

*W. S. Willford*

WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE

POWER TRAIN FOR LIGHT TANKS

M3 AND M3A1

APRIL 8, 1942

Ord. Officer	<i>[Signature]</i>
Asst. Ord. Officer	<i>[Signature]</i>
Maint. Officer	.....
Prop. Officer	.....
Shop Officer	.....

TECHNICAL MANUAL }  
 No. 9-1728 }

WAR DEPARTMENT,  
 WASHINGTON, April 8, 1942.

**ORDNANCE MAINTENANCE**  
**POWER TRAIN FOR LIGHT TANKS M3 AND M3A1**

Prepared under the direction of the  
 Chief of Ordnance

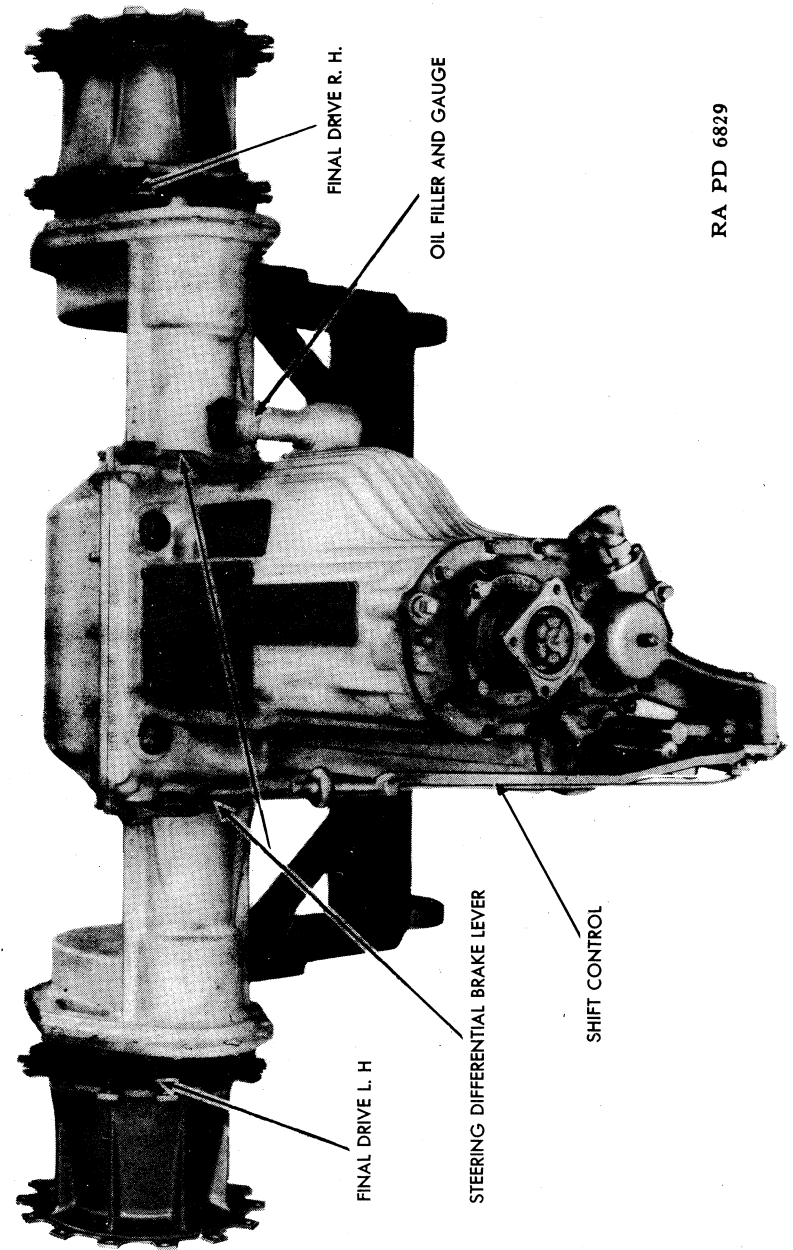
	Page
SECTION I. Introduction .....	2-3
II. Description .....	4-6
III. Trouble shooting .....	7-9
IV. Removal of transmission and final drive from vehicle	10-21
V. Inspection after removal.....	22
VI. Disassembly of transmission.....	23-51
VII. Disassembly, inspection, repair and assembly of transmission components .....	52-86
VIII. Assembly of transmission.....	87-110
IX. Disassembly of final drive.....	111-114
X. Inspection, repair and assembly of final drive components .....	115-121
XI. Final drive assembly.....	122-125
XII. Installation of transmission and final drives in vehicle .....	126-133
XIII. Special tools and equipment.....	134-154
XIV. References .....	155-156
Index .....	157-164

SECTION I  
INTRODUCTION

	Paragraph
Scope .....	1
Illustrative material .....	2

1. **Scope.**—This manual is published to provide information and guidance for ordnance personnel. It contains detailed instructions for disassembly, inspection, assembly, maintenance, and repair of the transmission and final drives used at present in the light tank M3. The information and instruction in this manual is supplementary to that to be found in the Field and Technical Manuals prepared for the personnel of the using arms.

