WSM

WORKSHOP MANUAL
TRACTOR

M4500(A/AC),M5500(A/AC), M7500(A/AC)

Kubota

KiSC issued 07, 2016 A

TO THE READER

This Workshop Manual has been prepared to provide servicing personnel with information on the mechanisms, service and maintenance of Kubota Tractor M4500(DT)-A(AC), M5500(DT)-A(AC) and M7500(DT)-A(AC). It is divided into two parts, "Mechanism" and "Disassembly and Servicing."

- **Mechanism**

Information on construction and functions are included for each tractor section. This part should be understood before proceeding with troubleshooting, disassembly and servicing.

- **Disassembly and Servicing**

Under the heading "General" comes general precautions, troubleshooting, and lists of servicing reference values and periodic inspection items. For each tractor section, there are "Checking and Adjustment", "Disassembly and Assembly", and "Servicing" which cover procedures, precautions, reference values and allowable limits.

For a detailed engine description, for D3000-A and V4000-A engines, refer to "Kubota Diesel Engine Workshop Manual D3000-B · D3200-B · V4000-B · V4300-B" (Code No. 97897-00740), and for S2600-A engine, refer to "Kubota Diesel Engine Workshop Manual S2200-B · S2600-B · S2800-B (Code No. 97897-00770).

All information, illustrations and specifications contained in this manual are based on the latest production information available at the time of publication. The right is reserved to make changes in all information at any time without notice.

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M MECHANISM

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GENERAL

[1] SPECIFICATIONS

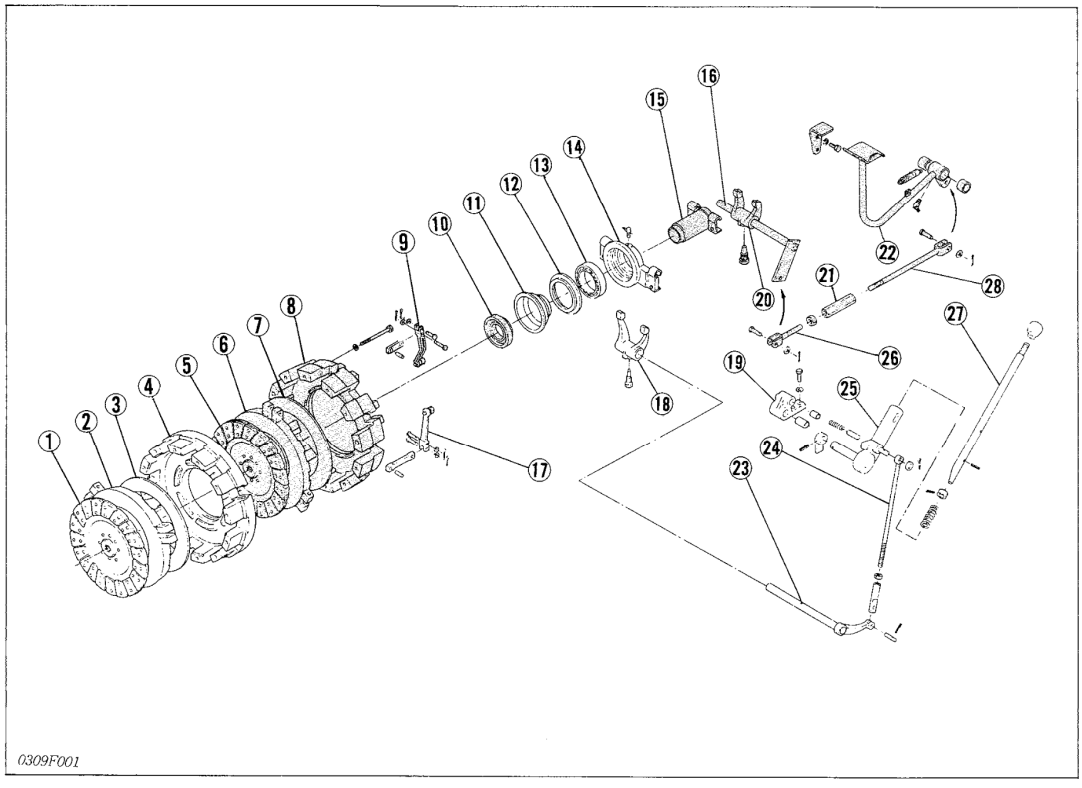
Model				M4500-A(AC) (2WD)	M4500DT-A(AC) (4WD)
Maximum PTO power				36.55kW (49.7PS, 49HP)*	
Engine	Model			S2600–A	
	Type			Vertical, water-cooled, 4-cycle diesel engine	
	Number of cylinders			6	
	Total displacement			2598cm³ (158.5 cu.in.)	
	Bore and stroke			82 x 82mm (3.23 x 3.23 in.)	
	Engine gross power			41.4kW (56.3PS, 55.5HP)	
	Rated revolution			2600 rpm	
	Maximum torque			158N·m (16.2kgf·m, 117.6ft-lbs)/1400 rpm	
	Battery			12V 150Ah	
	Fuel			Diesel fuel No.1-D [below –10°C (15°F)] Diesel fuel No.2-D [above –10°C (15°F)] (ASTM D975)	
	Fuel tank capacity			54ℓ (57.0 U.S. qts., 47.5 Imp. qts.)	
	Engine crankcase capacity			12ℓ (13.0 U.S. qts., 10.6 Imp. qts.)	
	Engine coolant capacity			8.4ℓ (8.9 U.S. qts., 7.4 Imp. qts.)	
Dimensions	Overall length			3365mm (132.5 in.)	3495mm (137.6 in.)
	Overall width			1685mm (66.3 in.)	1785mm (70.3 in.)
	Overall height			2260mm (89.0 in.)	2290mm (90.2 in.)
	Wheel base			1985mm (78.1 in.)	2020mm (79.5 in.)
	Tread	Front		1280 to 1880mm (50.4 to 74.0 in.)	1420mm (55.9 in.)
		Rear	with extension steps	1500 to 1900mm (59 to 75 in.)	
			without extension steps	1300 to 1900mm (51 to 75 in.)	
	Minimum ground clearance			395mm (15.6 in.)	340mm (13.4 in.) (at the bottom of front differential case)
Weight				1920kg (4233 lbs)	2200kg (4850 lbs)
Traveling system	Tire size		Front tires	6.00–16–6PR (AG)	8.3/8–24–6PR (AG)
			Rear tires	14.9/13–28–6PR (AG)	
	Clutch			Dry, single plate	
	Steering			Power steering	
	Transmission			16 forward and 4 reverse (AC type) 8 forward and 2 reverse (A type) F: 1st. 2nd constant mesh 3rd. 4th Synchronized mesh R: Constant mesh	
	Brake			Multiple wet discs operated by two foot pedals	
	Differential			Bevel gears (with differential lock)	
Hydraulic system	Hydraulic control system			Position control, draft control and mixed control	
	Pump-up capacity			35ℓ/min (37.0 U.S. qts./min, 30.8 Imp. qts./min)	
	Three-point hitch			Category I·II	
	Maximum lifting force			1700kg (3740 lbs)	
PTO				Independent	
	Live PTO (A type / AC type)		Direction of turning	Clockwise, viewed from tractor rear	
			PTO speed	540 rpm at 2193 engine rpm (1000 rpm at 2521 engine rpm according to specifications)	
	Ground PTO (AC type)		Direction of turning	Clockwise, viewed from tractor rear	
			PTO speed	1.59 turns/m (0.48 turns/ft) (with 14.9 –28 tires)	
Traction system				Swing drawbar, adjustable in direction and height	

Note: *Maximum PTO horse power in Official Test.

M5500-A(AC) (2WD)	M5500DT-A (AC) (4WD)	M7500-A(AC) (2WD)	M7500DT-A (AC) (4WD)
40.2kW (54.6PS, 53.9HP)*		53.71kW (73PS, 72HP)*	
D3000—A		V4000—A	
Vertical, water-cooled, 4-cycle diesel engine		Vertical, water-cooled, 4-cycle diesel engine	
3		4	
2987cm³ (182.2 cu.in.)		3983cm³ (243 cu.in.)	
105 x 115mm (4.13 x 4.53 in.)		105 x 115mm (4.13 x 4.53 in.)	
47kW (63.9PS, 63HP)		60.4kW (82PS, 81HP)	
2400 rpm		2400 rpm	
204N·m (20.8kgf·m, 150.3ft-lbs)/1400 rpm		273N·m (27.9kgf·m, 201.7ft-lbs)/1400 rpm	
12V 300Ah		12V 300Ah	
Diesel fuel No.1-D [below −10°C (15°F)] Diesel fuel No.2-D [above −10°C (15°F)] (ASTM D975)		Diesel fuel No.1-D [below −10°C (15°F)] Diesel fuel No.2-D [above −10°C (15°F)] (ASTM D975)	
54ℓ (57.0 U.S. qts., 47.5 Imp. qts.)		54ℓ (57.0 U.S. qts., 47.5 Imp. qts.)	
9.8ℓ (10.4 U.S. qts., 8.6 Imp. qts.)		11.8ℓ (12.5 U.S. qts., 10.4 Imp. qts.)	
11.6ℓ (12.3 U.S. qts., 10.2 Imp. qts.)		13ℓ (14.0 U.S. qts., 11.4 Imp. qts.)	
3370mm (132.7 in.)	3530mm (139 in.)	3630mm (142.9 in.)	3755mm (147.8 in.)
1685mm (66.3 in.)	1795mm (70.7 in.)	1810mm (71.3 in.)	1830mm (72 in.)
2215mm (87.2 in.)	2255mm (88.8 in.)	2265mm (89.2 in.)	2265mm (89.2 in.)
2030mm (79.9 in.)	2055mm (80.9 in.)	2155mm (84.8 in.)	2175mm (85.6 in.)
1280 to 1780mm (50.4 to 70.1 in.)	1420mm (55.9 in.)	1370 to 1870mm (53.9 to 73.6 in.)	1470mm (57.9 in.)
1500 to 1900mm (59 to 75 in.)		1500 to 1900mm (59 to 75 in.)	
1300 to 1900mm (51 to 75 in.)		1400 to 1900mm (55 to 75 in.)	
395mm (15.6 in.)	340mm (13.4 in.) (at the bottom of front differential case)	465mm (18.3 in.)	340mm (13.4 in.) (at the bottom of front differential case)
2100kg (4630 lbs)	2320kg (5115 lbs)	2230kg (4916 lbs)	2570kg (5666 lbs)
6.00—16—6PR (AG)	8.3/8—24—6PR (AG)	7.50—16—6PR (AG)	9.5/9—24—6PR (AG)
14.9/13—28—6PR (AG)		16.9/14—30—6PR (AG)	
Dry, single plate		Dry, single plate	
Power steering		Power steering	
16 forward and 4 reverse (AC type), 8 forward and 2 reverse (A type) F: Synchronized mesh R: Gear sliding mesh		16 forward and 4 reverse (AC type), 8 forward and 2 reverse (A type) F: Synchronized mesh R: Gear sliding mesh	
Multiple wet discs operated by two foot pedals		Multiple wet discs operated by two foot pedals	
Bevel gears (with differential lock)		Bevel gears (with differential lock)	
Position control, draft control and mixed control		Position control, draft control and mixed control	
35ℓ/min (37.0 U.S. qts./min, 30.8 Imp. qts./min)		35ℓ/min (37.0 U.S. qts./min, 30.8 Imp. qts./min)	
Category I·II		Category II	
1700kg (3740 lbs)		1700kg (3740 lbs)	
Independent		Independent	
Clockwise, viewed from tractor rear		Clockwise, viewed from tractor rear	
540 rpm at 2016 engine rpm (1000 rpm at 2381 engine rpm according to specifications)		540 rpm at 2016 engine rpm (1000 rpm at 2381 engine rpm according to specifications)	
Clockwise, viewed from tractor rear		Clockwise, viewed from tractor rear	
1.55 turns/m (0.47 turns/ft) (with 14.9 — 28 tires)		1.51 turns/m (0.46 turns/ft) (with 16.9 — 30 tires)	
Swing drawbar, adjustable in direction and height		Swing drawbar, adjustable in direction and height	

