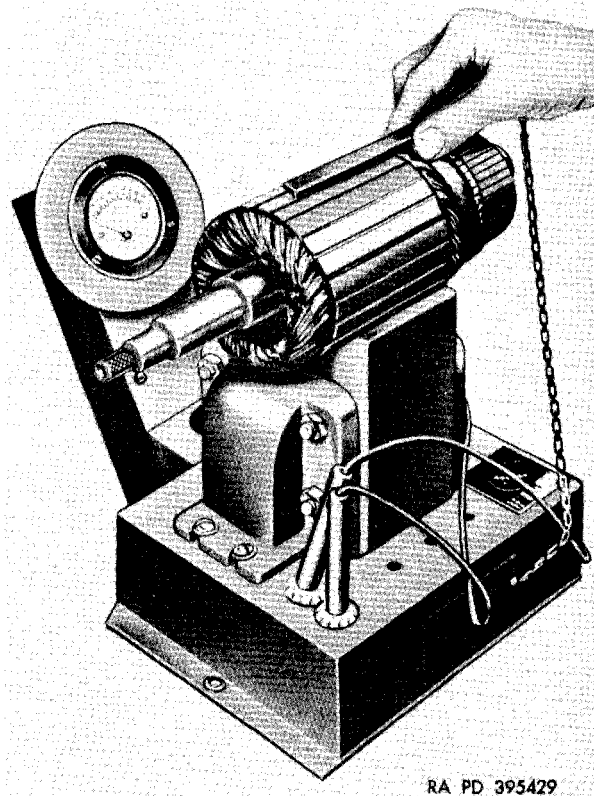


Figure 30. Testing armature for short circuits.

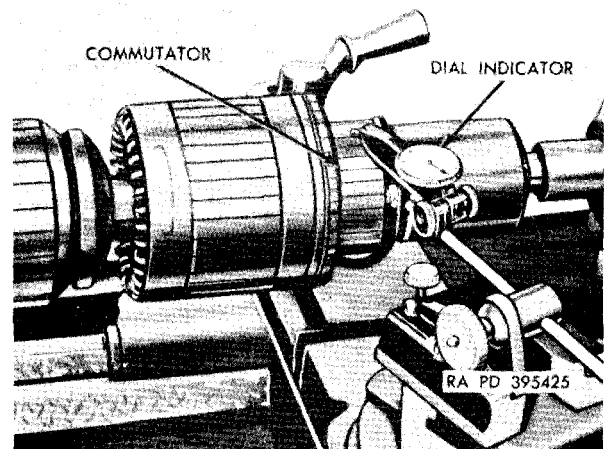


Figure 31. Checking armature eccentricity.

While holding the steel strip in position, rotate the armature slowly in the growler. A short circuit will pull the steel strip tightly against the armature core and cause the strip to vibrate. If a short circuit is found, the armature must be replaced.

- (4) Inspect armature shaft alignment and commutator for eccentricity to shaft with a lathe or "V" blocks and a dial indicator (fig. 31). Check armature shaft for true alignment. If shaft run out exceeds 0.005-inch, armature must be replaced. If commutator eccentricity exceeds 0.003-inch, commutator of armature shaft must be refinished provided it will not be cut below limits specified in repair and rebuild standards (par. 40). If commutator requires cutting below limits specified, replace armature.

h. Head and Bushing Assembly.

- (1) Inspect the commutator end head for cracks, distortion, and burs. Replace if damaged.
- (2) Inspect the head bushing-type bearing for score marks and wear patterns. Check bearing against limits specified in repair and rebuild standards (par. 40) and replace using a 0.750-inch arbor if worn beyond limits.
- (3) If head bushing-type bearing is removed, check diameter of bearing bore in commutator end head against limits specified in repair and rebuild standards (par. 40) and replace head if it is not within these limits.

i. End Cover. Inspect the end cover for dents, cracks, and distortion. Replace if damaged.

i. Switch Assembly.

- (1) Inspect the switch body for cracks, distortion, and burs. Replace if damaged.
- (2) Check plunger rod return spring against limits specified in repair and rebuild standards (par. 40) and replace the return spring if it is not within these limits.
- (3) Inspect the switch blade housing for cracks, distortion, and burs. Replace if damaged.

k. Shifting Lever and Yoke.

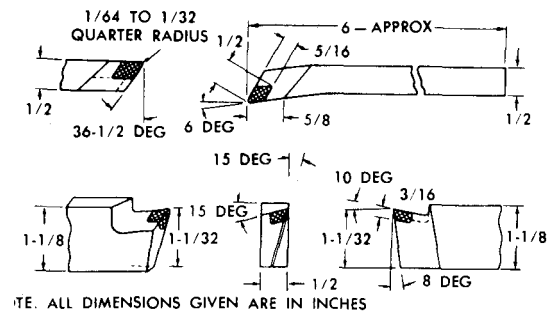
- (1) Inspect the shifting lever for wear on the shaft and burs in the packing groove. Replace the lever if worn or damaged.

- (2) Inspect the yoke for wear in the shaft hole and wear on the slider blocks. Replace the yoke if wear exists.

27. Repair

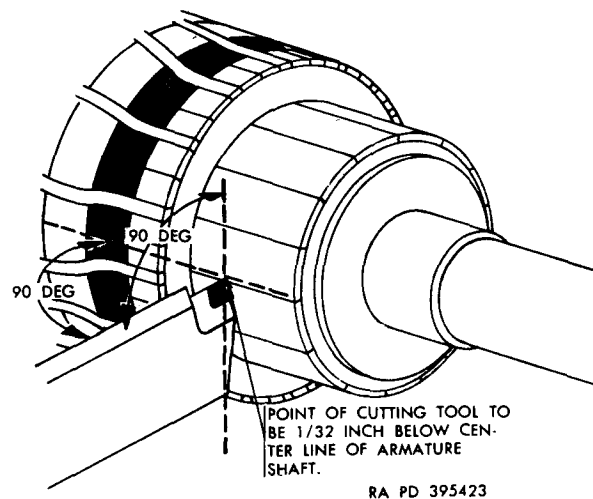
a. General. The following subparagraphs cover only those parts wherein a repair operation will return the damaged part to serviceable condition. Parts not detailed herein must be replaced when they fail to pass the required inspection (par. 26).

b. Pinion Housing. Minor burs or damage on the mating surfaces of the pinion housing can be removed or cleaned up with a fine mill file.



RA PD 39542

Figure 32. Cutting tool sharpening dimensions.



RA PD 395423

Figure 33. Proper position of cutting tool.

c. Positork Drive Assembly. Minor damage such as nicks, burs, etc, of the positork drive maybe repaired with a file providing it does not destroy the effectiveness of the snap ring groove.

d. Intermediate Bearing Retainer. Minor damage such as nicks, burs, etc, of the intermediate bearing retainer may be repaired with a fine mill file.

g. Armature.

- (1) Resurfacing. Sharpen the lathe cutting tool to the dimensions given in figure 32.

Note. For commutator turning, the lathe cutting tool must be extremely sharp. After grinding, hone the tool with a fine hard stone to insure a smooth cut during the turning operation.

Position the tool with respect to the commutator as shown in figure 33. Resurface the commutator at 800 rpm taking only light cuts each time. No more than 0.005-inch should be removed during any one cut and

the final cut should not be more than 0.002-inch. After resurfacing, check armature against limits specified in repair and rebuild standards (par. 40) and replace it if it falls below these limits.

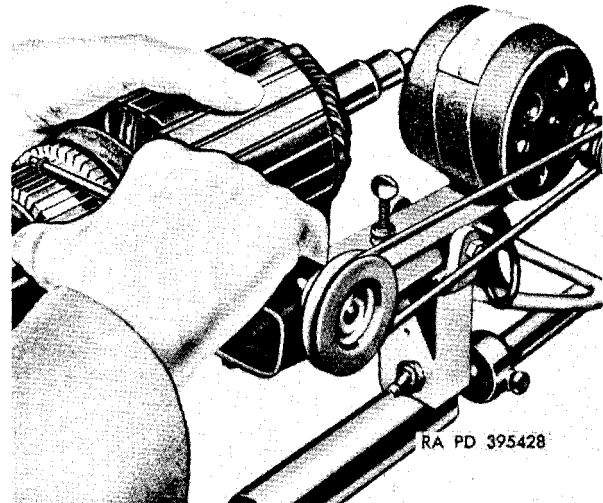
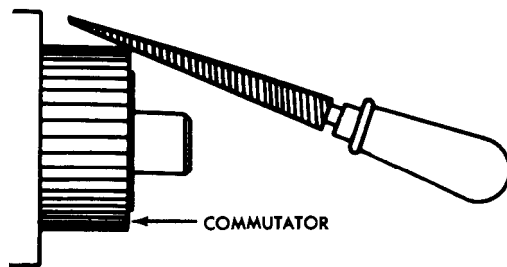
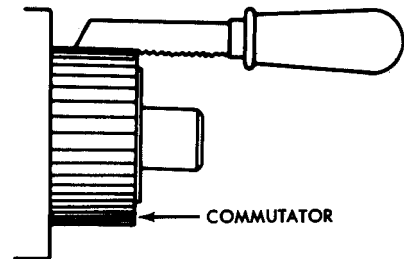


Figure 34. Undercutting mica using a power-driven tool.



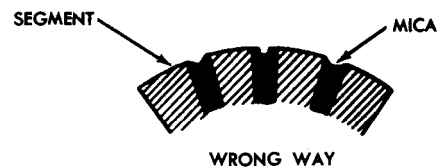
START GROOVE IN MICA
WITH 3 CORNERED FILE.



