

## TO THE READER

This Workshop Manual has been prepared to provide servicing personnel with information on the mechanism, service and maintenance of Kubota Tractor M4950(DT), M5950(DT), M6950(DT) and M7950(DT). It is divided into two parts, "Mechanism" and "Disassembly and Servicing".

### ■ Mechanism

Information on the construction and function 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 S2800 [M4950(DT)], refer to "Kubota Diesel Engine Work Shop Manual S2200-B-S2600B-S2800-B" (Code No: 97897-00771), and for D3200 [M5950(DT)], V4000-2 [M6950(DT)] and V4300 [M7950(DT)], refer to "Kubota Diesel Engine Workshop Manual D3000-B-D3200-B-V4000-B-V4300-B" (Code No: 97897-00741).

All information, illustrations and specifications contained in this manual are based on the latest production information available at the time of publication.

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November '89

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SPECIFICATIONS

**SPECIFICATIONS**

Model		M4950	M4950DT	
P.T.O. power		47HP, 34.6kW		
Engine	Model	S2800		
	Type	Vertical, water-cooled, 4-cycle diesel engine		
	Number of cylinders	6		
	Total displacement	2791cm <sup>3</sup> (170 cu.in.)		
	Bore and stroke	85 x 82mm (3.3 x 3.2 in.)		
	Gross power (DIN)	55.5 HP, 41.4kW		
	Rated revolution	2600 rpm		
	Maximum torque	17.9kgf·m (175.5N·m, 129.5ft·lbs)/1200 rpm		
	Battery	12V, 150Ah		
	Fuel	Diesel fuel No. 1-D [below -10°C (15°F)] (ASTM D975) Diesel fuel No. 2-D [above -10°C (15°F)]		
	Fuel tank capacity	70ℓ (18.5 U.S. gals, 15.4 Imp. gals)		
	Engine crankcase capacity	13.7ℓ (3.6 U.S. gals, 3.0 Imp. gals)		
	Engine coolant capacity	8.2ℓ (2.2 U.S. gals, 1.8 Imp. gals)		
Dimensions	Overall length	3665mm (144.3 in.)		
	Overall width	1800mm (70.9 in.)	1810mm (71.3 in.)	
	Height to top of muffler	2295mm (90.4 in.)		
	Wheel base	2055m (80.9 in.)	2090mm (82.3 in.)	
	Tread	Front	1320 to 1820mm (52.0 to 71.7 in.)	1420 to 1520mm (55.9 to 59.8 in.)
		Rear	1420 to 1920mm (55.9 to 75.6 in.)	
Minimum ground clearance	485mm (19.1 in.)	370mm (14.7 in.)		
Weight	2160kg (4762 lbs)		2470kg (5445 lbs)	
Travelling system	Tire size	Front tires	7.5-16	
		Rear tires	14.9/13-28	
	Clutch	Dry, single plate [285mm (11.2 in.)]		
	Steering	Full hydrostatic power steering		
	Transmission	Full synchromesh, 12 forward and 4 reverse		
	Brake	Travelling	Wet, multiple discs (mechanical)	
		Parking	Connected with the travelling brake	
Differential	Bevel gears (with differential lock)			
Hydraulic system	Hydraulic control system	Position, draft and mixed control		
	Pump-up capacity	35ℓ/min (9.2 U.S. gals/min, 7.7 Imp. gals/min)		
	Three-point hitch	Category I & II		
	Maximum lifting force	2000kg (4415 lbs.) at lift points with lower link horizontal 1500kg (3307 lbs) at 610mm (24 in.) behind lift point		
PTO	Live PTO	Independent clutch	Dry, single plate [257mm (10.8 in.)]	
		Direction of turning	Clockwise, viewed from tractor rear	
		Standard PTO	9 r/s (540 rpm)/36.6 r/s (2194 rpm) 16.7 r/s (1000 rpm)/42.1 r/s (2521 rpm) for engine ..... 6 spline shaft	
	Ground PTO	Direction of turning	Clockwise, viewed from tractor rear	
		PTO speed	1.6 tr/m (1st) 2.6 tr/m (2nd) (with 14.9/13-28 tires)	
Traction system	Swing drawbar, adjustable in direction			

M5950	M5950DT	M6950	M6950DT	M7950	M7950DT
57.2 HP, 42.1kW D3200	66.3 HP, 48.8kW V4100-2	76.1 HP, 56.0kW V4300	Vertical, water-cooled, 4-cycle diesel engine	Vertical, water-cooled, 4-cycle diesel engine	Vertical, water-cooled, 4-cycle diesel engine
3	4	4			
3219cm <sup>3</sup> (196 cu.in.)	3983cm <sup>3</sup> (243 cu.in.)	4293cm <sup>3</sup> (262 cu.in.)	109 x 115mm (4.3 x 4.5 in.)	109 x 115mm (4.3 x 4.5 in.)	109 x 115mm (4.3 x 4.5 in.)
62.5 HP, 46.6kW	75 HP, 55.95kW	84 HP, 62.66kW	2400 rpm	2400 rpm	2400 rpm
21.6kgf-m (211.8N-m), 156.2ft-lb(in)/1300 rpm	26.1kgf-m (256.0N-m), 188.8ft-lb(in)/1400 rpm	29.0kgf-m (284.4N-m), 209.8ft-lb(in)/1200 rpm	12V, 300Ah	12V, 300Ah	12V, 300Ah
Diesel fuel No. 1,D [below -10°C (15°F)] (ASTM D975) Diesel fuel No. 2,D [above -10°C (15°F)]	Diesel fuel No. 1,D [below -10°C (15°F)] (ASTM D975) Diesel fuel No. 2,D [above -10°C (15°F)]	Diesel fuel No. 1,D [below -10°C (15°F)] (ASTM D975) Diesel fuel No. 2,D [above -10°C (15°F)]	70ℓ (18.5 U.S. gals, 15.4 imp. gals)	100ℓ (26.4 U.S. gals, 22.0 imp. gals)	100ℓ (26.4 U.S. gals, 22.0 imp. gals)
9.8ℓ (2.6 U.S. gals, 2.2 imp. gals)	13.2ℓ (3.5 U.S. gals, 2.9 imp. gals)	13.2ℓ (3.5 U.S. gals, 2.9 imp. gals)	11.6ℓ (3.1 U.S. gals, 2.6 imp. gals)	13.6ℓ (3.6 U.S. gals, 3.0 imp. gals)	13.6ℓ (3.6 U.S. gals, 3.0 imp. gals)
3665mm (144.3 in.)	3880mm (152.8 in.)	3880mm (152.8 in.)	1850mm (72.3 in.)	3880mm (152.8 in.)	3880mm (152.8 in.)
2295mm (90.4 in.)	2420mm (95.3 in.)	2420mm (95.3 in.)	2100mm (82.7 in.)	2250mm (87.6 in.)	2250mm (87.6 in.)
2100mm (82.7 in.)	2225mm (87.6 in.)	2260mm (89.0 in.)	1320 to 1920mm (55.9 to 59.8 in.)	1320 to 1920mm (52.0 to 75.6 in.)	1320 to 1920mm (52.0 to 75.6 in.)
1420 to 1920mm (55.9 to 75.6 in.)	1420 to 1920mm (55.9 to 75.6 in.)	1420 to 1920mm (55.9 to 75.6 in.)	485mm (16.1 in.)	550mm (21.7 in.)	550mm (21.7 in.)
2260kg (4992 lbs)	2620kg (5776 lbs)	3000kg (6614 lbs)	2570kg (5666 lbs)	2700kg (5952 lbs)	3090kg (6790 lbs)
7.5-16	7.50-18	7.50-18	9.5/9-24	7.5-18	11.2/10-24
16.9/14-28	16.9/14-30	16.9/14-30	16.9/14-28	18.4/15-30	18.4/15-30
Dry, single plate [285mm (11.2 in.)]	Dry, single plate [325mm (12.8 in.)]	Dry, single plate [325mm (12.8 in.)]	Full hydrostatic power steering	Full hydrostatic power steering	Full hydrostatic power steering
Full hydrostatic power steering	Full hydrostatic power steering	Full hydrostatic power steering	Full synchromesh, 12 forward and 4 reverse	Full synchromesh, 12 forward and 4 reverse	Full synchromesh, 12 forward and 4 reverse
Full synchromesh, 12 forward and 4 reverse	Full synchromesh, 12 forward and 4 reverse	Full synchromesh, 12 forward and 4 reverse	Wet, multiple discs (mechanical)	Wet, multiple discs (hydraulic)	Wet, multiple discs (hydraulic)
Connected with the travelling brake	Wet, discs	Wet, discs	Bevel gears (with differential lock)	Bevel gears (with differential lock)	Bevel gears (with differential lock)
Bevel gears (with differential lock)	Bevel gears (with differential lock)	Bevel gears (with differential lock)	Position, draft and mixed control	Position, draft and mixed control	Position, draft and mixed control
Position, draft and mixed control	Position, draft and mixed control	Position, draft and mixed control	350/min (9.2 U.S. gals/min, 7.7 imp. gals/min)	41.5ℓ/min (11.0 U.S. gals/min, 9.1 imp. gals/min)	41.5ℓ/min (11.0 U.S. gals/min, 9.1 imp. gals/min)
Category I & II	Category II	Category II	2000kg (4415 lbs.) at lift points with lower link horizontal 1500kg (3307 lbs.) at 610mm (24 in.) behind lift point	2700kg (5952 lbs.) at lift points with lower link horizontal 2200kg (4848 lbs.) at 610mm (24 in.) behind lift point	2700kg (5952 lbs.) at lift points with lower link horizontal 2200kg (4848 lbs.) at 610mm (24 in.) behind lift point
Dry, single plate [257mm (10.8 in.)]	Wet, multiple plates (hydraulic)	Wet, multiple plates (hydraulic)	Clockwise, viewed from tractor rear	Clockwise, viewed from tractor rear	Clockwise, viewed from tractor rear
Clockwise, viewed from tractor rear	Clockwise, viewed from tractor rear	Clockwise, viewed from tractor rear	9 r/s (540 rpm)/33.6 r/s (2016 rpm)	9 r/s (540 rpm)/33.9 r/s (2035 rpm) for engine .... 6 spline shaft 16.7 r/s (1000 rpm)/39.8 r/s (2388 rpm) for engine .... 21 spline shaft	9 r/s (540 rpm)/33.9 r/s (2035 rpm) for engine .... 6 spline shaft 16.7 r/s (1000 rpm)/39.8 r/s (2388 rpm) for engine .... 21 spline shaft
16.7 r/s (1000 rpm)/39.8 r/s (2388 rpm) for engine .... 6 spline shaft 16.7 r/s (1000 rpm)/39.8 r/s (2388 rpm) for engine .... 21 spline shaft	Clockwise, viewed from tractor rear	Clockwise, viewed from tractor rear	1.48 tr/m (1st), 2.3 tr/m (2nd)	1.42 tr/m (1st), 2.2 tr/m (2nd)	1.42 tr/m (1st), 2.2 tr/m (2nd)
1.48 tr/m (1st), 2.3 tr/m (2nd)	1.52 tr/m (1st), 2.4 tr/m (2nd)	1.52 tr/m (1st), 2.4 tr/m (2nd)	(with 16.9/14-28 tires)	(with 18.4/15-30 tires)	(with 18.4/15-30 tires)
(with 16.9/14-28 tires)	(with 16.9/24-30 tires)	(with 16.9/24-30 tires)	Swing drawbar, adjustable in direction	Swing drawbar, adjustable in direction	Swing drawbar, adjustable in direction

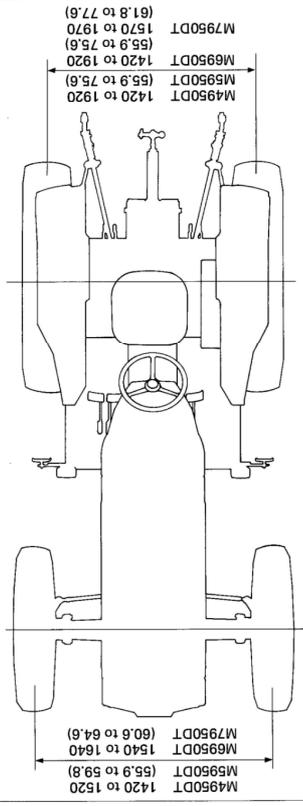
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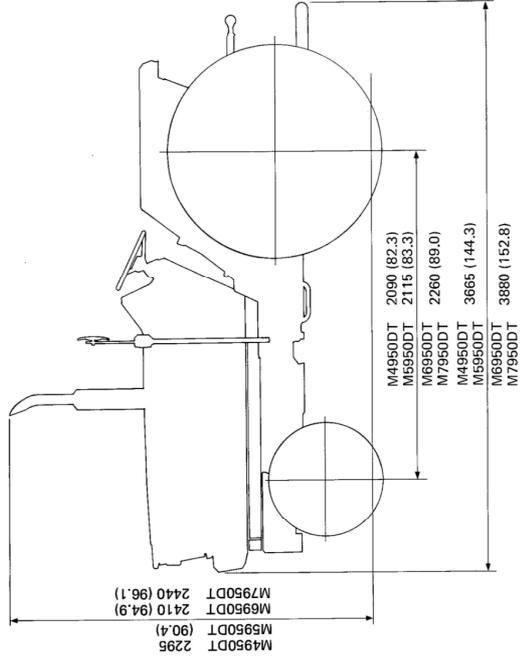
DIMENSION

[M4950DT · M5950DT · M6950DT · M7950DT]

Unit: mm (in.)



