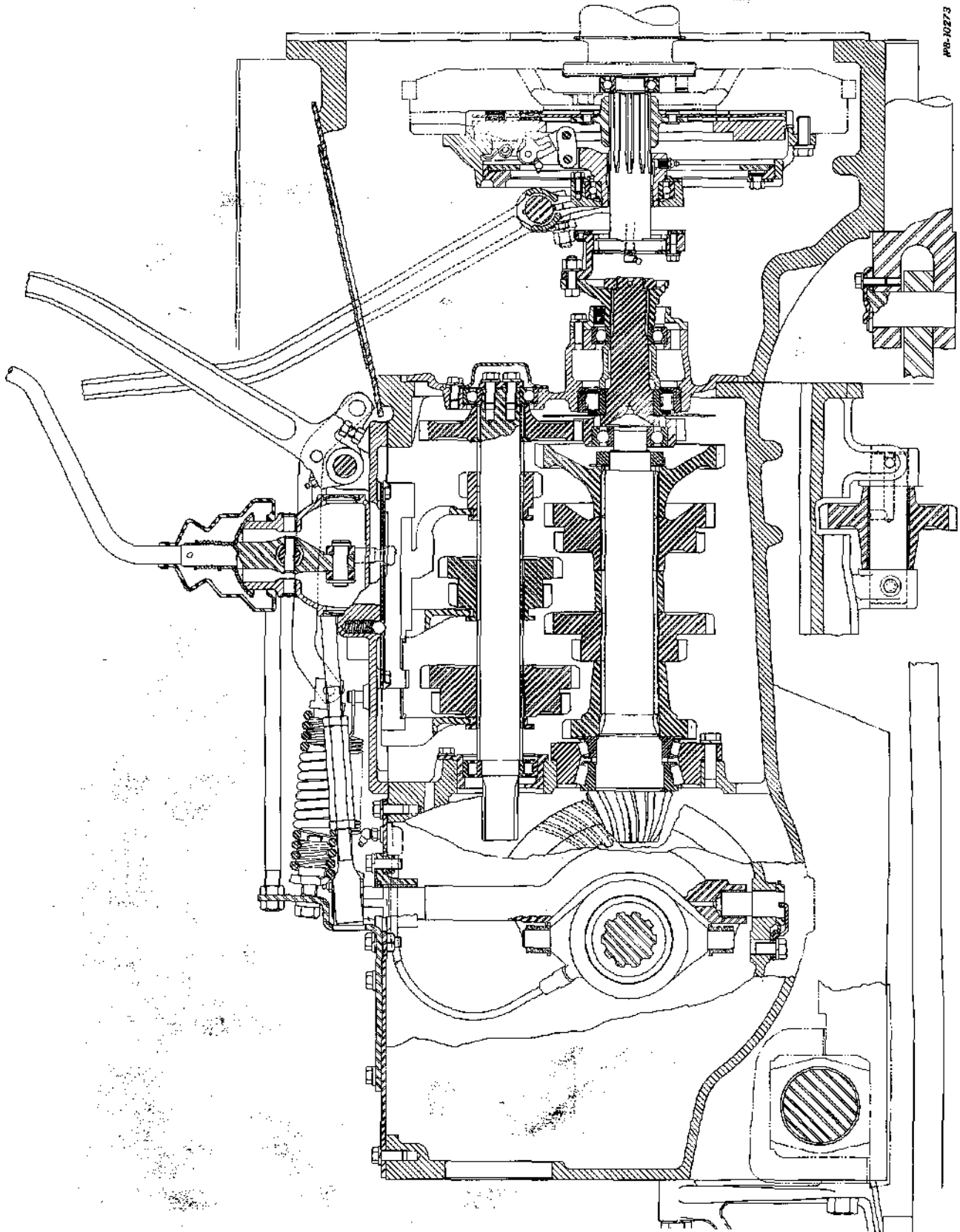




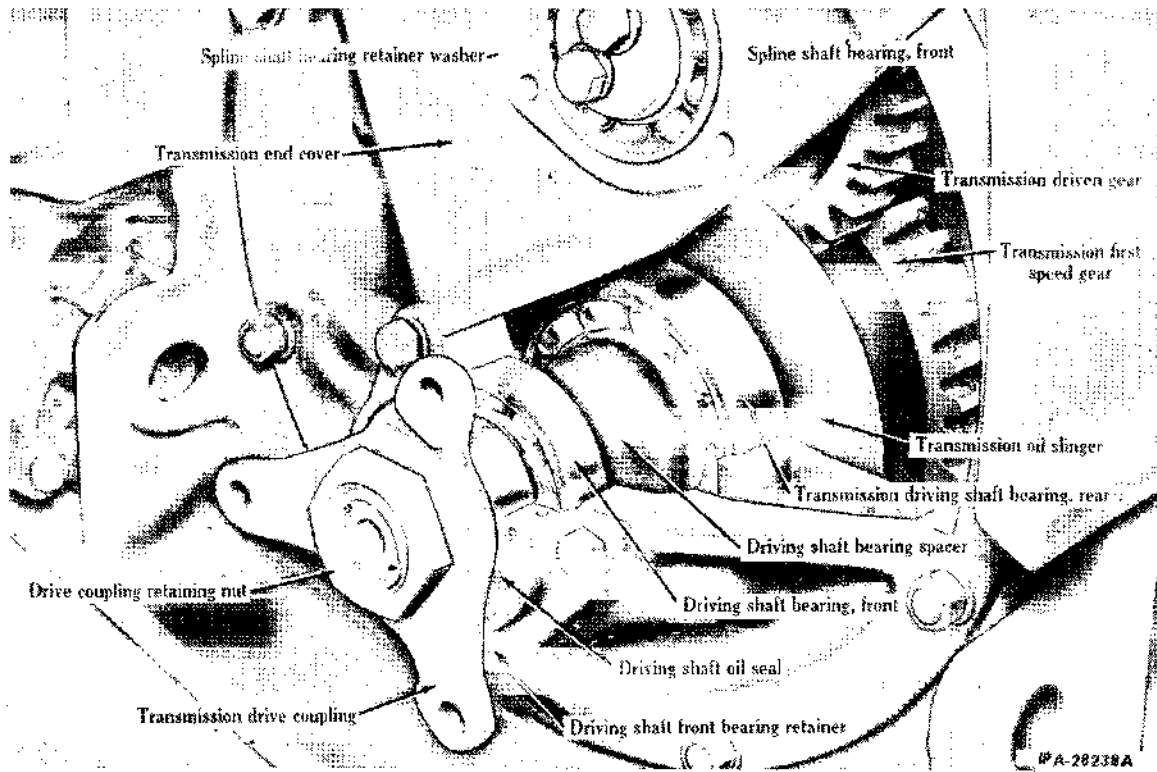
TRANSMISSION



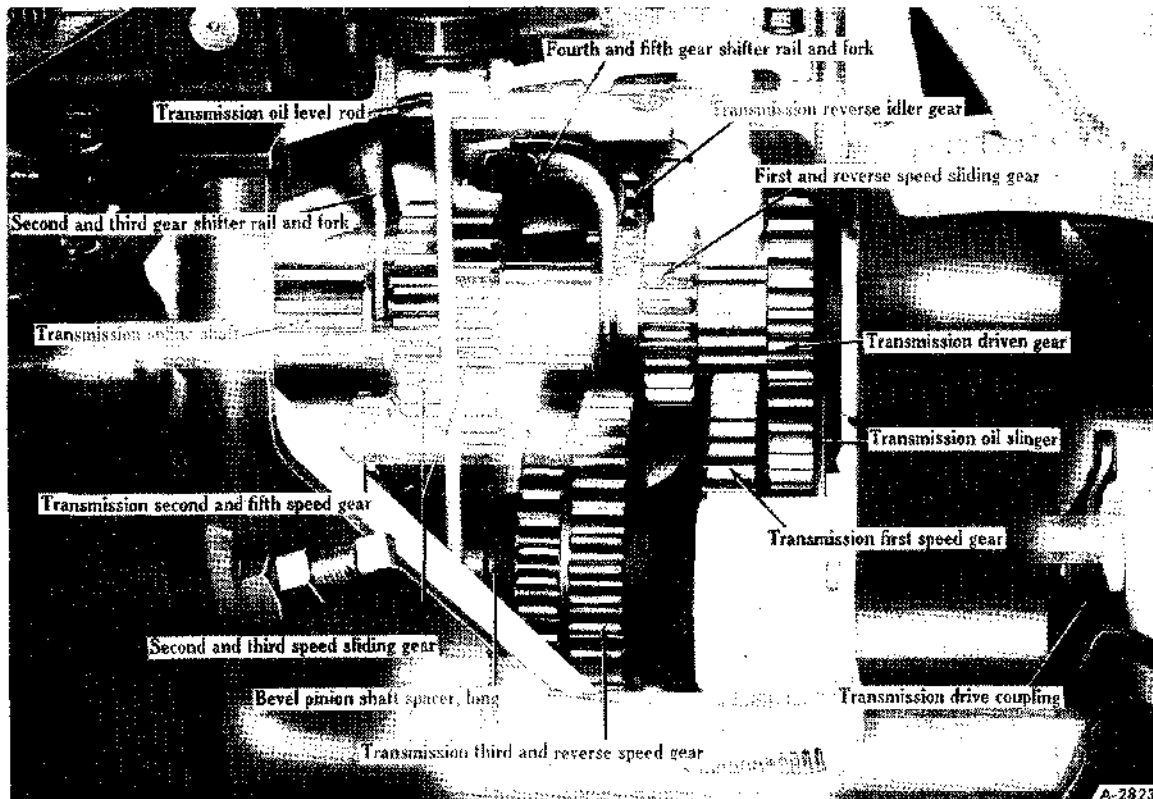
Illust. 1 - Schematic Drawing of TD-9(91) Engine Clutch, Transmission and Bevel Gear (9(92) Series Similar).



TRANSMISSION



Illust. 2 - Cutaway View of 9 Series Transmission Drive Coupling.



Illust. 3 - Cutaway View of 9 Series Transmission.



TRANSMISSION

1. DESCRIPTION

Power from the engine is transmitted to the power train by means of an engine clutch. The clutch coupling drives the transmission, which in turn supplies power to the drive bevel gear at the selected gear ratio.

The transmission and the bevel gear are housed in the rear main frame. The transmission is the selective spur gear type. It has five forward speeds and one reverse speed, all controlled by one lever, as standard equipment on all 6 and 9 series crawler tractors.

6 and 9 Series Crawler Tractors

6 Series Serial Below 38553
9 Series Serial Below 58451

Spur gears are mounted on three shafts: the upper spline shaft, the bevel pinion shaft, and the reverse idler shaft.

The spline shaft revolves on ball bearings suspended in bearing cages. The bevel pinion shaft rotates on ball bearings and is shimmed for end clearance setting between the bevel pinion and the bevel gear. The shims are situated between the bevel pinion shaft rear bearing cage and the main frame.

The reverse idler gear rotates on bushings on a stationary-mounted shaft located on the side of the transmission compartment of the main frame. The front end of the bevel pinion shaft is supported by a ball bearing situated inside the driving gear and shaft. This driving gear and shaft is suspended at the rear end by a roller bearing and at the front end by a ball bearing. The driving gear and shaft is situated in the end cover.

Adjustment of the bevel gear for backlash is handled by the addition or removal of shims between the hub of the bevel gear and the spacer.

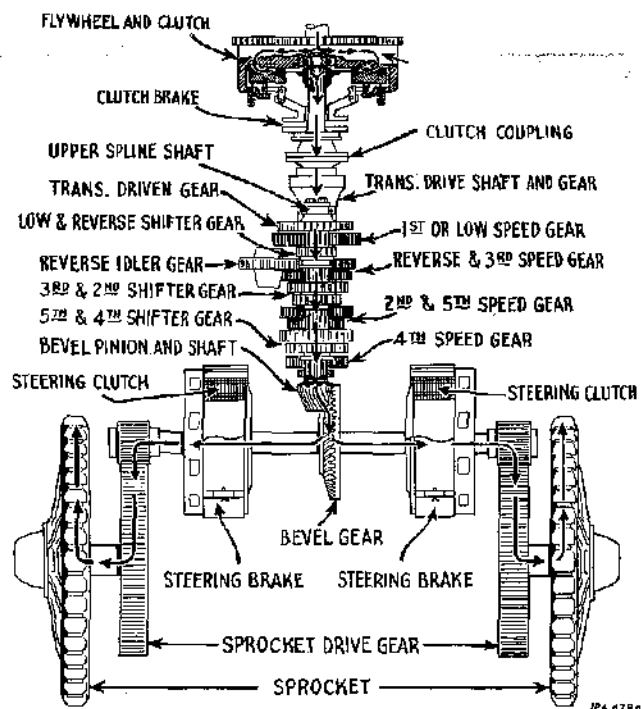
6, 6(61), 6(62), 9, 9(91) and 9(92) Series Crawler Tractors

6 Series Serial 38553 and up
9 Series Serial 58451 and up

The spline shaft revolves on ball bearings at the front end, and on roller bearings at the rear. A roller aligning shoulder is machined in the inner race for the rear bearing. The bevel gear and pinion are spiral.

Adjustment of the bevel gear bearing and bevel gear is by means of a screw thread bearing adjuster.