1 CLUTCH

The clutch, located between the engine and the transmission, shuts off or transmits torque from the flywheel to the transmission.
Tractor models M4500(DT), M5500(DT) and M7500(DT) have the dry, single-plate type dual clutch that shuts off or transmits torque to the traveling and PTO systems. The two clutches can be operated independently of each other.



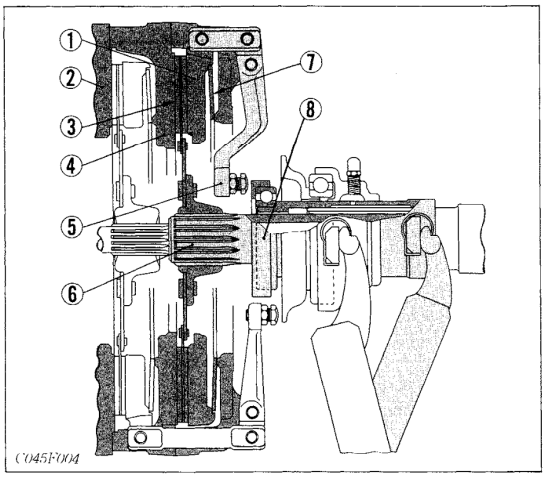
[PTO Clutch]

(1) Clutch Disc
(2) Pressure Plate
(3) Diaphragm Spring
(4) Clutch Cover
(11) Clutch Release Hub
(12) Release Bearing Cover
(13) Bearing
(14) Release Coupling
(17) Release Levers
(18) Release Fork
(19) Bracket
(23) PTO Lever Shaft
(24) PTO Rod
(25) Lever Guide
(27) Clutch Lever

[Traveling Clutch]

(5) Clutch Disc
(6) Pressure Plate
(7) Diaphragm Spring
(8) Clutch Cover
(9) Release Levers
(10) Clutch Release Bearing
(15) Release Hub
(16) Control Lever Shaft
(20) Release Fork
(21) Turnbuckle
(22) Clutch Pedal
(26) Clutch Rod 1
(28) Clutch Rod 2

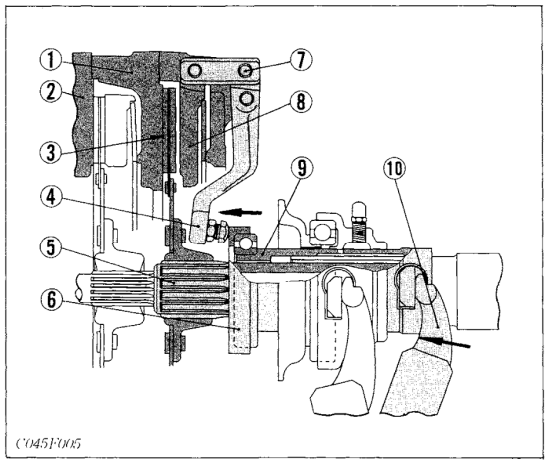
[1] DRY SINGLE-PLATE TYPE, DUAL CLUTCH



(1) Pressure Plate
(2) Flywheel
(3) Clutch Disc
(4) Clutch Cover
(5) Release Lever
(6) 1st Shaft
(7) Diaphragm Spring
(8) Clutch Release Bearing

■ Traveling Clutch "Engage"

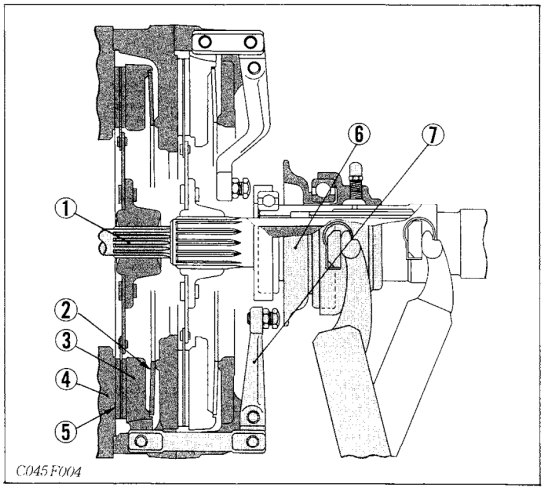
When the clutch pedal is not pressed, the clutch release bearing (8) and release lever (5) do not contact each other. Accordingly, the tension of the diaphragm spring (7) pushes the pressure plate (1) toward the flywheel (2) to tightly press it to the clutch disc (3). As a result, rotation of the flywheel (2) is transmitted from the clutch disc splines through the 1st shaft (6) to the transmission due to frictional force among the clutch cover (4), the traveling clutch disc and the pressure plate.



(1) Clutch Cover
(2) Flywheel
(3) Clutch Disc
(4) Release Lever
(5) 1st Shaft
(6) Clutch Release Bearing
(7) Clevis Pin
(8) Pressure Plate
(9) Release Hub
(10) Release Fork

■ Traveling Clutch "Disengage"

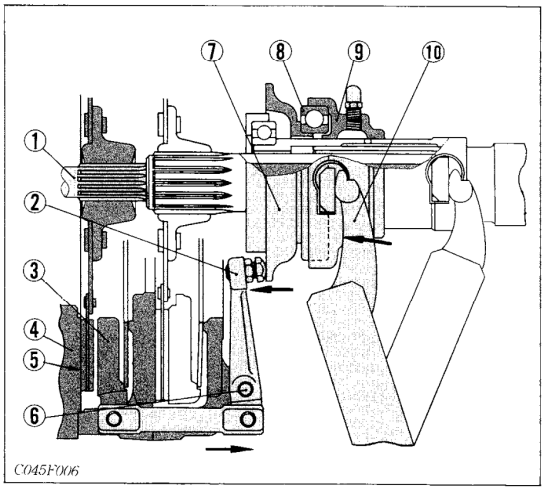
Pressing the clutch pedal pulls the clutch rod to rotate the control lever shaft.
When the shaft rotates, the release fork (10) pushes the release hub (9) toward the flywheel (2) and the clutch release bearing (6) presses the release lever (4). The release lever pressed by the clutch release bearing pulls the pressure plate (8), with the clevis pin (7) serving as a fulcrum.
The frictional force among the clutch cover (1), clutch disc (3) and pressure plate (8) disappear. Therefore, rotation of the flywheel (2) is not transmitted to the clutch disc (3), stopping rotation of the 1st shaft (5).



(1) PTO Propeller Shaft
(2) Diaphragm Spring
(3) Pressure Plate
(4) Flywheel
(5) Clutch Disc
(6) Clutch Release Hub
(7) Release Lever

■ PTO Clutch "Engage"

When the clutch lever is not operated, the clutch release hub (6) and the release lever (7) do not contact each other. Accordingly, as with the traveling system clutch "Engage", the diaphragm spring (2) pushes the pressure plate (3) toward the flywheel (4), causes it to tightly press the clutch disc (5). Thus, rotation of the flywheel is transmitted from the PTO propeller shaft (1) to the transmission due to the frictional force among the flywheel, PTO clutch disc and pressure plate.



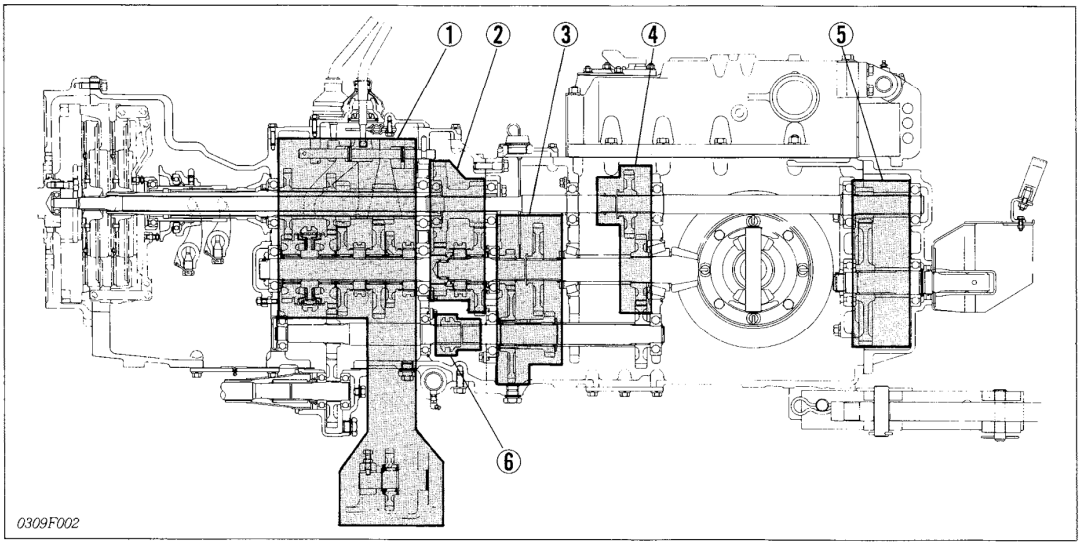
(1) PTO Propeller Shaft
(2) Release Lever
(3) Pressure Plate
(4) Flywheel
(5) Clutch Disc
(6) Clevis Pin
(7) Clutch Release Hub
(8) Bearing
(9) Release Coupling
(10) Release Fork

■ PTO Clutch "Disengage"