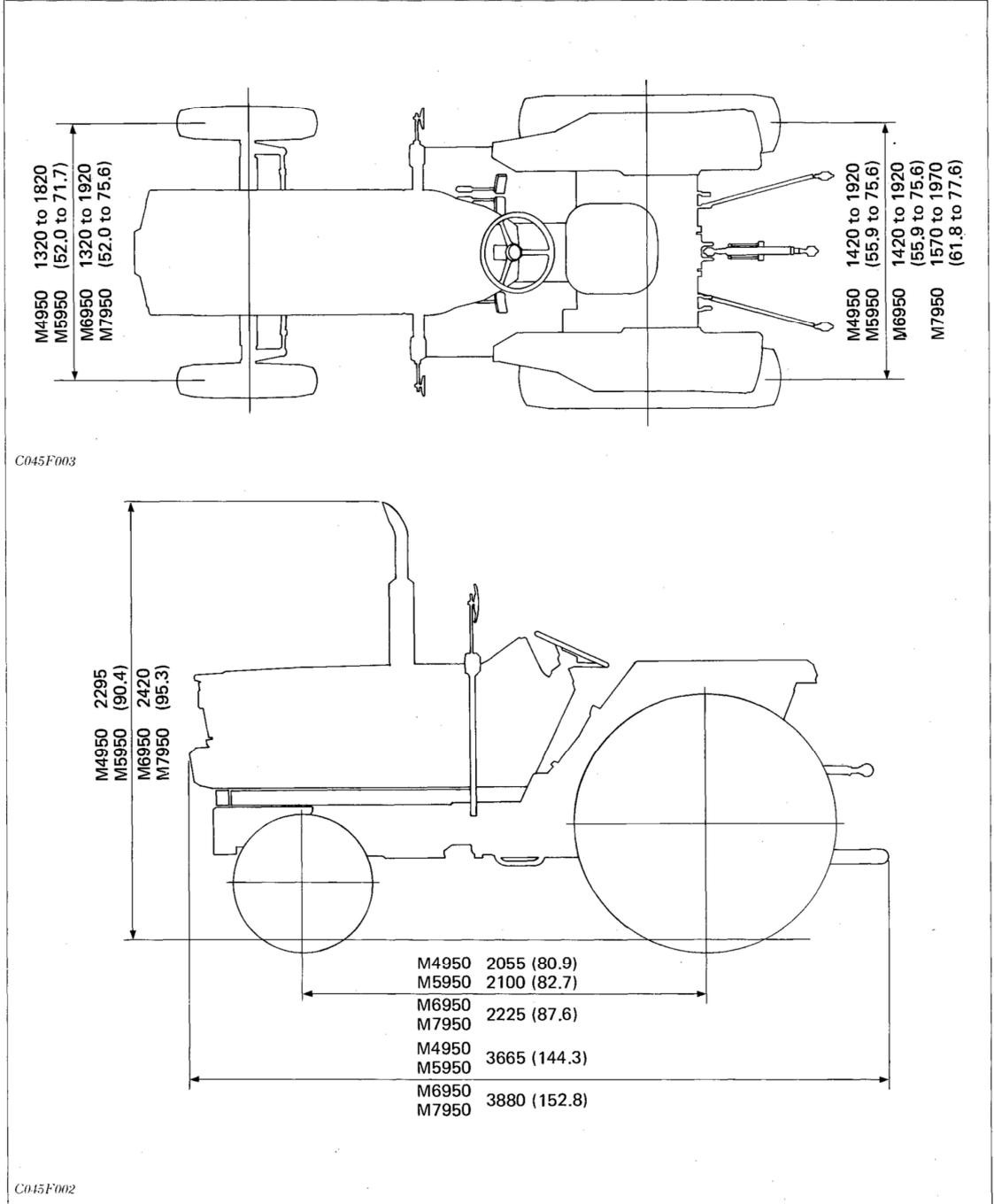
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CMSF002

[M4950 · M5950 · M6950 · M7950]

Unit: mm (in.)



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C045F002

# M MECHANISM

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## FEATURES

- 
- Full hydrostatic power steering
  - Tilt steering wheel
  - Conveniently located control levers
  - Key switch shut-off
  - Oil dampened, fore-aft/vertical adjustable deluxe seat.
  - S.M.V. Emblem bracket
  - Hydraulic quick coupler (Connectable under pressure)
  - Lift rod with float setting
  - Work light (Optional)
  - Single/Double acting switchable hydraulic control valve with self-cancelling feature
  - Double acting auxiliary control valve with detented float (optional)
  - Heavy duty 3 point hitch
  - Telescoping lower link [M6950 (DT) · M7950 (DT)]
  - Live/Ground PTO
  - 540/1000 two speed PTO [M4950(DT) · M5950(DT)]
  - 540/1000 interchangeable PTO shaft [M6950 (DT) · M7950 (DT)]
  - Tough, heavy power adjust cast wheels (optional)
  - Lower link draft sensing [M6950 (DT) · M7950 (DT)]
  - 3-Point hitch lowering speed adjustment
  - Positive, wet disc brakes
  - Hydraulically actuated wet disc brakes [M6950 (DT) · M7950 (DT)]
  - Front wheel differential lock (4WD ONLY)
  - Hydraulic independent PTO clutch [M6950 (DT) · M7950 (DT)]
  - Wide choice of power torque tire options
  - ROPS with Seatbelt
  - "Easy checker" for daily inspection
  - Large capacity fuel tank
  - Safety muffler
  - Block heater (optional)
  - Fuel efficient, high torque engine
  - Low noise, low vibration design
  - Cartridge type hydraulic oil filter
  - Large capacity hydraulic pump
  - 3-direction-opening hood for easy inspection
  - Dry type air cleaner with safety element
  - Pre-cleaner (optional)
  - Adjustable front wheel tread up to 80" 2WD (Standard) and 4WD (Optional)
  - Center drive system
  - Tough, durable one-piece front axle case
  - Fully sealed bevel gear drive system
  - Heavy duty large diameter clutch
  - Dual speed (Factory installed option) [M6950 (DT) · M7950 (DT)]
  - Comfortable wide foot space
  - Fully synchronized speed transmission with synchronized reverse feature 12 forward and 4 reverse speeds

# 1 CLUTCH

Models M4950 (DT) and M5950 (DT) are equipped with a dry single-plate type, dual clutch for the travelling and PTO system.  
Models M6950 (DT) and M7950 (DT) are equipped with a dry single-plate type for the travelling sys-

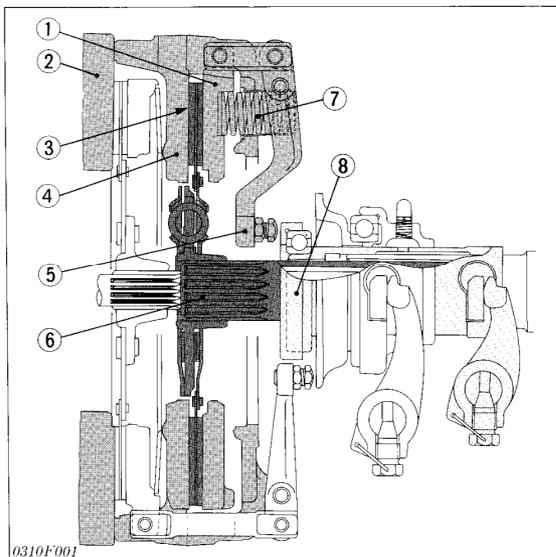
tem and wet multi-plates type for the PTO system. The travelling and PTO clutches can be operated independently by the travelling clutch pedal and the PTO clutch lever.

## [1] DRY SINGLE-PLATE TYPE, DUAL CLUTCH [M4950(DT)·M5950(DT)]

### ■ NOTE:

- The clutch for the tractors from serial number written below is explained on the page M.1-4.

Models	Serial number
M4950	From 10051
M4950DT	From 50123
M5950	From 10061
M5950DT	From 50033



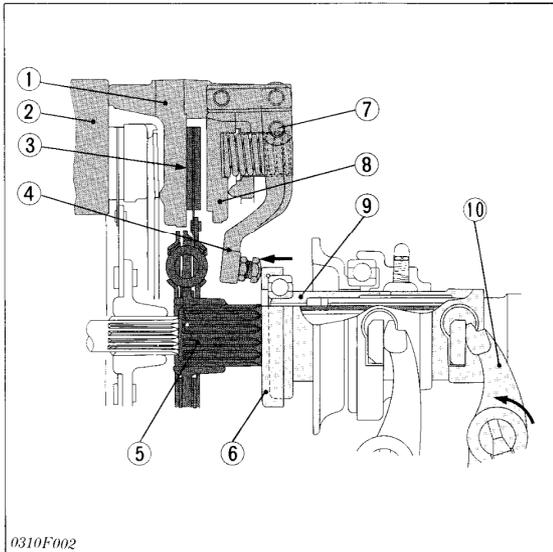
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|--------------------|----------------------------|
| (1) Pressure Plate | (5) Release Lever          |
| (2) Flywheel       | (6) 1st Shaft              |
| (3) Clutch Disc    | (7) Pressure Spring        |
| (4) Clutch Cover   | (8) Clutch Release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

### ■ Travelling Clutch "Engaged"

When the travelling clutch pedal is not depressed, the clutch release bearing (8) and the release levers (5) do not contact each other.

Accordingly the pressure plate (1) is tightly pressed toward the clutch cover (4) by the tension of the pressure springs (7).

As a result, rotation of the flywheel (2) is transmitted from the clutch disc spline to the transmission through the 1st shaft (6) due to the frictional force among the clutch cover (4), clutch disc (3) and pressure plate (1).



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

■ Travelling Clutch “Disengaged”

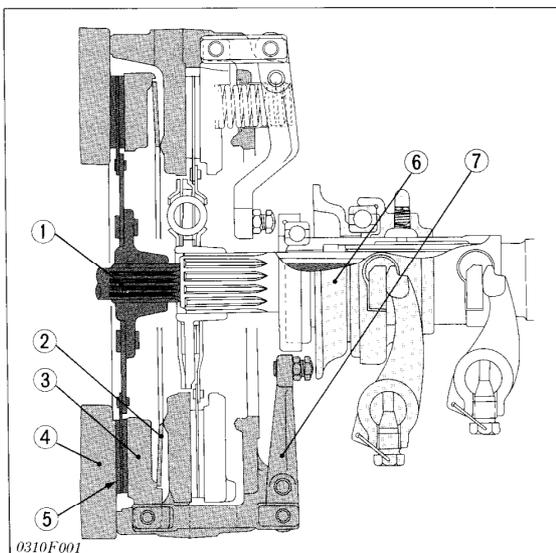
Depressing the travelling clutch pedal pulls the clutch rod to rotate the clutch control shaft.

When the control lever shaft rotates, the release fork (10) pushes the release hub (9) toward the flywheel(2) and the clutch release bearing (6) presses the release levers (4).

The release levers pull the pressure plate (8) with the clevis pins (7) functioning as a fulcrum.

The frictional force among the clutch cover (1), clutch disc (3) and pressure plate (8) disappears.

Therefore, rotation of the flywheel (2) is not transmitted to the clutch disc (3), stopping the rotation of the 1st shaft (5).



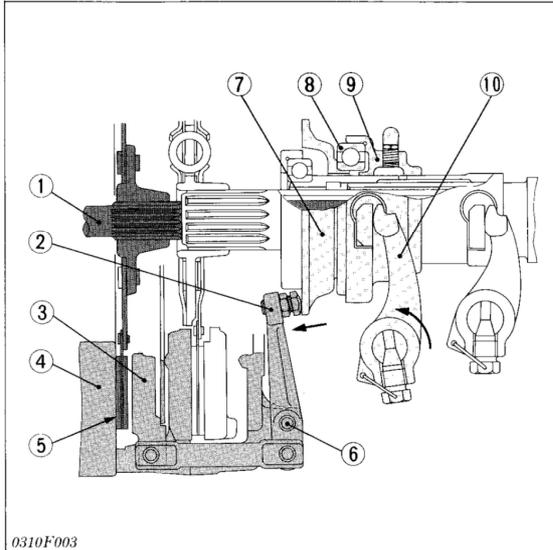
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- |                         |                        |
|-------------------------|------------------------|
| (1) PTO Propeller Shaft | (5) Clutch Disc        |
| (2) Diaphragm Spring    | (6) Clutch Release Hub |
| (3) Pressure Plate      | (7) Release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

■ PTO Clutch “Engaged”

When the PTO clutch lever is at the “engaged” position, the clutch release hub (6) and the release levers (7) do not contact each other.