2. **Illustrative material.**—Illustrations of specific operations are included to support and clarify the descriptive matter in the text. Exploded views of sub-assemblies are shown in the sections devoted to the inspection and repair of the different components. This is done to show graphically the correct relation of related parts and to aid in identification. The line drawings in Section VIII are provided in order that the special tools, which are not available, may be made up by the ordnance personnel.



RA PD 6829

FIGURE 1—Power train—rear view.

SECTION II  
DESCRIPTION

	Paragraph
Description .....	3
Construction .....	4
Characteristics .....	5
Allocation of maintenance operations.....	6

3. **Description.**—The transmission used in the light tank M3 has five forward speeds and one reverse. First speed and reverse are through sliding gears. Second, third, fourth and fifth speeds are synchromesh. Synchromesh is the name given to a type of transmission in which, by various means, the two members (or gears) to be engaged are brought to the same surface speed before actual engagement can be completed. The transmission case houses the bevel gear set and the controlled differential as well as the transmission proper. On the outer ends of the transmission case are carried the final drive housings which enclose the final drive gears and shafts through which the drive to the track is taken.

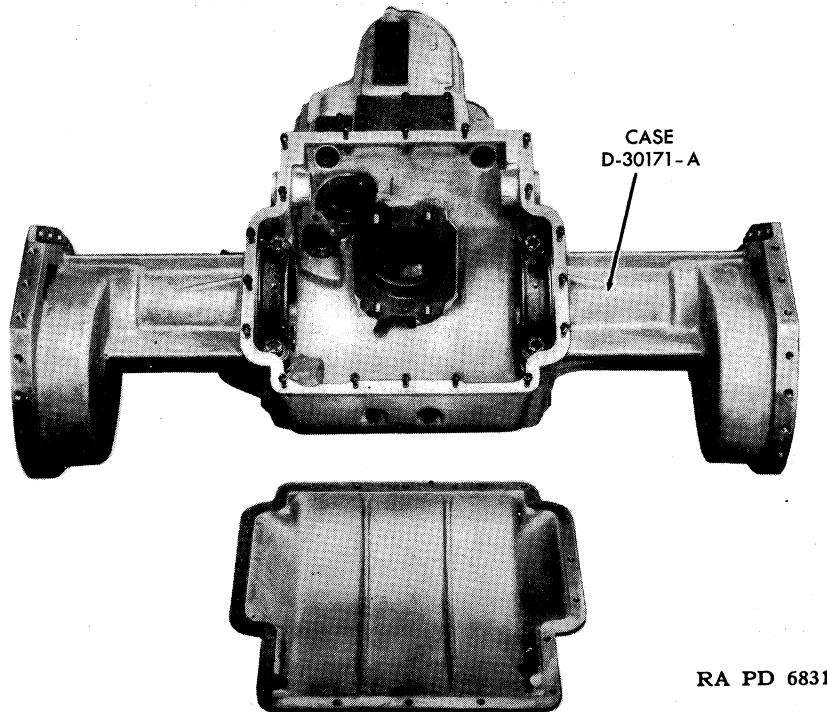


FIGURE 2—Transmission case and cover.

4. **Construction.**—The transmission case is an aluminum alloy casting with cast iron inserts or steel sleeves at all points where bearings are located. The final drive housings and final drive sprocket hubs are

DESCRIPTION

steel castings. The bevel gear set and differential unit are located in the front chamber of the transmission case; the input and output shafts are located in the rear chamber. The differential chamber and transmission proper are open to each other so that oil from the slightly elevated transmission flows to the differential chamber, lubricating the bevel and differential gears and bearings. Here the oil is picked up by two suction lines from the transmission oil pump, recirculated through the transmission oil cooler and returned to the gears and needle bearings of the transmission.