UNDERCUT MICA WITH PIECE
OF HACKSAW BLADE.



MICA MUST BE CUT AWAY
CLEAN BETWEEN SEGMENTS.



MICA MUST NOT BE LEFT
WITH A THIN EDGE NEXT
TO SEGMENTS.

RA PD 40198

Figure 35. Undercutting mica using alternate hand method.

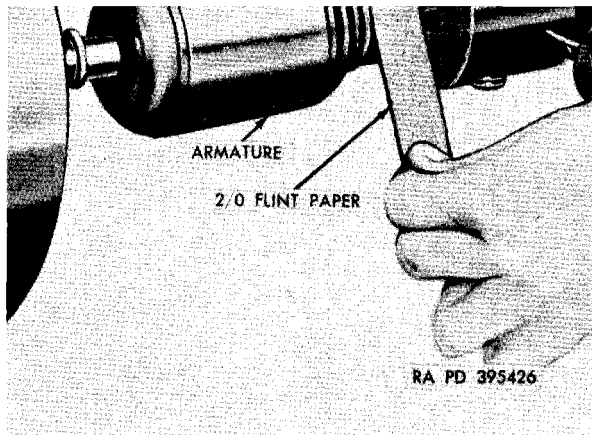


Figure 36. Polishing commutator with sandpaper.

Note. When a cut is started, it should be carried across entire surface without stopping.

- (2) Undercutting mica. After resurfacing the armature, undercut mica to 1/32-inch below the

surface of the commutator with a power-driven undercutting tool (fig. 34). If a power-driven tool is not available, the mica may be undercut by hand, as illustrated in figure 35. Should small burs extend beyond the grooves, they can be removed by running a three-cornered scraper along the bottom edge of the groove.

- (3) Polishing commutator. After the mica has been undercut, remove all copper and mica particles with compressed air. Polish the commutator in a lathe with 2/0 sandpaper as illustrated in figure 36, with the armature rotating at 1500 rpm.
- (4) Checking armature eccentricity. Setups dial indicator gage and measure the runout of the commutator (fig. 31). Total runout should not exceed 0.003-inch.

f. Insulating Field Coils. Apply as many coats of insulating varnish as necessary to properly insulate the field coils. Allow each coat to dry until "tacky" before applying another coat. After sufficient coats have been applied, place the field coils in a drying oven and bake for two hours at a temperature of 193°F (77°C).

Section IV. ASSEMBLY

28. General

a. The instructions covering assembly of the starter are almost identically the reverse of those covering disassembly. Therefore, the following assembly procedures, for the most part, will be referenced to the illustrations appearing under disassembly. When this occurs, the instructions appearing with each referenced illustration should be performed in the reverse order from which they are given. For example, callout letters A, B, C, and D indicate the sequence of the disassembly steps provided with figure 23. Assembly may be accomplished by performing these steps in reverse order; i.e., D, C, B, and A.

b. The exploded views, figures 48 through 50, are included in Appendix II of the manual to provide a visual reference to the relationship of the components

of the starter and for part identification

29. Brush Parts Kit

When one part of the brush parts kit - 5702664 (fig. 51) requires replacement, the entire kit should be used.

30. Brushes

a. Refer to figure 25 for instructions covering installation of square bushing and associated parts.

b. Refer to figure 24 for instructions covering installation of brushes.

31. Commutator End Head Assembly

a. Refer to figures 23 and 22 for instructions covering assembly of the commutator end head assembly.

b. Refer to figure 21 for instructions covering installation of the commutator end head assembly.

c. Position sandpaper on armature as shown in figure 37. Insert armature and install brushes. Rotate armature clockwise as shown in figure 38 to seat brushes.

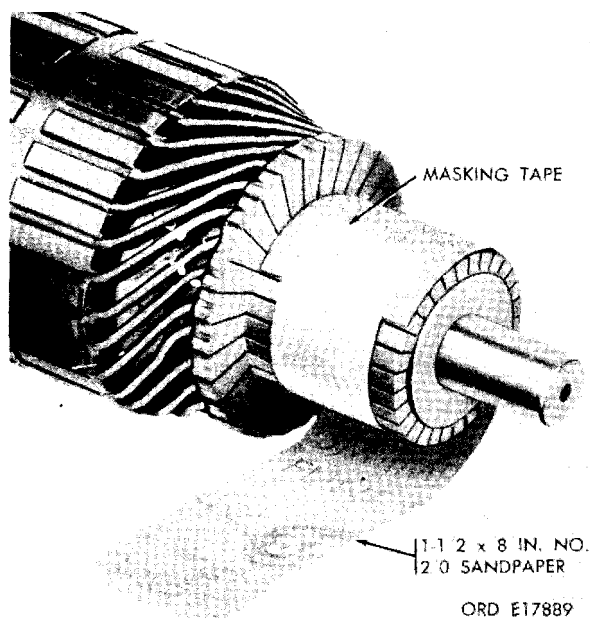


Figure 37. Positioning sandpaper on armature.

Seat brushes until satisfactory as shown in figure 39. Pull the brushes out of their holders. Remove armature and discard sandpaper. Wipe armature and brush with a clean, dry cloth.

32. Armature

a. Refer to figure 20 for instructions covering installation of intermediate bearing retainer assembly on the armature

b. Refer to figure 19 for instructions covering assembly of the positork drive assembly.

Note. Before installing the positork drive assembly, lubricate the splines of the armature shaft and the groove in the drive collar with grease, Specification MIL-G-3278.

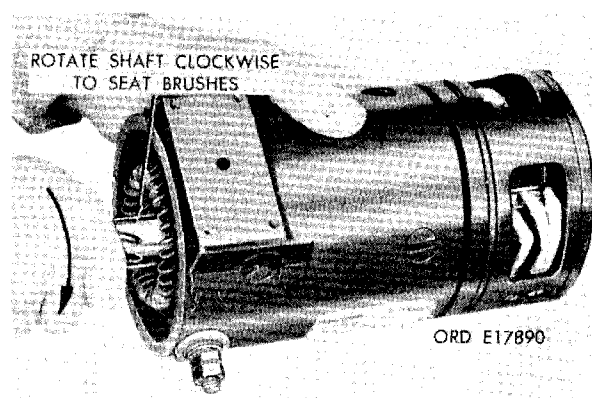


Figure 38. Rotating armature to seat brushes.

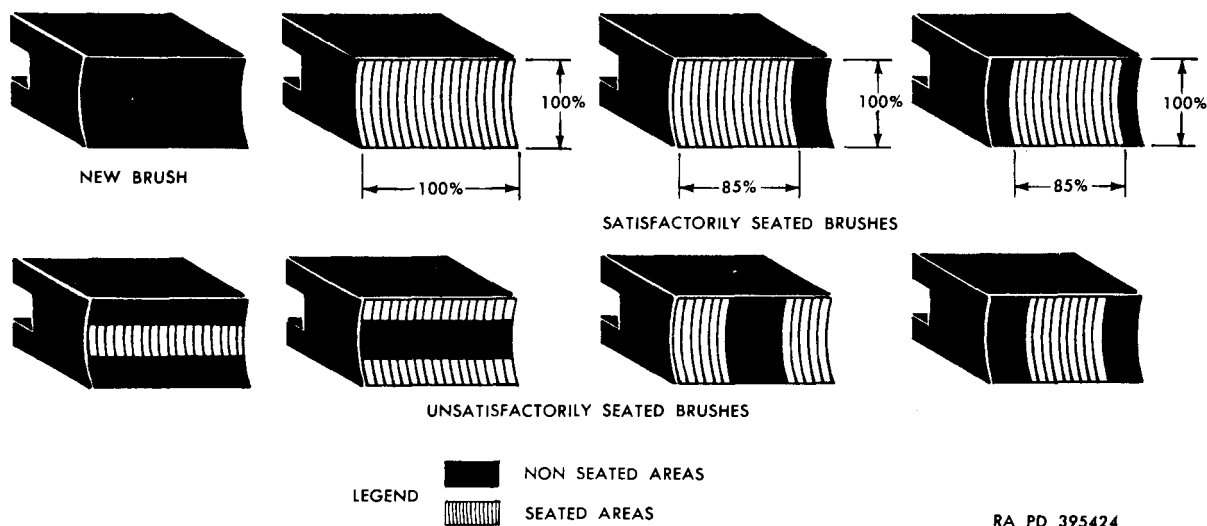


Figure 39. Examples of satisfactory and unsatisfactory brush seats.

c. Refer to figure 18 for instructions covering installation of the positork drive assembly on the armature.

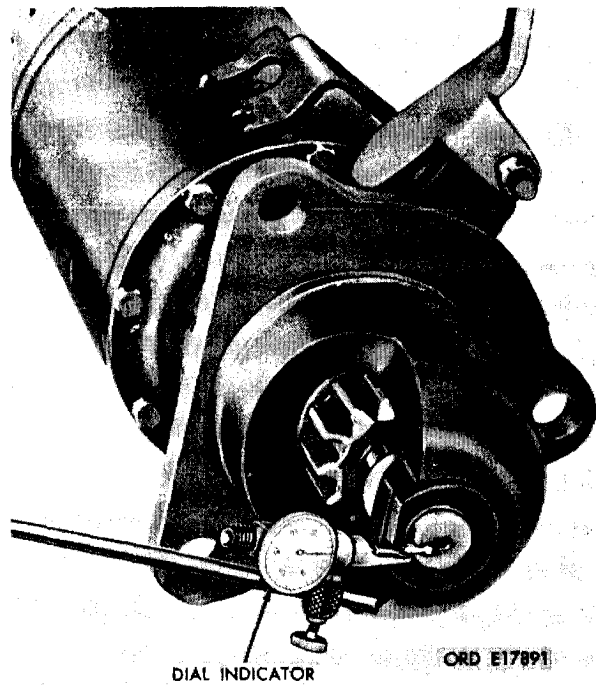


Figure 40. Measuring armature end play.