Accordingly, the pressure plate (3) is tightly pressed toward the flywheel (4) by the tension of the diaphragm spring (2). As a result, rotation of the flywheel (4) is transmitted from the clutch disc spline to the transmission through the PTO propeller shaft (1) due to the frictional force among the flywheel (4), clutch disc (5) and pressure plate (3).



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

■ PTO Clutch "Disengaged"

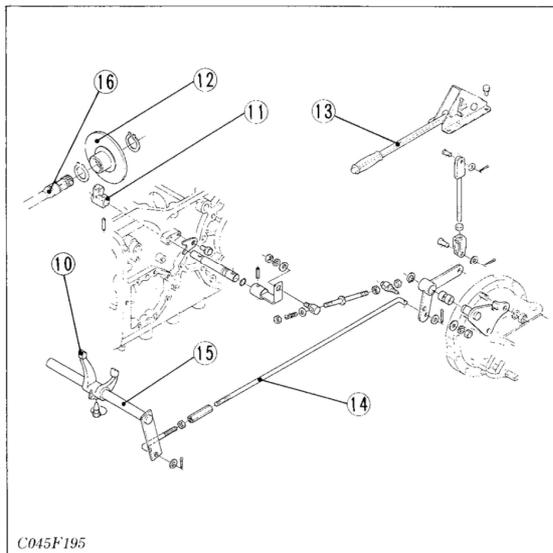
When the PTO clutch lever (13) is moved upward, the rod (14) is pulled and the control lever shaft (15) rotates.

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 levers (2).

As the depressed release levers (2) pull the pressure plate (3), with the clevis pins (6) functioning as a fulcrum, the frictional force among the flywheel (4), clutch disc (5) and pressure plate (3) disappears.

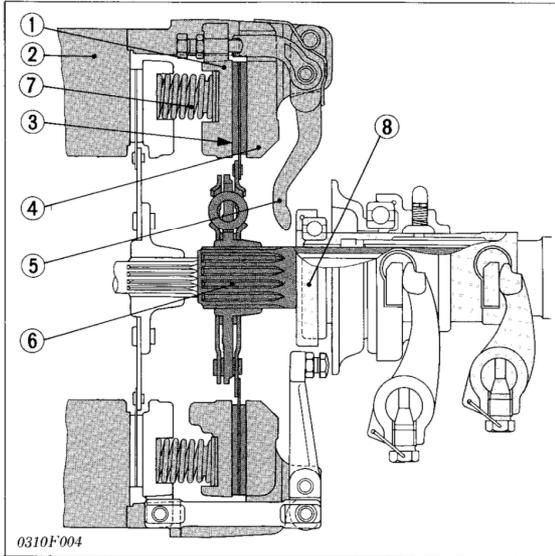
As a result, rotation of the flywheel (4) is not transmitted to the clutch disc (5).

Simultaneously the PTO brake cam (11) actuated by the PTO clutch lever linkage presses the friction plate (12) so as to stop the rotation of the PTO shaft (16).



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- |                       |                          |
|-----------------------|--------------------------|
| (10) Release Fork     | (14) Rod                 |
| (11) PTO Brake Cam    | (15) Control Lever Shaft |
| (12) Friction Plate   | (16) PTO Shaft           |
| (13) PTO Clutch Lever |                          |



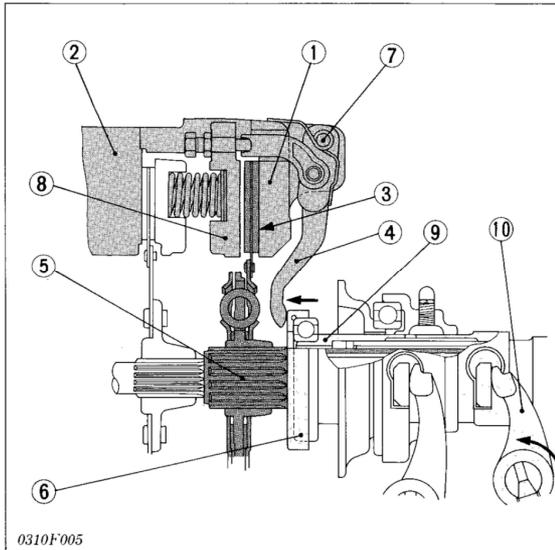
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|--------------------|----------------------------|
| (1) Pressure Plate | (5) Release Lever          |
| (2) Flywheel       | (6) 1st Shaft              |
| (3) Clutch Disc    | (7) Pressure Spring        |
| (4) Clutch Cover   | (8) Clutch Release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

■ Travelling Clutch “Engaged”

When the travelling clutch pedal is not depressed, the clutch release bearing (8) and the release levers (5) do not contact each other.

Accordingly the pressure plate (1) is tightly pressed toward the clutch cover (4) by the tension of the pressure springs (7).

As a result, rotation of the flywheel (2) is transmitted from the clutch disc spline to the transmission through the 1st shaft (6) due to the frictional force among the clutch cover (4), clutch disc (3) and pressure plate (1).



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

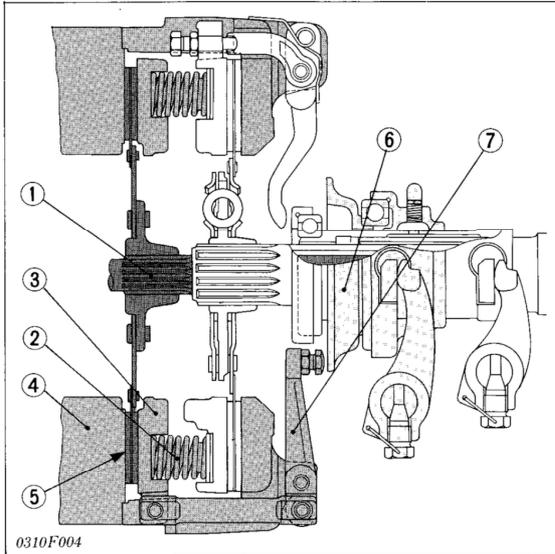
■ Travelling Clutch “Disengaged”

Depressing the travelling clutch pedal pulls the clutch rod to rotate the clutch control shaft.

When the control lever shaft rotates, the release fork (10) pushes the release hub (9) toward the flywheel (2) and the clutch release bearing (6) presses the release levers (4).

The release levers push the pressure plate (8) with the clevis pins (7) functioning as a fulcrum.

The frictional force among the clutch cover (1), clutch disc (3) and pressure plate (8) disappears. Therefore, rotation of the flywheel (2) is not transmitted to the clutch disc (3), stopping the rotation of the 1st shaft (5).

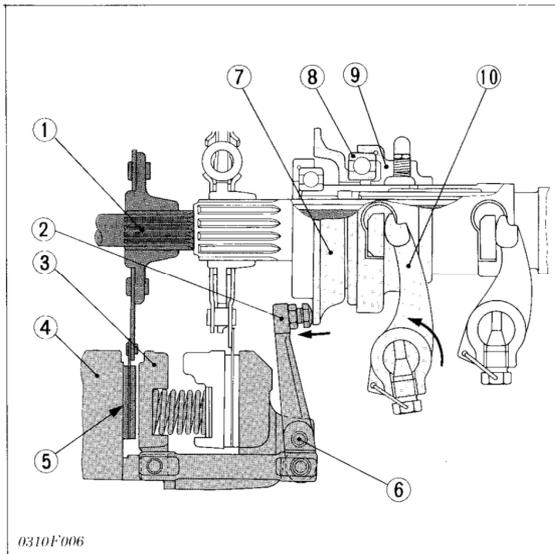


- |                         |                        |
|-------------------------|------------------------|
| (1) PTO Propeller Shaft | (5) Clutch Disc        |
| (2) Pressure Spring     | (6) Clutch Release Hub |
| (3) Pressure Plate      | (7) Release Lever      |
| (4) Flywheel            |      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

#### ■ PTO Clutch "Engaged"

When the PTO clutch lever is at the "engaged" position, the clutch release hub (6) and the release levers (7) do not contact each other. Accordingly, the pressure plate (3) is tightly pressed toward the flywheel (4) by the tension of the pressure springs (2).

As a result, rotation of the flywheel (4) is transmitted from the clutch disc spline to the transmission through the PTO propeller shaft (1) due to the frictional force among the flywheel (4), clutch disc (5) and pressure plate (3).



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

#### ■ PTO Clutch "Disengaged"

When the PTO clutch lever is moved upward, the rod is pulled and the control lever shaft rotates. (See page M.1-3, fig. C045F195)

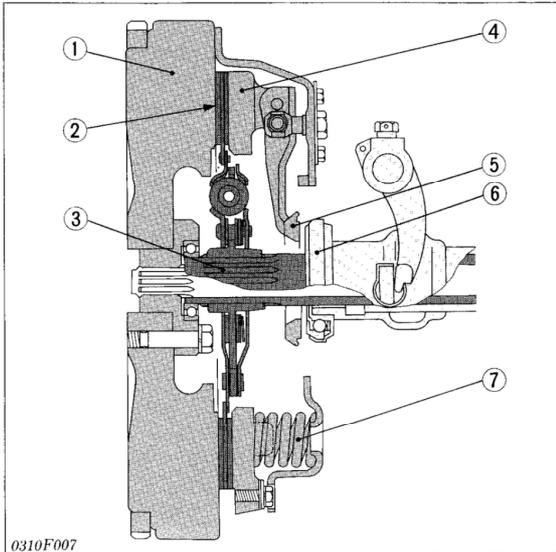
Due to this rotation, the release fork (10) pushes the release coupling (9) and bearing (8) toward the flywheel (4), and the clutch release hub (7) presses the release levers (2).

As the depressed release levers (2) pull the pressure plate (3), with the clevis pins (6) functioning as a fulcrum, the frictional force among the flywheel (4), clutch disc (5) and pressure plate (3) disappears.

As a result, rotation of the flywheel (4) is not transmitted to the clutch disc (5).

Simultaneously the PTO brake cam actuated by the PTO clutch lever linkage presses the friction plate so as to stop the rotation of the PTO shaft. (See page M.1-3, fig. C045F195)

[2] DRY SINGLE-PLATE TYPE CLUTCH [M6950(DT)-M7950(DT)]



0310F007

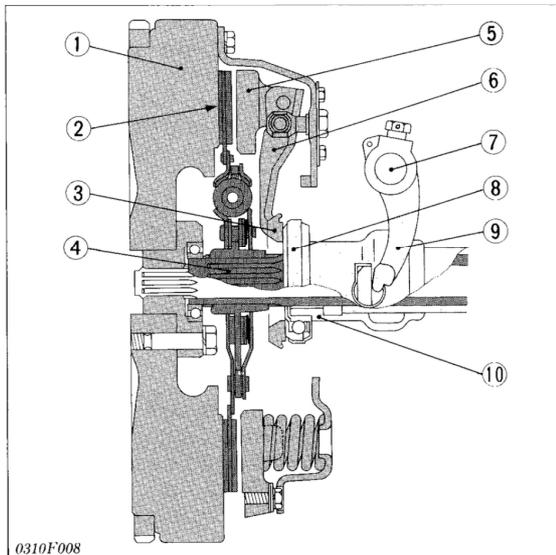
- |                    |                            |
|--------------------|----------------------------|
| (1) Flywheel       | (5) Lever Plate            |
| (2) Clutch Disc    | (6) Clutch Release Bearing |
| (3) 1st Shaft      | (7) Pressure Spring        |
| (4) Pressure Plate |                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

■ Travelling Clutch "Engaged"

When the travelling clutch pedal is not depressed, the clutch release bearing (6) and lever plate (5) do not contact each other.

Accordingly, the pressure plate (4) is tightly pressed toward the flywheel (1) by the tension of the pressure springs (7).

As a result, rotation of the flywheel (1) is transmitted from the clutch disc spline to the transmission through the 1st shaft (3) due to the frictional force among the flywheel (1), clutch disc (2) and pressure plate (4).



0310F008

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

■ Travelling Clutch "Disengaged"

Depressing the travelling clutch pedal pulls the clutch rod to rotate the clutch control shaft (7).