The reverse idler gear rotates on bushings on a stationary-mounted shaft located on the side of the transmission compartment of the main frame. The bevel gear is mounted to a gear hub with dowel bolts, and is supported by tapered roller bearings. The bevel pinion shaft is supported at the rear with a double-row tapered roller bearing, and a straight roller bearing at the front end on all 6 series (a single-row ball bearing at the front end on all the 9 series) located inside the driving gear and shaft. This driving gear and shaft is supported at the rear by a straight roller bearing.



Illustr. 4 - Line of Power from Engine to Tracks,
Gear Shifter Mechanism

The rear of the main frame, which houses the transmission and the bevel gear assemblies, is covered by a main frame cover and by the gear shifter housing. The forks of the gear shifter mechanism respond to the movement of the shifting lever. In this way, different speed gears are selected. The shifter forks fit into the recesses provided on each sliding gear. The sliding gear will then move in the direction of the selected drive gear.

continued on next page



TRANSMISSION

1. DESCRIPTION - Continued

Line of Power (See Illust. 4)

Bevel Gear

The drive bevel gear, located in the rear of the main frame, is always matched to the bevel pinion gear. Replacement of the bevel pinion shaft or the bevel gear entails replacement of the other matching gear. (Refer to opening note, Par. 8, "REASSEMBLY - INSTALLATION.")

The line of power from the engine to the tracks is through the flywheel and the engine clutch to the transmission and bevel gear. The power is distributed to both sides of the tractor through the steering clutches to the sprocket drive gear, sprocket and track chain on each side of the tractor.

2. SPECIFICATIONS

	T-6	TD-6	T-6 (61) TD-6 (61) TD-6 (62)	T-9	TD-9	TD-9 (91) TD-9 (92)
Make	IH	IH	IH	IH	IH	IH
Type	Selective spur gear	Selective spur gear	Selective spur gear	Selective spur gear	Selective spur gear	Selective spur gear
Number of forward speeds	5	5	5	5	5	5
Number of reverse speeds	1	1	1	1	1	1
Traveling speeds (at governed engine speed) - m.p.h.						
1st gear	1.5	1.5	1.6	1.5	1.5	1.6
2nd gear	2.2	2.2	2.3	2.2	2.2	2.4
3rd gear	3.1	3.1	3.3	3.0	3.0	3.3
4th gear	3.8	3.8	4.0	3.9	3.9	4.1
5th gear	5.4	5.4	5.7	5.3	5.3	5.7
Reverse gear	1.7	1.7	1.8	1.7	1.7	1.8
Bearings - type						
Spline shaft						
Front	*Single row ball	*Single row ball	*Single row ball	*Single row ball	*Single row ball	*Single row ball
Rear	*Single row ball	*Single row ball	Roller	*Single row ball	*Single row ball	Roller
Bevel pinion shaft						
Front	Roller	Roller	Roller	Single row ball	Single row ball	Roller
Rear	Single row ball	Single row ball	Double taper roller	Single row ball	Single row ball	Double taper roller

* Shielded



TRANSMISSION

	T-6	TD-6	T-6(61) TD-6(61)	T-9	TD-9	TD-9 (91) TD-9 (92)
Driving shaft and gear Front	*Single row ball	*Single row ball	*Single row ball	*Single row ball	*Single row ball	*Single row ball
Rear	*Single row ball	*Single row ball	Roller	*Single row ball	*Single row ball	Roller
Bushings, reverse idler Inside diam. - inches . (in assembly)	1.503 - 1.505	1.503 - 1.505	1.503 - 1.505	1.565 - 1.567	1.565 - 1.567	1.565 - 1.567

* Shielded

SPECIAL TORQUES (Foot Pounds) All threads to be lubricated with SAE-30 engine oil.

Bevel pinion shaft lock nut, all 6 series . . 400 - 450 All 9 series 500 - 550
Transmission drive coupling
retaining nut all 6 series . . 95 - 105 All 9 series 135 - 145

All 6 and 9 Series crawler tractors

TRACTOR	SERIAL NUMBER	END CLEARANCE	METHOD	BACKLASH
T and TD-6	Below TDBK-10323	.625 gauge	Use gauge between hub of gear and end of pinion	.010 to .012
T and TD-6	TDBK-10323 to 38950	See Note	Use gauge between hub of gear and end of pinion	.010 to .012
T-6 (61) TD-6 (61) TD-6 (62)	T-61 - 501 and up TDBK-38951 and up TD-62 - 501 and up	See Note	Use gauge between hub of gear and end of pinion	See Note
T and TD-9	Below TDCB-16825	.625 gauge	Use gauge between hub of gear and end of pinion	.010 to .012
T and TD-9	TDCB-16825 to 60300	See Note	Use gauge between hub of gear and end of pinion	.010 to .012
TD-9 (91) TD-9 (92)	TDCB-60301 and up TD-92 - 501 and up	See Note	Use gauge between hub of gear and end of pinion	See Note

NOTE: The drive bevel gears are marked on the bevel gear with decimal figures (stamped or etched) showing the distance from the gear end of the bevel pinion to the ground surface on the drive bevel gear hub. Figures designating the matched set of gears are found on the gear end of the bevel pinion shaft and the back side of the bevel gear. Matched numbers should correspond. All sets of gears are run in and checked for a high point. This point is marked on the teeth of the bevel pinion and bevel gear with white lead. These points should coincide before the gear setting is taken.



TRANSMISSION

3. CHECKING MECHANICAL PROBLEMS

GEARS HARD TO SHIFT

- | | |
|---|---|
| 1. Oil in transmission too heavy | Drain and fill with recommended oil. (Refer to Par. 2, "SPECIFICATIONS.") |
| 2. Gear shifter forks and shifter rails out of alignment or damaged | Inspect shifter forks and rails; if necessary, replace. |
| 3. Worn shifting controls. | Repair, or install new parts. |
| 4. Damaged transmission parts | Inspect; replace damaged parts. |

GEARS CLASH

- | | |
|---|--------------------------------------|
| 1. Engine clutch fails to engage - or drags | Refer to "ENGINE CLUTCH," Section 5. |
| 2. Damaged transmission parts | Inspect; replace worn parts. |

GEARS NOT IN FULL MESH
WHEN IN OPERATION

- | | |
|--|--|
| 1. Shifter forks and rails worn excessively. | Replace with new parts. |
| 2. Shifter forks and rails bent | Repair, or install new parts. |
| 3. Worn or broken bearings. | Inspect and replace with new bearings. |

GEARS SLIP OUT OF MESH

- | | |
|---|---|
| 1. Gears not fully engaged. | Inspect shifter rails and forks. Move shifting lever to extremes and note movement. |
| 2. Damaged transmission parts | Remove transmission and repair damaged parts. |

NOISE IN TRANSMISSION

- | | |
|--|---|
| 1. Bearings worn. | Install new bearings. |
| 2. Pinion shaft worn or twisted | Install new pinion and bevel gear. |
| 3. Foreign material in lubricating oil | Drain and flush, and refill with a clean, proper lubricant. |
| 4. Broken or damaged transmission case | Repair, or install new main frame. |
| 5. Gears very badly worn | Replace with new gears. |
| 6. Bevel gear and bevel pinion not properly adjusted | Adjust to proper clearance. (Refer to Par. 15, "ADJUSTMENT.") |



TRANSMISSION

TRANSMISSION OVERHEATS

- 1. Improper or insufficient lubrication Use recommended lubricant and fill to proper level.
- 2. Excessive friction in transmission parts Inspect transmission; check clearances and freedom of movement on splines.

GEARS DO NOT SHIFT

- 1. Engine clutch drags Refer to "ENGINE CLUTCH," Section 5.
- 2. Gears stuck on spline shaft Remove spline shaft; remove burrs and scored metal. Check freedom of movement of gear on the spline. If excessively worn, replace gear and spline.
- 3. Shifter forks and poppets not properly assembled, or broken poppet springs Remove housing; inspect and replace broken or damaged parts.

LUBRICANT LEAKAGE

- 1. Lubricant leaks past transmission drive shaft oil seal Remove; inspect and, if necessary, install new seal.
- 2. Lubricant leaks past transmission end cover gasket Remove end cover and install new gasket.

4. MAINTENANCE

The transmission requires little maintenance other than visual inspection. Care should be taken immediately to correct any evidence of oil leakage. Also, the oil level should be watched closely, and the specified lubricant used, since lubrication is very important in maintaining the transmission.

5. PREPARATION FOR REMOVAL AND DISASSEMBLY OF TRANSMISSION

- 1. Remove the seat cushion and battery covers.
- 2. Remove the batteries, the battery cables and support, and any electrical wiring attached to the seat side sheets or fender side sheets.
NOTE: Mark all cables as disconnected.
- 3. Drain the fuel tank and disconnect the fuel line. Remove the bolts that hold the fender side sheets to the seat side sheet, main frame, dash and clutch cover. Remove the bolts from the fuel tank support. Lift out the fuel tank, seat and fenders as a unit. Either hoist the tank out or slide it out from the rear.
- 4. Remove all hardware holding down the main frame cover. Disconnect all the electrical wiring.

Principal Steps in Preparation for Removal and Disassembly of the Transmission

- 1. Remove the seat cushion and battery covers.
- 2. Remove the battery cables and the battery support.
- 3. Remove the seat and the fuel tank.
- 4. Disconnect all wiring, and loosen all hardware holding down the main frame cover.
- 5. Drain the oil from the transmission.
- 6. Remove the steering clutch levers.
- 7. Remove the steering clutch release levers.
- 8. Remove the shifter lever housing.
- 9. Remove the main frame cover.
- 10. Remove the engine clutch cover.
- 11. Remove the engine clutch.

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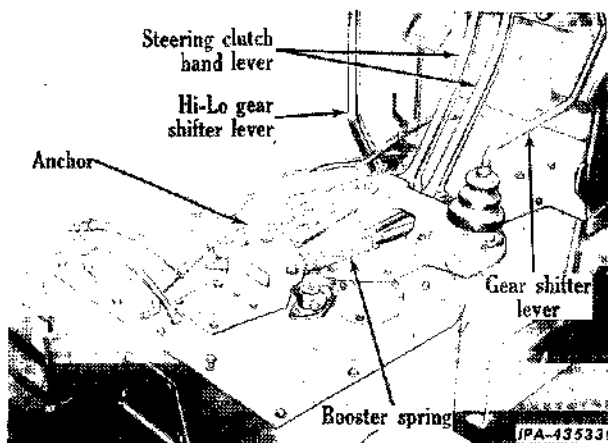
TRANSMISSION

NOTE: It is advisable to label each of the disconnected wires to avoid the possibility of confusion and wasted time when reassembly takes place.

5. Remove the steering clutch grease tubes. Remove the small inspection covers in the main frame cover. Then remove the cap screws holding the grease tubes to the main frame. The grease tubes will slip down into the main frame.

6. Drain the oil from the transmission after the tractor has been operated and the lubricant is warm. Remove the drain plug and when the oil has drained, install the drain plug.

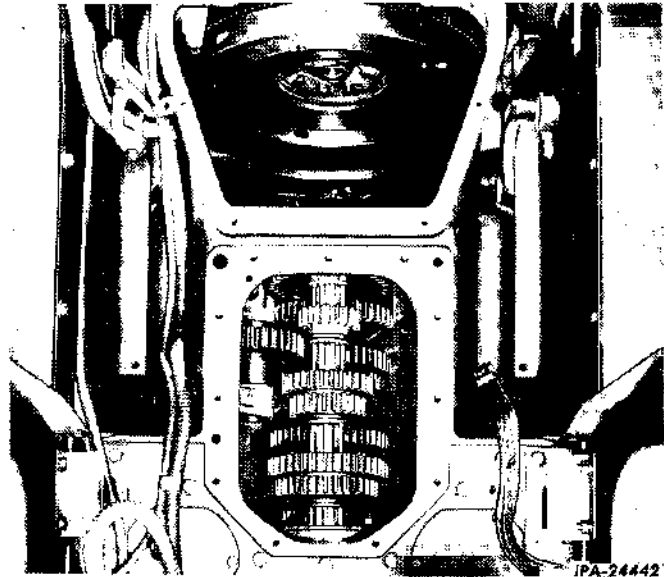
7. Remove the steering clutch levers by first removing the return springs. Loosen the set screws in the steering clutch lever support on the gear shifter housing. Push out the hand lever shaft. Lift up the levers, push out the eye pins, and remove the levers. Remove the hand lever booster springs on the 61, 62, 91 and 92 series crawler tractors by removing the spring adjuster bolts.



Illustr. 5 - TD-9(91) with Seat, Fenders and Fuel Tank Removed (61 Series Similar).

8. Remove the steering clutch release levers by loosening or removing the cap screw in the release lever and removing the steering clutch release lever. It may be necessary to pry the release lever off the steering clutch release shaft and fork.

9. Remove the shifter lever housing. Force the dowel pin out of the housing by running a nut down the threaded end of the dowel. The housing, shifter lever and shifter rails will come out as a unit.



Illustr. 6 - Showing Transmission Installed with Engine Clutch Removed.

10. Remove the main frame cover. Remove the two dowels by running a nut down the threaded end of the dowel. These dowels locate the cover on the main frame. When the dowels are removed, the cover may be lifted out of position.