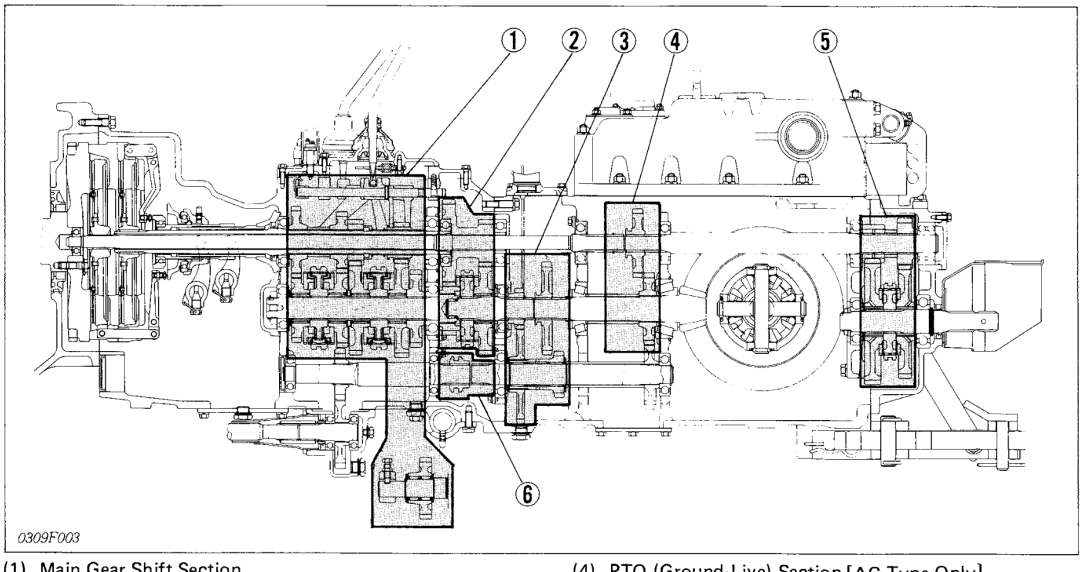
When the clutch lever is moved upward, the PTO rod is pulled and the PTO lever shaft rotates. Due to this rotation, the release fork (10) pushes the release coupling (9) and bearing (8) toward the flywheel (4) and the clutch release hub (7) presses the release lever (2). As the depressed release lever pulls the pressure plate (3), with the clevis pin (6) serving as a fulcrum, the frictional force among the flywheel, clutch disc (5) and pressure plate disappear. As a result, rotation of the flywheel is not transmitted to the clutch disc.

2 TRANSMISSION

[M4500(DT)-A(AC)]



[M5500(DT)-A(AC)·M7500(DT)-A(AC)]



(1) Main Gear Shift Section
(2) Hi-Lo Gear Shift Section
(3) Creep Gear Shift Section [AC Type Only]
(4) PTO (Ground-Live) Section [AC Type Only]
(5) PTO Gear Shift Section
(6) Front Wheel Drive Section [DT Type Only]

The transmission consists of a series of gears shown previously. It offers the most suitable speeds for traveling and operation by combination of these gears. It transmits power to the front or rear axles and the PTO shaft, which are classified respectively as the traveling system and PTO system.

■ Traveling System

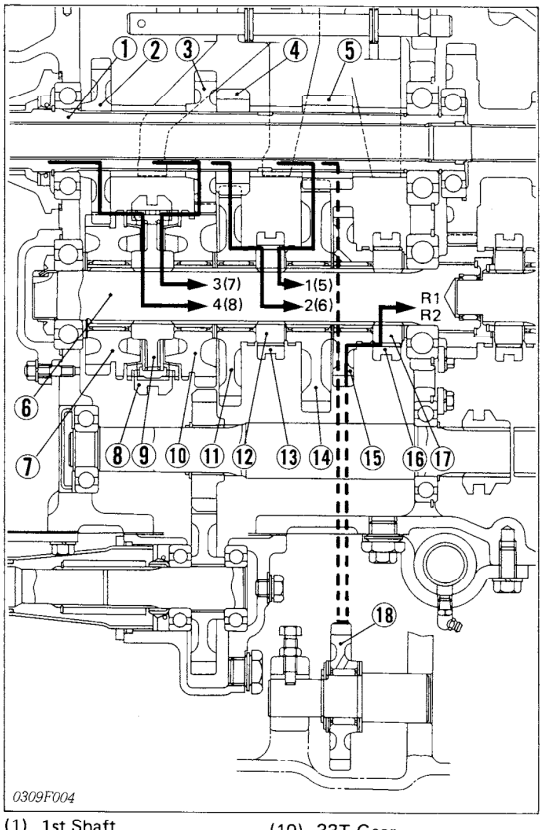
The traveling system consists of the main gear shift section (1), Hi-Lo gear shift section (2), creep gear shift section (3) and front wheel drive section (6).
M4500(DT)-A, M5500(DT)-A and M7500(DT)-A have 8 forward and 2 reverse speeds.
M4500(DT)-AC, M5500(DT)-AC and M7500(DT)-AC have 16 forward and 4 reverse speeds.
They are selected by the operation of the main gear shift, Hi-Lo gear shift and creep gear shift levers.

■ PTO System

M4500(DT)-A, M5500(DT)-A and M7500(DT)-A have Live PTO in which the engine rotation is transmitted directly to the PTO drive shaft by the PTO propeller shaft.
M4500(DT)-AC, M5500(DT)-AC and M7500(DT)-AC have Live PTO and also have Ground PTO in which the PTO drive shaft is driven by spiral bevel pinion shaft in traveling system.

[1] MAIN GEAR SHIFT SECTION

[M4500(DT) - A(AC)]



(1) 1st Shaft
(2) 30T Gear
(3) 25T Gear
(4) 18T Gear
(5) 16T Gear
(6) Counter Shaft
(7) 29T Gear
(8) Shifter
(9) Coupling
(10) 33T Gear
(11) 40T Gear
(12) Coupling
(13) Shifter
(14) 44T Gear
(15) 33T Gear
(16) Shifter
(17) Coupling
(18) 26T Gear

Besides neutral, five ways of power flow (from 1st shaft to counter shaft) are available by operating the main gear shift lever to shift positions of the shifter (8), (13), (16) on the counter shaft (6).

▪ 1 · 5 Position
1st Shaft (1) ⟶ 16T Gear (5) ⟶ 44T Gear (14) ⟶ Shifter (13) ⟶ Coupling (12) ⟶ Counter Shaft (6).

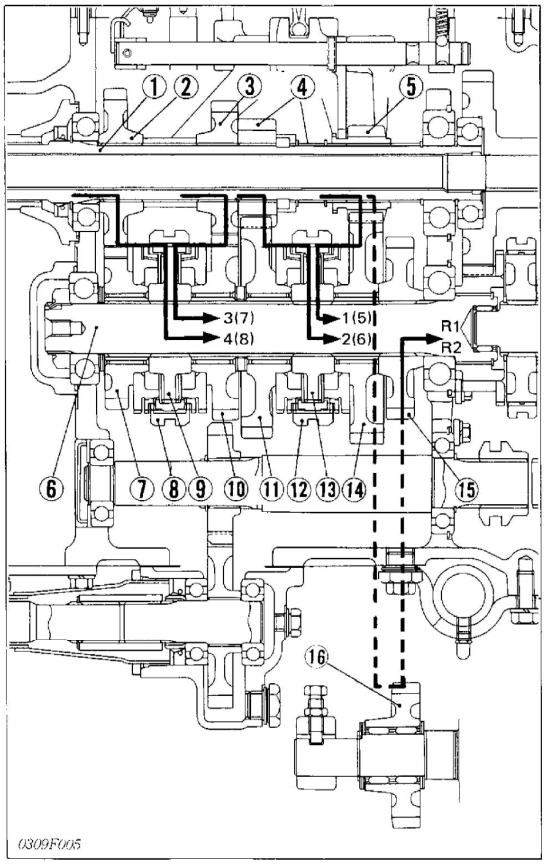
■ 2 · 6 Position
1st Shaft (1) ⟶ 18T Gear (4) ⟶ 40T Gear (11) ⟶ Shifter (13) ⟶ Coupling (12) ⟶ Counter Shaft (6).

■ 3 · 7 Position
1st Shaft (1) ⟶ 25T Gear (3) ⟶ 33T Gear (10) ⟶ Shifter (8) ⟶ Coupling (9) ⟶ Counter Shaft (6).

■ 4 · 8 Position
1st Shaft (1) ⟶ 30T Gear (2) ⟶ 29T Gear (7) ⟶ Shifter (8) ⟶ Coupling (9) ⟶ Counter Shaft (6).

■ R1 · R2 Position
1st Shaft (1) ⟶ 16T Gear (5) ⟶ 26T Gear (18) ⟶ 33T Gear (15) ⟶ Shifter (16) ⟶ Coupling (17) ⟶ Counter Shaft (6).

[M5500(DT)-A(AC) · M7500(DT)-A(AC)]



(1) 1st Shaft
(2) 30T Gear
(3) 25T Gear
(4) 18T Gear
(5) Gear (A)
(6) Counter Shaft
(7) 29T Gear
(8) Shifter
(9) Coupling
(10) 33T Gear
(11) 40T Gear
(12) Shifter
(13) Coupling
(14) Gear (B)
(15) Gear (D)
(16) Gear (C)

Besides neutral, five ways of power flow (from 1st shaft to counter shaft) are available by operating the main gear shift lever to shift positions of the shifter (8), (12) on the counter shaft (6) and gear (A) (5) on the 1st shaft (1).

■ 1 · 5 Position
1st Shaft (1) ⟶ Gear (A) (5) ⟶ Gear (B) (14) ⟶ Shifter (12) ⟶ Coupling (13) ⟶ Counter Shaft (6).

■ 2 · 6 Position
1st Shaft (1) ⟶ 18T Gear (4) ⟶ 40T Gear (11) ⟶ Shifter (12) ⟶ Coupling (13) ⟶ Counter Shaft (6).

■ 3 · 7 Position
1st Shaft (1) ⟶ 25T Gear (3) ⟶ 33T Gear (10) ⟶ Shifter (8) ⟶ Coupling (9) ⟶ Counter Shaft (6).

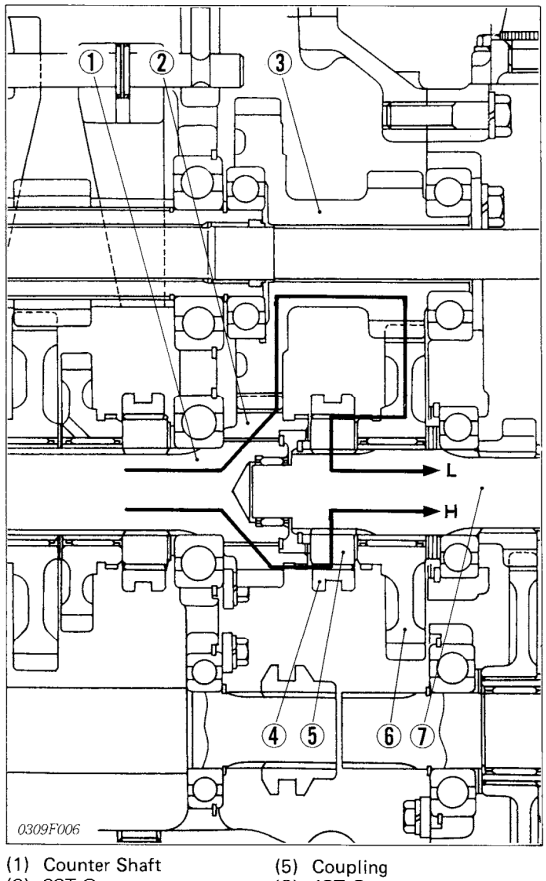
■ 4 · 8 Position
1st Shaft (1) ⟶ 30T Gear (2) ⟶ 29T Gear (7) ⟶ Shifter (8) ⟶ Coupling (9) ⟶ Counter Shaft (6).