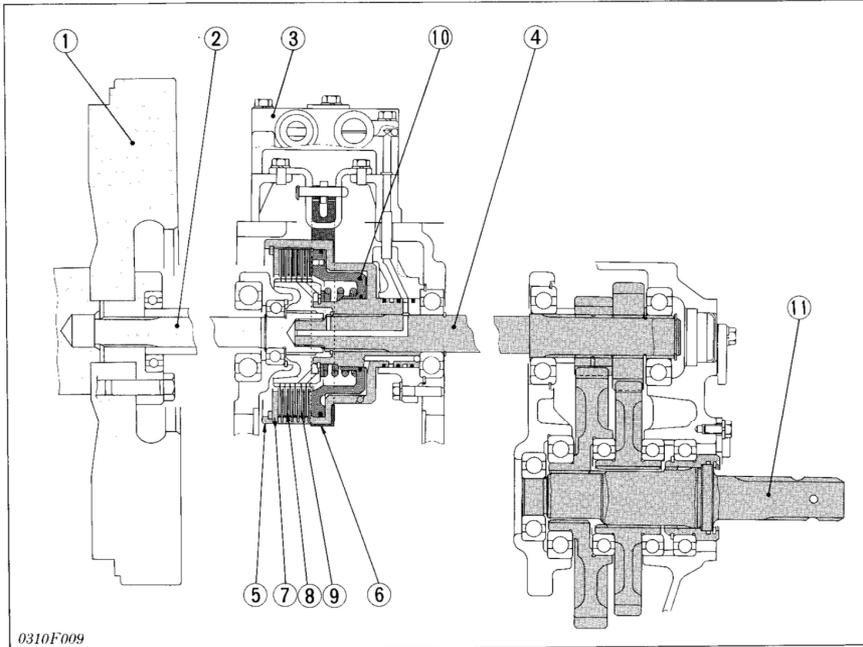
When the control lever shaft rotates, the release fork (9) pushes the release hub (10) toward the flywheel (1) and the clutch release bearing (8) presses the lever plate (3).

The release levers (6) pressed by the lever plate (3) pull the pressure plate (5).

The frictional force among the flywheel (1), clutch disc (2) and pressure plate (5) disappears.

Therefore, rotation of the flywheel (1) is not transmitted to the clutch disc (2), stopping the rotation of the 1st shaft (4).

[3] WET MULTI-PLATES TYPE CLUTCH [M6950(DT)·M7950(DT)]



- (1) Flywheel
- (2) PTO Propeller Shaft
- (3) Control Valve
- (4) PTO Clutch Shaft
- (5) Clutch Body
- (6) Brake Band
- (7) Pressure Plate
- (8) Drive Plates
- (9) Clutch Discs
- (10) Clutch Piston
- (11) PTO Shaft

0310F009

As shown in the figure above, the PTO propeller shaft (2) is splined to the flywheel (1) and is always rotated while the engine runs.

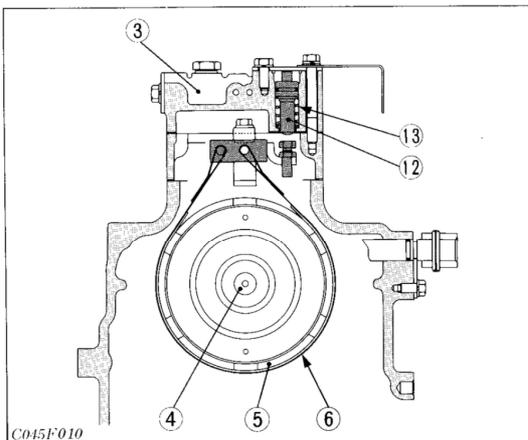
The wet multi-plates type clutch for the PTO system have six clutch discs (9), six drive plates (8) and one pressure plate (7).

The clutch piston (10) actuated by hydraulic pressure from the control valve (3) tightly presses the

clutch discs (9) and drive plates (8) toward the pressure plate (7).

As a result, rotation of the PTO propeller shaft (2) is transmitted to the PTO clutch shaft (4).

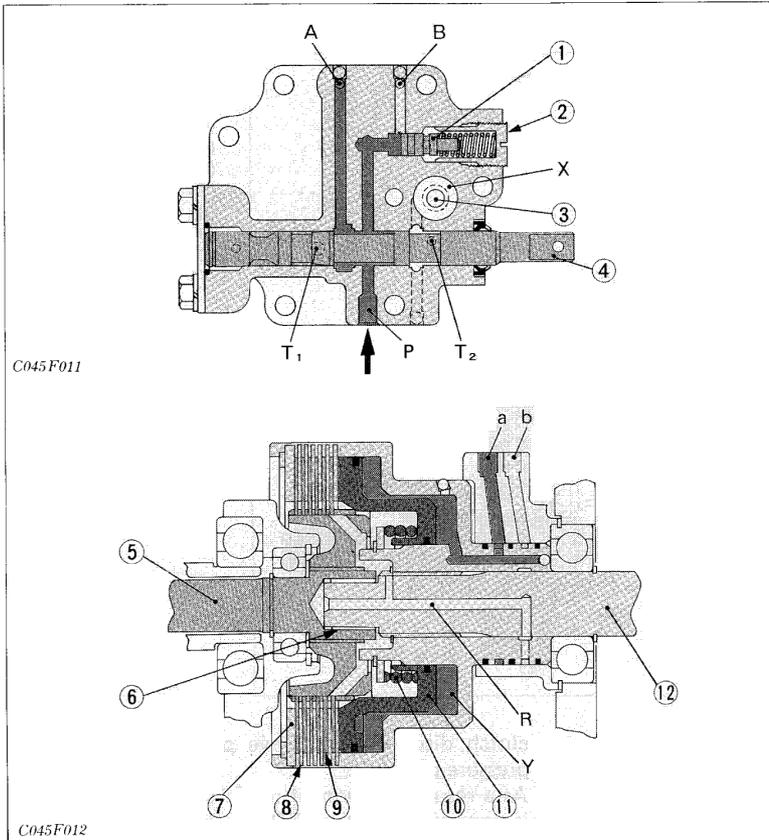
The PTO control valve (3) can be in a semi-clutching state, thereby, the PTO clutch engages or disengages smoothly.



C045F010

- (3) Control Valve
- (4) PTO Clutch Shaft
- (5) Clutch Body
- (6) Brake Band
- (12) Brake Piston
- (13) Spring

When the PTO clutch lever is operated to the "OFF" position, the brake band (6) actuated by the brake piston (12) in the control valve (3) clamps the clutch body (5) so as to stop the rotation of the PTO shaft (11).



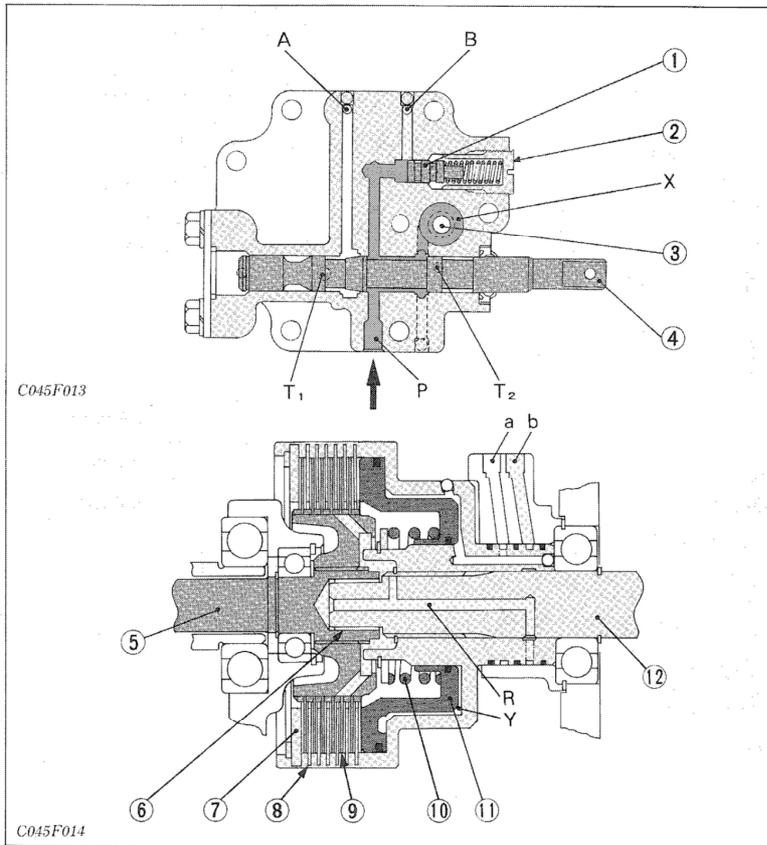
- (1) Poppet
- (2) Relief Valve
- (3) Brake Piston
- (4) Spool
- (5) PTO Propeller Shaft
- (6) Bushing
- (7) Pressure Plate
- (8) Drive Plates
- (9) Clutch Discs
- (10) Spring
- (11) Clutch Piston
- (12) PTO Clutch Shaft

- A : "A" Port
- B : "B" Port
- a : "a" Port
- b : "b" Port
- P : "P" Port  
(From Hydraulic Pump)
- T1 : "T1" Port  
(To Transmission Case)
- T2 : "T2" Port  
(To Transmission Case)
- R : Passage "R"
- X : "X" Chamber
- Y : "Y" Chamber

■ PTO Clutch "Engaged"

1. When the PTO clutch lever is operated to the "ON" position, the clutch lever linkage forces the spool (4) to shift to the left, thereby, a hydraulic circuit from the "P" port to the "A" port is formed and a hydraulic circuit from the "P" port to the "X" chamber above the brake piston (3) is closed. At the same time, as the "X" chamber is opened to the "T2" port, the brake piston (3) is forced to return into the "X" chamber by the spring (13) (See page M.1-7, fig. C045F010) and oil in the "X" chamber flows into the transmission case after passing through the "T2" port.
2. Oil delivered by the hydraulic pump flows from the "P" port into the "a" port after passing through the "A" port.

3. As the pressure-fed oil is led into the "Y" chamber, the hydraulic pressure actuates the clutch piston (11). Accordingly, the clutch discs (9), drive plates (8) and pressure plate (7) are depressed each other, and rotation of the PTO propeller shaft (5) is transmitted to the PTO clutch shaft (12).
4. At the same time, the pressure in the hydraulic circuit becomes high. When it exceeds the relief setting pressure, the pressure-fed oil forces the poppet (1) of the relief valve (2) to open and flows from the "B" port into the "b" port.
5. This oil is led into the passage "R" provided in the PTO clutch shaft (12), lubricates the clutch discs (9) and bushing (6), and then flows into the transmission case.



- (1) Poppet
- (2) Relief Valve
- (3) Brake Piston
- (4) Spool
- (5) PTO Propeller Shaft
- (6) Bushing
- (7) Pressure Plate
- (8) Drive Plates
- (9) Clutch Discs
- (10) Spring
- (11) Clutch Piston
- (12) PTO Clutch Shaft

- A : "A" Port
- B : "B" Port
- a : "a" Port
- b : "b" Port
- P : "P" Port  
(From Hydraulic Pump)
- T1 : "T1" Port  
(To Transmission Case)
- T2 : "T2" Port  
(To Transmission Case)
- R : Passage "R"
- X : "X" Chamber
- Y : "Y" Chamber

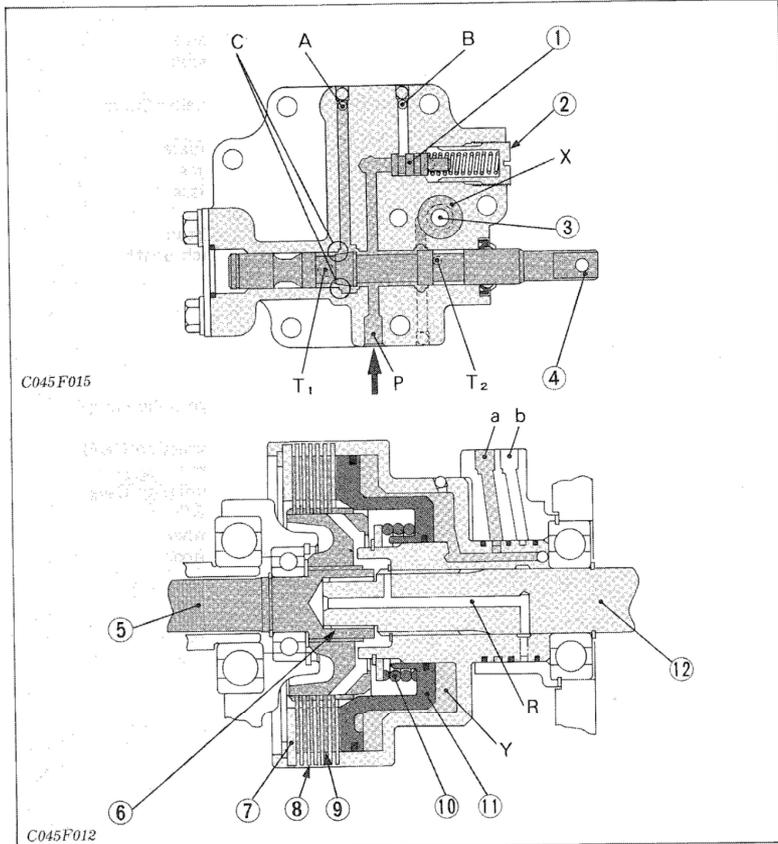
■ PTO Clutch "Disengaged"

1. When the PTO clutch lever is operated to the "OFF" position, the clutch lever linkage forces the spool (4) to shift to the left, thereby, a hydraulic circuit from the "P" port to the "A" port is closed and a hydraulic circuit from the "P" port to the "X" chamber above the brake piston (3) is formed. At the same time, as the "A" port is opened to the "T1" port, the clutch piston (11) is forced to return by the spring (10) and oil in the "Y" chamber flows from the "a" port to the "T1" port after passing through the "A" port. Accordingly, rotation of the PTO propeller shaft (5) is not transmitted to the PTO clutch shaft (12).