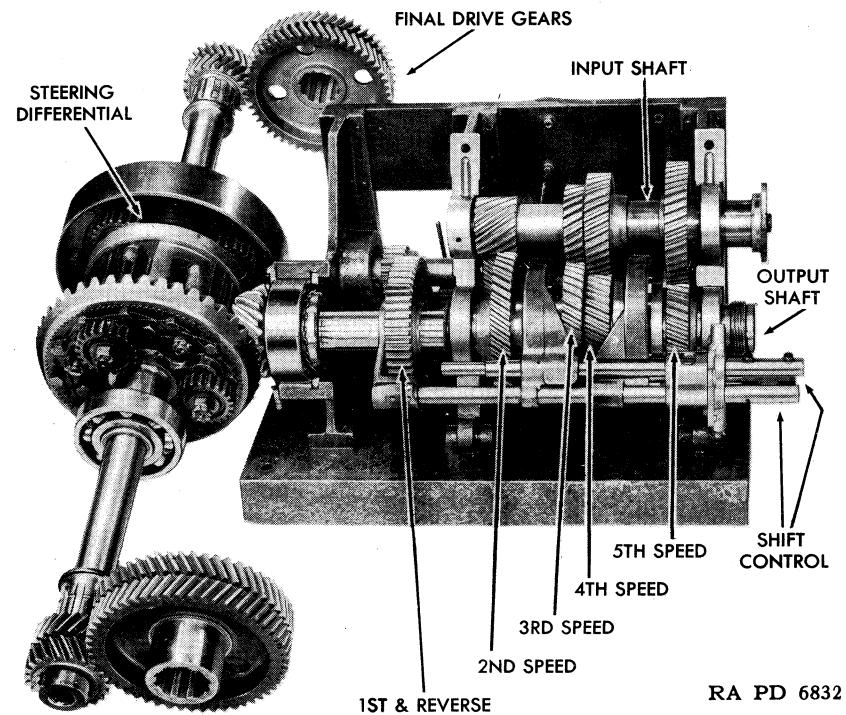


FIGURE 3—Complete transmission gearing.

5. **Characteristics.**—The transmission used in the light tank M3 differs from the transmissions used in light tank M2A4 and earlier vehicles in that the earlier vehicles used conventional sliding gears throughout. The capacity of the transmission oil pump has been increased to give better distribution of oil and to provide a supply of oil to the needle bearings used on the output shaft of the synchromesh transmission and some of the later sliding gear transmissions.

6. **Allocation of maintenance operations.** — a. *General.* — The chart shown below in this paragraph, c., covers the allocation of maintenance operations on the M3 light tank transmission, and will be used as a guide in maintaining this unit. The using arms or combat troops are authorized to remove and reinstall a transmission. However, *replacement*

of a transmission with another transmission must not be done by combat troops unless authorization is received by ordnance personnel. Also shown in the chart below are several operations, usually done by the using arms, which must sometimes be done by ordnance personnel.

*b. Definitions.* — (1) *Service.* — Consists of cleaning, lubricating, tightening bolts and nuts, and making external adjustments of sub-assemblies or assemblies and controls.

(2) *Repair.* — Consists of making repairs to, or replacement of such parts, sub-assemblies or assemblies that can be accomplished without completely disassembling the sub-assembly or assemblies and does not require heavy welding or riveting, machining, fitting, and/or alining.

(3) *Replace.* — Consists of removing a part, sub-assembly or assembly from the vehicle and replacing it with a new, reconditioned or rebuilt part, sub-assembly or assembly, whichever the case may be.

(4) *Rebuild.* — Consists of completely reconditioning and placing in serviceable condition any unserviceable part, sub-assembly or assembly of the motor vehicle including welding, riveting, machining, fitting, alining, assembling, and testing.

*c. Chart.* —

Operations	Using arm	Ordnance personnel
Final drive assembly — REPLACE .....	X	—
Final drive assembly — REPAIR .....	—	X
Final drive assembly — REBUILD .....	—	X
Gear shift hand lever — REPLACE .....	X	—
Gear shift hand lever — REPAIR .....	—	X
Sprockets — REPLACE .....	X	—
Sprockets — REBUILD, ALINE .....	—	X
Steering brake band — ADJUST .....	X	—
Steering brake band — REPAIR, RELINE .....	—	X
Steering brake band assembly — REPLACE .....	X	—
Steering hand lever — REPLACE .....	X	—
Steering hand lever — REPAIR .....	—	X
Transmission — REPLACE .....	—	X
Transmission — REPAIR .....	—	X
Transmission — REBUILD .....	—	X

SECTION III

TROUBLE SHOOTING

Paragraph

Inspection of transmission in vehicle..... 7  
 Trouble shooting ..... 8

**7. Inspection of transmission in vehicle.**—If the transmission trouble is such that the vehicle may be driven without danger of further damage to the transmission, carefully inspect the unit in motion to pre-determine the trouble and its probable cause. If the vehicle cannot be moved, disengage the engine clutch and determine whether the propeller shaft can be turned freely. Remove propeller shaft housing (par. 10) and use a wrench on input shaft flange. If the propeller shaft turns freely and without unusual noise, start the engine with the clutch disengaged and carefully check all gear shift positions, noting any unusual condition which should be corrected. A loose or badly balanced propeller shaft or a defective clutch can be responsible for much noise and vibration. This, unless carefully checked, might be mistaken for transmission trouble and result in the needless removal and overhaul of a good transmission.

**8. Trouble shooting.**—*a. Trouble Chart.*—The following chart is provided as a guide to common troubles, their causes, and a recommended procedure for inspection to locate the cause.