■ R1 · R2 Position
1st Shaft (1) ⟶ Gear (A) (5) ⟶ Gear (C) (16) ⟶ Gear (D) (15) ⟶ Counter Shaft (6).

- **Number of gear teeth**

Model \ Gear	(A)	(B)	(C)	(D)
M5500(DT)-A(AC)	17	46	28	35
M7500(DT)-A(AC)	15	40	24	31

[2] Hi-Lo GEAR SHIFT SECTION



(1) Counter Shaft
(2) 23T Gear
(3) 20T - 40T Gear
(4) Shifter
(5) Coupling
(6) 43T Gear
(7) Hi-Lo Speed Change Shaft

When the Hi-Lo gear shift lever is in neutral, shifter (4) on the Hi-Lo speed change shaft (7) is not engaged with 23T gear (2) on the counter shaft (1) or 43T gear (6) on the Hi-Lo speed change shaft. Therefore, power is not transmitted from the counter shaft to the Hi-Lo speed change shaft. Besides neutral, two ways of power flow are available by operating the Hi-Lo gear shift lever to shift positions of the shifter on the Hi-Lo speed change shaft.

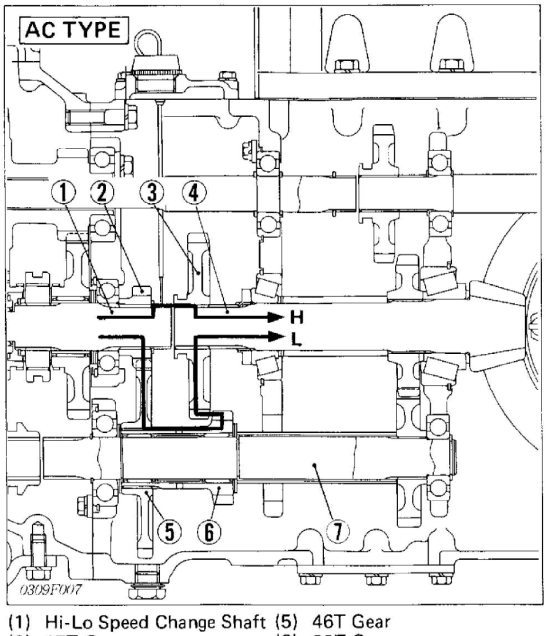
■ **Low (L) Position**

Counter Shaft (1) → 23T Gear (2) → 20T-40T Gear (3) → 43T Gear (6) → Shifter (4) → Coupling (5) → Hi-Lo Speed Change Shaft (7).

■ **High (H) Position**

Counter Shaft (1) → 23T Gear (2) → Shifter (4) → Coupling (5) → Hi-Lo Speed Change Shaft (7).

[3] CREEP GEAR SHIFT SECTION [AC TYPE ONLY]



(1) Hi-Lo Speed Change Shaft
(2) 17T Gear
(3) 43T Gear
(4) Spiral Bevel Pinion Shaft
(5) 46T Gear
(6) 20T Gear
(7) Transmitting Shaft Rear

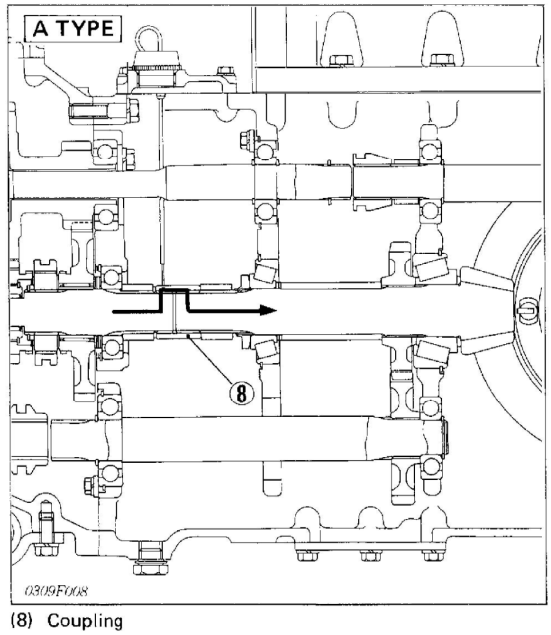
When the creep gear shift lever is in neutral, 43T gear (3) on the spiral bevel pinion shaft (4) is not engaged with 20T gear (6) on the transmitting shaft rear (7) or Hi-Lo speed change shaft (1). Therefore, power is not transmitted from the Hi-Lo speed change shaft to the spiral bevel pinion shaft.
Besides neutral, two ways of power flow are available by operating the creep gear shift lever to shift positions of the 43T gear on the spiral bevel pinion shaft.

■ Low (L) Position

Hi-Lo Speed Change Shaft (1) ⟶ 17T Gear (2) ⟶ 46T Gear (5) ⟶ 20T Gear (6) ⟶ 43T Gear (3) ⟶ Spiral Bevel Pinion Shaft (4).

■ High (H) Position

Hi-Lo Speed Change Shaft (1) ⟶ 43T Gear (3) ⟶ Spiral Bevel Pinion Shaft (4).



(8) Coupling

■ Note:

- "A" type tractors do not have a creep gear shift system. On those tractors, power is transmitted via the same route as in Creep High Speed Position, and the coupling (8) is used instead of 43T gear (3).

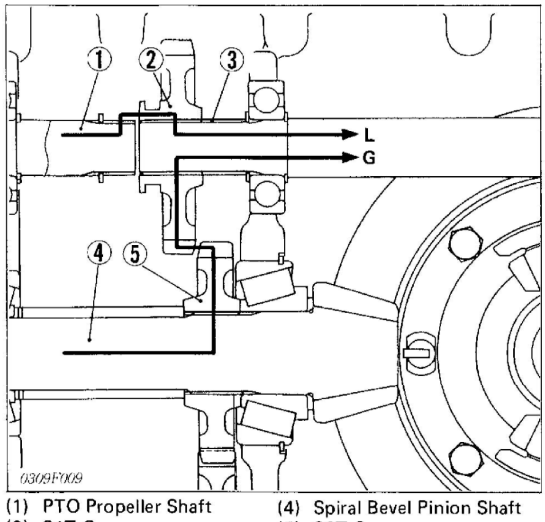
[4] PTO (GROUND/LIVE) SECTION [AC TYPE ONLY]

■ Ground PTO

Ground PTO's operate only when the traveling clutch is engaged. They stop whenever the clutch is disengaged (stopping tractor travel).

■ Live PTO

Live PTO's have their own clutch controls completely separate from the traveling clutch and transmission. Therefore, the PTO can operate while the tractor travel is stopped and also the PTO can be disengaged and engaged while the tractor is in motion.



(1) PTO Propeller Shaft
(2) 31T Gear
(3) PTO Drive Shaft
(4) Spiral Bevel Pinion Shaft
(5) 32T Gear

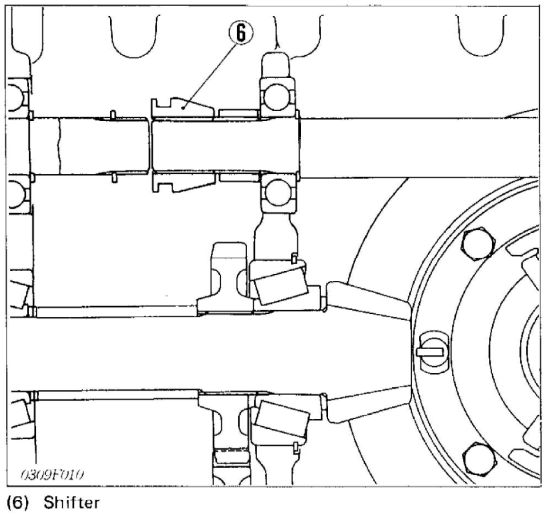
When the ground PTO gear shift lever is in neutral, 31T gear (2) on the PTO drive shaft (3) is not engaged with 32T gear (5) on the spiral bevel pinion shaft (4) or PTO propeller shaft (1). Therefore, power is not transmitted from the spiral bevel pinion shaft or PTO propeller shaft to the PTO drive shaft. Besides neutral, two ways of power flow are available by operating the ground PTO gear shift lever to shift positions of 31T gear on the PTO drive shaft.

■ Ground (G) Position

Spiral Bevel Pinion Shaft (4) ⟶ 32T Gear (5) ⟶ 31T Gear (2) ⟶ PTO Drive Shaft (3).

■ Live (L) Position

PTO Propeller Shaft (1) ⟶ 31T Gear (2) ⟶ PTO Drive Shaft (3).

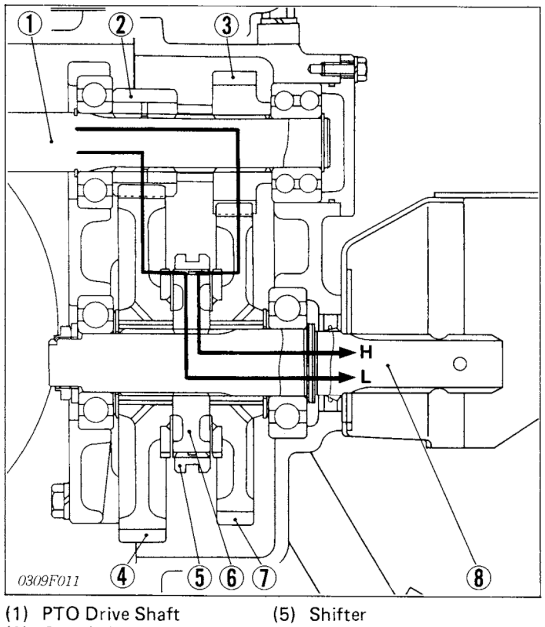


(6) Shifter

■ Note:

- Tractors (with Live PTO only) have the shifter (6) instead of 31T gear (2).