11. Remove the engine clutch cover by removing the cap screws holding the clutch cover to the clutch compartment of the main frame.

12. Remove the engine clutch. Refer to "ENGINE CLUTCH," Section 5.

NOTE: Since the transmission assembly cannot be removed as a unit, the actual removal is described in Par. 6, "REMOVAL AND DISASSEMBLY."

6. REMOVAL AND DISASSEMBLY

Principal Steps in Removal and Disassembly of the Transmission

1. Remove the spline shaft bearing retainer, front.
2. Remove the end cover.
3. Remove the spline shaft and its gear assembly.



TRANSMISSION

4. Remove the bevel pinion shaft.
5. Remove the reverse idler gear.
6. Remove the driven gear from the spline shaft.
7. Remove all gears from the spline shaft.
8. Remove the transmission spline shaft bearing.
9. Remove the bevel pinion shaft bearing, front.
10. Remove the bevel pinion shaft lock nut.
11. Remove all gears from the bevel pinion shaft.
12. Remove the bevel pinion shaft bearing, rear.
13. Remove the transmission coupling.
14. Remove the transmission drive shaft oil seal.
15. Remove the transmission drive shaft.
16. Remove the drive shaft inner bearing.
17. Remove the transmission drive shaft bearing, front.
18. Remove the bushings from the reverse idler gear.
19. Remove the shifter rail guide.
20. Remove the gear shift lever.

(Ref. Nos. of Parts Apply to Illust. 7.)

1. Remove the spline shaft bearing retainer, front (49) by removing the cap screws. Slip off the retainer gasket (48). Remove the cap screws from the bearing retainer washer (47) which will allow removal of the washer.

2. Remove the end cover. Remove the cap screws from the end cover (45) and use the same cap screws as puller screws in the holes provided. Run the puller screws in evenly; the cover will be loosened and can be removed easily. Then, the end cover gasket (43) can be removed. The driving shaft and gear (64) will come off with the end cover.

3. Remove the spline shaft (40) and the gear assembly on it through the engine clutch end of the transmission compartment. It first will be necessary to remove the cap screws from the bearing cage (33) at the rear of the spline shaft.

4. 6 AND 9 SERIES: Remove the bevel pinion shaft. It will be necessary to remove the cap screws holding the bevel pinion and shaft bearing cage, rear, to the main frame. Then the bevel pinion and shaft (51) with the entire assembly on it can be removed through the front end of the transmission compartment.

6 (61), 6 (62), 9 (91) AND 9 (92) SERIES: Remove the cap screws holding the bevel pinion and shaft rear bearing (55) to the main frame. The entire bevel pinion and shaft assembly can then be removed through the front end of the transmission compartment.

(Ref. Nos. of Parts Apply to Illust. 7.)

5. Remove the reverse idler gear. To free the reverse idler gear (39), remove the cotter pin and nut from the reverse idler gear shaft bolt (32) and withdraw the bolt. Push out the reverse idler gear shaft (31) and lift out the idler gear.

6. Remove the driven gear (42) from the spline shaft (40) simultaneously freeing the split collar (41). Remove the split collar.

7. Remove all gears from the spline shaft.

8. Remove the transmission spline shaft bearing, rear. First position the shaft (40) in an arbor press with two pieces of wood under the bearing (34); then lower the press ram to contact the spline shaft, and press the shaft out of the bearing.

9. Remove the bevel pinion shaft bearing, front, (63) from the bevel pinion shaft. First position the bevel pinion shaft (51) in a press.

Carefully block up the bevel pinion shaft bearing, front, (63) and press the shaft out of the bearing.

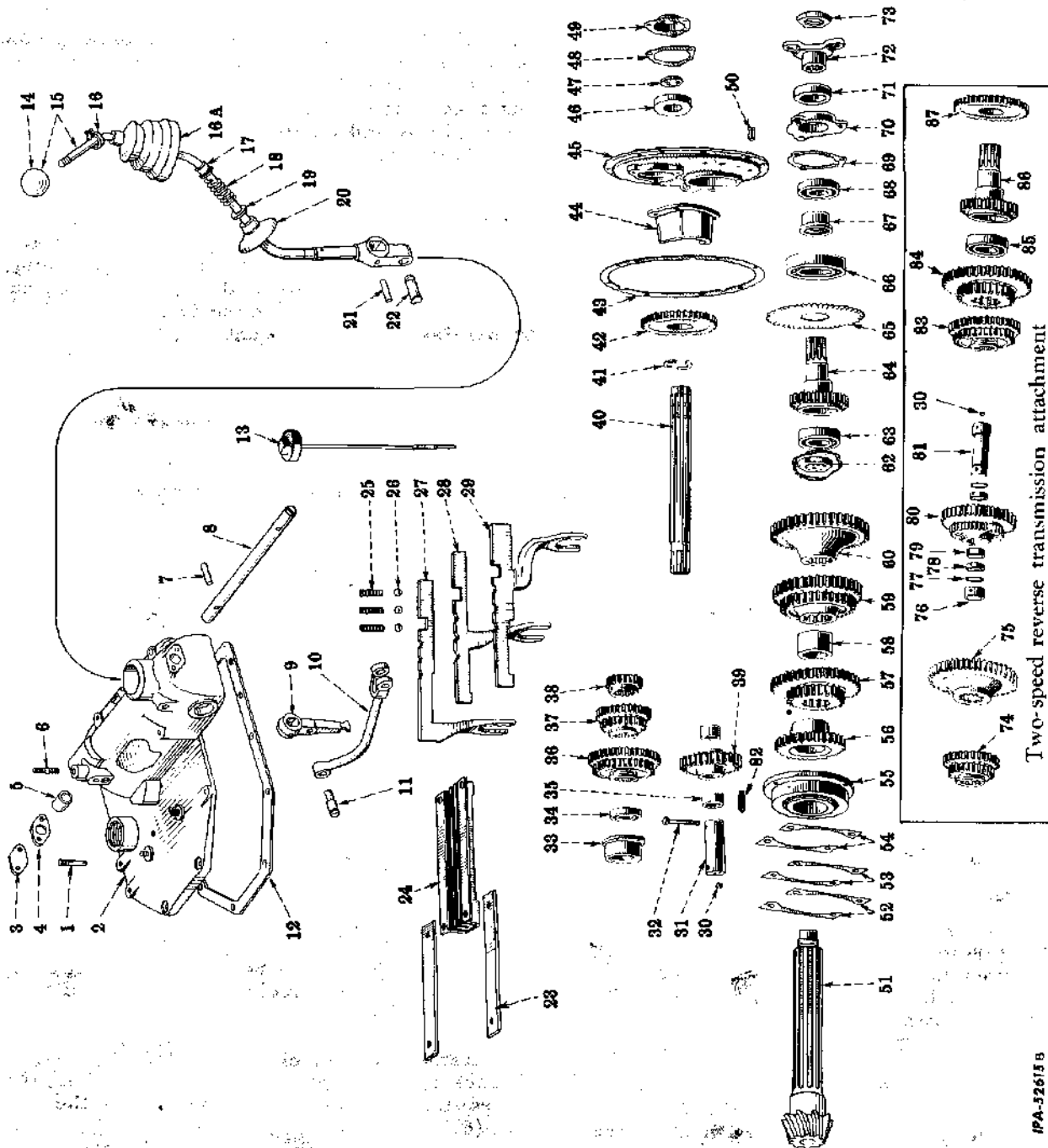
10. Remove the bevel pinion shaft lock nut. Unlock the bevel pinion shaft lock washer, if so equipped, and unscrew and remove the lock nut (62).

11. 6 AND 9 SERIES: Remove all gears from the bevel pinion shaft.

Continued on page 12.



TRANSMISSION



IPA-52615 B

Illust. 7 - Exploded View of Crawler Tractor Transmission.

TRANSMISSION

Reference List for Illust. 7.

REF. NO.	DESCRIPTION	REF. NO.	DESCRIPTION	REF. NO.	DESCRIPTION
1.	Gear shifter housing to main frame dowel.	29.	Low and reverse gear shifter rail and fork.	60.	First speed gear.
2.	Gear shifter housing.	30.	Reverse idler gear shaft plug.	62.	Bevel pinion shaft lock nut.
3.	Gear shift lever shaft end cover.	31.	Reverse idler gear shaft.	63.	Bevel pinion shaft front bearing.
4.	Gear shift lever shaft end cover gasket.	32.	Reverse idler gear shaft bolt.	64.	Driving shaft and gear.
5.	Shifter lever shaft bushing.	33.	Spline shaft rear bearing cage.	65.	Oil slinger.
6.	Platform stud.	34.	Spline shaft rear bearing.	66.	Driving shaft rear bearing.
7.	Gear shift hand lever upper pin.	35.	Reverse idler gear bushing.	67.	Driving shaft rear bearing spacer.
8.	Gear shift lever upper shaft.	36.	Fourth and fifth speed sliding gear.	68.	Driving shaft front bearing.
9.	Gear shift lever, with pin.	37.	Second and third speed sliding gear.	69.	Front bearing retainer gasket.
10.	Gear shift lever lower shaft.	38.	First and reverse speed sliding gear.	70.	Driving shaft front bearing retainer.
11.	Gear shift lever lower pin.	39.	Reverse idler gear.	71.	Driving shaft oil seal.
12.	Gear shifter housing gasket.	40.	Reverse idler gear.	72.	Transmission drive coupling.
13.	Transmission oil level rod.	41.	Driven gear split collar	73.	Drive coupling retaining nut.
14.	Gear shift hand lever ball.	42.	Driven gear.	74.	Second and high reverse sliding gear. *
15.	Gear shift hand lever.	43.	End cover gasket.	75.	High and low reverse idler gear. *
16.	Gear shift hand lever boot clamp.	44.	End cover oil pocket.	76.	Reverse idler gear shaft sleeve. *
16A.	Gear shift hand lever boot.	45.	End cover.	77.	High and low reverse idler snap ring. *
17.	Gear shift hand lever swivel shield spring upper stop.	46.	Spline shaft front bearing.	78.	High and low reverse idler gear bearing. *
18.	Gear shift hand lever swivel shield spring.	47.	Spline shaft front bearing retainer washer.	79.	High and low reverse idler gear spacer. *
19.	Gear shift hand lever swivel shield.	48.	Spline shaft front bearing retainer gasket.	80.	High and low reverse idler gear. *
20.	Gear shift hand lever swivel shield.	49.	Spline shaft front bearing retainer.	81.	Reverse idler gear shaft. *
21.	Gear shift hand lever upper pin.	50.	End cover dowel pin.	82.	Reverse idler oil strainer.
22.	Gear shift hand lever lower pin.	51.	Bevel pinion and shaft.	83.	Third and fourth speed sliding gear. * (9 (92) series only.)
23.	Gear shifter rail guide support bolt lock.	52.	Bevel pinion and shaft bearing cage shim (heavy).	84.	Second and fourth speed gear. * (9 (92) series only.)
24.	Gear shifter rail guide.	53.	Bevel pinion and shaft bearing cage shim (medium).	85.	Bevel pinion shaft front bearing. * (9 (92) series only.)
25.	Gear shifter rail poppet spring.	54.	Bevel pinion and shaft bearing cage shim (light).	86.	Driving shaft. *
26.	Gear shifter rail poppet.	55.	Bevel pinion and shaft rear bearing.	87.	(9 (92) series only.)
27.	Fourth and fifth gear shifter rail and fork.	56.	Fourth speed gear.		
28.	Second and third gear shifter rail and fork.	57.	Second and fifth speed gear.		
		58.	Bevel pinion shaft spacer.		
		59.	Third and reverse speed gear.		

* For tractors equipped with "Two speed reverse transmission attachment."



TRANSMISSION

6. REMOVAL AND DISASSEMBLY - Continued

6 (61) AFTER SERIAL 41229, 9 (91) AFTER SERIAL 66832 AND ALL 6 (62) AND 9 (92) SERIES: The bevel pinion shaft gears are all press fit and will have to be heated to be pressed off. A torch can be used to heat the hub of the gears. Care must be taken that the heat is uniform all around the hub and kept away from the gear bores and the shaft. Temperatures exceeding 400°F should be avoided or the hardness may be lost.

NOTE: Do not press the gears off without properly heating them or damage will result to the gears and shaft.

12. 6 AND 9 SERIES: Remove the bevel pinion shaft bearing, rear. Remove the snap ring from the bearing cage and press the cage off the bevel pinion shaft bearing, rear. Then press the bearing off the bevel pinion shaft (51).

6 (61), 6 (62), 9 (91) and 9 (92) SERIES: Press the bevel pinion shaft bearing, rear (55) (flanged, double taper) from the shaft. The shims (52, 53 and 54) may be kept and re-installed if the same bevel gear and bevel pinion also are to be installed.

13. On tractors with new type transmission drive shaft, unstake and remove the transmission drive coupling nut (73). Remove the drive coupling (72). On tractors with old type transmission drive shaft, unlock the transmission drive coupling retainer screw lock, then remove the drive coupling retainer screw. Remove the drive coupling.

NOTE: When disassembling the transmission drive coupling (72) from the shaft (64) it may be necessary to use a puller. Since lack of space prohibits the use of a puller in the tractor, remove the transmission end cover (45) from the tractor with the coupling and shaft attached.