33. Pinion Housing

a. Refer to figures 17 through 13 for instructions covering assembly of the pinion housing.

Note. Before installing the lever and shaft assembly, lubricate the shaft with grease, Specification MIL-G-3278.

b. Refer to figures 12 and 11 for instructions covering installation of the pinion housing and brushes.

c. Measure the end play of the armature shaft using a dial indicator as shown in figure 40. If the end play is not between 0.005 to 0.030-inch install or remove fiber washers (A, fig. 13) as necessary. This can be accomplished by pulling the brushes out of their holders (fig. 11) and removing the commutator end head assembly (fig. 21). Replace the above parts and recheck end play.

34. Switch Assembly and End Cover

a. Refer to figures 8 through 5 for instructions covering assembly of the switch assembly.

b. Refer to figure 4 for instruction covering installation of switch assembly and the end cover.

Section V. TESTS AND ADJUSTMENTS

35. General

Whenever a starter is tested, it should be checked for any unusual noises or vibration that might indicate an unserviceable condition. If either condition exists, further testing should not be attempted and starter returned for rebuild.

36. Pinion Clearance

Check starter to make certain positork drive is fully engaged when switch energizes starter motor and pinion clearance is between 0.010 to 0.050-inch as shown in figure 41. Perform the pinion clearance check as follows:

a. Loosen locknut and turn adjusting bolt to the position shown in figure 42.

b. Use screwdriver or wrench to engage switch by compressing spring as shown in figure 43.

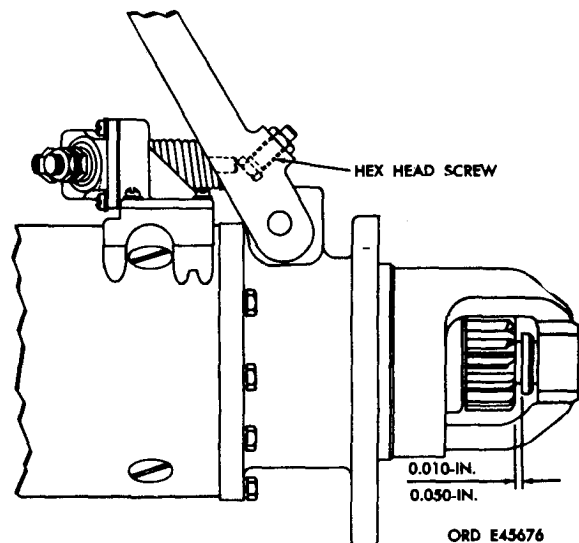


Figure 41. Measuring pinion clearance.

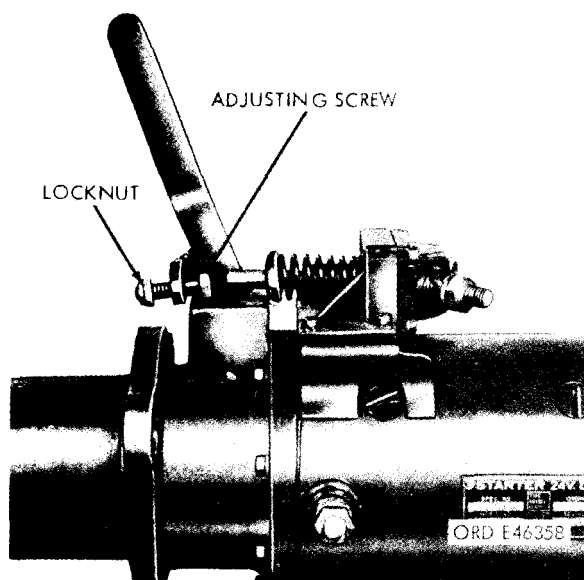


Figure 42. Adjusting bolt turned in.

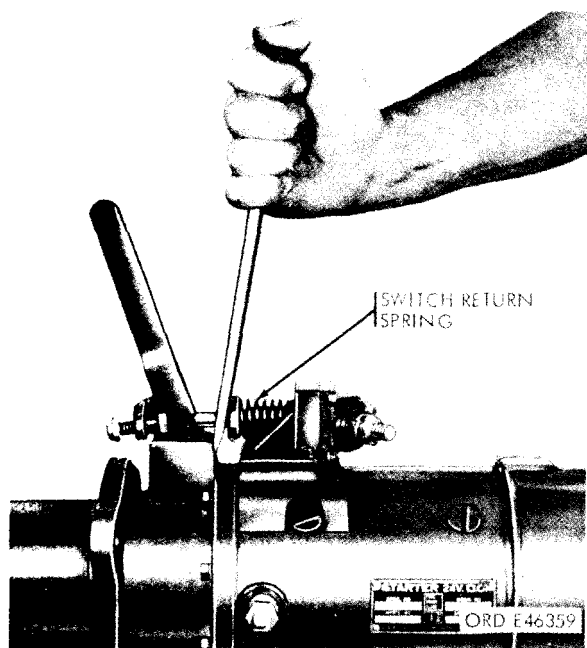


Figure 43. Compressing spring to engage switch.

c. While holding switch in engaged position, pull lever forward until positork drive comes to rest against collar and pinion stop. At this point the lever is in a near vertical position. Further movement of lever causes the 30 lb drive spring to compress. Do not compress the drive spring.

Note. In proper operation the lever and shaft assembly moves freely from initial to near vertical position. If any stickiness or binding is felt, the lever and shaft must be removed (fig. 14) and the shaft lubricated with grease, Specification MIL-G-3278.

d. With switch engaged and lever positioned, turn adjusting bolt out until the bolt head rests against the blade and plunger rod as shown in figure 44.

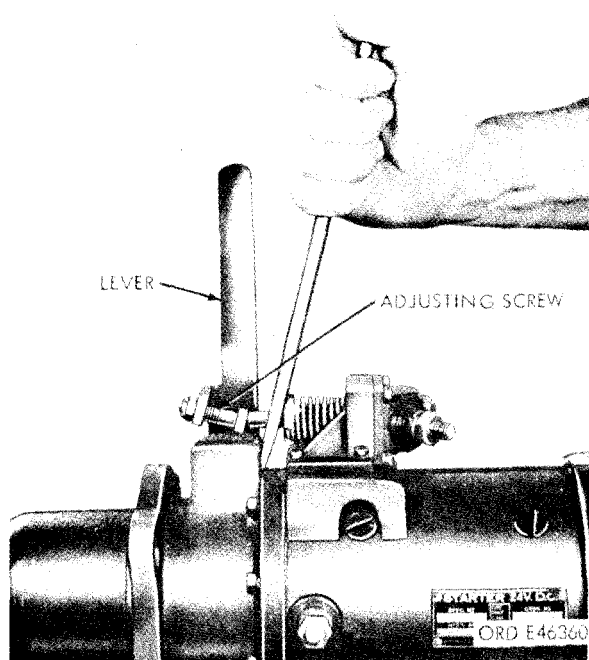


Figure 44. Head of adjusting bolt resting against blade and plunger rod.

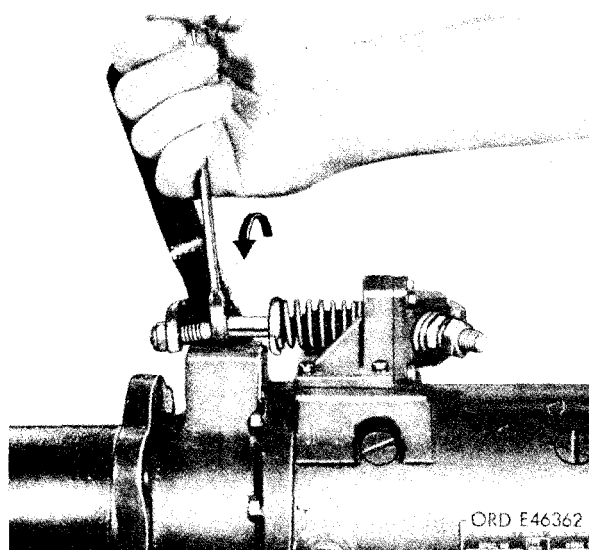


Figure 45. Turning adjusting bolt.

e. Release lever and switch.

i. Turn adjusting bolt one-half turn away from lever as shown in figure 45.

g. Tighten locknut as shown in figure 46.