2. Oil, pressure-fed from the hydraulic pump into the "P" port, is delivered into the "X" chamber above the brake piston (3) and actuates the brake piston (3), so that the brake band clamps the PTO clutch body to stop the rotation of the PTO clutch shaft (12) (See page M.1-7, fig. C045F010).

3. At the same time, the pressure in the hydraulic circuit becomes high. When it exceeds the relief setting pressure, the pressure-fed oil forces the poppet (1) of the relief valve (2) to open and flows from the "B" port into the "b" port.

4. This oil is led into the passage "R" provided in the PTO clutch shaft (12), lubricates the clutch discs (9) and bushing (6), and then flows into the transmission case.



- (1) Poppet
- (2) Relief Valve
- (3) Brake Piston
- (4) Spool
- (5) PTO Propeller Shaft
- (6) Bushing
- (7) Pressure Plate
- (8) Drive Plate
- (9) Clutch Disc
- (10) Spring
- (11) Clutch Piston
- (12) PTO Clutch Shaft

- A : "A" Port
- B : "B" Port
- C : Restriction "C"
- a : "a" Port
- b : "b" Port
- P : "P" Port  
(From Hydraulic Pump)
- T1 : "T1" Port  
(To Transmission Case)
- T2 : "T2" Port  
(To Transmission Case)
- R : Passage "R"
- Y : "Y" Port

■ PTO Clutch "Semi Clutching"

When the PTO clutch lever is being operated from the "OFF" position to the "ON", a restriction "C" is momentarily formed between the tapered portion of the spool (4) and the spool land of the control valve.

Then, the pressure-fed oil from the hydraulic pump goes into the "P" port and flows through the "T1" port to the transmission case, the pressure-fed oil is also delivered from "A" port passing through the "a" port into the "Y" chamber and actuates the clutch piston (11).

At the same time, the hydraulic pressure acting on the clutch piston (11) varies with the position of the spool (4), that is to say, it changes depending on the amount of restriction "C", within the relief setting pressure.

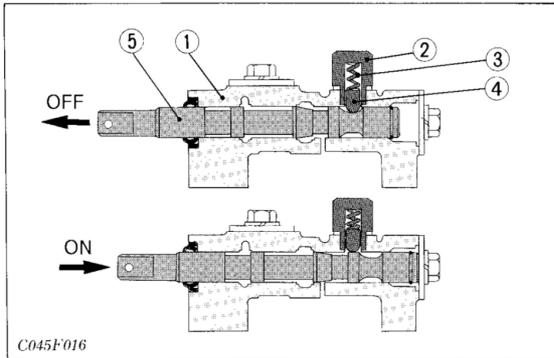
Accordingly, the more the spool (4) is shifted to the left, the higher the pressure becomes in the "Y" chamber, and this means that the hydraulic pressure acting on the clutch piston (11) varies progressively.

Especially, when the clutch is being engaged, it is possible to prevent the PTO components suffering damage due to dynamic impact.

This is most important because without it, the engine H.P. will be transmitted quickly to the PTO implement causing severe component damage in both implement and tractor.

■ IMPORTANT:

- During "semi clutching" when the "B" port is closed and the "A" port is not yet fully open, no pressure-fed oil is lubricating clutch surfaces. Therefore, do not leave the PTO clutch lever in a "semi clutching" state.



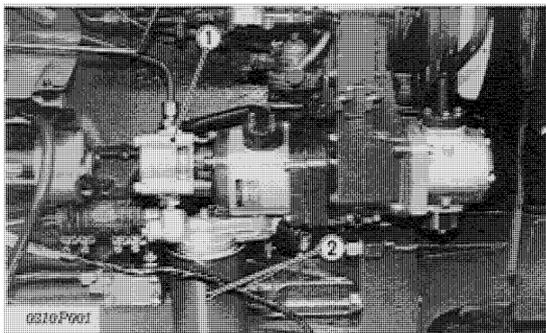
- |                       |                  |
|-----------------------|------------------|
| (1) PTO Control Valve | (4) Detent Piece |
| (2) Detent Plug       | (5) Spool        |
| (3) Spring            |                  |

### ■ Detent of Control Valve

Abrupt change of the spool (5) from "OFF" to "ON" causes pressure acting on the PTO clutch piston to rise sharply.

As a result, the PTO clutch is suddenly engaged and this dynamic impact is transmitted to the implement.

Therefore, the spool (5) is equipped with a detent mechanism to limit rapid spool movement, preventing PTO components suffering damage due to dynamic impact and ensuring smooth spool switching.



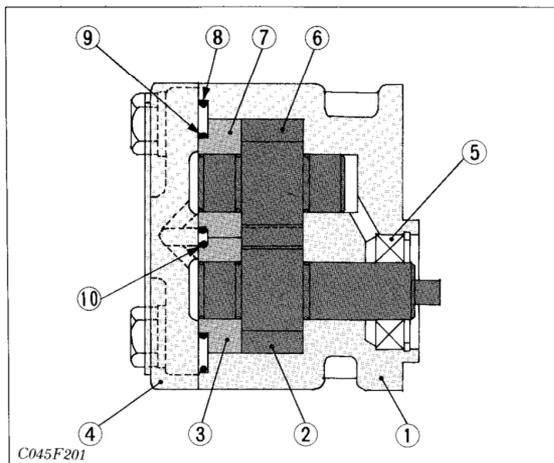
- |  |                |
|--|----------------|
| (1) PTO Clutch System Hydraulic Pump [Gear Pump] | (2) Oil Filter |
|--|----------------|

### ■ PTO Clutch System Hydraulic Pump

Models M6950 (DT) and M7950 (DT) are equipped with a gear pump (1) for the PTO clutches.

The gear pump sucks oil from the transmission case through the oil filter (2) and delivers the oil to the PTO control valve.

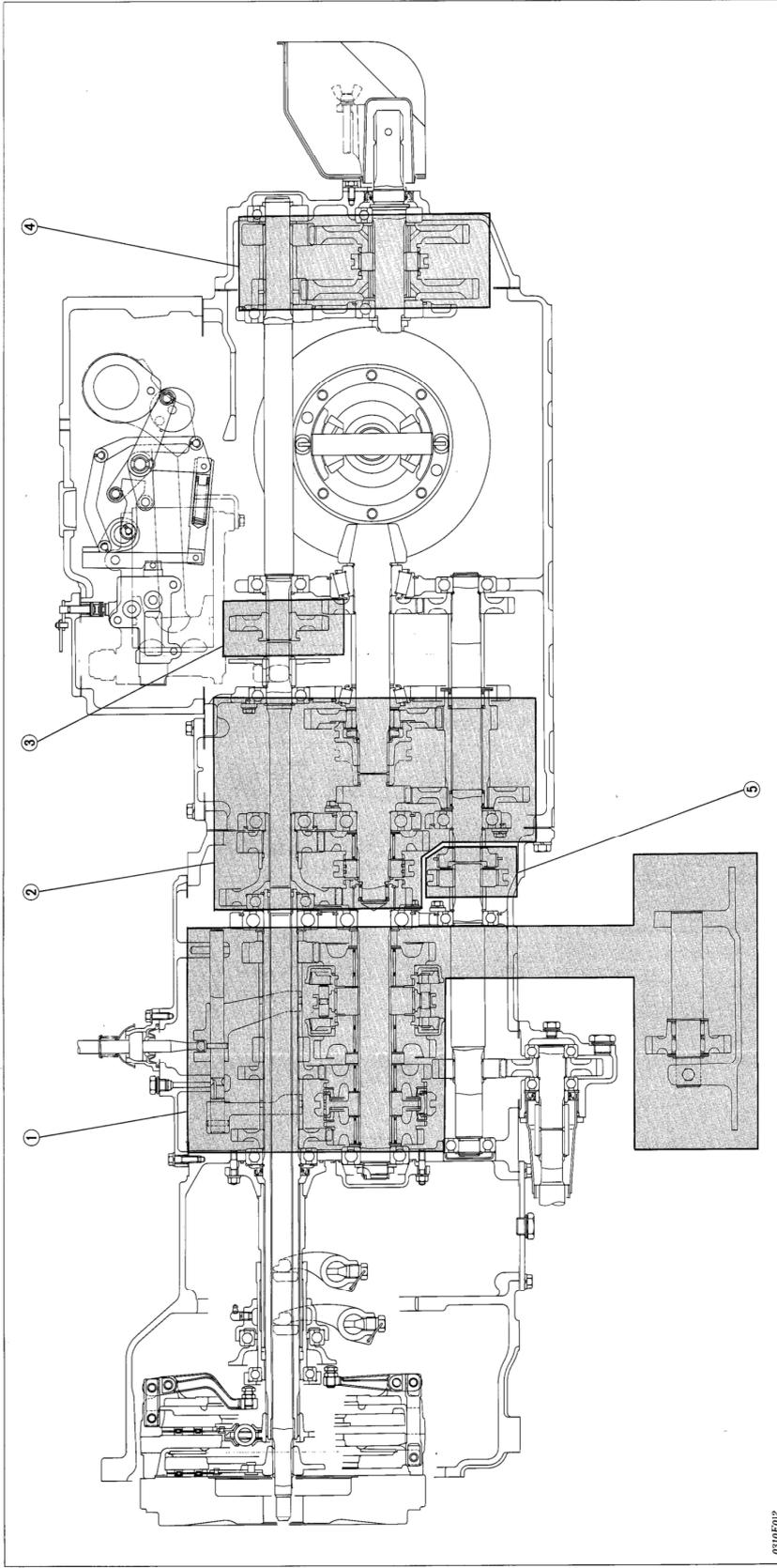
This gear pump is pressure loading type with an excellent volumetric efficiency. See page M.6-2 for the details of the gear pump.



- |                |                 |
|----------------|-----------------|
| (1) Housing    | (6) Driven Gear |
| (2) Drive Gear | (7) Bushing     |
| (3) Bushing    | (8) O-ring      |
| (4) Cover      | (9) O-ring      |
| (5) Oil Seal   | (10) O-ring     |

## 2 TRANSMISSION

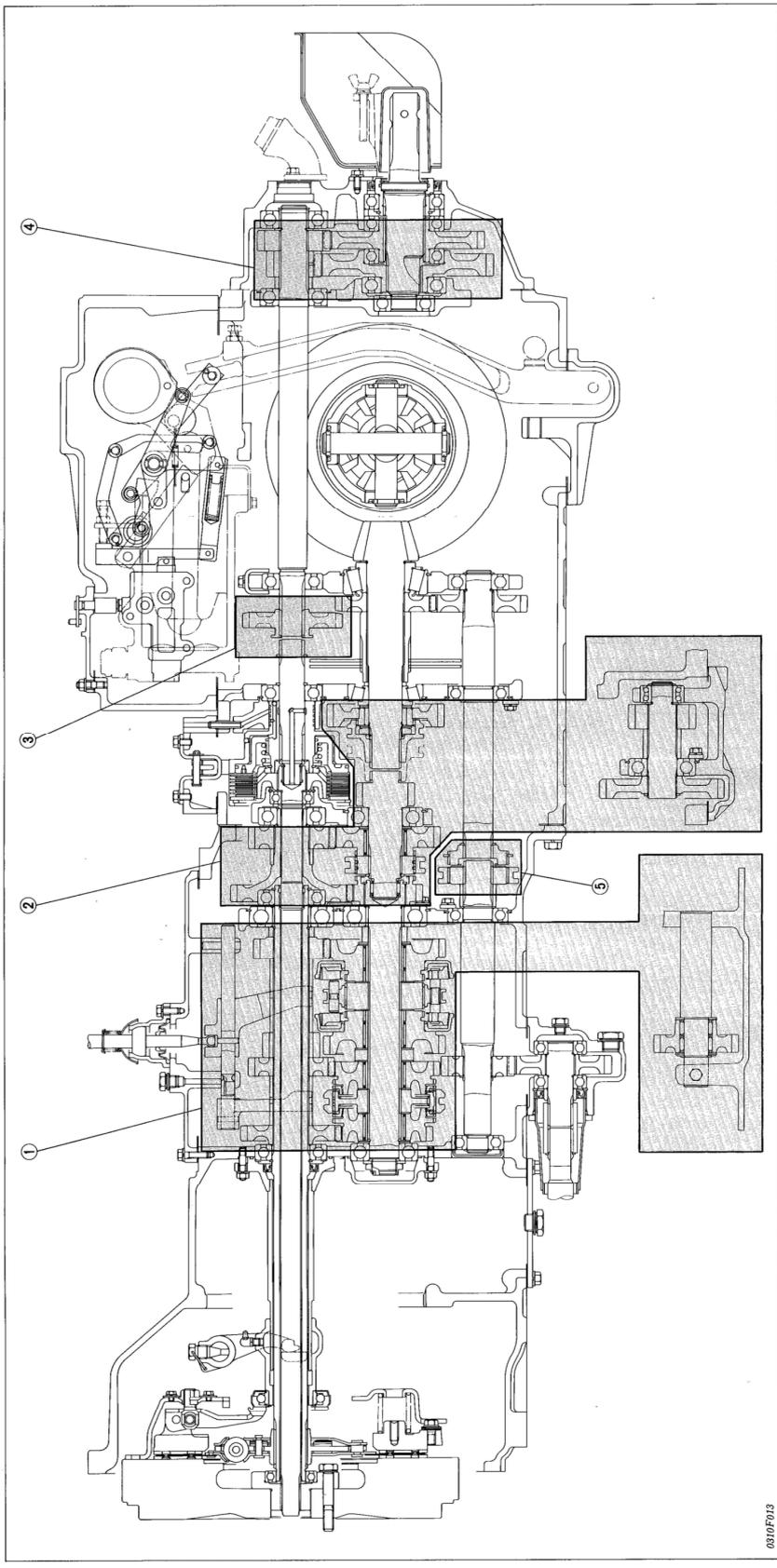
[M4950DT-M5950DT]



0310F012

- (1) Main Gear Shift Section
- (2) Auxiliary Gear Shift Section
- (3) PTO Shift Section
- (4) PTO Gear Section
- (5) Front Wheel Drive Section

[M6950DT - M7950DT]



0310F013

- (1) Main Gear Shift Section
- (2) Auxiliary Gear Shift Section
- (3) PTO Shift Section
- (4) PTO Gear Section
- (5) Front Wheel Drive Section

The transmission consists of a series of gears shown previously. It offers the most suitable speed for travelling 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 travelling system and PTO system.