14. Remove the transmission drive shaft oil seal. Remove the hardware securing the drive shaft front bearing retainer (70). The retainer will then come off, as will the retainer gasket (69). Then remove the oil seal (71) from the bearing retainer (70).

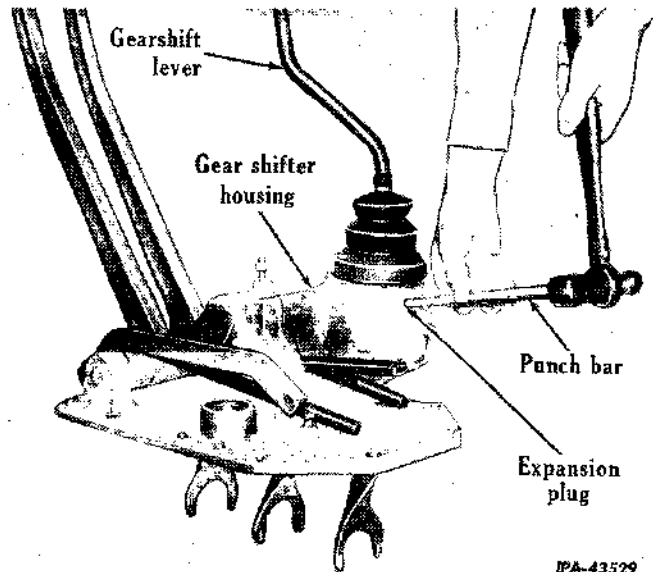
15. Remove the transmission driving shaft by using a press to remove the driving shaft and gear (64) from the end cover (45). The transmission driving shaft bearing, front, (68) will remain in the end cover (45).

16. Remove the transmission driving shaft rear bearing. Pull the rear bearing (66) from the driving shaft (64) and free the transmission oil slinger (65).

17. Remove the transmission driving shaft bearing, front, by positioning the end cover (45) in a press, lowering the press ram to contact the driving shaft bearing, front, (68) and pressing the bearing from the end cover.

If the spline shaft front ball bearing (46) needs replacement, it may be pressed from the end cover (45).

18. Remove the bushings from the reverse idler gear. Position the idler gear (39) in a press; set up a suitable adapter and lower the ram to press the idler gear bushing (35) from the reverse idler gear.



Illust. 8 - Removing Expansion Plug and Swivel Shaft (91 Series Shown).

19. Remove the shifter rail guide assembly. Remove the cap screws holding the gear shifter rail guide (24) to the gear shifter housing (2). With the rail guide (24) removed, shifter forks (27, 28 and 29) may be removed. Also, the shifter rail poppet ball (26) and the poppet ball spring (25) may be removed.

20. Remove the gear shift lever after the two expansion plugs have been removed and the small swivel shaft, has been driven out. On the 6 (61), 6 (62), 9 (91) and 9 (92) series, remove the hand lever upper pin (21) and lower pin (22). (See Illust. 8.) The gear shift lever may then be lifted from its position in the shifter housing.



TRANSMISSION

7. INSPECTION AND REPAIR

1. After the entire transmission has been removed and disassembled completely, wash all parts in a good cleaning solvent. Take care to remove any foreign matter on the gears, shafts, bushings or bearings. After the parts have

been thoroughly cleaned, dry them with compressed air. Wash all bearings particularly well, and clean and flush the transmission case. Be sure the oil strainer in the reverse idler gear shaft is clean and in serviceable condition.

2. Inspect all parts for scores, cracks, chipping and excessive wear in accordance with the following chart:

INSPECTION

REMEDY

BEARINGS

- | | |
|---|---|
| 1. Inspect for cracks, scores, and general wear | Replace if necessary. Soak in oil, wrap and cover until ready for assembly. |
|---|---|

BUSHINGS

- | | |
|--|---|
| 1. Inspect reverse idler gear bushings for wear and damage | Install new bushings if necessary. Keep clean until reassembly. |
| 2. Inspect power take-off bushing for wear | Replace if necessary. |

OIL SEALS

- | | |
|--|---|
| 1. Inspect for damaged or excessively worn areas | Replace if necessary. The seal must be installed with the lip facing the inside of the housing. |
|--|---|

GEARS

- | | |
|--|---|
| 1. Inspect the gears for wear, and chipped or broken teeth | Replace the gears that are worn excessively or that are damaged. |
| 2. Inspect the splines for snugness in fit | Replace gear if spline fit is excessively loose. |
| 3. Inspect splines for burrs | If the burrs are slight, they may be smoothed down with a stone. If badly burred, replace the gear. |

BEVEL PINION AND SHAFT

- | | |
|---|---|
| 1. Inspect for scores, cracks and excessive wear at the pinion gear | Install a new shaft if cracks or excessive wear is in evidence. Refer to "NOTE" that opens Par. 8, "REASSEMBLY," pertaining to replacement. |
|---|---|

SPLINE SHAFT

- | | |
|--|--|
| 1. Inspect spline shaft for cracks, wear, galling and chipping | If the spline shaft indicates extreme wear, galling, cracks or chipping, replace the spline shaft. |
|--|--|



TRANSMISSION

7. INSPECTION AND REPAIR - Continued

INSPECTION

REMEDY

SHIFTER RAILS AND FORKS

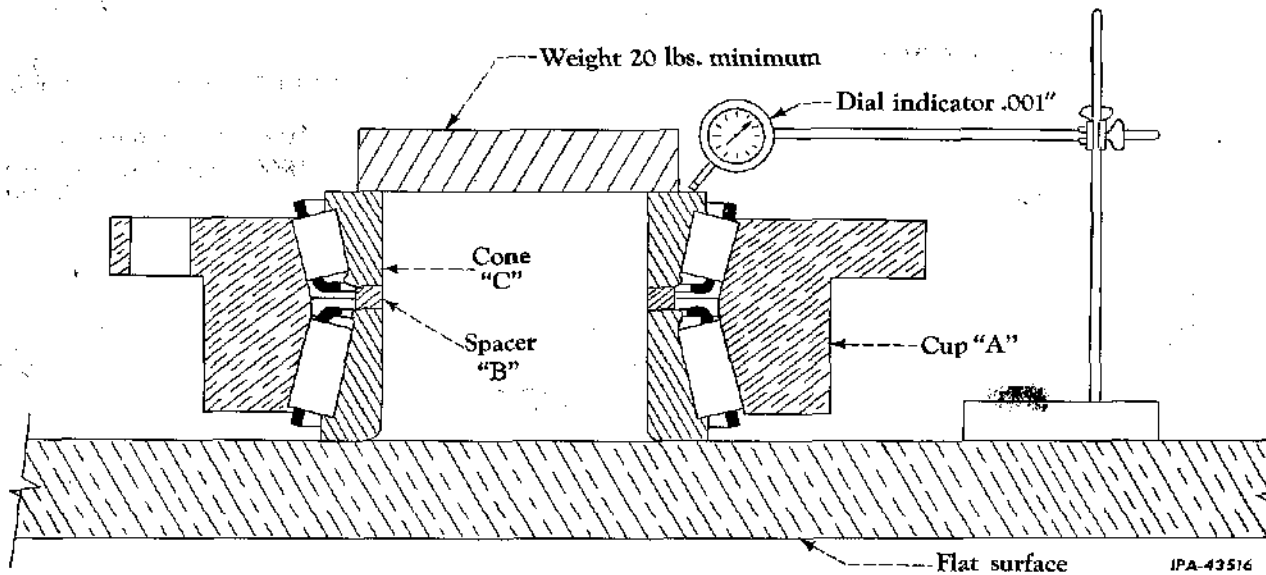
- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Note the condition of the notches in the shifter rails 2. Inspect the shifter forks for wear or damage 3. Inspect the condition of the gear shifter rail poppet balls and springs | <p>If they are worn to the extent that the transmission will not stay in gear, the shifter rails must be replaced.</p> <p>Replace shifter fork and rail if required.</p> <p>If they are damaged or badly worn, they must be replaced.</p> |
|--|---|

Pinion Shaft Rear Bearing.

Since the bearings, spacer and cage assembly (55) are furnished as a matched unit, definite procedure for adjustment of the double tapered roller bearings, due to normal wear, must be followed.

1. Place the complete bearing assembly on a flat surface (surface plate).
2. Place a weight (20 lbs. minimum) on top of bearing assembly, as shown in Illust. 9. (This will keep roller in alignment.)
3. Rotate the cup (A) a minimum of four revolutions in each direction.
4. With spacer (B) in place, set the dial indicator at zero. Check at three different points.

5. Slide dial indicator off cone (C) carefully. (Do not upset indicator setting.)
 6. Remove weight, cone (C) and spacer (B). Then replace cone (C) and weight. (Do not replace spacer (B).)
 7. Repeat rotation of cup (A) and slide dial indicator on cone (C). Be careful to get an accurate reading from dial indicator. Check at three different points.
 8. Factory end play specification in a new bearing assembly for the TD-6 is $.006 \pm .001$ inch, and for the TD-9 is $.007 \pm .001$ inch.
- If the reading on dial indicator shows a greater drop than the maximum factory set end play,



Illust. 9 - Adjustment of Tapered Roller Bearings.



TRANSMISSION

grinding or lapping of spacer is necessary. The amount to be ground off the spacer is the difference between the indicator reading and the factory set end play.

A bearing assembly that is heavily pitted or scored should not be salvaged.

8. REASSEMBLY AND INSTALLATION

(Ref. Nos. of Parts Apply to Illust. 7.)

NOTE: The bevel pinions and drive bevel gears, previously serviced in matched sets only, are now available both individually and in matched set for service. However, a new gear may be used with an old pinion, or vice versa, only if the used gear or pinion is in good condition. Bevel pinions and drive bevel gears, as furnished individually for replacement purposes, will be identified by the following markings:

"S.P." (Single Pinion) etched on the head end of the pinion.

"S.G." (Single Gear) etched on the outside rim of the bevel gear.

For adjusting the end clearance and backlash, refer to Par. 15.

PRINCIPAL STEPS IN REASSEMBLY AND INSTALLATION OF THE TRANSMISSION

REASSEMBLY

1. Install the reverse idler gear.
2. Install the bevel pinion shaft rear bearing cage.
3. Install all gears on the bevel pinion shaft.
4. Install the pinion shaft lock nut and bearing.
5. Install the spline shaft rear bearing and cage.
6. Install all spline shaft gears.
7. Install the split collar and driven gear.

8. Install the inner bearing and the oil slinger on the driven gear.
9. Install the driving shaft, spacer and bearing into the front cover.
10. Install the oil seal and retainer.
11. Install the transmission drive coupling.
12. Install the shifter rails.
13. Install the shifter lever.

INSTALLATION

14. Install the bevel pinion shaft.
15. Install the spline shaft.
16. Install the end cover.
17. Install the spline shaft bearing and retainer.
18. Install the engine clutch.
19. Install the main frame cover.
20. Install the gear shifter housing.
21. Install the steering clutch release levers.
22. Install the steering clutch levers.
23. Install the steering clutch grease tubes.
24. Fill the transmission.
25. Connect all secondary wiring.
26. Install the seat and fuel tank.
27. Install the batteries, battery covers and seat cushion.

1. Install the reverse idler gear (39) between the two supports on the main frame with the larger hub to the rear of the tractor. Then push the reverse idler shaft (31) in place. Note that the shaft bolt hole is in an off-center position so that the reverse idler gear shaft bolt (32) can be inserted through the shaft and support in only one way. Install the nut securely and slip the cotter pin through the bolt.

Continued on next page.



TRANSMISSION

8. REASSEMBLY AND INSTALLATION - Continued

(Ref. Nos. of Parts Apply to Illust. 7.)

2. 6 AND 9 SERIES ONLY: Install the bevel pinion and shaft rear bearing cage onto the bevel pinion and shaft bearing, rear. Then place the snap ring onto the cage and press the assembly onto the bevel pinion shaft (51).

6 (61), 6 (62), 9 (91) AND 9 (92) SERIES ONLY: Press the rear cone of the bevel pinion shaft rear bearing (55) on the bevel pinion shaft, being sure it seats firmly against the shoulder of the pinion gear. Install the bearing outer race and spacer over the rear cone. Press the front cone on the shaft, seating it firmly against the spacer.

3. Assemble the gears on the bevel pinion shaft in the sequence shown below.

NOTE: With the exception of the machines listed below, the gears on the bevel pinion shaft are a tight press fit. Before the gears can be pressed on they must be heated to 380-400°F for one hour. Avoid heating the gears over 400°F or the hardness may be lost. Press each gear down as far as it will go and hold the pressure on the gear until it cools enough to shrink tightly on the shaft. After all the gears are installed, press the complete assembly of gears with 50 tons of pressure. Check to see that there is no gap between any of the gears or spacers.

The following machines do not require heating and pressing on gears, provided they are equipped with original bevel pinion shaft:

- All 6 and 9 series tractors
- T and TD-61-41228 and below
- T and TD-91-66831 and below

Install the fourth speed gear (56) on the pinion shaft (51) with the shorter hub toward bearing. The 6 (61), 6 (62), 9 (91) and 9 (92) series fourth speed gear has no short hub, so the gear end will be toward bearing. No short spacer is needed as is found on the 6 and 9 series. Place the bevel pinion shaft spacer, short, on the shaft. Place second and fifth speed gears (57) on the shaft with smaller gear toward pinion. Slide the bevel pinion shaft spacer, long (58), onto the pinion shaft. Position third and reverse speed gears (59) on the shaft with smaller gear toward pinion. Install first speed gear (60) with the long hub toward pinion.