[5] PTO GEAR SHIFT SECTION



(1) PTO Drive Shaft
(2) Gear (A)
(3) Gear (B)
(4) Gear (C)
(5) Shifter
(6) Coupling
(7) Gear (D)
(8) PTO Shaft

When the PTO gear shift lever is in neutral, shifter (5) on the PTO shaft (8) is not engaged with gear (C) (4) or gear (D) (7) on the PTO shaft. Therefore, power is not transmitted from the PTO drive shaft (1) to the PTO shaft (8).
Besides neutral, two ways of power flow are available by operating the PTO gear shift lever to shift positions of the shifter on the PTO shaft.

■ Low (L) Position

PTO Drive Shaft (1) → Gear (A) (2) → Gear (C) (4) → Shifter (5) → Coupling (6) → PTO Shaft (8).

■ High (H) Position

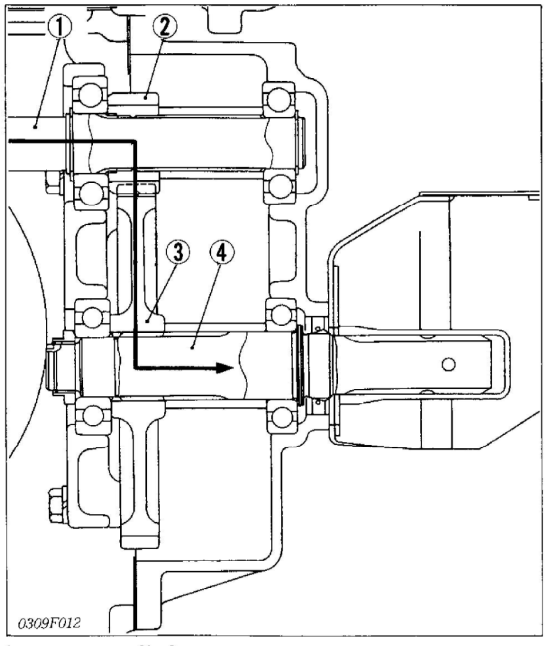
PTO Drive Shaft (1) → Gear (B) (3) → Gear (D) (7) → Shifter (5) → Coupling (6) → PTO Shaft (8).

- **Number of gear teeth**

Model \ Gear	(A)	(B)	(C)	(D)
M4500(DT)-A (AC)	16	23	65	58
M5500(DT)-A (AC) M7500(DT)-A (AC)	15	21	56	50

Relationship between engine speed and PTO shaft speed is as shown in the table below.

Model \ Speed	PTO (rpm) / Engine (rpm) L		PTO (rpm) / Engine (rpm) H	
M4500(DT)-A(AC)	540/2193	640/2600	1000/2522	1031/2600
M5500(DT)-A(AC) M7500(DT)-A(AC)	540/2016	642/2400	1000/2381	1008/2400



(1) PTO Drive Shaft
(2) Gear (E)
(3) Gear (F)
(4) PTO Shaft

For PTO single speed type (Tractor does not have a PTO speed change system), the power is transmitted as follows.

PTO Drive Shaft (1) ⟶ Gear (E) (2) ⟶ Gear (F) (3) ⟶ PTO Shaft (4).

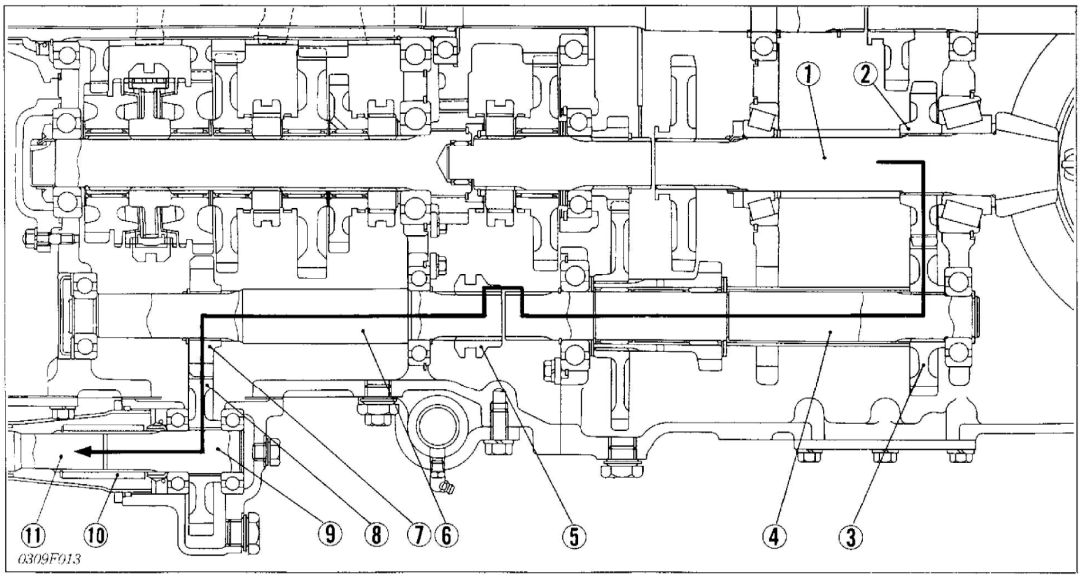
- **Number of gear teeth**

Gear / Model	(E)	(F)
M4500(DT)-A(AC)	16	65
M5500(DT)-A(AC) M7500(DT)-A(AC)	15	56

Relationship between engine speed and PTO shaft speed is as shown in the table below.

Speed / Model	L PTO (rpm) / Engine (rpm)	
M4500(DT)-A(AC)	540/2193	640/2600
M5500(DT)-A(AC) M7500(DT)-A(AC)	540/2016	642/2400

[6] FRONT WHEEL DRIVE SECTION [DT TYPE ONLY]



(1) Spiral Bevel Pinion Shaft
(2) 32T Gear
(3) 31T Gear
(4) Transmitting Shaft Rear
(5) Shifter
(6) Transmitting Shaft Front
(7) Gear (A)
(8) Gear (B)
(9) Front Wheel Drive Shaft
(10) Coupling
(11) Propeller Shaft

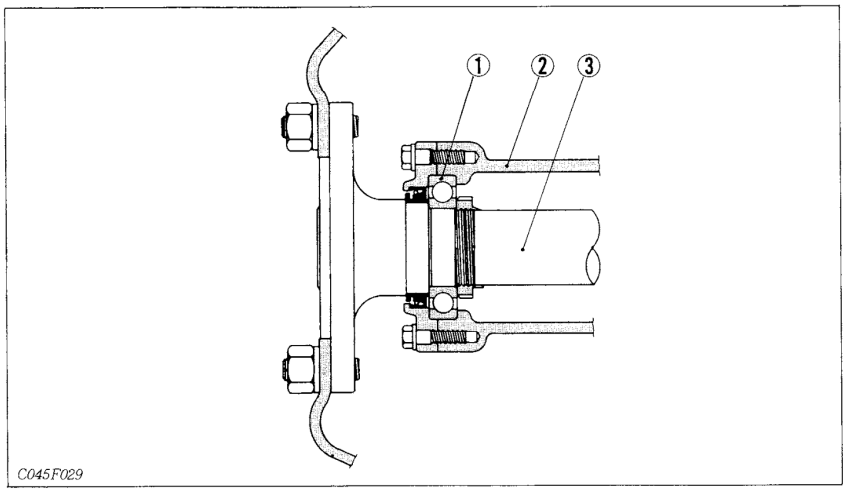
2-wheel drive or 4-wheel drive is selected by changing position of the shifter (5) on the transmitting shaft front (6) using the front wheel drive lever. When the front wheel drive lever is set to "Disengage", the shifter is in neutral and power is not transmitted to the front wheel drive shaft (9). When the front wheel drive lever is set to "Engage", the shifter slides to the right to engage with the transmitting shaft rear (4). Power is transmitted as follows.

Spiral Bevel Pinion Shaft (1) ⟶ 32T Gear (2) ⟶ 31T Gear (3) ⟶ Transmitting Shaft Rear (4) ⟶ Shifter (5) ⟶ Transmitting Shaft Front (6) ⟶ Gear (A) (7) ⟶ Gear (B) (8) ⟶ Front Wheel Drive Shaft (9) ⟶ Coupling (10) ⟶ Propeller Shaft (11).

- **Number of gear teeth**

Model \ Gear	(A)	(B)
M4500DT-A(AC)	19	28
M5500DT-A(AC)	24	32
M7500DT-A(AC)	20	29

3 REAR AXLE

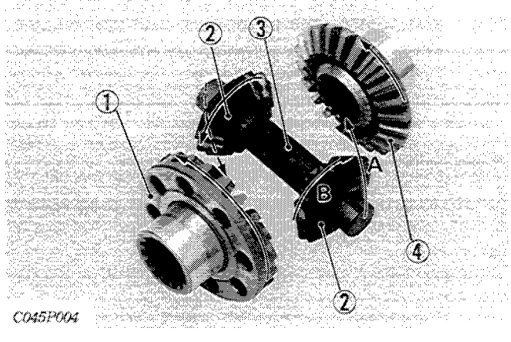


(1) Bearing
(2) Rear Axle Case
(3) Rear Axle

The rear axles are the final mechanism which transmits power from the transmission to the rear wheels. Direction of power transmitted is changed at a right angle by the differential gear and, at the same time, speed is reduced. It is further reduced by the planetary gear to drive the rear axles.

The rear axles are semifloating type with the ball bearings (1) between the rear axles (3) and rear axle cases (2), which support the rear wheel load as well as transmitting power to the rear wheels. They withstand all the forces caused by tire rotation and side skidding.

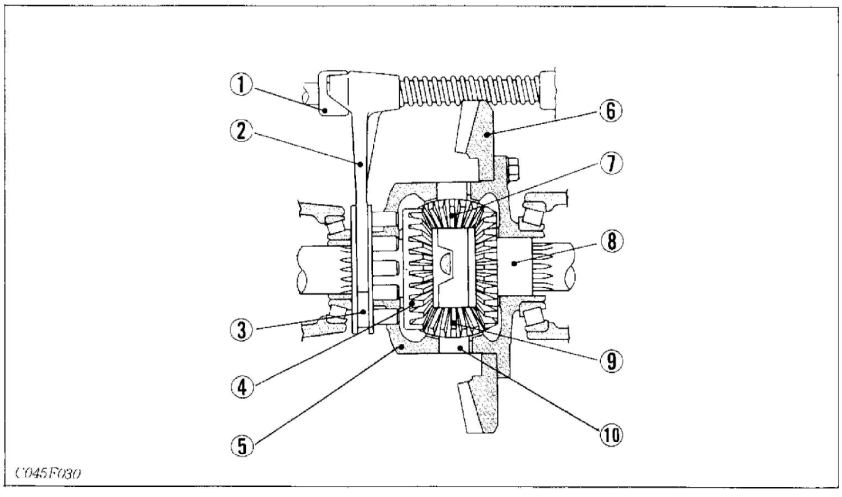
[1] DIFFERENTIAL GEAR ASSEMBLY



(1) Differential Side Gear
(2) Differential Pinions
(3) Differential Pinion Shaft
(4) Differential Side Gear

A : Revolution
B : Rotation

The differential gear assembly is a mechanism to provide smooth steering by automatically providing different optimum torque to the right and left wheels depending on the tread resistance and braking friction at the wheels when the tractor turns, makes pivoted turn or travels straight on rough road.
The differential gear assembly comprises the bevel gear, differential case, differential pinion, and differential side gear mainly. Tractor models M4500 (DT) have a differential gear assembly with two differential pinions, and M5500(DT), M7500(DT) with four differential pinions.