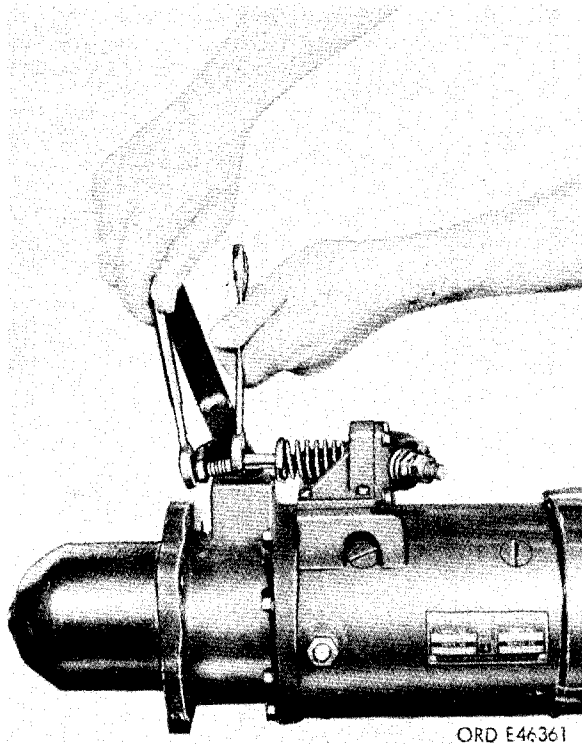


Figure 46. Tightening locknut to secure adjusting bolt.

37. No-load Test

a. Connect a 24 volt dc power source, variable resistance voltmeter, 1,000 ampere ammeter, test switch, and the starter to the test circuit as shown in figure 47. Check the current draw at the ammeter at 20 volts. It should be 65 amps. Measure the speed of rotation of the armature. It should be 5,300 rpm.

b. If a low speed and high current condition exists, check the armature for excessive arcing, grounds (fig. 29), and

shorts (fig. 30). Also examine the starter for armature drag. If drag exists, check for loose pole shoe screws and tighten as necessary; or, disassemble the starter and check for armature eccentricity (fig. 31) or faulty bearings.

c. If a low speed and low current condition exists, inspect the starter for faulty connections and for poor brush contact (fig. 39).

38. Stall Current and Torque Test

a. Connect the starter as shown in figure 47 and clamp starter down. Mount a torque arm and tension gage on the starter. Close test switch and adjust voltage to 4.0 volts. Check the current draw at the ammeter. It should be 380 amps maximum. Check the torque reading at the tension gage. Multiply tension gage reading by foot-length of torque arm to obtain stall torque. It should be 21.0 foot-pounds minimum.

b. If a high current and low torque condition exists, check for shorts and proper assembly of the starter components.

c. If a low current and low torque condition exists, check field coils (par. 26), armature (fig. 29), and brushes (fig. 39).

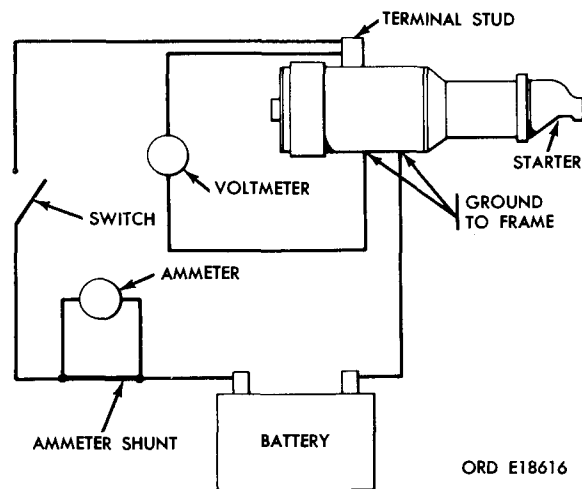


Figure 47. Starter test setup.

Section VI. REPAIR AND REBUILD STANDARDS

39. General

The repair and rebuild standards listed give maximum, minimum, and key clearances of new or rebuilt parts. They also give wear limits which indicate that point to which a part or parts may be worn before replacement, in order to receive maximum service with minimum replacement. Normally, all parts which have not been worn beyond the dimensions shown in the "Wear

limits" column or damaged from corrosion will be approved for service. An asterisk (*) in the "Wear limits" column indicates that the part or parts should be replaced when worn beyond the limits given in the "Sizes and fits of new parts" column. In "Sizes and fits of new parts" column, the letter "L" indicates a loose fit and the letter "T" indicates a tight fit. All dimensions are given in inches unless otherwise specified.

40. Starter Assembly Standards

a. Armature and Bearings.

Fig. No.	Ref. letter	Point of measurement	Sizes and fits of new parts	Wear limits	
				Field maint	Depot maint
48	a	OD of bearing -----	0.7545 to 0.7555	*	*
	b	ID of bearing -----	0.6260 to 0.6270	0.6310	0.6290
	c	Dia of bearing bore in head ---	0.7150 to 0.7520	*	*
	a-c	Fit of bearing in head -----	0.0025T to 0.0045T	*	*
	d	OF of commutator end of armature shaft -----	0.6239 to 0.6250	0.6234	0.6238
	b-d	Fit of shaft in bearing -----	0.0010L to 0.0031L	0.0076L	0.0052L
	e	Commutator diameter -----	1.6800	*	*
	f	OD of drive end of armature shaft (large dia) -----	0.8700 to 0.8720	0.8696	0.8700
	g	OD of drive end of armature shaft (small dia) -----	0.7456 to 0.7465	0.7451	0.7456
	h	Dia of bearing bore in intermediate bearing retainer -----	0.9995 to 1.0005	*	*
	j	ID of bearing -----	0.8725 to 0.8745	0.8785	0.8765
	f-j	Fit of shaft in bearing -----	0.0005L to 0.0045L	0.0089L	0.0065L
	k	OD of bearing -----	1.0030 to 1.0040	*	*
	h-k	Fit of bearing in intermediate retainer -----	0.0025T to 0.0045T	*	*
	l	Drive spring:			
		Free length -----	2.21	*	*
		Lbs compression at 1.81-inch length -----	20 lbs	*	*
	m	ID of bearing -----	0.7475 to 0.7485	0.7525	0.7505
	g-m	Fit of shaft in bearing -----	0.0010L to 0.0029L	0.0074L	0.0049L
	n	OD of bearing -----	0.8780 to 0.8790	*	*
	p	Dia of bearing bore in housing	0.8745 to 0.8755	*	*
	n-p	Fit of bearing in housing -----	0.0025T to 0.0045T	*	*

b. Brushes and Return Spring.

49	a	Return spring:			
		Free length -----	2.078	*	*
		Lbs compression at 1.25-inch length -----	41.7 lbs	*	*
50	a	Brush length -----	0.750	0.5000	*

APPENDIX I

REFERENCES

1. Supply Manuals

The following Department of the Army Supply Manuals pertain to this materiel:

a. Repair and Rebuild.

Engine, Diesel, (Multi-fuel): Turbosupercharged, Fuel Injected, TM 9-2815-204-35P
Water Cooled, 6-Cylinder (Continental Model LDS-427-2) ----- TM 9-2815-204-35P
Shop Equipment: Internal Combustion Engine Repair, Base Maintenance SM 9-4-4910-A69
Shop Equipment: Motor Vehicle, Field Maintenance, Motor Vehicle
Assembly Company ----- SM 9-4-4910-A59
Shop Set: Automotive Repair, Field Maintenance, Post, Camp or
Station, Combat or Track ----- SM 9-4-4910-A04
Shop Set: Depot Maintenance, Engine and Power Train Rebuild Company
(Armament) ----- SM 9-4-4910-J9-8
Shop Set: Depot Maintenance, Power Train Rebuild Company (Automotive) SM 9-4-4910-J9-1
Shop Set: Field Maintenance, Automotive ----- SM 9-4-4910-A38
Shop Sets: Field Maintenance, Automotive ----- SM 9-4-4910-J8-13
Shop Sets: Field Maintenance, Automotive No. 1 Supplemental ----- SM 9-4-4910-A73
Shop Sets: Field Maintenance, Automotive No. 2 Supplemental ----- SM 9-4-4910-A74
Tool Kit: Automotive Maintenance Field Ordnance Collecting Point
Company ----- SM 9-4-5180-A16
Tool Kit: General Mechanics ----- SM 9-4-5180-A58
Tool Kit: General Mechanics, Field Ordnance Park Company (Army or
COMZ) ----- SM 9-4-5180-A24

b. Vehicle.

Truck, Cargo: 2-1/2 Ton, 6 x 6, M35A1 (Multi-fuel) ----- TM 9-2320-235-35p

2. Forms

The following form pertains to this materiel. (Refer to DA Pamphlet 310-2 for index of blank forms.)

DA Form 2028, Recommended Changes to DA Technical Manual, Parts List or Supply Manual
7, 8, or 9

3. Other Publications

The following publications contain information pertinent to major item materiel and associated equipment.

a. Operation.

Operation: Truck, Cargo, 2-1/2Ton, 6x6, M35A1 (Multi-fuel) ----- TM 9-2320-235-10
Organizational Maintenance: Truck, Cargo, 2-1/2 Ton, 6 x6, M35A1
(Multi-fuel) ----- TM 9-2320-235-20

b. Maintenance and Repair.

Engine, Diesel; (Multi-fuel): Turbosupercharged, Fuel Injected,
Water Cooled, 6-Cylinder (Continental Model LDS-427-2) ----- TM 9-2815-204-35
Field Maintenance, Consolidated Authorized Field Stockage List of
Repair Parts for Tank Automotive Materiel ----- TM 9-2300-223-34P

APPENDIX II

REPAIR PARTS LIST

Section I. PREFACE

1. General

a. This appendix contains an illustrated list of repair parts allocated to Field and Depot Maintenance columns and indicates the estimated quantities of component parts and equipment authorized for support of field and depot maintenance.

b. For fifth echelon, this list serves as a guide for recommended repair parts for the rebuild of 100 major components and/or major end items.

c. The non-supply items are not stocked for-issue and are contained herein for identification only.