4. Slip the pinion shaft lock nut lock washer (61), if used, on the pinion shaft next to the first speed gear (60). Then place the pinion shaft lock nut (62) on the shaft, tighten to the torque specified in Par. 2 and lock. The security type lock nut (if so equipped) should screw onto the shaft with a drag of 20 to 30 ft.-lbs. If it spins on freely or binds too much, it will not lock itself properly; remove the nut and start it over again. After torquing the nut, press the pinion shaft front bearing (63) on the shaft.

9 (92) SERIES: When installing the new front roller bearing on the pinion shaft, the inner race of the bearing is to be pressed in place against the threaded shoulder on the bevel pinion shaft. The inner and outer race may be lubricated with a light coat of transmission oil to aid in assembly.

5. Press the transmission spline shaft bearing, rear (34), on the rear end of the spline shaft (40). Then place the spline shaft bearing cage, rear (33), on the bearing.

6. Install all spline shaft gears. After closely inspecting the spline shaft and the inside splines in each sliding gear, install the fourth and fifth speed sliding gears (36), the second and third speed sliding gears (37), and the first and reverse sliding gears (38) on the spline shaft. When all gears are assembled on the spline shaft, the shifter fork recesses, or collars, should be toward the rear of the spline shaft.

7. Install the driven gear split collar (41) in the groove on the spline shaft (40) and slip the driven gear (42) on the shaft with the longer hub toward the front end of the shaft. The driven gear will hold the split collar in place.

8. Install the oil slinger (65) on the driving shaft and gear (64). Then position the driving shaft rear bearing (66) on the driving shaft and gear and press into place.

9. Install the driving shaft, assembled, spacer and front bearing into the front cover. Position the driving shaft, oil slinger, and bearing, in the end cover, and press into place. Slide on the driving shaft bearing spacer (67) with the flare toward the rear. Then install the driving shaft bearing, front (68), by pressing into the front of the end cover (45).

If the spline shaft front ball bearing (46) was pressed from the end cover (45), press the bearing in being sure the shielded side is toward the rear of the tractor. The shield is to prevent dirt from entering the bearing.

10. Install oil seal and retainer. Position the driving shaft front bearing retainer (70) beneath the rim of an arbor press resting on the flange. Then place the driving shaft oil seal (71) with the lips downward, and press the seal into the retainer. Then assemble the gasket (69), retainer (70), and bolt into position.

NOTE: Apply a coat of "Never-Seez" No. 999 617 R1 to the splines when assembling the coupling (72) to the shaft (64). It may be necessary to press these parts together, in which case the drive shaft and coupling should be assembled to and installed with the end cover (45).

11. Install the transmission drive coupling (72). On tractors with new type transmission drive shaft, install drive coupling nut (73) and stake it. On tractors with old type transmission drive shaft, slip the retainer screw lock on the retainer



TRANSMISSION

screw and tighten. Lock the screw into position.

12. Install shifter rails. Turn the gear shifter housing (2) upside down and install the shifter rail poppet ball springs (25) and the shifter rail poppet balls (26) in holes provided for them. Then install shifter rails (27), (28) and (29) in the shifter rail guides (24) so the proper shifter forks engage the proper sliding gears. Secure the rail guides to the shifter housing with cap screws.

NOTE: The square notches in the shifter rails should line up when properly installed.

13. 6 AND 9 SERIES ONLY: Install the shifting lever by placing the gear shifter lever swivel shaft in the gearshift lever (15) and insert the lever (15) in the housing (2). Drive in the small swivel shaft and the expansion plugs.

6 (61), 6 (62), 9 (91) AND 9 (92) ONLY: Install the gearshift hand lever. Attach the hand lever lower shift (10) to the gearshift hand lever (15) with the lever lower pin (22). Lower the gearshift hand lever in place in the gear shifter housing (2). Attach the lower lever shaft (10) to the lower lever (9) with the lever pin (11) andpeen the end to secure it. Push the gearshift lever upper shaft (8) through the shaft hole in the housing, engaging the elongated hole in the gearshift hand lever (15) and gearshift lever (9). Locate the pin holes and drive the hand lever upper roll pins (7) and (21) in place.

14. Install the bevel pinion and shaft. Lift the assembled bevel pinion and shaft into position and install the bearing cage or bearing into the main frame. If the pinion and bevel gear were not replaced by new ones, the same number of shims may be used between the bearing cage and the main frame. Then replace and tighten the cap screws holding the bearing or bearing cage to the main frame.

NOTE: Refer to Par. 15 for adjustment of the pinion and bevel gear.

15. Install the spline shaft. Place the spline shaft bearing cage (33) with the spline shaft assembly in the main frame. Run in the cap screws and secure the bearing cage (33) to the main frame.

16. Install the end cover completely reassembled. Place the assembled end cover (45) and end cover gasket (43) in position. Line up the bevel pinion shaft bearing, front (63), with the driving shaft and gear (64) and set the end cover in position. Align the dowels and tap them into position. Then install the cap screws, lock washers and nuts on the studs, and tighten them.

17. Drive the spline shaft bearing, front (46) onto the spline shaft (40) with the shielded side

towards the rear of the tractor, and secure it with cap screws and lock washers. Then place the spline shaft front bearing retainer (49) and the gasket (48) in position, and install and tighten the cap screws.

18. Install the engine clutch. (Refer to "ENGINE CLUTCH," Section 5.)

19. Install the main frame cover. Clean the main frame compartments before installing the main frame cover. Then place the cover into position. Tap in the dowels and secure with cap screws and lock washers.

20. Install the gear shifter housing. First install the gasket (12) in the main frame, then align the sliding gear shifting collars to receive the shifter forks, and lower the housing. Align the dowel holes and drive in the dowels. Secure the housing with cap screws.

21. Install the steering clutch release levers. Position the steering clutch release levers to hold the linkage reasonably snug. Fit the release lever over the release fork and tap the lever onto the fork.

NOTE: After installation is complete, refer to "STEERING CLUTCHES AND BRAKES," Section 7 for adjustments.

22. Install the steering clutch levers. Line up the steering clutch levers with the eye pins. Then position the levers in the housing and install the hand lever shaft. Tighten the set screws on the steering clutch lever support on the gear shifter housing. Install the return springs. Install the hand lever booster springs.

23. Install the steering clutch grease tubes. This may be done through the small inspection cover openings. Bolt the grease tubes to the main frame cover; then secure the inspection covers.

24. Fill the transmission case. Refer to the operator's manual for specifications. Fill the case, with the proper lubricant, to the proper level.

25. Connect all electrical wiring to the proper terminals, as marked, before disassembly.

26. Install the fuel tank, seat and fenders as a unit into position and secure with cap screws. Connect the fuel lines, and fill the fuel tank with a recommended grade of fuel.

27. Install the batteries, battery covers and seat. Connect all cables to the proper terminals as marked during disassembly. Then install the battery covers and the seat cushion.



BEVEL GEAR

9. DESCRIPTION

The drive bevel gear is situated in the main frame to the rear of the transmission compartment. The drive bevel gear transmits the power from the transmission to the sprocket drives through the steering clutches. It also changes the direction of the line of power and it provides a definite, set, gear reduction.

The drive bevel gear is lubricated by the same oil that lubricates the transmission.

The hub of the bevel gear is mounted on two ball bearings (later models have roller bearings), and it is connected on each side to the steering clutches.

The bevel pinions and drive bevel gears, previously serviced in matched sets only, are now available both individually and in matched sets for service. However, a new gear may be used with an old pinion, or vice versa, only if the used gear or pinion is in good condition. Bevel pinions and drive bevel gears, as furnished individually for replacement purposes, will be identified by the following markings:

"S.P." (Single Pinion) etched on the head end of the pinion.

"S.G." (Single Gear) etched on the outside rim of the bevel gear.

For adjusting the end clearance and backlash, refer to Par. 15.

Shims are provided between the bevel pinion shaft rear bearing cage and the main frame for the purpose of establishing proper end clearance. They are used to adjust the bevel gear and bevel pinion for end clearance. The bevel gear has a shimming provision for setting backlash between the bevel pinion and the bevel gear. These shims will be found between the drive bevel gear and the drive bevel gear spacer.

Later model tractors are equipped with bevel gear bearing adjusters and adjuster locking screws, instead of shims.

On older model tractors a set screw projects through the side of the drive bevel gear compartment. It contacts the drive bevel gear momentarily when the gear is subjected to shock loads.

10. CHECKING MECHANICAL PROBLEMS

PROBABLE CAUSE

REMEDY

EXCESSIVE BACKLASH

1. Improper adjustment of bevel gear and pinion

Adjust bevel gear and pinion in accordance with specifications.

2. Loose transmission drive coupling

Remove engine clutch and inspect coupling for condition. Tighten if found in loosened condition.

GEARS NOISY

1. Improper or insufficient lubricant

Use proper lubricant; fill to proper level.

2. Improper adjustment of pinion and bevel gear

Adjust pinion and bevel gear in accordance with specifications.

LUBRICANT LEAKAGE

1. Faulty oil seal in bevel gear compartment

Determine if the leak is coming from the sprocket drive or bevel gear compartment. If bevel gear compartment indicates leakage, remove steering clutches and replace oil seal and gasket at bevel gear hub.



- 2. Lubricant leaks at drain If sprocket drive leaks, refer to "SPROCKET DRIVE," Section 8. Tighten drain plug or replace plug if damaged.

TRACTOR WILL NOT MOVE

- 1. Pinion shaft sheared Replace bevel pinion shaft.*
- 2. Bevel gear broken Replace bevel gear.*

* Replace both bevel pinion and bevel gear.

11. MAINTENANCE

The bevel gear requires no maintenance other than extreme care during installation of a new bevel gear and bevel pinion. The backlash and end clearance should be set precisely. There will be little general maintenance other than checking the lubricating oil in the transmission case which also fills the bevel gear compartment, at intervals of 100 hours of operation.

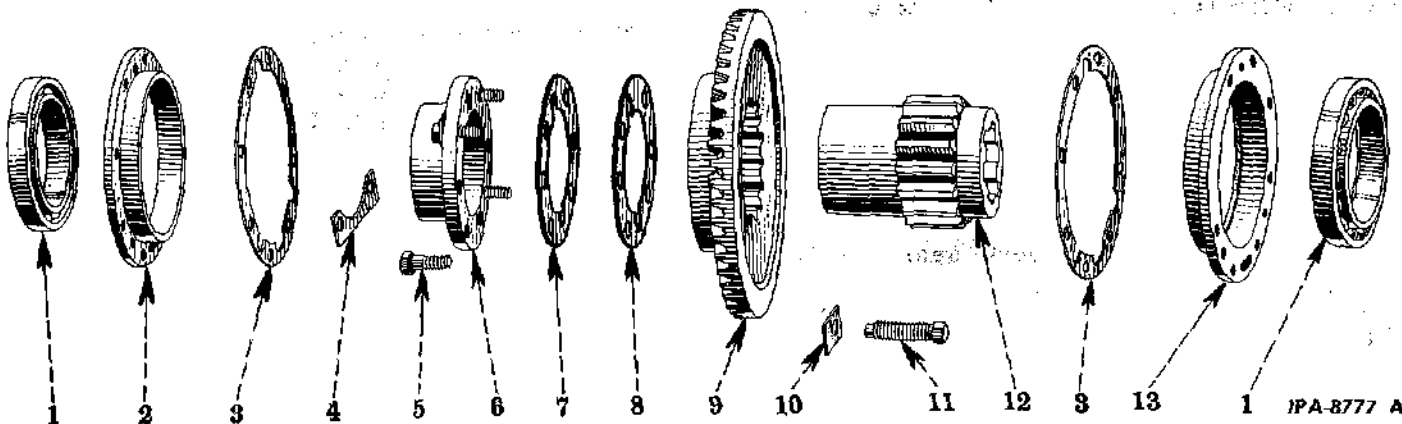
After 100 hours of operation, the oil level should be checked. After 1,000 hours of operation, the lubricating oil should be changed.

NOTE: If the lubricating oil has been thinned for winter use, change it to proper grade when warm weather begins. (Refer to operator's manual.)

12. REMOVAL AND DISASSEMBLY

- | PRINCIPAL STEPS IN REMOVAL AND DISASSEMBLY OF THE BEVEL GEAR |
|--|
| 1. Remove the fuel tank and connections. |
| 2. Remove the main frame cover. |
| 3. Remove the steering clutches and brakes. |
| 4. Remove the drive bevel gear bearing cage. (RH, 6 and 9 series.) |
| 5. Remove drive bevel gear bearing cage. (LH, 6 and 9 series.) |
| 6. Remove drive bevel gear hub and drive bevel gear. |

Continued on next page.



Illust. 10 - Exploded View of Bevel Gear and Related Parts (6 and 9 Series) (TD-6, TDBK-37202 to 38552; TD-9, TDCB-55130 to 58450).

1PA-8777 A



BEVEL GEAR

Legend for Illust. 10.