(1) Differential Lock Cam
(2) Differential Lock Fork
(3) Differential Lock Shifter
(4) Differential Side Gear
(5) Differetial Case
(6) Bevel Gear
(7) Differential Pinion
(8) Differential Side Gear
(9) Differential Pinion
(10) Differential Pinion Shaft

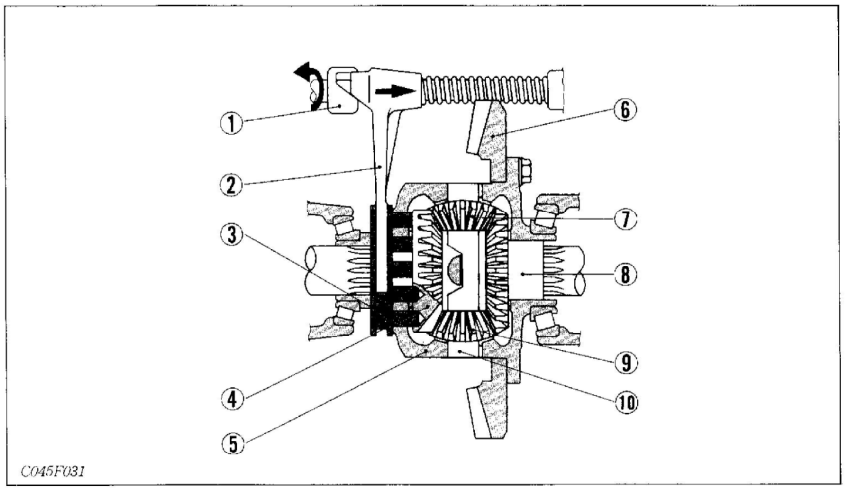
■ During Straight Running

Rotation of the spiral bevel pinion is transmitted to the bevel gear (6) and differential case (5).
When road resistance to the right and left wheels are equal, the differential pinions (7), (9) and differential side gears (4), (8) rotate as a unit.

Both rear axles received equal input, and both wheels turn at the same speed, allowing the tractor to go straight ahead.
At this time, the differential pinions (7), (9) do not rotate around the differential pinion shaft (10).

■ During Turning

When the tractor turns, the road resistance to the inside tire increases (as if braking was applied to that side only). In other words, if one of tires slows down, revolution difference is generated in the differential side gears (4), (8). When rotation of one differential side gear becomes lower than the other, the differential pinions (7), (9) begin rotating around the differential pinion shaft (10). The other differential side gear is increased in speed by the speed increment of differential pinion rotating around differential pinion shaft. This means that rotation of one rear axle is slowed down and that of the other rear axle is increased. Thus, the tractor turns smoothly without power loss. The combined number of revolution of the right and left differential side gears (4), (8) is always twice that of the bevel gear (6). When bevel gear revolution is 100 rpm and if one of the differential side gears stops moving, the revolution of the other differential side gear becomes 200 rpm and if one rotates at 50 rpm the other rotates at 150 rpm.



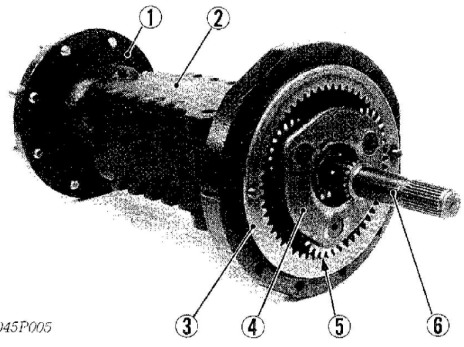
(1) Differential Lock Cam
(2) Differential Lock Fork
(3) Differential Lock Shifter
(4) Differential Side Gear
(5) Differential Case
(6) Bevel Gear
(7) Differential Pinion
(8) Differential Side Gear
(9) Differential Pinion
(10) Differential Pinion Shaft

■ Differential Lock

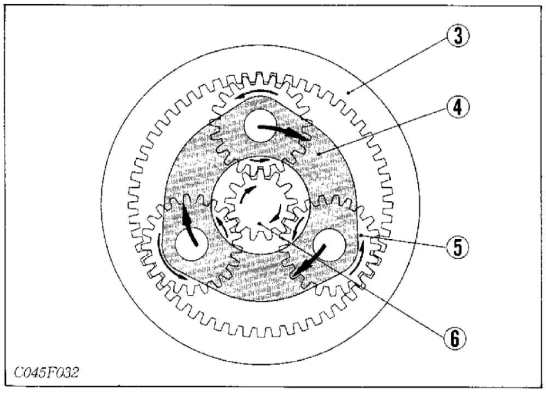
When resistance to the right and left tires are greatly different due to ground conditions or type of work, the tire with less resistance slips and prevents the tractor from moving ahead. To compensate for this drawback, the differential lock restricts the differential action and causes both rear axles to rotate as a unit.
M4500(DT), M5500(DT) and M7500(DT) use the pin type differential lock system.

When the differential lock pedal is stepped on, it causes the differential lock cam (1) and differential lock fork (2) to move toward the bevel gear (6). The differential lock shifter (3) goes into holes in the differential side gear (4) through holes in the differential case (5) to cause the differential case, differential lock shifter and differential side gear to rotate as a unit.
Therefore, the differential pinions (7), (9) are unable to rotate around the differential pinion shaft and identical revolutions are transmitted to the both rear axles.

[2] PLANETARY GEAR SYSTEM



(1) Rear Axle
(2) Rear Axle Case
(3) Internal Gear (56T)
(4) Planetary Gear Support
(5) Planetary Gears
(6) Brake Shaft (13T)



(3) Internal Gear (56T)
(4) Planetary Gear Support
(5) Planetary Gears (26T)
(6) Brake Shaft (13T)

The final reduction gear uses the planetary gear system, which is compact and excells in durability and can get reasonable higher speed reduction.
This planetary gear system consists of the internal gear (3), three planetary gears (5), planetary gear support (4), etc. The planetary gear surface pressure is as low as about 1/3 as compared with a pair of gears.
The tractor rear axles are affected by not only rotational force but also rear wheel load, propelling reactive force, braking reactive force (inertia force), axle thrust load, etc.
The planetary gear system affords one advantage that these forces are not transmitted to the transmission as these forces are absorbed by the planetary gear system.
Power, transmitted from the differential gear to the brake shaft (6), drives the three planetary gears (5). As the internal gear (3) is fixed to rear axle case (2), the planetary gears turn on their shafts, meshing with the inner teeth of internal gear, thereby turning around the brake shaft. This rotation is transmitted to the rear axle (1) by the planetary gear support (4). The planetary gear support, holding the planetary gears at its apexes, rotates identically with the rotation of the planetary gears around the brake shaft, thereby transmitting power to the rear axle through splines.
As the reduction ratio is given by the formula "Drive gear"/"Driven gear", we obtain 13/(13+56) = 0.19. Thereby, speed is greatly reduced.
Torque ratio is expressed by the formula "Driven gear"/"Drive gear", we obtain (13+56)/13 = 5.31.

4 BRAKES

All tractor models use independent mechanical wet type disc brakes for right and left traveling brakes, which provide stable braking and requires less adjustments.

■ Features of Wet Type Disc Brakes

1. Reduced wear of disc

Although in the initial period (50 hrs. or so) of use the wet type discs wear by about several tens of microns depending on initial contact and accuracy of parts, almost no wear occurs afterwards.
Thereby, there is little need to adjust the brakes.

2. Stable braking

The brake discs are immersed in transmission oil, *Fading is rarely caused by repeated braking and stable braking force is obtained.

3. Pedal stroke does not change under influence of heat.

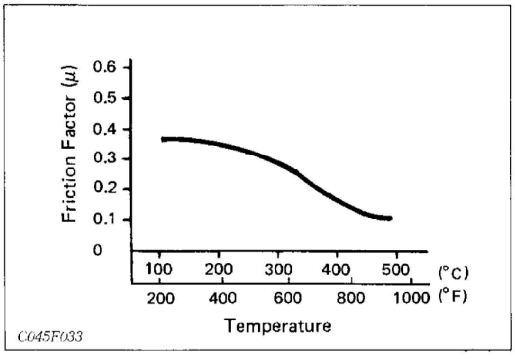
Unlike the internal expanding type brake, in which the drum-to-shoe clearance increases due to thermal expansion, resulting in increase of pedal stroke, the wet type disc brake provides constant pedal stroke.

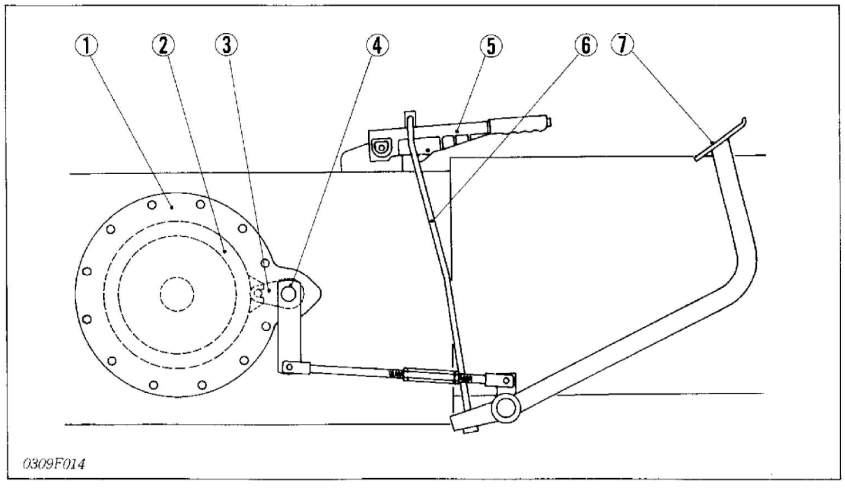
* Fading

Fading is a phenomenon of braking force loss caused by friction heat in repeated braking. Generally, the friction factor of friction material tends to lower as temperature rises, and the braking force reduces as temperature rises.