Note. Every individual part is not necessarily stored by itself; many parts are stored as authorized kits, sets, or assemblies. Such items are indicated herein. Their components are listed individually. Components of an assembly are bracketed to indicate their relationship in the assembly, whereas components of kits or sets are indicated by their index numbers. When a complete illustration consists only of the components of a kit or set, these components will not be bracketed and will bear different main index numbers.

d. For prices of Ordnance items listed herein, see the appropriate supply manual of the SM 9-2 series, Stock List of All Items-Price List. Prices of items that are the responsibility of material agencies other than Ordnance may be obtained from the appropriate type 2 supply manuals for those services.

e. Additional applications of items in this manual are listed in the supply manuals of the SM 9-3 series, Stock List of Repair Parts.

2. Illustration and Text Relationship

a. Illustrated supply items are keyed by numbers to their text listing.

b. Non-supply items will be identified by name and part number in legend on the illustration and the identifying key number will be encircled to indicate non-supply status.

c. Lower case key letters are reference points for repair standards listed in the maintenance portion of this manual.

3. Requisition Notes

a. If the exact item requisitioned is not furnished, or if other action is necessary, the exact nature of the action taken by the supplying agency will be indicated by standard symbols on prescribed forms.

b. When requisitioning an item, the requesting agency will order the listed item. However, the supplying agencies will take necessary action to issue the exhaust stock item until stock is exhausted, whether it be an individual item, kit, set, or assembly.

4. Explanation of Columns

a. Illustrations. This column indicates the figure number of the illustration that depicts the item. When more than one item appears on the illustration, the item number is also indicated.

b. Source, Maintenance, and Recoverability Code. This column lists a code that indicates the selection status and source of supply of the repair part, the lowest echelon authorized to install or manufacture the repair part, and the recoverability and expendability aspects of the repair part. An example of this code is P-O-R. The "P" indicates that the item is a mission stockage list repair part procured and stocked on a national program basis, the "O" indicates the repair part is authorized to organizational echelons, and the "R" indicates that the repair part is an expendable, recoverable item. These codes will vary and contain different combinations of numbers and letters that pertain to the pertinent item being coded. Refer to paragraph 6b. "Symbols" for the identification of all symbols contained within this column.

c. Federal Stock Number. This column lists the Federal Stock Number assigned by the Cataloging Division, Armed Forces Supply Support Center.

d. Description. The Federal Item name (shown in capital letters) and any additional description required for supply op-

erations are listed in this column. All dimensions listed are in inches unless otherwise specified. For further identification, the materiel agency or manufacturer's part number is parenthetically listed at the end of each nomenclature.

e. Unit of Issue. The Unit of Issue column lists the actual unit of issue for each item (ea, ft, bulk, etc.).

i. Quantity Incorporated in Unit. The Quantity Incorporated in Unit column indicates the number of these parts required for the particular use indicated.

g. 15-day Maintenance Allowance Per 100 Major Items. No quantities are listed in these columns. Refer to TM 9-2300-223-34P for allowance factors for items to be stocked. If any item appears herein and is not listed in TM 9-2300-223-34P, it can be requisitioned as required for immediate use only.

h. Depot Maintenance Guide Per 100 Major Items.

- (1) This column lists the guide quantity factors for the repair parts recommended for the rebuild of 100 major components and/or major end items.
- (2) The quantities indicated in this column are for initial requisition. They will be revised by the depot organization to conform to actual usage, which may be more or less than the quantities indicated herein.
- (3) Since the allowance factors are based on 100 equipments, it is necessary to compute the exact quantity authorized. This quantity is determined by the use of a simple mathematical formula. Resulting fractional values of 0.5 or larger will be rounded to the next higher number. Fractional values below 0.5 will be rounded to the next lower number.

Example 1: If the number of equipments supported is 30, and the allowance factor for 100 equipments is 1.9, the following computation would be made:

$$\frac{30 \times 1.9}{100} = 0.57$$

Since the resulting figure is larger than 0.5, the echelon would be authorized a quantity of 1.

Example 2: If the number of equipments supported is 89, and the allowance factor for 100 equipments is 3.4, the following computation would be made:

$$\frac{89 \times 3.4}{100} = 3.026$$

In this instance, the result is rounded to the next lower whole number since the fractional value is less than 0.5 and the echelon would be authorized a quantity of 3.

5. How To Find Parts

Parts may be located by referring to the Table of Contents which lists the titles of all illustrations. Refer to paragraph 2, in this appendix, for an explanation of illustration and text relationship.

6. Abbreviations and Symbols

a. Abbreviations.

alw	-----	allowance
assy	-----	assembly(ies)
br	-----	brass
cd-	or zn-chromate-fin.	-- cadmium or zinc chromate finish
cd-	or zn-pltd	----- cadmium or zinc plated
cop.	-----	copper
DA	-----	Department of the Army
dir	-----	direct
ea	-----	each
ech	-----	echelon
e.g.	-----	for example
equip.	-----	equipment
etc.	-----	and so forth
fig.	-----	figure
fil-hd	-----	fillister head
fl-hd	-----	flat head
FM	-----	field manual
ft	-----	feet(foot)
hex-hd	-----	hexagon head
id	-----	inside diameter
i.e.	-----	that is
illust	-----	illustration
in.	-----	inch
inc	-----	incorporated
gen	-----	general
lg	-----	long
lt	-----	light(weight)
maint	-----	maintenance
med	-----	medium
NC	-----	American National Coarse Thread
NF	-----	American National Fine Thread
no.	-----	number
od	-----	outside diameter,
		olive drab
ORD	-----	O r d n a n c e

qty ----- quantity
 rd-hd ----- round head
 s ----- --s- teal
 SM ----- supply manual
 sup ----- support
 thk ----- thick
 TM ----- technical manual
 tn-pltd ----- tin plated
 UNF ----- Unified National Fine
 wd ----- wide(width)

b. Symbols.

(1) Source, maintenance, and recoverability code.

(a) Source code.

P Applies to repair parts which are high mortality parts, procured by materiel agencies, stocked in and supplied from the materiel agency depot system, and authorized for use at indicated maintenance echelons.

X1 Applies to repair parts which are not procured or stocked, the requirements for which will be supplied by use of next higher component or assembly.

(b) Maintenance code.

O Organizational Maintenance (2nd echelon)

F Field Maintenance (3rd echelon)

(c) Recoverability code.

R Indicates an item or assembly that is expendable and recoverable and is economically repairable and, when available, is furnished by supply on an exchange basis.

(2) Miscellaneous symbols.

‡ As required.

☆☆ Indicates items available as part of SET or KIT shown.

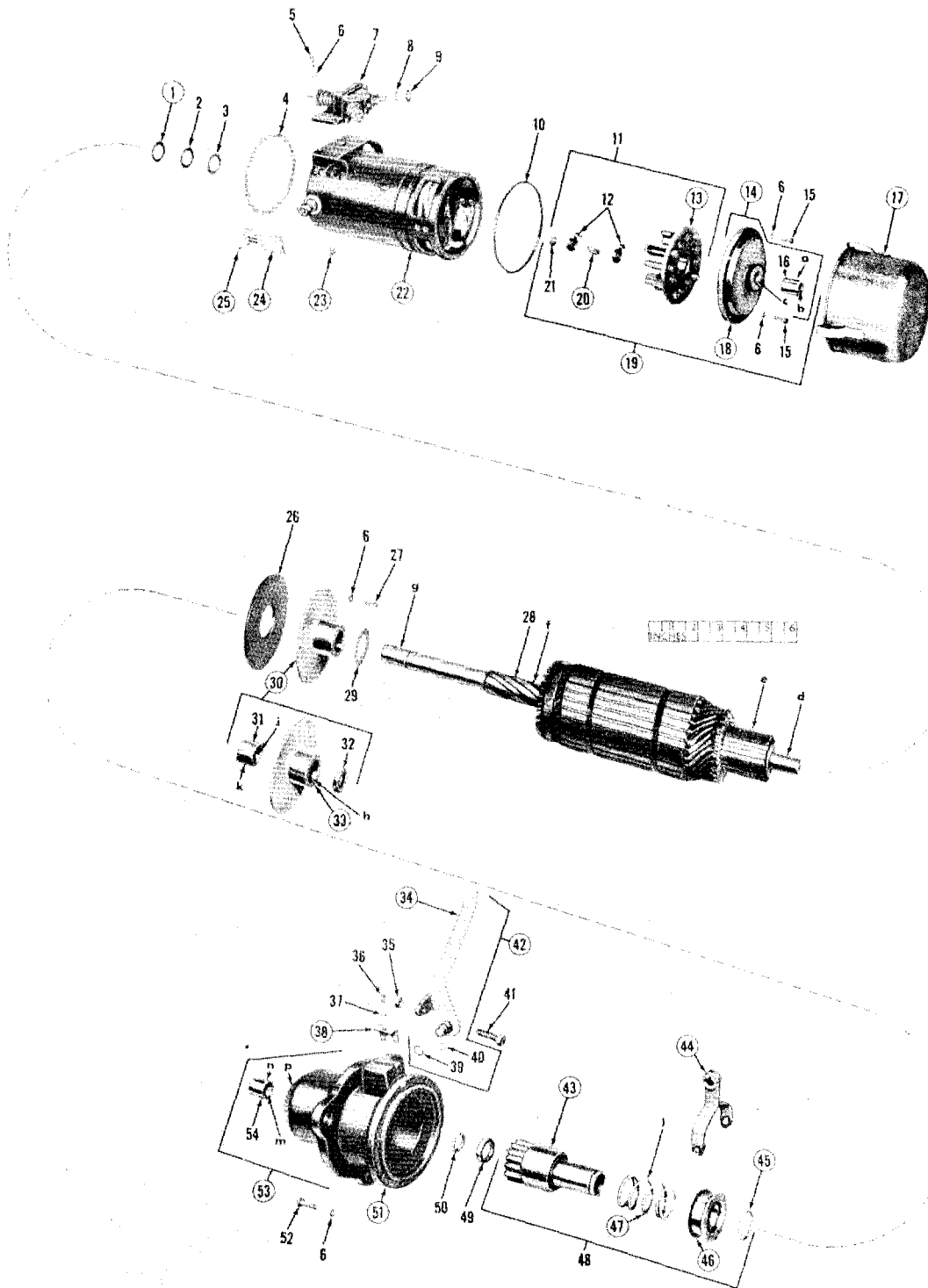
7. **Manufacturer's Symbols**

<u>Symbol</u>	<u>Former Symbol</u>	<u>Manufacturer</u>
19728	AL	The Electric Auto-Lite co.
96906	MS	Military Standard