Ref. No.	DESCRIPTION	Ref. No.	DESCRIPTION
1.	Drive bevel gear bearing.	8.	Drive bevel gear shim (light).
2.	Drive bevel gear bearing cage, left.	9.	Drive bevel gear.
3.	Drive bevel gear bearing cage gasket.	10.	Deflection set screw lock.
4.	Drive bevel gear dowel bolt lock.	11.	Drive bevel gear deflection set screw.
5.	Drive bevel gear dowel bolt.	12.	Drive bevel gear hub.
6.	Drive bevel gear spacer.	13.	Drive bevel gear bearing cage, right.
7.	Drive bevel gear shim (heavy).		

12. REMOVAL AND DISASSEMBLY - Continued

Preparation for Removal

1. Remove fuel tank and connections. Refer to "STEERING CLUTCHES AND BRAKES," Section 7.

2. Remove main frame cover. Refer to "STEERING CLUTCHES AND BRAKES," Section 7.

3. Remove steering clutches and brakes. Refer to "STEERING CLUTCHES AND BRAKES," Section 7.

(See Illust. 11.)

4. Remove the right bearing cage. The bearing adjuster (1), shaft coupling oil seal (2), adjuster nut lock (3) and bearing adjuster ring (4) will have been removed with the steering clutches and brakes. Install puller screws in bearing cage (5), running them in evenly until the bearing cage is free from the main frame. Remove adjuster sealing ring (7). Press bearing cup (8) out of the bearing cage (5). The gasket (6) will usually come off with the bearing cage.

5. Remove the left bearing cage. Follow the same procedure as outlined in step 4.

6. Remove the right bearing cone (9) by removing the six nuts and six dowel bolts (12) securing the bevel gear (10) to bevel gear hub (11). Pusher holes are provided in the hub for three screws used to force the ring gear against the right bearing (9). By running the screws in evenly, the bearing will be forced off the hub.

7. Lift the bevel gear (10) out of the compartment.

8. Remove the drive bevel gear hub (11) from the compartment. Use a bearing puller to remove the left bearing cone (9).

To separate the adjuster (1) from the adjuster ring (4), remove the adjuster nut lock (3) and screw out the adjuster. The shaft coupling oil seal (2) will remain in the bearing adjuster and need not be removed except for replacement.

Bevel Gear Removal (6 and 9 Series)

(TD-6, 38552 and below.)

(TD-9, 58450 and below.)

(See Illust. 10.)

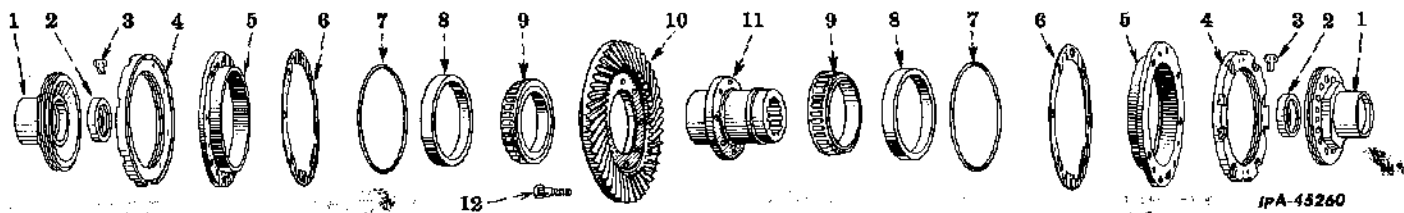
1. Remove the right bearing cage. First remove the drive bevel gear dowel bolts (5) holding the drive bevel gear spacer (6) to the bevel gear (9), and back out the deflection set screw (11). Then install three puller cap screws in the right bearing cage (13). Run in these cap screws evenly until the right bearing cage (13) is free from the main frame. The bearing (1) may then be pressed out of the bearing cage. The gasket (3) usually will come off with the bearing cage.

2. Remove the left bearing cage by wedging a piece of wood between the drive bevel gear (9) and the main frame to keep the bevel gear from drifting to the left. Install puller cap screws in the left bearing cage (2) and run them in evenly until the left bearing cage (2) is free from the main frame. The bearing (1) may be removed from the hub. The bevel gear bearing cage gasket (3) will usually stick to the bearing cage. The drive bevel gear shims (7) and (8) can be removed when the left bearing cage is loosened or removed.

3. Remove the drive bevel gear hub spacer and the drive bevel gear. This may be done after the left and right bevel gear bearing cages have been removed from the main frame. Slide the drive bevel gear spacer (6) and drive bevel gear hub (12) out the left side of the main frame. Then the drive bevel gear (9) may be lifted from the compartment.



BEVEL GEAR



Illustr. 11 - Exploded View of Bevel Gear and Related Parts TD-6(61), 6(62) and TD-9(91), 9(92) Series.

REF. NO.	DESCRIPTION	REF. NO.	DESCRIPTION
1	Bearing adjuster.	7	Bearing adjuster sealing ring.
2	Shaft coupling oil seal.	8	Bearing cup.
3	Bearing adjuster nut lock.	9	Bearing cone.
4	Bearing adjuster ring.	10	Drive bevel gear.
5	Bearing cage.	11	Drive bevel gear hub.
6	Bearing cage gasket.	12	Bevel gear dowel bolt.

13. INSPECTION AND REPAIR

1. Clean all parts thoroughly with dry-cleaning solvent, and dry off with compressed air.
2. Examine the drive bevel gear for cracks, chipping, broken teeth and excessive damage. If necessary, replace the bevel gear. Refer to Par. 9 regarding replacement.
3. Examine all bearings. Place them in dry-cleaning solvent and clean thoroughly. Blow out the bearings, directing air pressure across the bearing, blowing out all traces of the old

lubricant. Avoid spinning the bearings with the air stream. Inspect balls and races, cups, rollers and cones carefully for chipping, cracks, or worn spots to determine their fitness for future use. If bearings are damaged, replace with new ones; otherwise, repack with proper grease or lubricant and wrap in paper until ready for reassembly.

4. Inspect all other parts for cracks, chips or severe wear. Replace if necessary.

NOTE: When installing a new bevel gear hub or dowel bolts on tractors equipped with screw type bevel gear adjusters, refer to the following chart, and ream the dowel bolt holes in the hub to proper size. The dowel section of the new dowel bolt has been increased .002 inch.

Machine*	Hub	When used w/bolt	Ream	When used w/bolt	Ream
"6" Series	271 755 R1	274 075 R1	.4990/.5005	274 075 R2	.5005/.5025
"9" Series	271 853 R1	274 075 R1	.4990/.5005	274 075 R2	.5005/.5025



BEVEL GEAR

14. REASSEMBLY AND INSTALLATION

6 and 9 Series

Principal Steps in Reassembly and Installation of the Bevel Gear

1. Install the drive bevel gear bearing into the bearing cage.
2. Install the bevel gear bearing cage and the steering clutch bearing cap.
3. Install the bevel gear bearing on the drive bevel gear hub.
4. Install the bevel gear, shims, hub and bevel gear spacer.
5. Install the bevel gear bearing cage.
6. Install the steering clutch coupling and the steering clutch bearing cap.
7. Install the deflection set screw.

NOTE: Install the bevel gear bearing on the spacer with the extended lip of the inner race facing away from the spacer.

4. Install the bevel gear, the shims, the bevel gear hub, and the bevel gear spacer. Position the bevel gear on the right side of the bevel gear compartment in the main frame. Remove the spacer from the bevel gear hub. Insert the bevel gear hub through the bevel gear from the left steering clutch compartment, and drive the hub into the right bevel gear bearing. Slide the spacer on the hub, and insert the original shims between the spacer and the hub of the bevel gear. Attach the spacer to the bevel gear having the cap screw locks on the cap screws, but do not bend the locks over the cap screws at this time, since it may be necessary to remove or add shims.

5. Install the bevel gear bearing cage. First shellac a new gasket to the bearing cage, left, and drive the bearing cage onto the bearing and into the main frame.

NOTE: The shims should be between the bearing cages, both left and right, and the main frame.

Then assemble the bearing cage cap to the right side of the tractor.

6. Install the steering clutch coupling and the steering clutch bearing cap. Install the steering clutch coupling in the left side of the bevel gear. Then install the steering clutch bearing cap and secure with cap screws. Remove the bearing cap, right. Install the steering clutch coupling, right. Install the right steering clutch bearing cap.

7. Install the bevel gear deflection screw. Note that the drive bevel gear deflection set screw lock and jam nut are on the deflection set screw. Screw the set screw into the right side of the main frame. Adjustment is covered in Par. 15.

NOTE: Tighten the cap screws holding the drive bevel gear hub to the drive bevel gear with the proper torque. (See "SPECIFICATIONS," Par. 2.) On units so equipped, torque the self-locking cap screws that hold the bevel gear spacer to the bevel gear.

Adapters are available for use with a torque wrench for tightening the drive bevel gear dowel bolts. These adapters (Part number 1 020 378

1. Install the drive bevel gear bearing into the drive bevel gear bearing cage.

Place the right bevel gear bearing cage in a press so the flange of the bearing cage is up off the bed of the press. Place the bearing on the bearing cage so the extended lip of the inner race is downward or toward the bed of the press. Lower the ram and press the bearing into position.

2. Install the bevel gear bearing cage and the steering clutch bearing cap. Shellac a new gasket to the right bevel gear bearing cage. Locate the bearing cage in the main frame and drive the cage into position. Then reassemble the right steering clutch bearing cage cap and secure with several cap screws.

NOTE: Attaching the steering clutch bearing cap is only a temporary installation that is necessary when driving the hub into the bearing. The bearing cap will later be removed to install the steering clutch coupling.

3. Install the bevel gear bearing on the bevel gear spacer. Slide the bevel gear spacer on the bevel gear hub. Position the hub and the spacer in an arbor press with the spacer upward, away from the bed of the press. Position the bevel gear bearing on the spacer, and press it into position.



BEVEL GEAR

R1) when used with a torque wrench, will assure proper torque. Refer to "Service Tools" manual, ISS-1002.

6 (61), 6 (62), 9 (91) and 9 (92) Series

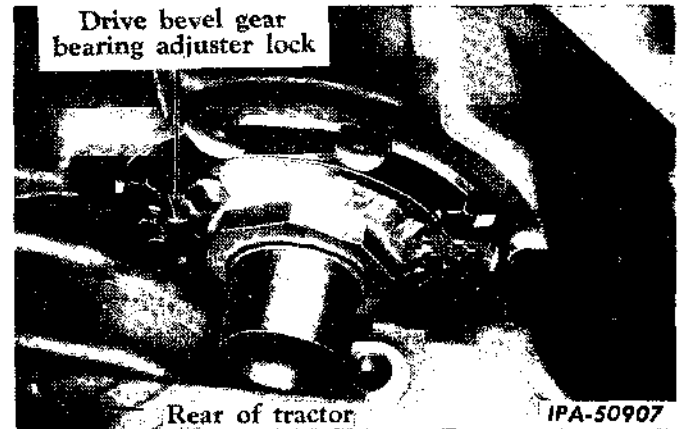
PRINCIPAL STEPS IN REASSEMBLY AND INSTALLATION OF THE BEVEL GEAR

1. Install the bearing cups into the drive bevel gear bearing cages.
2. Install bearing cone to the long end of drive bevel gear hub.
3. Install drive bevel gear to the gear hub.
4. Install bearing cone to the right end of drive bevel gear hub.
5. Install the bearing cage and cup assemblies to the main frame.
6. Assemble the ring type adjuster and clutch shaft coupling.
7. Install the assembled adjuster and coupling to the steering clutch shafts before installing the steering clutches.

NOTE: At any time the drive bevel gear bearing adjuster locks have been removed and then re-installed, be sure that they are installed in the tapped holes provided to the rear of the bearings (toward rear of tractor).

Illustration 12 shows drive bevel gear bearing adjuster lock installed properly.

Interference will be encountered with the steering clutch release fork if they are installed in the tapped holes to the front of the bearings (toward front of tractor).



Illust. 12 - Showing Adjuster Lock Properly Installed.

(Reference numbers refer to Illust. 11.)

1. Install the drive bevel gear bearing cups (8) into the bearing cages (5).

Place either bearing cage (5) in a press so that the flange side will be up off the bed of the press. Place cup (8) over the cage opening to position small ID of taper toward the press ram. Press the cup into cage until flush with the flanged surface.

2. Install either bearing cone (9) to the long end of the gear hub (11). Refer to the following **NOTE** regarding preheating the bearing cones.