#### ■ Travelling System

The travelling system consists of the main gear shift section (1), auxiliary gear shift section (2) and front wheel drive section (5).

All models have 12 forward and 4 reverse speeds. They are selected by the operation of the main gear shift and auxiliary gear shift levers.

#### (Reference)

- On M6950 (DT) and M7950 (DT), a dual speed device is available as factory installed option. With this device, the added range of 24 forward and 8 reverse ratios are available. (See page M.2-16.)

#### ■ PTO System

Live (Independent) or Ground PTO's is available. Live (Independent) PTO's have their own clutch controlled completely separate from the travelling clutch and transmission. This means that the PTO operation is independent of the tractor travel. Therefore, the PTO can operate while the tractor is stopped and also the PTO can be disengaged and engaged while the tractor is in motion.

#### (Reference)

- M4950(DT) and M5950(DT) are equipped with a dry single-plate type, dual clutch. (See page M.1-4.)
- M6950(DT) and M7950(DT) are equipped with a hydraulic PTO clutch (wet multi-plates type clutch). (See page M.1-7.)

In Ground PTO, it is not necessary to operate the PTO clutch control lever, and the PTO shaft is driven when the tractor is travelling.

PTO offers two speeds – 540 rpm and 1000 rpm (Live PTO), 1st and 2nd (Ground PTO). To get these speeds, PTO speed change lever is used on M4950(DT) and M5950(DT) and two interchangeable PTO shafts are used on M6950(DT) and M7950(DT).

## [1] TYPES OF TRANSMISSION

Transmissions are largely classified into two types: mechanical transmissions and hydraulic assisted transmissions. This chapter discusses the mechanical transmissions. Three major types of mechanical transmissions are the sliding gear, the collar shift and the synchromesh transmissions.

### 1) Sliding Gear

The sliding gear transmission has two or more shafts mounted in parallel or in line, with sliding spur gears arranged to mesh with each other and provide a change in speed or direction.

This device is a popular transmission for use in farm and industrial machines.

Made up mainly of spur gears and shafts, it is simple but gives a variety of speeds.

### 2) Collar Shift

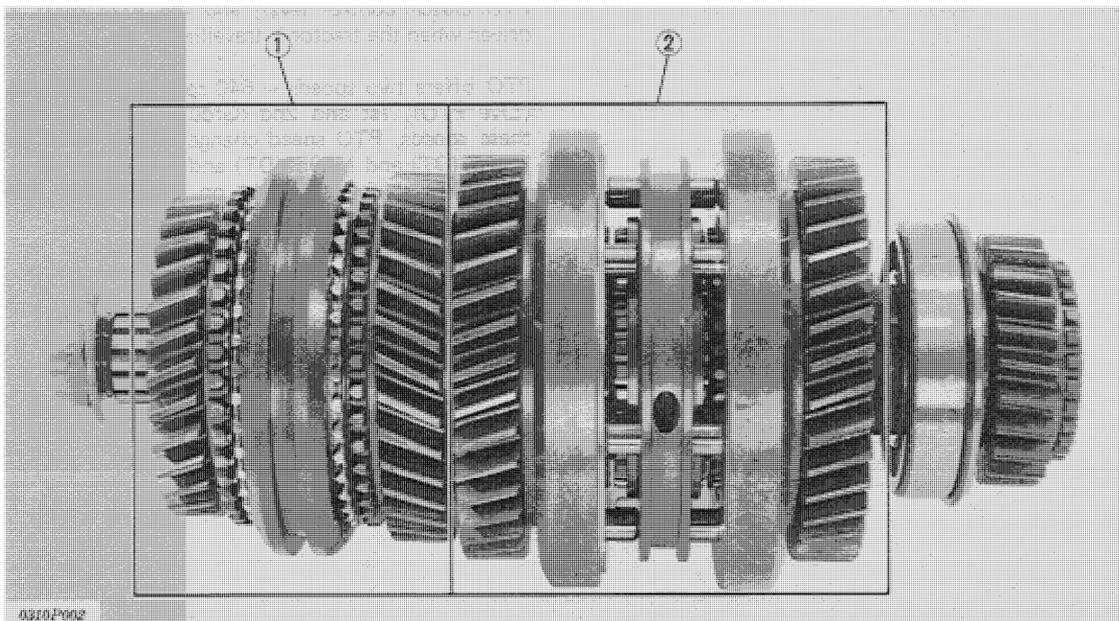
The collar shift transmission has parallel shafts with gears in constant mesh.

Shifting is done by locking free-running gears to their shafts using sliding collars.

### 3) Synchromesh

The synchromesh transmission is basically a constant mesh, collar-shift transmission with an extra device (called a synchronizer) to equalize the speed of the mating parts before they engage. The synchronizer is used in all manual automotive transmissions and is common in other machines where "on-the-go" shifting is required.

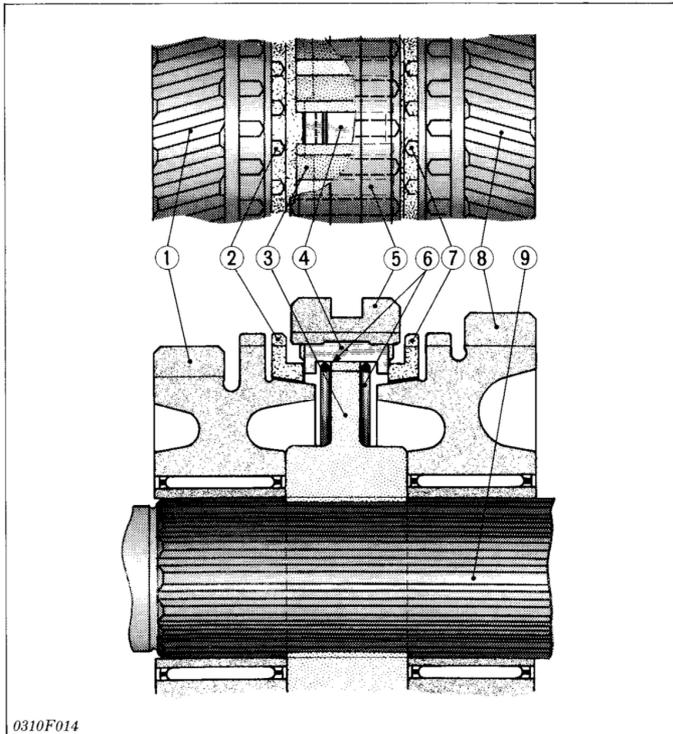
Four common types of synchronizers are block-type, pin-type, disk-and-plate-type and plain-type synchronizer. In this tractor, block-type and pin-type synchronizers are used. For operations, refer to the following.



(1) Block-type Synchromesh  
(Main speed change 2nd-3rd speed)

(2) Pin-type Synchromesh  
(Main speed change 1st speed-Reverse)

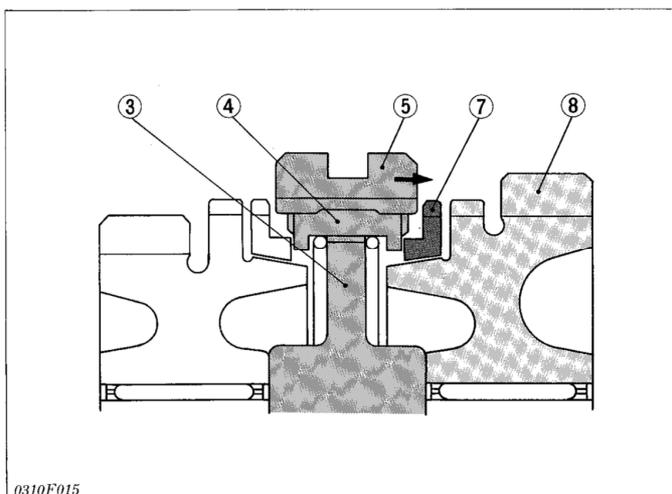
■ Operation of Block-type Synchronizer  
(Main speed change 2nd-3rd speed)



0310F014

- |                       |                          |
|-----------------------|--------------------------|
| (1) Gear              | (6) Synchronizer Springs |
| (2) Synchronizer Ring | (7) Synchronizer Ring    |
| (3) Coupling          | (8) Gear                 |
| (4) Synchronizer Key  | (9) Counter Shaft        |
| (5) Shifter           |                          |

The coupling (3) is splined to the counter shaft (9) and the shifter (5) is mounted on the coupling. The two synchronizer springs (6) hold the synchronizer keys (4) out against the shifter (5). The bronze synchronizer rings (2), (7) each have three slots into which the ends of the synchronizer keys (4) fit. The inner surfaces of the synchronizer rings (2), (7) are cone-shaped and match the conical shape of the gear (1), (8) shoulders which they contact. These cone-shaped surfaces provide the frictional force to synchronize the speed of the first shaft and the gear (1), (8).

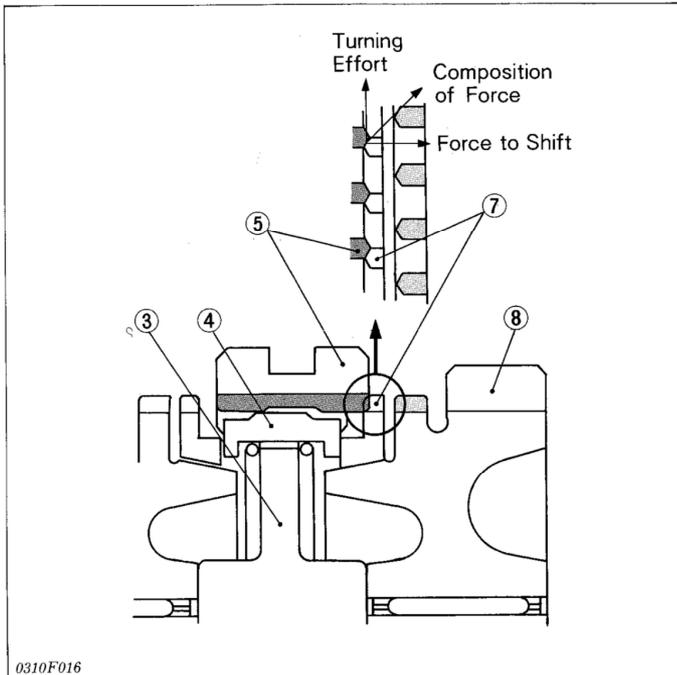


0310F015

- |                      |                       |
|----------------------|-----------------------|
| (3) Coupling         | (7) Synchronizer Ring |
| (4) Synchronizer Key | (8) Gear              |
| (5) Shifter          |                       |

**First stage**

An effort to place the main gear shift lever to the 2nd or 3rd speed causes the shifter (5) and synchronizer keys (4) to move slightly. Then, the end surface of the synchronizer key (4) presses the synchronizer ring (7) against the cone-shaped portion of the gear (8). The frictional force generated at the cone-shaped portion rotates the synchronizer ring (7), synchronizer keys (4) and coupling (3) which is splined to the counter shaft.