8. **Suggestions and Recommendations**

Notice of discrepancies and recommendations for additions and deletions of repair parts and special tools should be forwarded on DA Form 2028 to Commanding General, U.S. Army Tank Automotive Center, 28251 Van Dyke, Warren, Michigan, ATTN: SMOTA-FM. 48090

(1) ILLUST		(2) SOURCE, MAINT AND RECOVERABILITY CODE				(3) FEDERAL STOCK NO	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) QTY INC IN UNIT	(7) 15-DAY MAINT ALW PER 100 EQUIP		(8) DEPOT MAINT GUIDE PER 100 EQUIP (5TH ECH)
(a) FIG	(b) ITEM NO	(a) MATERIAL CODE	(b) SOURCE	(c) MAINTENANCE LEVEL	(d) RECOVERABILITY					(a) 3RD ECH (DIR SUP)	(b) 4TH ECH (GEN SUP)	
1			P	O	R	2920-852-5483	<p>SECTION II</p> <p><u>FIELDAND DEPOT MAINTENANCE REPAIR PARTS</u></p> <p>STARTER, ENGINE ELECTRICAL: assy (7748881) ----</p> <p>Note.</p> <p>Refer to field and depot maintenance re- pair parts manual TM 9-2815-204-35P for 6 cylinder, water cooled, fuel injected, turbosupercharged, multi- fuel engine as- sembly (Continental model LDS-427-2) for listing of starter assembly, attaching, and associated parts and their issue al- lowances.</p>	ea	±			



ORD F45677

Figure 48. Engine Electrical Starter Assembly (2920-852-5483)-Exploded View.

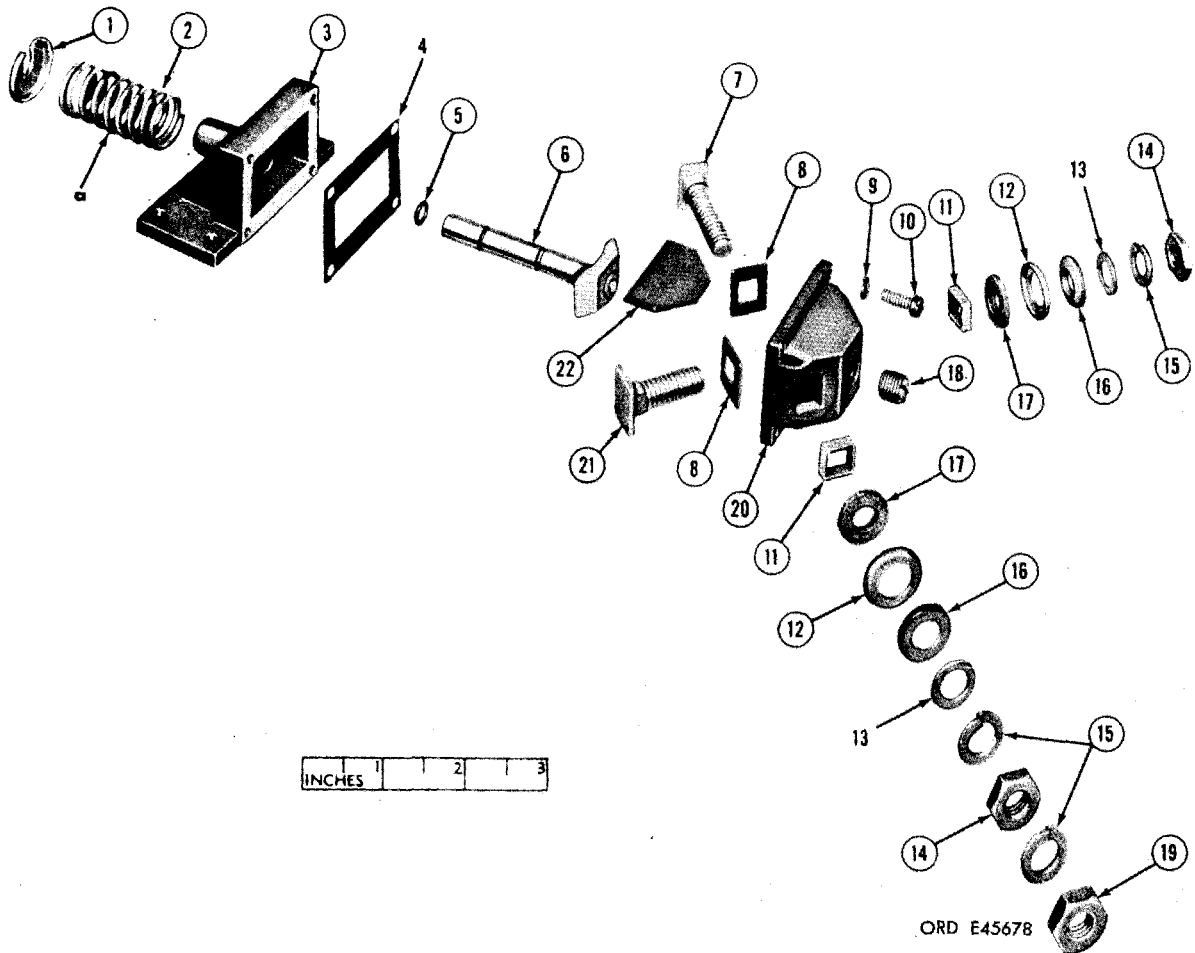
(1) ILLUST		(2) SOURCE, MAINT AND RECOVERABILITY CODE				(3) FEDERAL STOCK NO	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) QTY INC IN UNIT	(7) 15-DAY MAINT ALW PER 100 EQUIP		(8) DEPOT MAINT GUIDE PER 100 EQUIP 15TH ECH
(a) FIG NO	(b) ITEM NO	(a) MATERIEL CODE	(b) SOURCE	(c) MAINTENANCE LEVEL	(d) RECOVERABILITY					(a) 3RD ECH (DIR SUP)	(b) 4TH ECH (GEN SUP)	
48	2		P	F		3120-530-8275	Engine Electrical Starter Assembly (fig. 48) WASHER, THRUST: (fiber) commutator end head to commutator (5308275)	ea	1			50
	3		P	F		5330-534-6760	WASHER, NONMETALLIC: (fiber) commutator end head to commutator (5346760)	ea	1			50
	4		P	F		2920-886-2989	GASKET: frame to pinion housing (10917157) ----	ea	1			100
	5		P	F		5305-013-2110	SCREW, MACHINE: fil-hd, S, cd-pltd, no. 10-32NF-2 x 7/16 in. lg (switch to frame) (132110)	ea	4			40
	6		P	F		5310-043-1680	WASHER, LOCK: split, lt, S, tn-pltd, no. 10 screw size (switch to frame (4), commutator end head to frame (4), brush carrying plate to commutator end head (4), pinion housing to frame (8), intermediate bearing to pinion housing (4)) (431680)	ea	24			240
	7		P	O	R	2920-322-9613	SWITCH ASSEMBLY, STARTER, ENGINE: (Refer to fig. 49.) (8328134)	ea	1			10
	8		P	F		5310-043-2646	WASHER, LOCK: split, lt, S, tn-pltd, 3/8 in. bolt size (switch terminals) (432646)	ea	2			20
	9		P	O		5310-734-7571	NUT, PLAIN, HEXAGON: br orcop., 3/8-16UNC-2A, 5/8 in. wd across flats (switch terminals) (7347571)	ea	2			20
	10		P	F		5330-197-9582	PACKING, PREFORMED: "O" ring, 4.734 id, 5.012 od, 0.139 in. thk (commutator end head to frame) (546884)	ea	1			10
	11		P	F		5977-353-7343	PLATE ASSEMBLY: brush (10921612) -----	ea	1			10
	12	X1					SPRING: brush (☆ ☆ PARTS KIT - 5702664) (19728-MBD-19C)	ea	8			
	15		P	F		5305-013-2119	SCREW, MACHINE: fil-hd, S, cd-pltd, no. 10-32NF-2 x 5/8 in. lg (commutator end head to frame (4), brush carrying plate to commutator end head (4)) (7744780)	ea	8			80
	16		P	F		2920-293-5041	BEARING, SLEEVE: commutator end head (7706704)	ea	1			10
	21	X1					CLIP: brush holder post (☆ ☆ PARTS KIT - 5702664) (19728-GG-81B)	ea	4			
	26		P	F		5330-879-3011	GASKET: fiber (intermediate bearing to pinion housing) (10917163)	ea	1			20