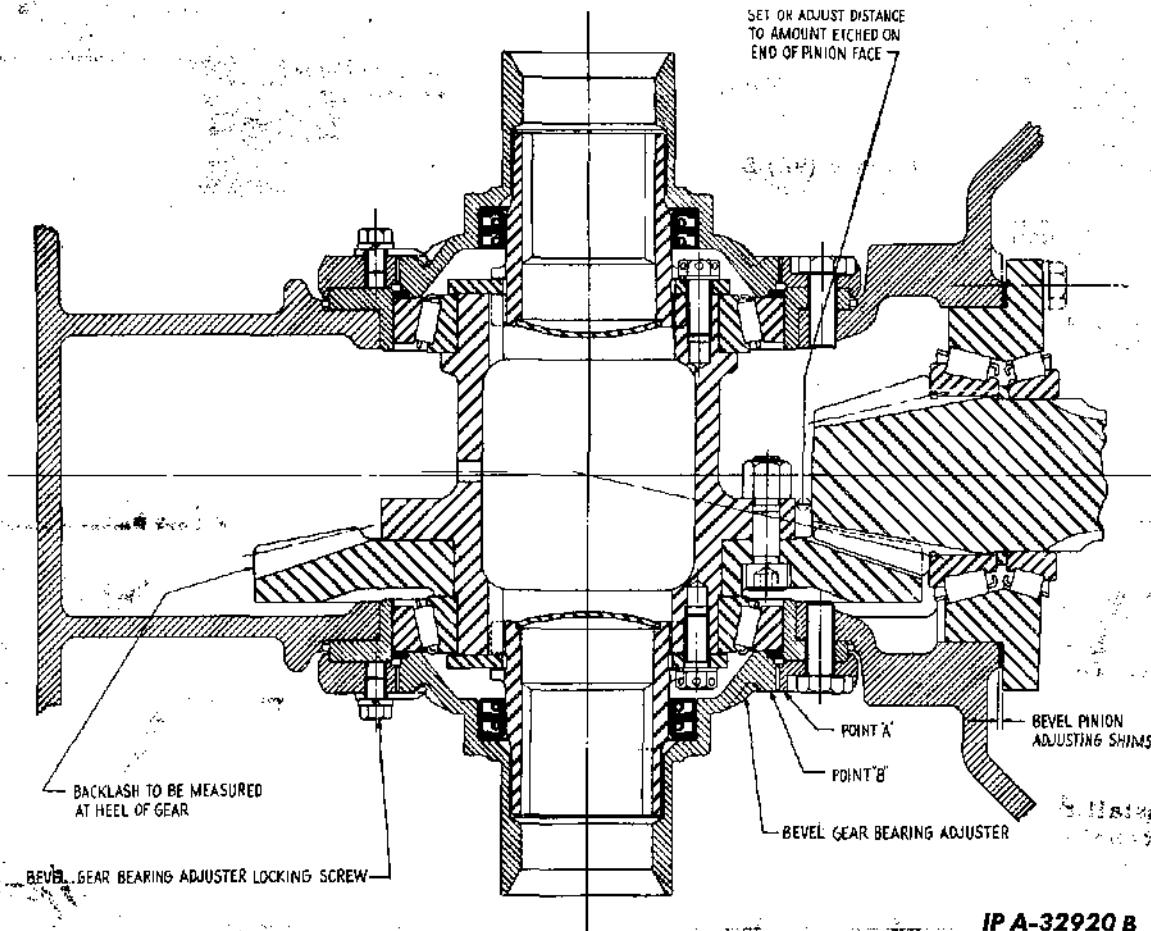
Set the preheated bearing cone on the hub so the taper slopes toward the left end of the hub when cone is installed. Tap the cone lightly with a soft hammer until seated against the shoulder of hub.

NOTE: Preheat the bearing cones or inner races. Before installing, both bearing cones (9) should be preheated to not over 250 degrees F in oil, oven, or infra-red lamp. Adjustment should not be made until the cones are solidly against their respective shoulders and have cooled to room temperature.

Continued on page 25

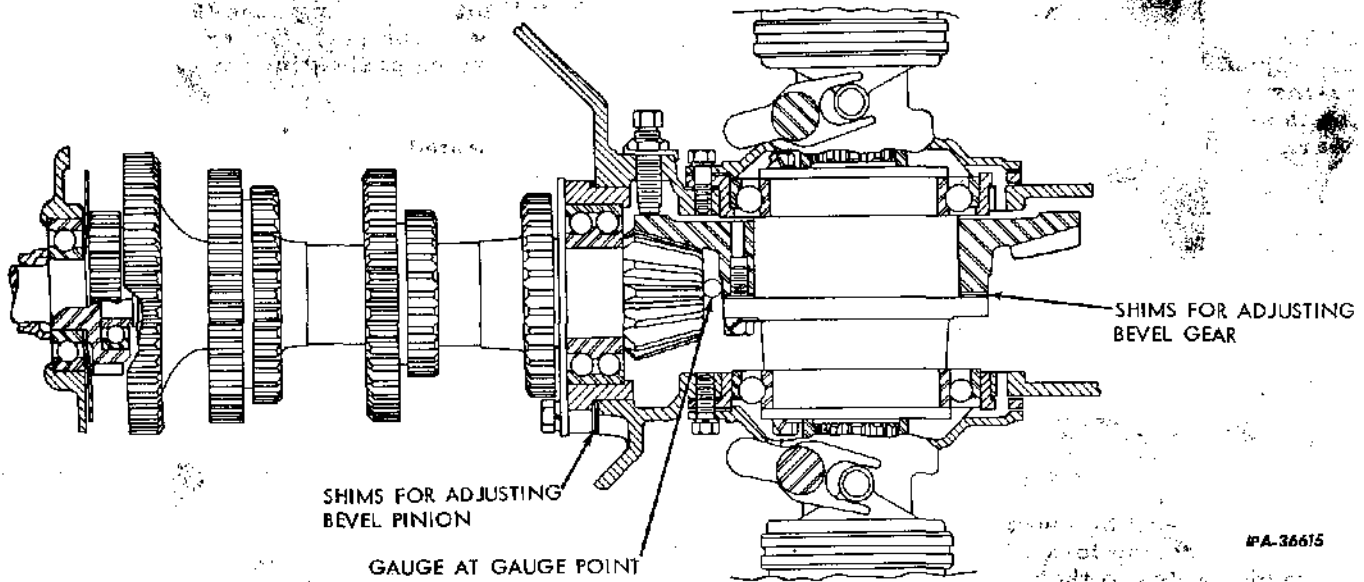


BEVEL GEAR



IP A-32920 B

Illustr. 13.



Illustr. 14.

PA-36615



BEVEL GEAR

14. REASSEMBLY AND INSTALLATION - Continued

3. Install the drive bevel gear (10) to the gear hub (11) in the rear compartment. Refer to NOTE in Par. 2 "SPECIFICATIONS" if a new gear set is being installed.

Place the gear hub (11) into the drive compartment so that the long end of the hub, with cone installed, can be inserted into the left side wall opening. Lower the drive bevel gear (10) into the drive compartment to mesh with the right side of the pinion bevel gear. While holding the drive bevel gear in this position, insert the short end of gear hub through the gear to line up the bolt holes in gear and the flange on hub, refer to Illust. 13. Install six new dowel bolts (12) to the gear and hub by passing them through the opening in main frame from the steering clutch side.

NOTE: Do not re-use the drive bevel gear dowel bolts. The head of the bolt may have been weakened or damaged at some previous torquing operation. Always use NEW bolts to avoid the possibility of premature failure.

Lubricate the threads with SAE-30 engine oil, install the nuts to the dowel bolts and tighten to 130-145 foot pounds torque. To prevent bolts from turning, insert a 3/8 inch Allen wrench through the side wall opening to engage the bolt head.

4. Install the other bearing cone (9) to the right or gear end of the hub. Refer to NOTE regarding preheating bearing cones.

Block up the bevel drive gear and hub from the bottom to support the assembly so that the hub centers in the side wall openings. Place props between the left side wall and the hub flange to wedge the drive gear against the right side wall, also to prevent the gear and hub from sliding to the left during bearing cone installation.

Place the preheated bearing cone through the right side wall opening and onto the hub so that the taper slopes toward the hub right end when installed. Tap slightly with a soft hammer until the cone bottoms against the hub shoulder.

5. Install the bearing cage and cup assemblies to the main frame.

Install a gasket (6) over the shoulder of each bearing cage (5). Position the bearing cages into the main frame openings to line up the bolt holes and be sure that the lip of cup will override the bearing rollers. Tap lightly with a soft hammer to get them started. Then, temporarily install the adjusting ring to the bearing cage and main frame with three cap screws evenly spaced to draw both bearing cages into

the openings evenly, Illust. 12. Do not install the nut lock (3). Remove the temporary puller screws and the adjuster assembly. Install seal ring (7) into the bearing bore of the bearing cages against the bearing cup and the OD of the cage bore.

TD-6 (61 AND 62) ONLY: It is often necessary to soak the cork sealing ring in hot water or oil, then stretch the ring to fit the bearing area and stay in position during steering clutch assembly, without the use of adhesive compounds.

6. Assemble the ring type adjuster and clutch shaft coupling. Pre-lubricate and install a new oil seal (2) to the inner recess of both bearing adjusters (1). Position each oil seal so the flat metal surface will be toward the bevel gear hub when the adjuster is installed. Turn the adjuster ring (4) onto the bearing adjuster until the ring surface with bolt head recesses is flush with the adjuster edge, Illust. 12. Do not install the nut lock (3) at this time.

7. Install the assembled adjuster and the shaft coupling to the steering clutch shaft before installing the steering clutches in their respective compartments.

Insert the clutch shaft coupling into the adjuster (1) passing the coupling through the oil seal (2) installed in the adjuster until the coupling shoulder is against the oil seal. Position the adjuster and coupling onto the clutch shaft to engage the splines, and push the assembly onto the clutch shaft as far as it will go. Install the steering clutch, refer to "STEERING CLUTCHES AND BRAKES."

15. ADJUSTMENT (Screw Type Bevel Gear Adjusters)

To provide maximum life and quiet operation, the drive bevel gear and bevel pinion must be properly adjusted, whether in matched sets or individually. This adjustment normally involves three operations: pre-loading the drive bevel gear bearings, setting the cone center, and setting the gears for proper backlash.

PRELOADING THE BEARINGS

1. (Without pinion or steering clutches installed.) Install the bevel gear, hub, bearings, cages, adjuster rings and adjusters in their respective positions. All rubber rings should be lubricated before assembly. In order to assure free meshed gears when the pinion is installed, set the outer face of the right hand bearing adjuster (next to gear) flush with the outer face of the adjuster ring for the 6 series, and 1/8 inch above the outer face of the adjuster ring (points "A" and "B," Illust. 13) for the 9 series. Insert the adapter for inch-pound

Continued on next page.



BEVEL GEAR

15. ADJUSTMENT (Screw Type Bevel Gear Adjusters) - Continued

torque wrench in the female spline on the left hand side of the drive bevel gear hub, install the left hand bearing adjuster and tighten to obtain a preload of 25 to 30 inch-pounds of drag while the bevel gear is being rotated approximately ten times to properly seat the bearings. Drag can be measured with an inch-pound torque wrench in the adapter inserted in the female spline in either end of the drive bevel gear hub. If more convenient, drag can be measured with a spring scale and length of cord wrapped around any known diameter. To convert spring scale reading to inch-pound drag, multiply spring scale reading by one-half the known diameter in inches. Line up a notch in the bearing adjuster to the center of the two tapped holes in the adjuster ring for the drive bevel gear bearing adjuster lock. Always tighten the adjusters clockwise to line up the notches for the lock.

2. (With steering clutches and pinion installed.) Release the steering clutch or clutches, not removed from the assembly, with compression tools. Place the transmission in neutral position. Adjust the left hand bearing adjuster to obtain .002 - .004 inch end clearance in the bearing assembly. The end clearance can be detected with a dial indicator and the use of a pry bar. When .002 - .004 inch end clearance is obtained, measure the amount of drag on the bevel gear assembly and tighten the left hand bearing adjuster to obtain an increase of 25 to 30 inch-pounds over the initial measured drag while the gear is being rotated properly seat the bearings. If the original bearings are to be reinstalled, the preload torque should be 12 to 15 inch-pounds instead of 25 to 30 inch-pounds. Line up a notch in the bearing adjusters to the center of the two tapped holes in the adjuster ring for the drive bevel gear bearing adjuster lock. Always tighten the adjusters clockwise to line up the notches for the lock.

IMPORTANT: When making the cone setting or backlash adjustment, hold the pinion shaft forward using a pry bar or heavy duty screw driver.

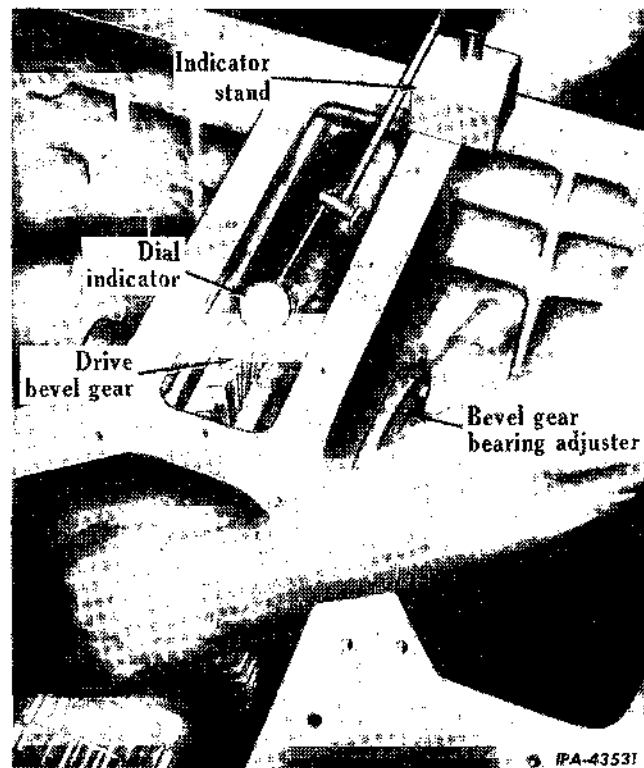
Cone Setting Adjustment

3. Install the bevel pinion shaft assembly and the remaining components of transmission, being sure that all parts are properly seated, and that the nut at the front end of the shaft is tight and locked. Use approximately .080 inch shim pack behind the flange of the bevel pinion shaft rear bearing cage. Rotate the pinion shaft at least ten revolutions. Tighten the bearing cage in place and measure with cone-setting gage between the end of the pinion and the hub of the bevel gear. Add or deduct the necessary

shims to obtain the required gage dimension for proper gear cone setting (Refer to "SPECIFICATIONS", Par. 2). To adjust size of shim pack, remove rear bearing cage cap screws and move the pinion shaft assembly forward to release shim pack behind the bearing cage flange. Be sure the bearing cage and the nut at front end of pinion shaft are tight when final check is made.