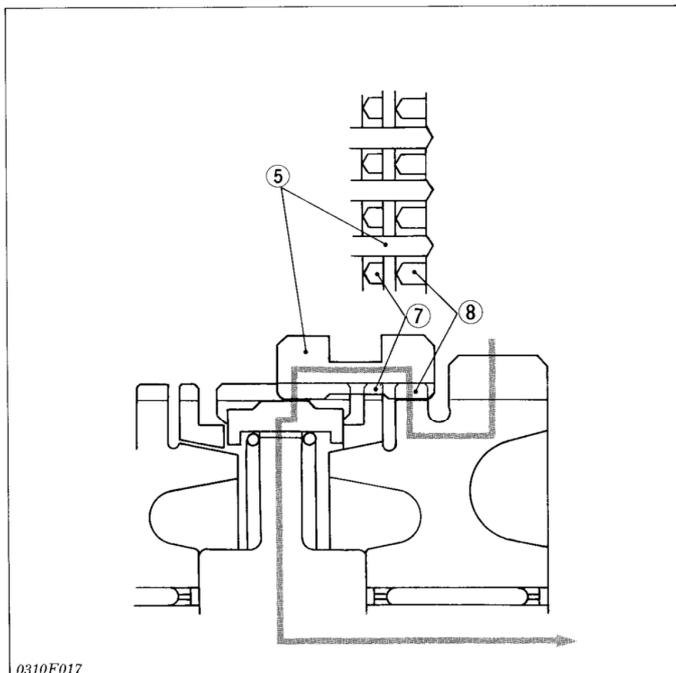


0310F016

- (3) Coupling
- (4) Synchronizer Key
- (5) Shifter
- (7) Synchronizer Ring
- (8) Gear

**Second stage**

When synchronizer keys (4) are prevented by the synchronizer ring (7) from sliding, the synchronizer keys (4) are disengaged from the shifter (5). The synchronizer keys (4) go into the grooves provided on the synchronizer ring (7), however, since the width of the grooves is wider than that of the keys, the synchronizer keys begin rotating at the same speed with the shifter (5) and coupling (3) with a time lag. In the meantime, the shifter (5) in its sliding direction and the synchronizer ring (7) in its rotating direction press each other at their chamfered portions to synchronize the synchronizer ring (7) speed with the gear (8) speed.



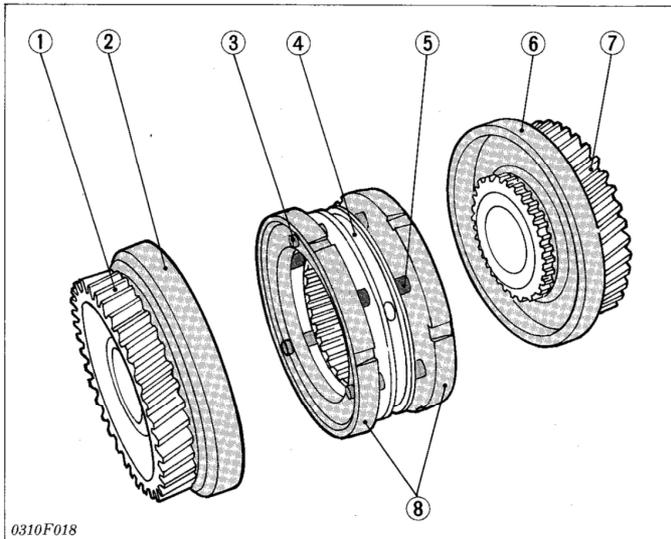
0310F017

- (5) Shifter
- (7) Synchronizer Ring
- (8) Gear

**Final stage**

When the shifter (5) speed becomes the same as the gear (8) speed, the force of the synchronizer ring (7) in its rotating direction is not applied to the shifter (5) and the synchronizer ring (7) rotation is no longer transmitted to the shifter (5). Therefore, the shifter (5) engages with the synchronizer ring (7) and further engages with the gear (8) for complete connection.

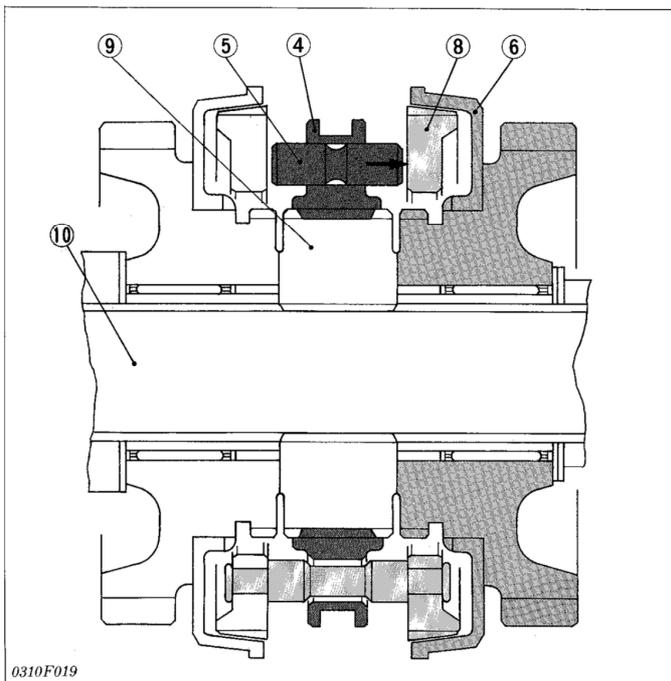
■ Operation of Pin-type Synchronizer  
(Main speed change 1st Speed-Reverse)



0310F018

- |                |                        |
|----------------|------------------------|
| (1) Gear       | (5) Synchronizer Pin   |
| (2) Outer Ring | (6) Outer Ring         |
| (3) Balk Pin   | (7) Gear               |
| (4) Shifter    | (8) Synchronizer Rings |

The shifter (4) splined to the hub has six equidistant holes in which balk pins (3) and synchronizer pins (5) are alternately inserted. The both ends of the balk pins (3) are clinched with synchronizer rings (8). The outer rings (2), (6) are welded to the gear (1), (7). As with the block-type synchronizer, the inner surfaces of the outer rings (2), (6) are cone-shaped and match the conical shaped friction surfaces of the synchronizer rings (8) which they contact.

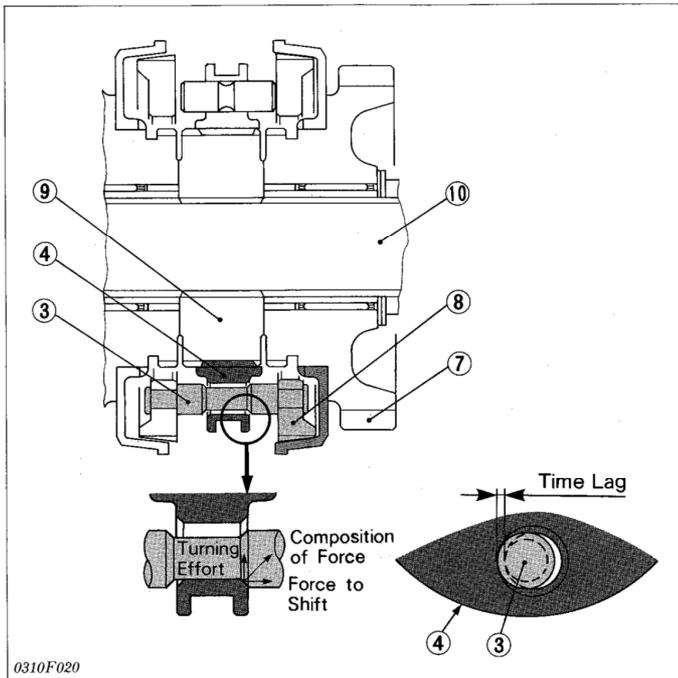


0310F019

- |                      |                       |
|----------------------|-----------------------|
| (4) Shifter          | (8) Synchronizer Ring |
| (5) Synchronizer Pin | (9) Hub               |
| (6) Outer Ring       | (10) Counter Shaft    |

**First stage**

An effort to place the main gear shift lever into the 1st speed or Reverse causes the shifter (4) and synchronizer pins (5) to move slightly. The end surfaces of the synchronizer pins (5) press the synchronizer ring (8) to the cone-shaped portion of the outer ring (6). The friction force generated at the cone-shaped portion rotates the synchronizer ring (8), shifter (4) and hub (9) which is splined to the counter shaft (10).

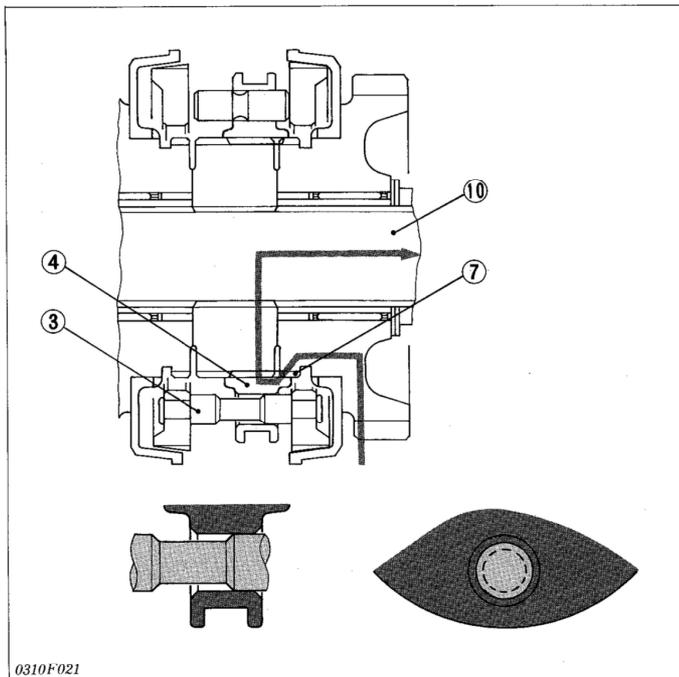


0310F020

- |              |                       |
|--------------|-----------------------|
| (3) Balk Pin | (8) Synchronizer Ring |
| (4) Shifter  | (9) Hub               |
| (7) Gear     | (10) Counter Shaft    |

**Second stage**

The balk pins (3) have the largest diameter at both ends and smallest diameter at their center. The shifter (4) and hub (9) begin rotating at the same speed with the balk pins (3) with a time lag. In the meantime, the shifter (4) in its sliding direction and the balk pins (3) in their rotating direction press each other at their chamfered portions to synchronize the synchronizer ring (8) speed with the gear (7) speed.



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- |              |                    |
|--------------|--------------------|
| (3) Balk Pin | (7) Gear           |
| (4) Shifter  | (10) Counter Shaft |

M.2-8

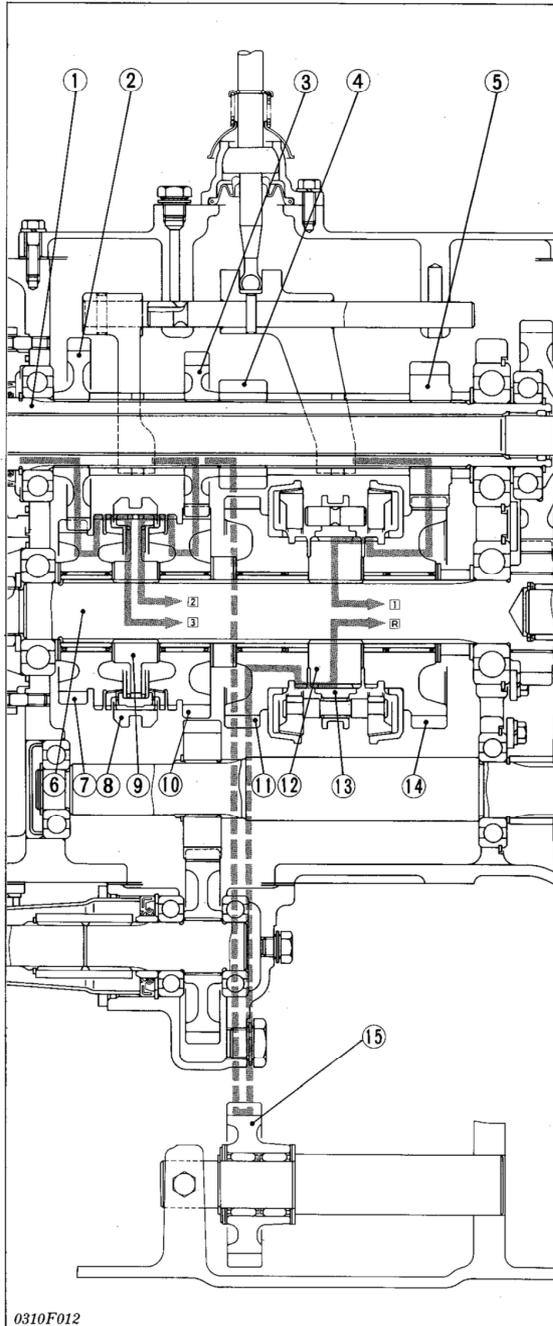
**Final stage**

When the shifter (4) speed become the same as the gear (7) speed, the force of the balk pins (3) in their rotating direction is not applied to the shifter (4) and the rotation of the balk pins (3) is no longer transmitted to the shifter (4). Therefore, the shifter (4) slides toward the larger diameter side of the balk pins (3), and then engages with the gear (7) for complete connection.