- | | |
|---|---|
| 1. WASHER (19728-MAK-61) | 30. BEARING ASSY (19728-MBD-1451) |
| 13. PLATE (No Number) | 33. BEARING (No Number) |
| 14. HEAD AND BUSHING ASSY (19728-MBD-1448) | 34. LEVER (19728-MBD-1452) |
| 17. COVER (19728-MBD-1447) | 38. PLATE (19728-MBD-445) |
| 18. HEAD (19728-MBD-448) | 42. LEVER AND SHAFT ASSY (19728-MBD-2452) |
| 19. HEAD ASSY (19728-MBD-2448) | 43. DRIVE (10917175) |
| 20. SPACER (19728-MBD-47A) | 44. YOKE (19728-MBD-2449) |
| 22. FRAME AND FIELD ASSY (Refer to fig. 50.) (19728-MBD-2435) | 45. RING (No Number) |
| 23. PLUG (19728-X-865A) | 46. COLLAR (No Number) |
| 24. PLATE (19728-MBD-455) | 47. SPRING (19728-8CZ-71) |
| 25. SCREW (19728-19X-453) | 51. HOUSING (19728-PS-408) |
| | 53. HOUSING ASSY (19728-1408) |

Figure 48. Engine Electrical Starter Assembly (2920-852-5483) - Exploded View - Continued.

(1) ILLUST		(2) SOURCE, MAINT AND RECOVERABILITY CODE				(3) FEDERAL STOCK NO	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) QTY INC IN UNIT	(7) 15-DAY MAINT ALW PER 100 EQUIP		(8) DEPOT MAINT GUIDE PER 100 EQUIP (5TH ECH)
IG	IO	(a) ITEM NO	(a) MATERIAL CODE	(b) SOURCE	(c) MAINTENANCE LEVEL	(d) RECOVERABILITY				(a) 3RD ECH (DIR SUP)	(b) 4TH ECH (GEN SUP)	
48		27					SCREW, MACHINE: rd-hd, slotted, S, no. 10-32NF x 1/2 in. lg (intermediate bearing pinion housing) (for field service use SCREW - 5305-043-6750) (19728-19X-309)		4			
		27		P	F		5305-043-6750 SCREW, MACHINE: S, cd- or zn-chromat e-fin., no. 10-32 NF-2A x 1/2 in. lg (intermediate bearing pinion housing) (96906-35226-63)	ea	4			40
		28		P	F		2920-886-2990 ARMATURE, MOTOR: (10917176) -----	ea	1			10
		29		P	F		5330-883-2237 WASHER: flat, fiber (armature to intermediate bearing) (10917159)	ea	1			20
		31		P	F		3120-287-9082 BEARING, SLEEVE: intermediate (10917158) -----	ea	1			20
		32		P	F		5330-820-1626 SEAL, PLAIN, ENCASED: intermediate bearing (10917165)	ea	1			100
		35					NUT, SELF-LOCKING, HEXAGON: "Elastic Stop" type, S, cd- or zn-pltd, 5/16 -24NF (shift lever and shaft) (for field service use NUT - 5310-665-6687) (19728-19X-1681)		1			
		35		P	F		5310-655-6687 NUT, SELF-LOCKING, HEXAGON: S, cd- or zn-pltd, 5/16 -24UNF-3B, 1/2 wd, 1/4 in. thk (shift lever and shaft) (96906-20365-524C)	ea	1			10
		36		P	F		5305-013-1958 SCREW, MACHINE: fil-hd, S, no. 8-32NF x 5/16 in. lg (retainer plate to pinion housing) (131958)	ea	1			10
		37		P	F		5310-042-6678 WASHER, LOCK: split, med, S, tn-pltd, no. 8 screw size (shift lever retainer plate) (426678)	ea	1			10
		39		P	F		5330-541-2476 PACKING, PREFORMED: "O" ring, 0.426 id, 9/16 od, 0.070 in. thk (shift lever shaft) (96906-28775-13)	ea	1			100
		40		P	F		5315-715-1699 KEY, WOODRUFF: shift lever shaft (96906-35756-6)	ea	1			10
		41					BOLT, MACHINE: S, cd- or zn-pltd, 5/16 -24NF x 1-1/4 in. lg (shift lever and shaft) (for field service use BOLT - 5306-754-4208) (19728-19X-863)		1			
		41		P	F		5306-754-4208 BOLT, MACHINE: hex-hd, cd- or zn-chromate-f in., 5/16 -24UNF-2A x 2-1/4 in. lg (shift lever and shaft) (96906-35292-36)	ea	1			10
		48		P	F		2920-884-4836 DRIVE, ENGINE, ELECTRICAL STARTER: (10917175)	ea	1			20
		49		P	F		2920-884-4837 COLLAR, SHAFT: snap ring pinion stop (10917162)	ea	1			10
		50		P	F		5340-879-0641 RING, RETAINING: pinion stop (10917160) -----	ea	1			100
		52		P	F		5306-878-8205 BOLT, MACHINE, HEXAGON HEAD: S, cd- or zn-pltd, no. 10-32NF-3 x 7/8 in. lg (pinion housing to frame) (10885757)	ea	8			80
		54		P	F		2920-886-2991 BEARING, SLEEVE: bushing-type (pinion housing) (10917161)	ea	1			20

(1) ILLUST		(2) SOURCE, MAINT AND RECOVERABILITY CODE				(3) FEDERAL STOCK NO	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) QTY INC IN UNIT	(7) 15-DAY MAINT ALWY PER 100 EQUI		(8) PER 100 EQUIP (5TH ECH)
(a) FIG NO	(b) ITEM NO	(a) SOURCE	(b) MAINTENANCE CODE	(c) RECOVERABILITY CODE	(d) RECOVERABILITY CODE					(a) 3RD ECH (DIR SUP)	(b) 4TH ECH (GEN SUP)	
49	4	P	O			2920-622-0643	GASKET: switch blade housing to switch body (8328062)	ea	1			12
	13	P	O			5310-734-7568	WASHER: plain, 3/8 id (switch to terminal) (7347568)	*	2			10



NON-SUPPLY ITEMS

- | | | |
|------------------------------------|-----------------------------|-------------------------------|
| 1. RETAINER (8328063) | 9. WASHER (431680) | 16. BUSHING (19728-MCS-67) |
| 2. SPRING (8328064) | 10. SCREW (19728-19X-119) | 17. GASKET (19728-MCS-78) |
| 3. BODY (19728-MCZ-69) | 11. BUSHING (19728-MCS-69) | 18. PLUG (19728-X-865A) |
| 5. PACKING (8328066) | 12. RETAINER (19728-MCS-76) | 19. NUT (7000369) |
| 6. BLADE AND PLUNGER ROD (8328065) | 14. NUT (7347571) | 20. HOUSING (19728-MCZ-73) |
| 7. TERMINAL (19728-MCS-1060) | 15. WASHER (432646) | 21. TERMINAL (19728-MCZ-1060) |
| 8. WASHER (19728-MCS-63) | | 22. INSULATOR (19728-MCZ-62) |

Figure 49. Starter Switch Assembly (2920-322-9613) - Exploded View.

(1) ILLUST		(2) SOURCE, MAIN AND RECOVERABILITY CODE				(3) FEDERAL STOCK NO	(4) DESCRIPTION	(5) INIT OF ISUE	(6) QTY INC IN INI	(7) 15-DAY MAINT ALW PER OO EQUIP	(8) PER 100 EQUIP (KTH EPM)
(a) FIG NO	(b) TEM NO	(a) SOURCE FIELD	(b) SOURCE	(c) MAINTENANCE	d						
50	4		X1				Frame and Field Assembly (fig. 50)				
	5		X1				BRUSH: electrical contact (☆ ☆ PARTS KIT - 5702664) (19728 -MBD-12D)		1		
	8		X1				BRUSH: electrical contact (☆ ☆ PARTS KIT - 5702664) (19728 -MBD-13D)		1		
	9		X1				BRUSH: electrical contact (☆ ☆ PARTS KIT - 5702664) (19728 -MBD-13F)		2		
	10		X1				BRUSH: electrical contact (☆ ☆ PARTS KIT - 5702664) (19728 -MBD-12E)		2		
	17		P	F		5310-013-4570	SCREW, MACHINE: f1-hd, cd-pltd, no. 10-32NF-2 x 1/2 in. lg (brush retaining) (☆ ☆ PARTS KIT - 5702664) (19728-19X-66)		4		
	18						NUT, PLAIN HEXAGON: 3/8-16NC (starter frame terminal) (7000369)	ea	1		10
	18		P	F		5310-045-1817	NUT, PLAIN, HEXAGON: 3/8-16NC (starter frame terminal) (for field service use NUT -5310-045-1817) (19728-X-2852)		1		
	19		P	F		5310-043-2646	NUT, PLAIN, HEXAGON: br, plain-fin., 3/8-16UNC-2B, 5/8 wd, 13/64 in. thk (frame terminal) (451817)	ea	1		10
	21		K1				WASHER, LOCK: split, lt, S, tn-pltd, 3/8 in. screw size (starter frame terminal) (432646)	ea	2		20
	22		K1				BRUSH: electrical contact (☆ ☆ PARTS KIT - 5702664) (19728 -MBD-13C)		1		
							BRUSH: electrical contact (☆ ☆ PARTS KIT - 5702664) (19728 -MBD-12C)		1		