Backlash Adjustment. (Refer to Illust. 14 and 15)

4. Alternately loosen one and tighten the other bearing adjuster to move the bevel gear assembly sideways until the required backlash is obtained. (Refer to "SPECIFICATIONS", Par. 2.) Be sure that both adjusters are moved the same number of notches so as not to disturb the preload on the bearing as set up in step 1 or 2. Install the drive bevel gear bearing adjuster locks (Illust. 12), so that the settings cannot be accidentally disturbed when the adjuster ring and adjuster are removed for installation of the



Illust. 15 - Adjusting the Backlash of Bevel Pinion and Bevel Gear (TD-9 (91) Shown.)



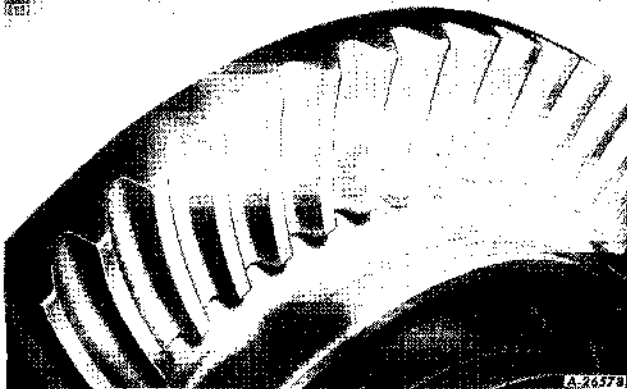
BEVEL GEAR

drive pinion shafts and steering clutches. During assembly of the steering clutches, and before final assembly of the drive bevel gear bearing adjuster and ring, be sure to properly install the sealing rings into the bearing bore of the bevel gear bearing cage against the outer cap of the bearing and OD of the cage bore.

TD-6 (61 AND 62) ONLY: It is often necessary to soak the cork sealing ring in hot water or oil, then stretch to fit the bearing area and stay in position during assembly without the use of adhesive compounds.

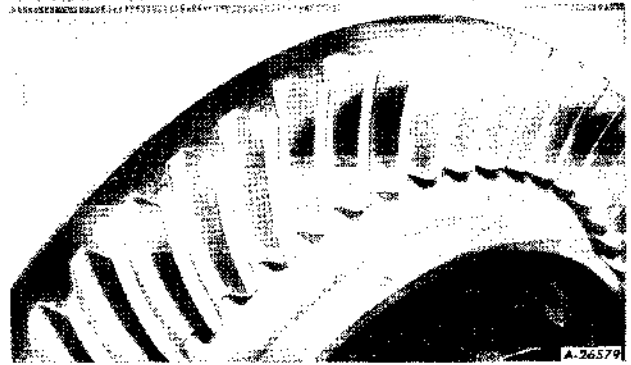
NOTE: The drive bevel gear bearing adjuster lock, Illust. 12, on both sides, must be positioned toward the rear of tractor, or otherwise they will interfere with the steering clutch release fork operation. Whenever the adjuster locks are removed they must be reinstalled to the tapped holes provided in the adjusting ring that are at the rear of the bearings, not the two holes at the front.

5. The required bearing preload, gear cone setting, and backlash should now be correctly set. To check tooth contact, apply red lead to the pinion and turn against the gear to indicate the tooth bearing. The resultant patterns should appear as shown in Illust. 16. If these patterns are not closely approximated, recheck the settings. Also refer to Illust. 17 and 18.



Illust. 16 - Preferred Tooth Bearing of Spiral Drive Bevel Gear.

Illust. 16 illustrates the tooth bearing that is preferred when gears are not under load. Both the pinion and drive bevel gear should have similar tooth bearing when the gears are properly adjusted.



Illust. 17 - Illustrating Tooth Bearing of Spiral Drive Bevel Gear Caused by Setting Pinion Too Far In.

Illust. 17 illustrates the result of setting the pinion too far in. To correct this bearing, move the pinion out, and recheck the backlash.



Illust. 18 - Illustrating Tooth Bearing of Spiral Drive Bevel Gear Caused by Setting Pinion Too Far Out.

Illust. 18, illustrates the result of setting the pinion too far out. To correct this bearing, move the pinion in and recheck the backlash.

Matched Sets of Gears Recommended

It is recommended that matched sets of bevel pinion and drive bevel gears be used but, in cases where this is not possible, unmatched sets may be used, providing both gears are in good condition, by following instructions. Refer to "NOTE" at the beginning of par. 8.



BEVEL GEAR

16. ADJUSTMENT (Shim Type Bevel Gear Adjusters)

To provide maximum life and quiet operation, the bevel gear and pinion must be properly adjusted, whether in matched sets or individually.

This adjustment normally involves two operations: setting the cone center, and setting the gears for proper backlash.

Install the pinion and drive bevel gear, using the original shims. Tighten all bearing cage cap screws.

Cone Center Adjustment (Matched Sets)

1. Measure the distance between the end of the bevel pinion and the machined surface of the drive bevel gear hub.

While the importance of absolute tightness of the bevel pinion shaft front bearing retaining nut is generally realized, the need for firm tightening of the front bearing retainer, as well as the front end cover, is important. Both affect the position of the pinion shaft and should not be neglected between measurements of cone distance.

2. The difference between the measured distance and the figure etched on the bevel pinion gear is the thickness of shims to be added or removed.

3. Make backlash adjustments as described below.

4. Obtain both contact patterns, also described below. If the preceding steps have been carefully followed, correct tooth patterns will result. If the patterns are not correct, a mistake has been made, and it is necessary to repeat the procedure until proper tooth contact patterns are obtained.

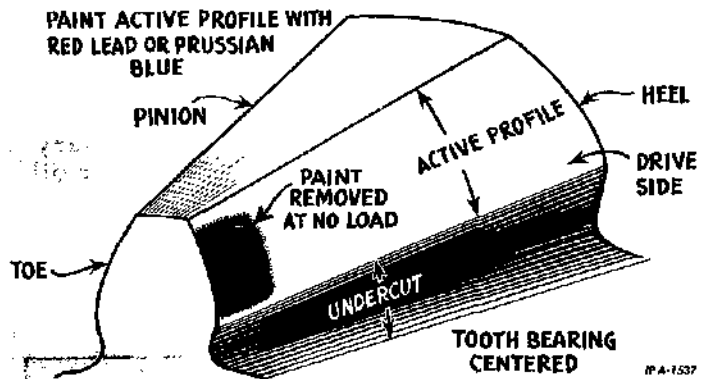
Cone Center Adjustment (Unmatched Sets)

1. Obtain tentative number of shims required as outlined in steps 1 and 2 under matched gear procedure to equal tentative cone distance shown in "SPECIFICATIONS", par. 2.

2. Make backlash adjustments.

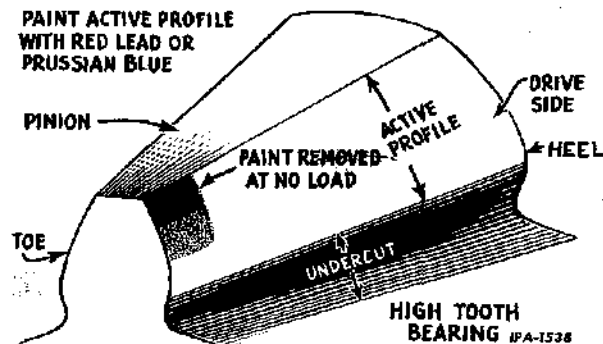
3. Obtain tooth contact patterns. In all likelihood, correct patterns will not result, since the number of shims must be determined by trial and error.

4. Follow instructions given under Illust. 19 and 20 for condition most nearly describing tooth pattern actually obtained. Add or remove shims until correct tooth patterns result with proper backlash adjustment.



Illust. 19 - Preferred Tooth Bearing.

Illust. 19 illustrates the pinion tooth bearing of straight bevel gears that is correctly centered on the active profile, at the toe, when the gears are not under load. This setting should assure that the gears will operate quietly. Both the pinion and bevel gear should have similar tooth bearing when properly set.

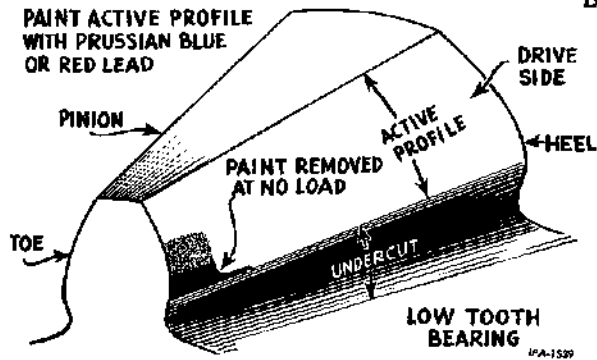


Illust. 20 - Pinion Set Too Far In.

Illust. 20 illustrates the result of setting the pinion of straight bevel gears too far in. It is a high tooth bearing on the pinion (no load). It is also a toe bearing, but it is not properly centered. To correct this bearing, move the pinion out; then, if necessary, move the drive gear in for proper backlash.



BEVEL GEAR



Illust. 21 - Pinion Set Too Far Out.

Illust. 21 illustrates the result of setting the pinion of straight bevel gears too far out. It is a low tooth bearing on the pinion (no load). It is also a toe bearing, but it is not properly centered. To correct this bearing, move the pinion in; then, if necessary, move the drive gear out for proper backlash.

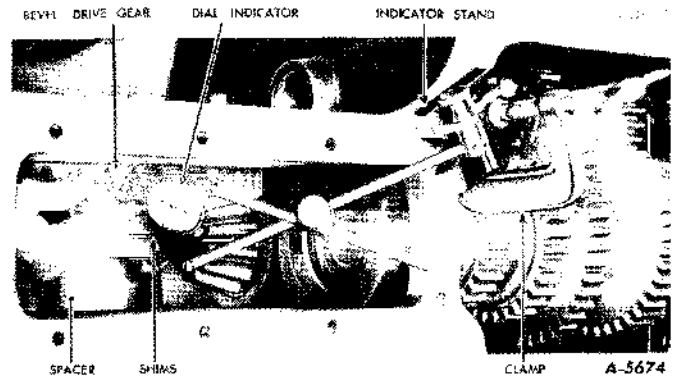
Backlash Adjustment.

1. Before measuring the backlash, force the bevel gear carrier assembly away from the bevel pinion. Measure the backlash between the bevel pinion and the drive bevel gear with a dial indicator gauge at four different points on the drive bevel gear. (Refer to Illust. 22.)

A true dial indicator reading of backlash present cannot be obtained unless the same conditions are established as when the complete assembly, including steering clutches, were in place.

After the bevel gear hub with gear, shims, bearings and cages with gaskets between cages and main frame are in place, force the right bearing up tight against the shoulder on hub by installing one steering clutch shaft coupling retainer to the hub. (The coupling itself need not be in place.) The right bearing cage cap should be mounted with gasket. The bevel gear bolts must be torqued to at least one-half of torque, after each change of shims for each series of backlash readings taken at four points, as is customary. When the backlash has been satisfactorily determined, the bolts should be torqued and secured.

2. Add or remove shims as necessary to equal the difference between the measured backlash at the average point and the figure etched on the bevel gear. (Refer to "SPECIFICATIONS", par. 2.)



Illust. 22 - Adjusting Backlash of Bevel Pinion and Bevel Gear.

To adjust the pinion on the 6 and 9 series crawler tractors, add or remove shims from between the bevel pinion shaft rear bearing cage and the main frame.

To adjust the drive bevel gear, add or remove shims from between the drive bevel gear hub and the drive bevel gear.

After the bevel pinion and drive bevel gear have been adjusted in the above manner, coat the contact area of the bevel gear teeth with red lead or prussian blue. Revolve the gears, using the pinion as the driver. Compare tooth contact with Illust. 19 (for straight bevel gears). If results are similar to Illust. 19, no further adjustment is necessary. If results are not similar to Illust. 19, correct the adjustment by following instructions below the illustration (Illust. 20 and 21) which compares with the test pattern. Check backlash after every bevel pinion adjustment.

Deflection Set Screw Adjustment

If transmission is so equipped, run the deflection screw in until it contacts the drive bevel gear, then back it out one quarter (1/4) turn. Lock the set screw.