TRANSMISSION TROUBLES

TROUBLE	CAUSE	INSPECTION
Shifts two rails at once or can't shift either rail.	Interlock ball lost. Interlock ball retaining screw loose or lost.	Check ball. Check security of screw.
Won't stay in gear.	Interlock housing poppets loose or lost.	Inspect poppets. Check for weak springs.
Difficult to shift.	Interlock trouble listed above. Bent shifter rails.	Check interlock parts. Inspect rails, rail movement.
	Shifter lever selector finger broken.	Inspect shifter lever.
	Pivot block and quadrant bolts loose or lost.	Check security of bolts.
	Plate B157706 assembled backward.	Check plate.
	Synchromesh clutch worn.	Overhaul transmission.
	Clutch dragging or not fully disengaged.	Check clutch action and adjustment.
Jumps into first or reverse.	Shifter lever safety lock broken.	Check shifter lever.
Excessive heat.	Low oil level. Poor oil circulation, pump broken, stopped lines, valves in cooler inoperative.	Check oil level. Check oil circulation, pet-cock.

TROUBLE	CAUSE	INSPECTION
Excessive heat (cont.)	Covered or damaged cooler.	Inspect cooler and bypass valve.
	Steering brakes dragging. Bad bearings.	Check brake adjustment. Listen for sound of worn-out bearings or gears.
	Worn gears.	Check magnetic plug for metal particles.
Oil leaks.	Damaged oil lines.	Inspect lines, fittings.
	Poor fittings.	Inspect floor and exterior of tank.
	Cracked housing. Loose cover bolts, bad gaskets.	Inspect housings, covers. Check bolts for security.
	Interlock ball pipe plug loose or lost.	Check pipe plug for security.
Unusual noises.	Worn gears.	} Check oil level. Check magnetic plug for metal particles.
	Worn bearings.	
	Low oil.	} Check transmission in all gears. Check propeller shaft for excessive vibration, loose bolts, worn parts. Check clutch — out of balance.
	Translated troubles of propeller shaft.	
	Translated troubles of clutch.	
Translated troubles of engine.	Check engine for smooth operation.	
Faulty steering.	Brakes out of adjustment.	Check adjustment of brakes.
	Jammed linkage.	Check action of levers.
	Lining worn, torn.	Inspect linkage. Check brake action.

*b. Needle bearing failure.* — Needle bearing failure usually results in the transmission being locked in the speed in which the failure occurs. The cause can generally be traced to a lack of lubrication. The excessive heat, generated by the metal-to-metal contact of the poorly lubricated bearing causes the bearing to weld itself to the gear and to the output shaft. Remove the transmission from the vehicle (par. 10) and proceed with disassembly (par. 14) through step (18).

(1) *Failure in fifth speed.* — Use a puller and remove fifth speed gear. If the gear pulls easily the collar will probably remain on the shaft and it will then be necessary to use pry bars or puller to remove the collar. If these methods fail, split the collar with an oxyacetylene torch or by grinding. Proceed with the removal of the output shaft as described in paragraph 14, if the shaft cannot be cleaned up and made serviceable. Do not hesitate to replace an output shaft which has been badly scored or mutilated due to needle bearing failure.

(2) *Failure in fourth speed.* — Failure of needle bearings at fourth

speed does not necessitate a special procedure, since the output shaft may be removed as in the normal disassembly, described in paragraph 14.

(3) *Failure in second or third speed.* — Use standard disassembly procedure described in paragraph 14 through step number (21). Since second and third gears have to be tilted to affect their removal from the case and since second gear is now welded to the shaft, the shaft cannot be removed without cutting. Proceed as follows: Use a soft drift and drive fourth speed gear forward or away from its snap ring. Remove the snap ring. Remove fourth speed gear and needle bearing collar. Remove second-third shift rod from its fork and from the case. Protect the inside of the case and second and third gears by using asbestos board and paper as extensively as possible around the area at third speed gear where the shaft is to be cut. Using an acetylene torch, cut the shaft about 1/2-in. in back of third speed gear. Make the cut as clean as possible. After cutting use a file and chisel and clean up the shaft spline so that third gear and collar and splined spacer can be driven off. Use a brass bar through the input shaft front bearing bore and drive against third speed gear. A second man will rotate the shaft to prevent binding of the gear on the spline. Remove second-third synchronizer and sleeve. Remove oil pump. Remove nut and washer from reverse gear shaft. Remove bevel pinion assembly. Slide low-reverse gear forward as far as possible. Cut shaft as close as possible to output shaft center bearing protecting all other parts, as before, with asbestos board or paper. Drive reverse gear shaft and the center section of the output shaft to the rear and out of the case. Complete the disassembly and very carefully clean and inspect the case. Clean all bearings as directed in paragraph 25. Make needed replacements and reassemble as in paragraph 32.