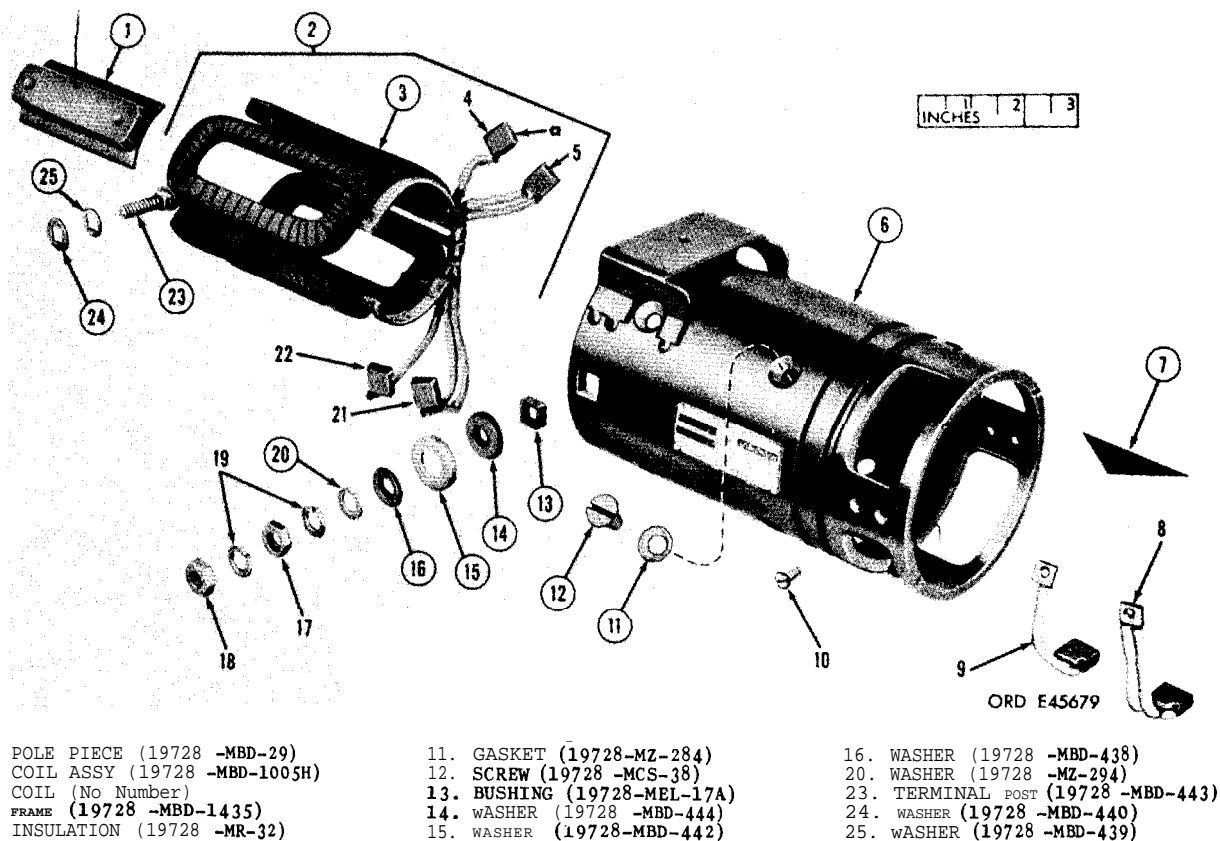


Figure 50. Frame and Field Assembly - Exploded View.

(1) ILLUST		(2) SOURCE, MAINT AND RECOVERABILITY CODE				(3) FEDERAL STOCK NO	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) QTY INC IN UNIT	(7) 1 5-DAY MAINT ALW PER 100 EQUIP		(8) DEPT MAINT GUIDE
(a)	(b)	(a)	(b)	(c)	(d)					(a)	(b)	
FIG NO	ITEM NO	MATERIAL CODE	SOURCE	MAINTENANCE LEVEL	RECOVERABILITY					3RD ECH (DIR SUP)	4TH ECH (GEN SUP)	
51			P	F		2920-882-5941	<u>Electrical Contact Brush Parts Kit (fig. 51)</u> PARTS KIT: brush and spring (5702664) ----- Compo sed of: BRUSH: electrical contact (19728 -MBD-13C) BRUSH: electrical contact (19728 -MBD-12C) SCREW, MACHINE: fl-hd, no.10-32NF-2 x 1/2 in. lg (brush retaining) (19728- 19X-66) BRUSH: electrical contact (19728 -MBD-12E) BRUSH: electrical contact (19728 -MBD-13F) BRUSH: electrical contact (19728 -MBD-12D) BRUSH: electrical contact (19728 -MBD-13D) CLIP: brush holder post (19728 -GG-81B) ----- SPRING: brush (19728 -MBD-19C) -----	ea	1			
	1						BRUSH: electrical contact (19728 -MBD-13C)	ea	1			
	2						BRUSH: electrical contact (19728 -MBD-12C)	ea	1			
	3						SCREW, MACHINE: fl-hd, no.10-32NF-2 x 1/2 in. lg (brush retaining) (19728- 19X-66)	ea	4			
	4						BRUSH: electrical contact (19728 -MBD-12E)	ea	2			
	5						BRUSH: electrical contact (19728 -MBD-13F)	ea	2			
	6						BRUSH: electrical contact (19728 -MBD-12D)	ea	1			
	7						BRUSH: electrical contact (19728 -MBD-13D)	ea	1			
	8						CLIP: brush holder post (19728 -GG-81B) -----	ea	4			
	9						SPRING: brush (19728 -MBD-19C) -----	ea	8			

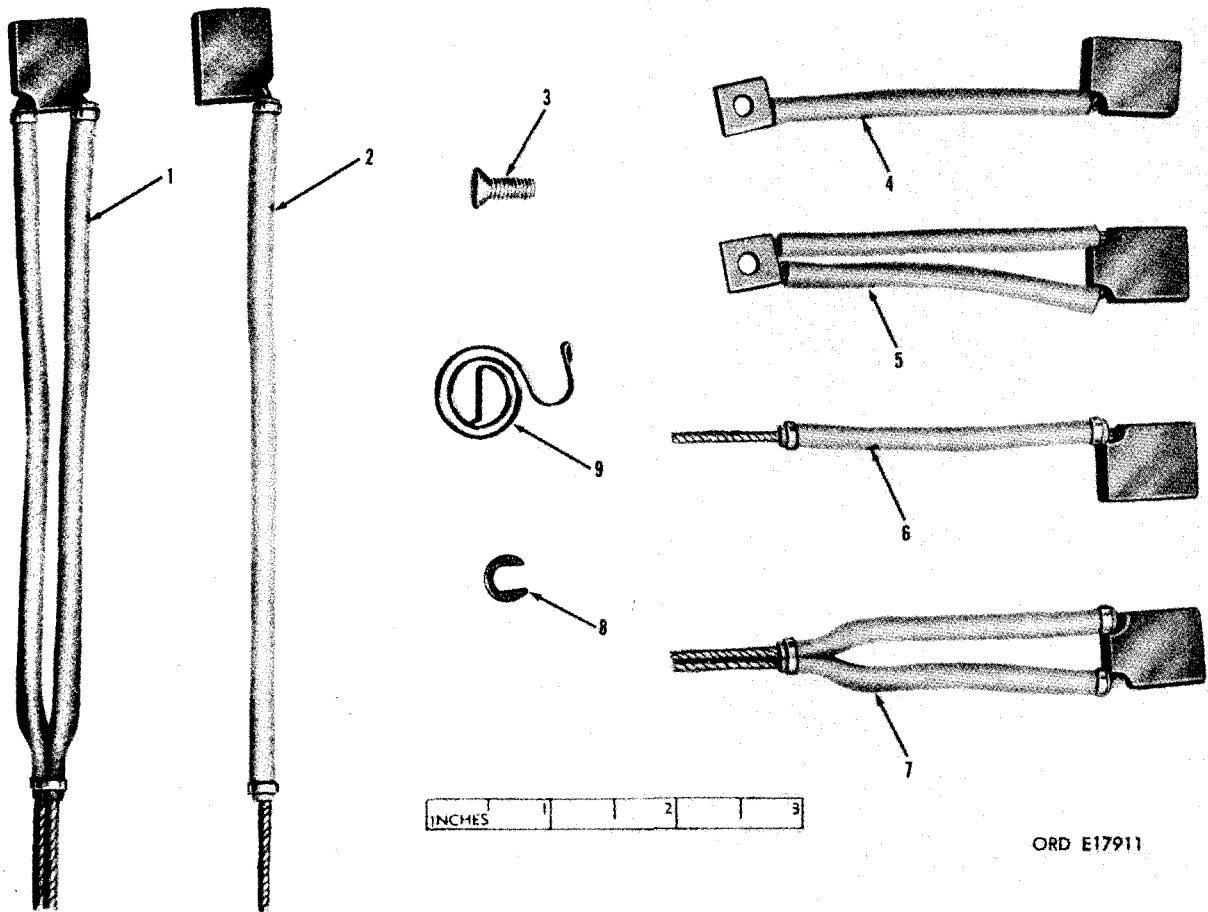


Figure 51. Electrical Contact Brush Parts Kit.

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NG: State AG (3).

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For explanation of abbreviations used, see AR 320-50.

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