Example:

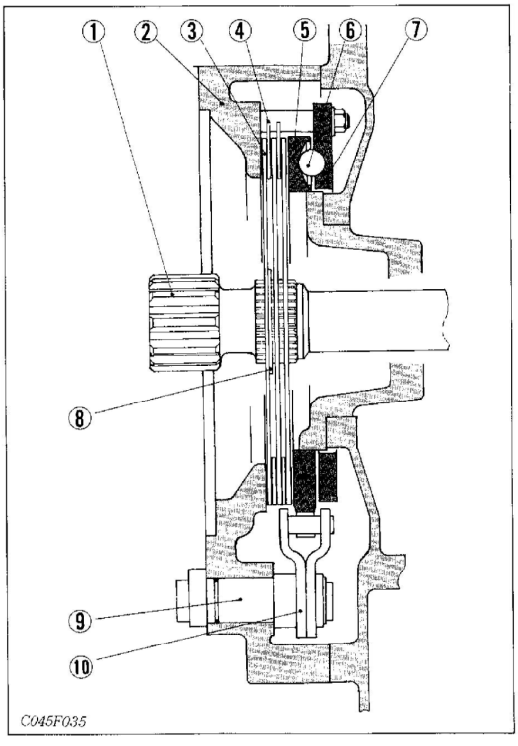
Relation between Temperature and Friction Factor of Friction Material





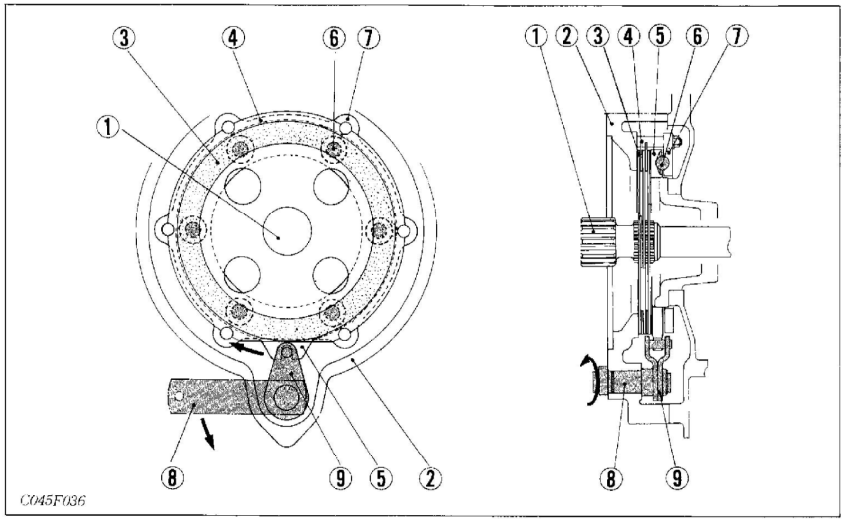
(1) Brake Case
(2) Cam Plate
(3) Brake Cam Lever
(4) Brake Cam Shaft
(5) Parking Brake Lever
(6) Hand Brake Rod
(7) Brake Pedals

[1] TRAVELING BRAKES



(1) Brake Shaft
(2) Brake Case
(3) Brake Discs
(4) Plates
(5) Cam Plate 1
(6) Steel Balls
(7) Cam Plate 2
(8) External Circlip
(9) Brake Cam Shaft
(10) Brake Cam Lever

For the traveling brake of tractors, independent mechanical wet type disc brakes are provided on the power transmitting shafts (brake shaft (1)) through which power is transmitted to the rear wheels.
In this type, brakes are incorporated in the brake case (2) filled with transmission oil. The brakes are designed to brake by pressing the cam plate 1 (5) against the spline-coupled brake discs (3), rotating together with the brake shaft, with the cam mechanism using steel balls (6). For more greater braking force, two brake discs for M4500(DT), three discs for M5500(DT) and four discs for M7500 (DT) are provided at the left and right sides respectively, and plates (4) fixed to the brake case are arranged between brake discs.

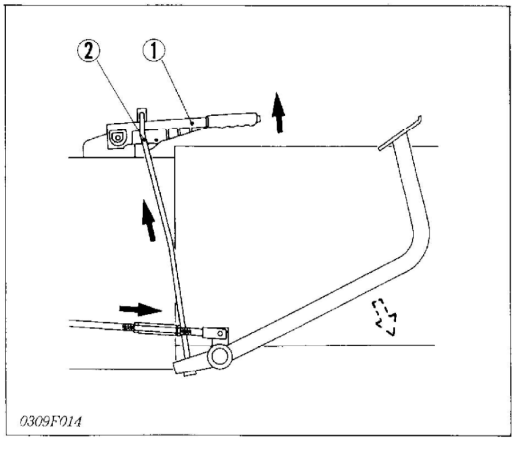


(1) Brake Shaft
(2) Brake Case
(3) Brake Discs
(4) Plates
(5) Cam Plate 1
(6) Steel Balls
(7) Cam Plate 2
(8) Brake Cam Shaft
(9) Brake Cam Lever

During Braking

When the brake pedal is pressed, the force causes the brake cam shaft (8) to move in the direction of arrow through the brake rod. At the same time, the brake cam lever (9), spline-coupled with the brake cam shaft, also moves. Due to this force, the cam plate 1 (5) moves in the direction of arrow. Since the steel balls (6) are set in the grooves of the cam plate 2 (7), the cam plate 1 is pushed out against the brake discs (3), thereby causing braking with the friction force created.

[2] PARKING BRAKE



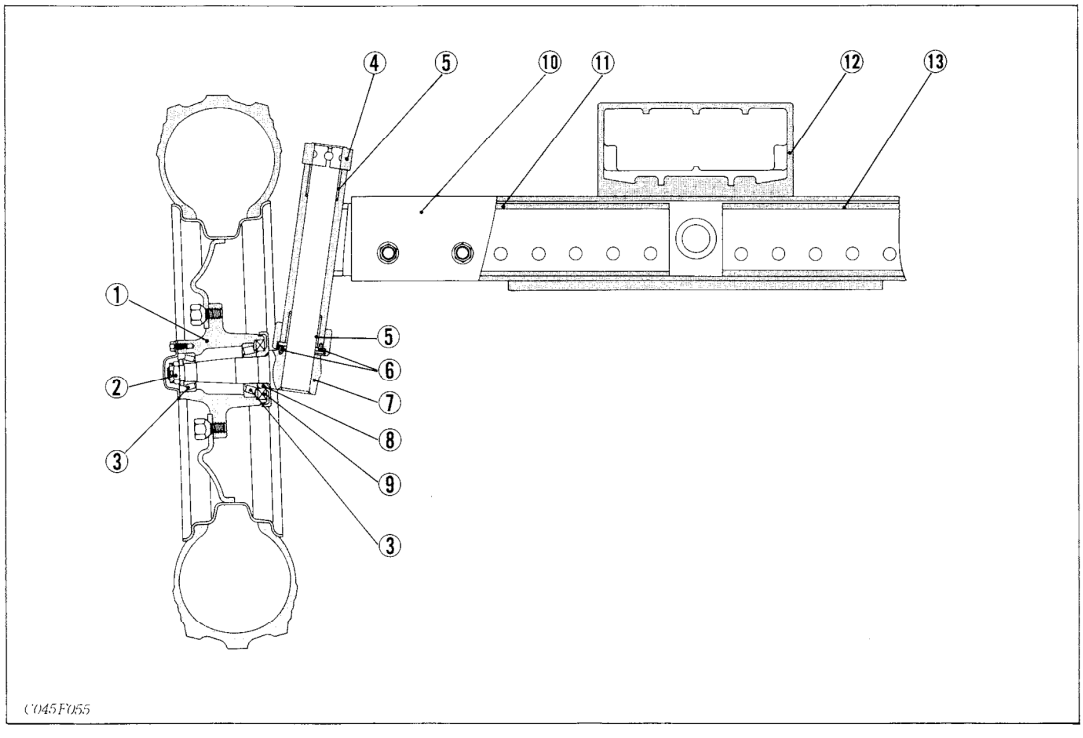
(1) Parking Brake Lever (2) Hand Brake Rod

The parking brake is designed to actuate the traveling brakes through the rod.
Pulling the parking brake lever (1) results in the same state as that obtained when the brake pedals are pressed due to action of the hand brake rods (2) as shown left.

5 FRONT AXLE

The front axle system supports the front of the tractor, and performs a steering function.
4WD type tractors have powered front wheels and 2WD type tractors have free running front wheels.

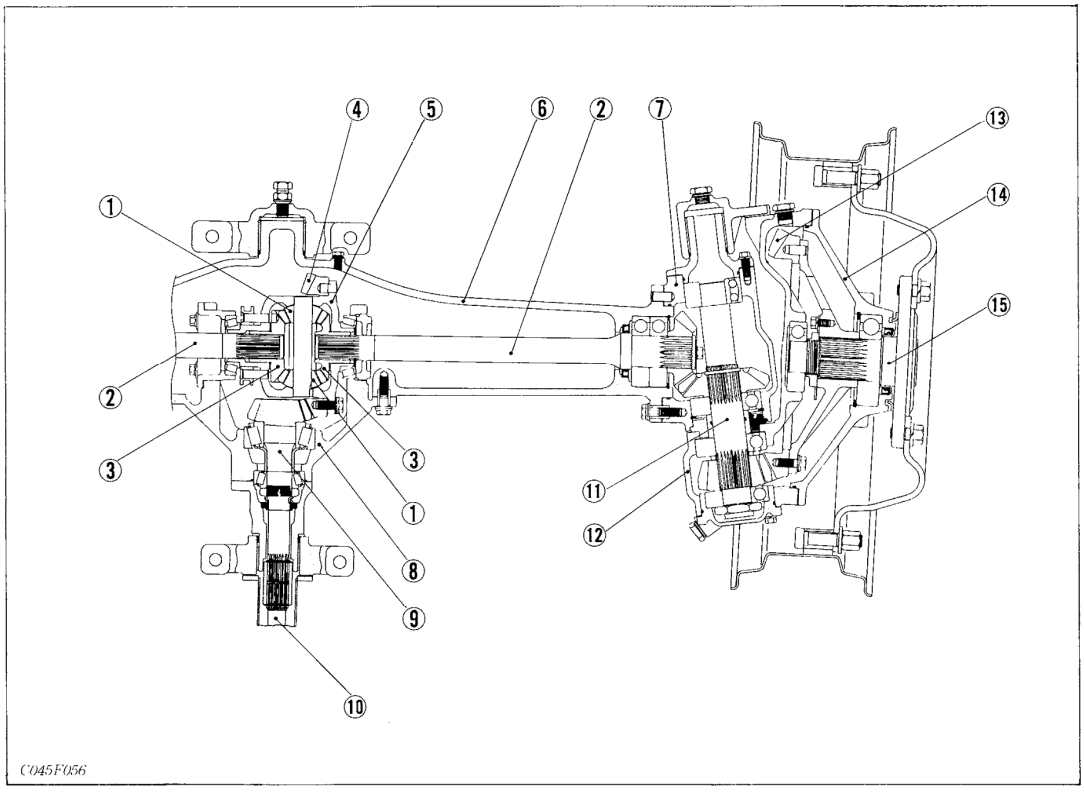
[1] 2WD TYPE



(1) Front Wheel Hub
(2) Slotted Nut
(3) Ball Bearings
[For M4500 and M5500]
Taper Roller Bearings
[For M7500]
(4) Knuckle Arm
(5) Knuckle Shaft Bushings
(6) Knuckle Shaft Knock Pins
(7) Knuckle Shaft
(8) Knuckle Dustproof Cover
(9) Knuckle Stub Gasket
(10) Front Axle
(11) Front Axle Right
(12) Front Axle Bracket
(13) Front Axle Left

The front axle of the 2WD type is constructed as shown above.
The knuckle shafts are attached to the front axle by the "RUMOAN" method.
With this method, the shape of the front axle is relatively simple, and front axle is supported at its center with the center pin on the front axle bracket, so that steering operation is stable even on an uneven ground encountered in a farm field.