## [2] TRAVELLING SYSTEM

### 1) Main Gear Shift Section

[M4950(DT) · M5950(DT) · M6950(DT) · M7950(DT)]



0310F012

Besides neutral, four 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) on the counter shaft (6).

#### ■ 1st Position

1st Shaft (1) → 22T Gear (5) → 37T Gear (14) → Shifter (13) → Hub (12) → Counter Shaft (6).

#### ■ 2nd Position

1st Shaft (1) → 25T Gear (3) → 33T Gear (10) → Shifter (8) → Coupling (9) → Counter Shaft (6).

#### ■ 3rd Position

1st Shaft (1) → 30T Gear (2) → 29T Gear (7) → Shifter (8) → Coupling (9) → Counter Shaft (6).

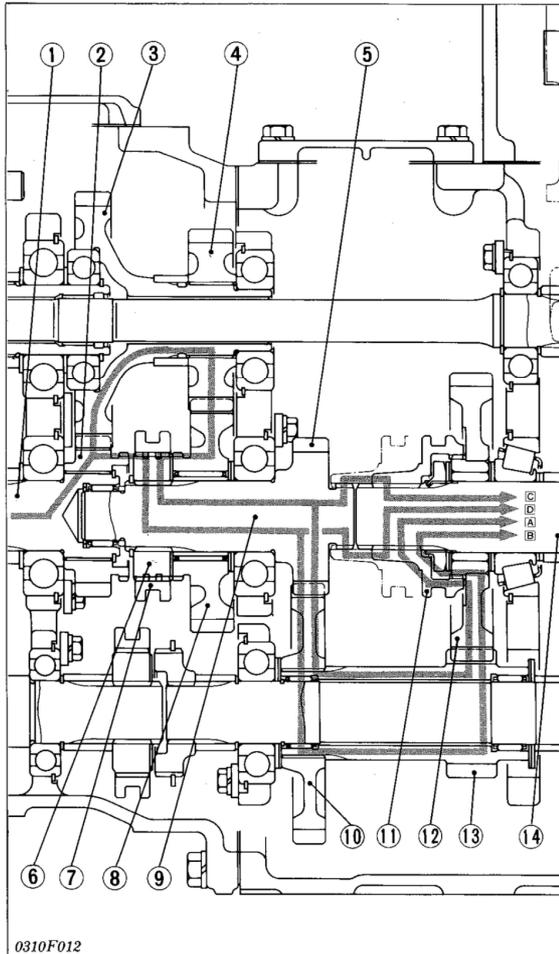
#### ■ Reverse Position

1st Shaft (1) → 16 Gear (4) → 26T Gear (15)  
37T Gear (11) → Shifter (13) → Hub (12)  
→ Counter Shaft (6).

- (1) 1st Shaft
- (2) 30T Gear
- (3) 25T Gear
- (4) 16T Gear
- (5) 22T Gear
- (6) Counter Shaft
- (7) 29T Gear
- (8) Shifter
- (9) Coupling
- (10) 33T Gear
- (11) 37T Gear
- (12) Hub
- (13) Shifter
- (14) 37T Gear
- (15) 26T Gear

## 2) Auxiliary Gear Shift Section

[M4950(DT) · M5950(DT)]



0310F012

- |                   |                                  |
|-------------------|----------------------------------|
| (1) Counter Shaft | (9) Auxiliary Speed Change Shaft |
| (2) 23T Gear      | (10) 40T Gear                    |
| (3) 39T Gear      | (11) Shifter                     |
| (4) 27T Gear      | (12) 45T Gear                    |
| (5) 23T Gear      | (13) 18T Gear                    |
| (6) Coupling      | (14) Spiral Bevel Pinion Shaft   |
| (7) Shifter       |                                  |
| (8) 35T Gear      |                                  |

Besides neutral, four ways of power flow (from counter shaft (1) to spiral bevel pinion shaft (14)) are available by operating the auxiliary gear shift lever to shift the shifter (7) on the auxiliary speed change shaft (9) and the shifter (11) on the spiral bevel pinion shaft (14).

■ A Position

Counter Shaft (1) → 23T Gear (2) → 39T Gear (3) → 27T Gear (4) → 35T Gear (8) → Shifter (7) → Coupling (6) → Auxiliary Speed Change Shaft (9) → 23T Gear (5) → 40T Gear (10) → 18T Gear (13) → 45T Gear (12) → Shifter (11) → Spiral Bevel Pinion Shaft (14).

■ B Position

Counter Shaft (1) → 23T Gear (2) → Shifter (7) → Coupling (6) → Auxiliary Speed Change Shaft (9) → 23T Gear (5) → 40T Gear (10) → 18T Gear (13) → 45T Gear (12) → Shifter (11) → Spiral Bevel Pinion Shaft (14).

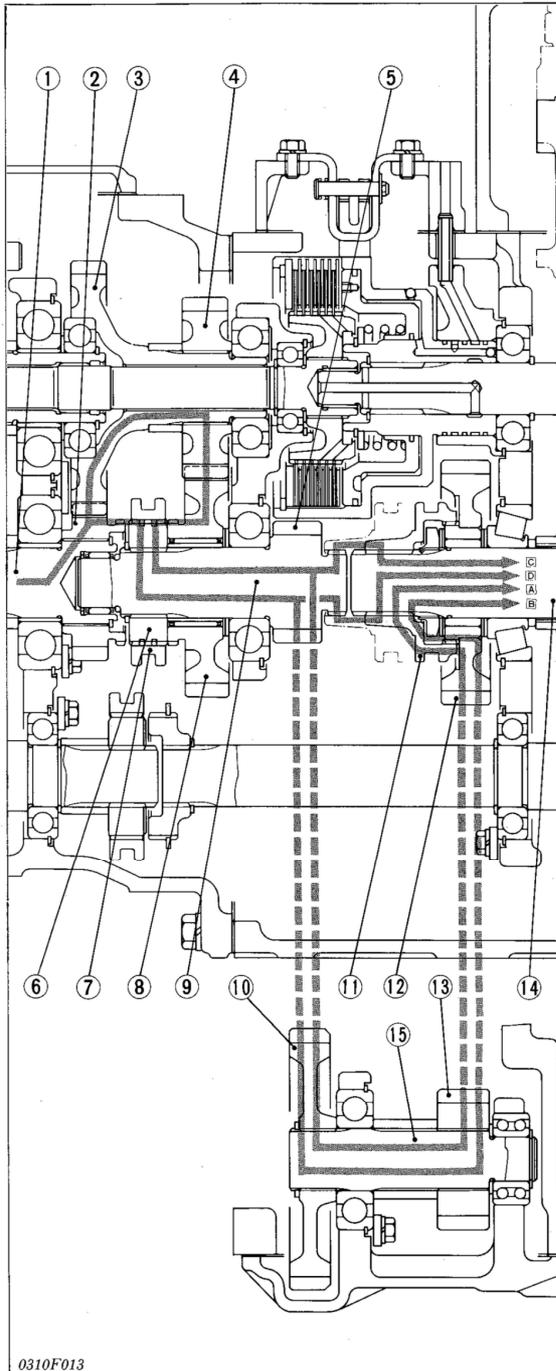
■ C Position

Counter Shaft (1) → 23T Gear (2) → 39T Gear (3) → 27T Gear (4) → 35T Gear (8) → Shifter (7) → Coupling (6) → Auxiliary Speed Change Shaft (9) → Shifter (11) → Spiral Bevel Pinion Shaft (14)

■ D Position

Counter Shaft (1) → 23T Gear (2) → Shifter (7) → Coupling (6) → Auxiliary Speed Change Shaft (9) → Shifter (11) → Spiral Bevel Pinion Shaft (14).

[M6950(DT) · M7950(DT)]



0310F013

Besides neutral, four ways of power flow (from counter shaft (1) to spiral bevel pinion shaft (14)) are available by operating the auxiliary gear shift lever to shift the shifter (7) on the auxiliary speed change shaft (9) and the shifter (11) on the spiral bevel pinion shaft (14).

■ A Position

Counter Shaft (1) → 23T Gear (2) → 39T Gear (3) → 27T Gear (4) → 35T Gear (8) → Shifter (7) → Coupling (6) → Auxiliary Speed Change Shaft (9) → 17T Gear (5) → 40T Gear (10) → Half Shaft (15) → 20T Gear (13) → 37T Gear (12) → Shifter (11) → Spiral Bevel Pinion Shaft (14).

■ B Position

Counter Shaft (1) → 23T Gear (2) → Shifter (7) → Coupling (6) → Auxiliary Speed Change Shaft (9) → 17T Gear (5) → 40T Gear (10) → Half Shaft (15) → 20T Gear (13) → 37T Gear (12) → Shifter (11) → Spiral Bevel Pinion Shaft (14).

■ C Position

Counter Shaft (1) → 23T Gear (2) → 39T Gear (3) → 27T Gear (4) → 35T Gear (8) → Shifter (7) → Coupling (6) → Auxiliary Speed Change Shaft (9) → Shifter (11) → Spiral Bevel Pinion Shaft (14).

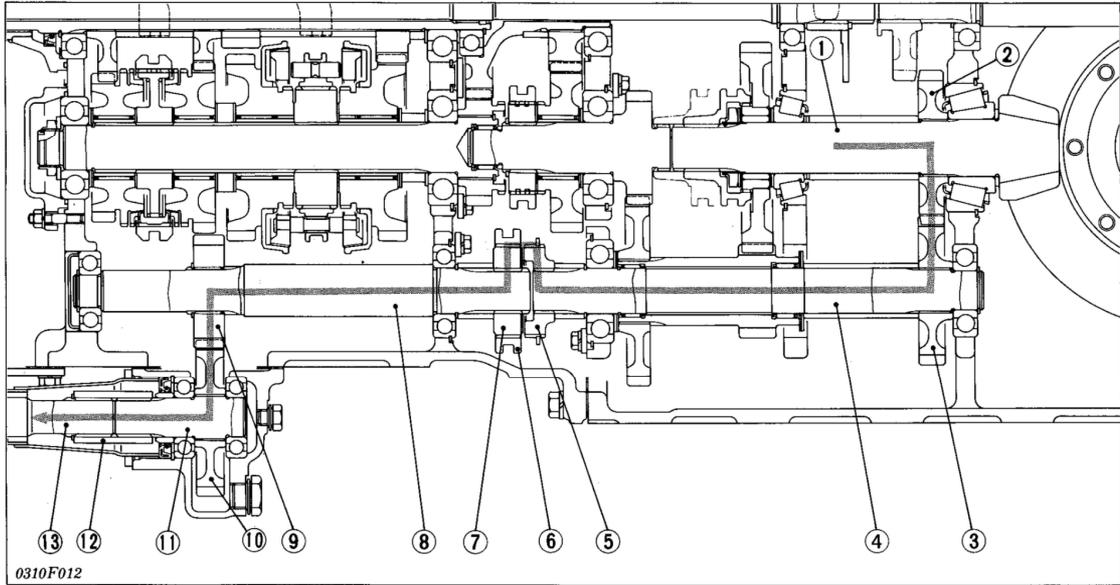
■ D Position

Counter Shaft (1) → 23T Gear (2) → Shifter (7) → Coupling (6) → Auxiliary Speed Change Shaft (9) → Shifter (11) → Spiral Bevel Pinion Shaft (14).

- (1) Counter Shaft
- (2) 23T Gear
- (3) 39T Gear
- (4) 27T Gear
- (5) 17T Gear
- (6) Coupling
- (7) Shifter
- (8) 35T Gear
- (9) Auxiliary Speed Change Shaft
- (10) 40T Gear
- (11) Shifter
- (12) 37T Gear
- (13) 20T Gear
- (14) Spiral Bevel Pinion Shaft
- (15) Half Shaft

3) Front Wheel Drive Section [DT Type Only]

[M4950DT · M5950DT]



- |                               |                              |                         |                              |
|-------------------------------|------------------------------|-------------------------|------------------------------|
| (1) Spiral Bevel Pinion Shaft | (5) Coupling                 | (9) 19T Gear [M4950DT]  | (11) Front Wheel Drive Shaft |
| (2) 32T Gear                  | (6) Shifter                  | (10) 28T Gear [M4950DT] | (12) Coupling                |
| (3) 31T Gear                  | (7) Coupling                 | (13) Propeller Shaft    |                              |
| (4) Transmitting Shaft Rear   | (8) Transmitting Shaft Front |                         |                              |

2-wheel drive or 4-wheel drive is selected by changing position of the shifter (6) on the transmitting shaft front (8) 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 (11). 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) → Coupling (5) → Shifter (6) → Coupling (7) → Transmitting Shaft Front (8) → 19T Gear (9) [M4950DT] · 24T Gear (9) [M5950DT] → 28T Gear (10) [M4950DT] · 32T Gear (10) [M5950DT] → Front Wheel Drive Shaft (11) → Coupling (12) → Propeller Shaft (13)