[2] 4WD TYPE

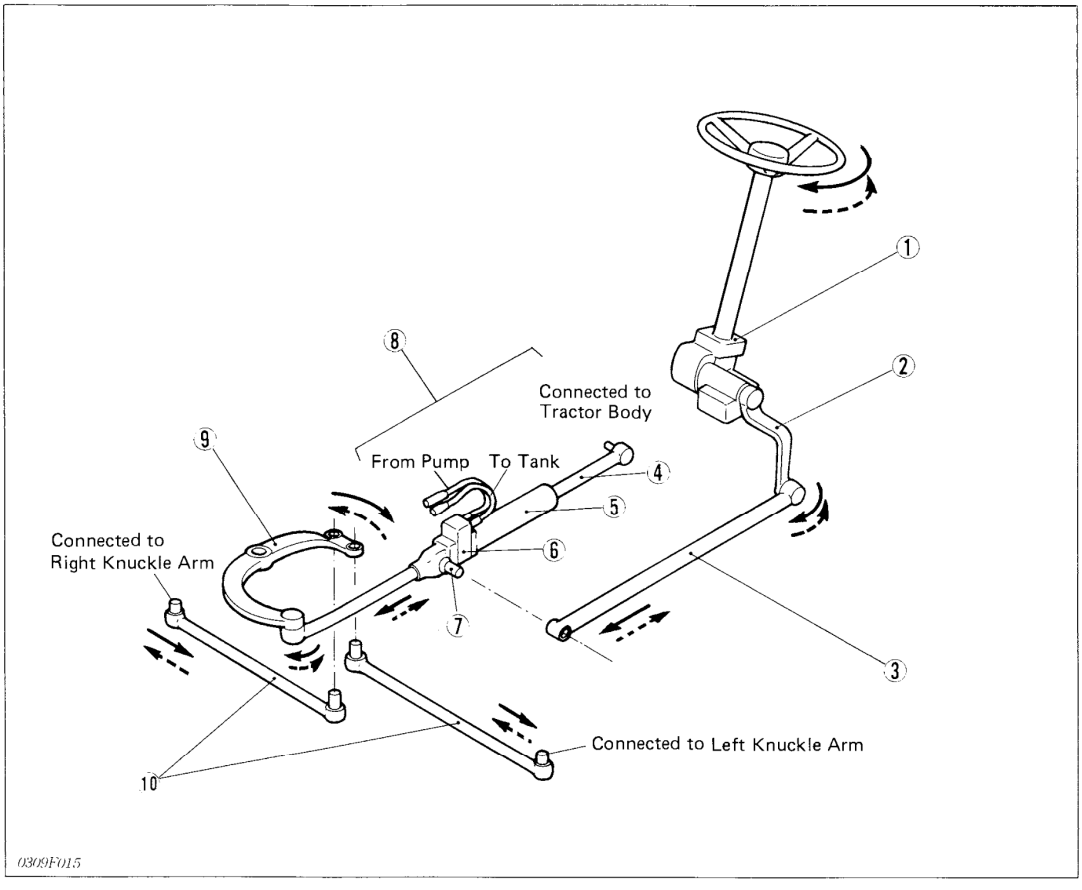


(1) Differential Pinions
(2) Differential Gear Shafts
(3) Differential Side Gears
(4) Spiral Bevel Gear
(5) Differential Case
(6) Front Differential Case
(7) Bevel Gear Case
(8) Pinion Bearing Case
(9) Bevel Pinion Shaft
(10) Propeller Shaft
(11) King Pin
(12) Front Axle Case
(13) 36T Bevel Gear [For M4500DT and M5500DT] 42T Bevel Gear [For M7500DT]
(14) Front Axle Case Cover
(15) Front Axle

The traction of this type is stronger, because both the rear wheels and front wheels are driven. The front axle of this type is constructed as shown above.
Power is transmitted from the drive shaft through the propeller shaft (10) to the bevel pinion shaft (9), and to the differential, and through the differential gear shaft (2) in the front differential case (6) to the king pin (11) in the bevel gear case (7).
Finally the power, greatly reduced by the 36T bevel gear for M4500DT and M5500DT and by the 42T bevel gear for M7500DT, is transmitted to the front axle (15).
The differential system allows each wheel to rotate at a different speed to make turning easier. The differential system is composed of the spiral bevel gear (4), differential case (5), differential pinions (1), differential side gears (3) and other parts. M4500DT and M5500DT use four differential pinions and M7500DT use two differential pinions.

6 STEERING

[1] STEERING LINKAGE

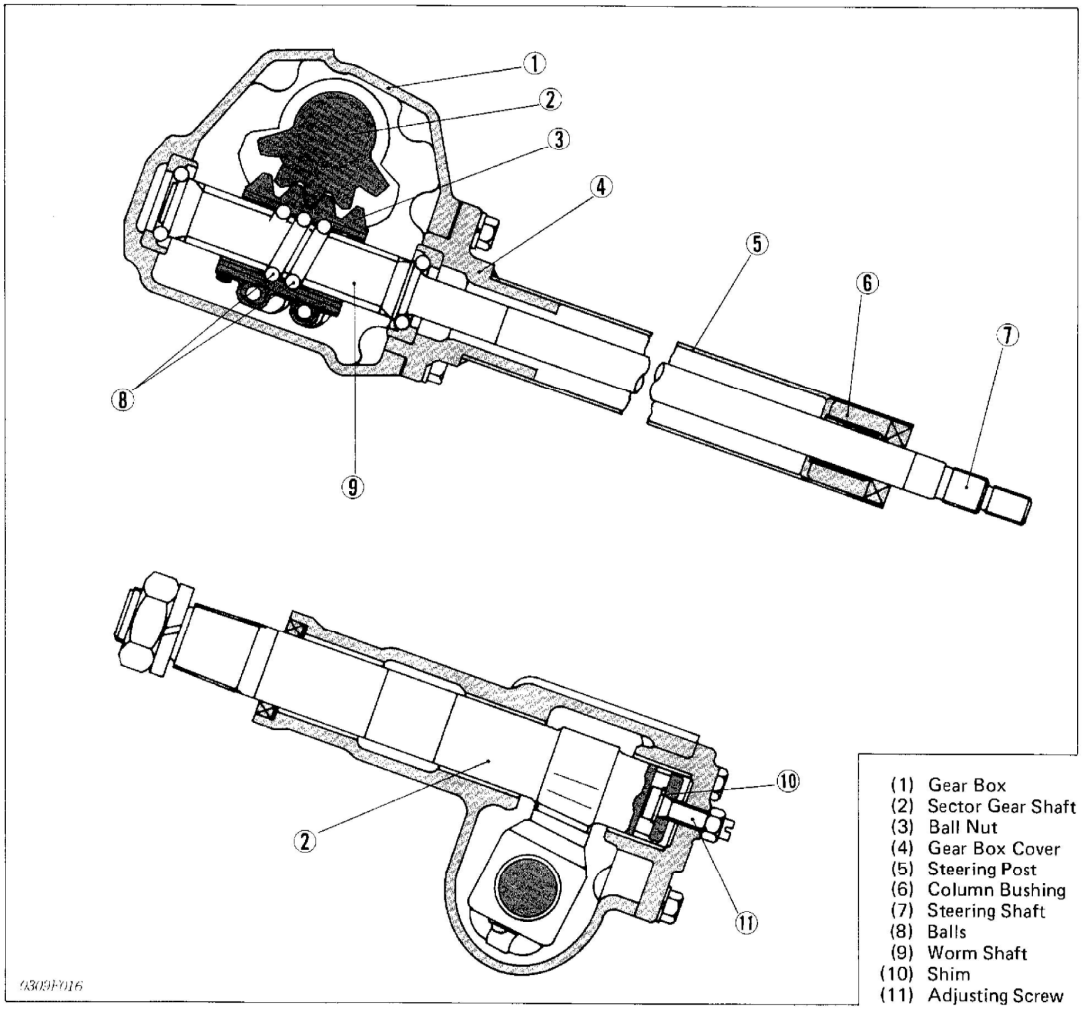


(1) Steering Gear Box
(2) Pitman Arm
(3) Drag Link
(4) Piston Rod
(5) Cylinder
(6) Valve Housing
(7) Stud
(8) Booster Unit
(9) Steering Lever
(10) Tie Rods

The steering gear box (1) converts the rotating motion of the steering wheel to the swinging motion of the pitman arm (2). The drag link (3), connected to the pitman arm (2) pushes or pulls the stud (7) of the booster unit (8).
The stud (4) is connected to the spool valve in the valve housing (6) and the spool valve controls the oil flow to the cylinder (5) to force the piston rod (4) in or out. Since the end of the piston rod (4) is connected to the tractor body, the cylinder moves to push or pull the steering lever (9).

The steering lever (9) swings around the steering lever shaft to push or pull the tie rods (10). The tie rods push or pull the knuckle arms to turn the wheels right or left.

[2] STEERING GEAR BOX



The steering unit mainly consists of two parts: the ball nut (3) and sector gear shaft (2).
The ball nut (3) keeps the friction exceptionally low by interposing balls (8) between the grooves cut in its inner face and the worm teeth. These balls are called "recirculating balls", because they continuously recirculate from one end of the ball nut to the other end through a pair of ball return guides.
When the worm shaft (9) is rotated, the balls roll and cause the ball nut to move along the worm shaft. For example, the rotation of steering wheel to turn right causes the worm shaft to rotate clockwise and the ball nut to move downward.

Up or down motion of the ball nut causes the sector gear shaft (2) to rotate and the pitman arm to swing.
Steering wheel play can be adjusted by turning the adjusting screw (11) at the end of the sector gear shaft, and with shims (10). As the sector gear shaft is moved axially by the adjusting screw, the backlash between the sector gear and the ball nut teeth increases or decreases.
When the adjusting screw is turned clockwise, the steering wheel play reduces in proportion to the backlash. Counterclockwise increases the play.