## GENERAL

### 1. DESCRIPTION

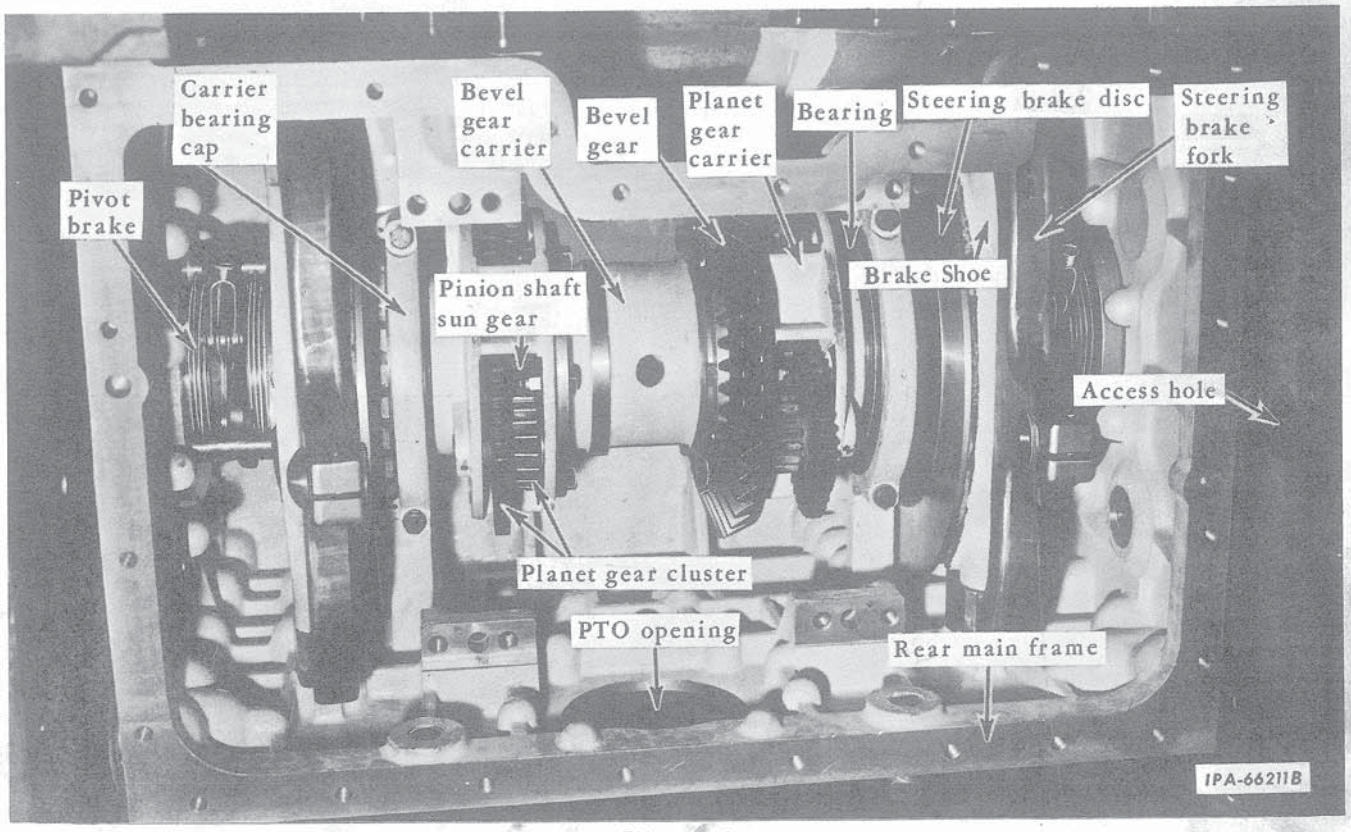
The steering system on this tractor combines a planetary gear type drive, steering brakes and pivot brakes for making short turns. These are all located in the rear main frame (Illust. 1). The steering is manually operated by hand levers. A brake pedal is used to apply both pivot brakes at the same time for stopping or holding the tractor. Hydraulic boosters are used as an assist for steering.

#### Steering Planetary (Refer to Illust. 1)

This steering-planetary unit functions as an intermediate drive crosswise between the transmission and the sprocket final planetary drives. It provides a gear reduction and permits a power disconnect on each side for turning the tractor. Power to the tracks is transmitted through the drive bevel gear, which is bolted to the bevel gear carrier, the planetary gear carriers, located at both ends of the bevel gear carrier, and the sprocket drive pinion shafts out to the sprocket planetary gear drives.

The planet gear carriers are located at the ends of the bevel gear carrier and the hubs are supported by tapered roller bearings mounted in a cage installed in the brake partitions of the main frame. The tapered bearings are preloaded by a circular adjusting nut in a threaded section of the bearing cages. These adjusting nuts are also used to adjust backlash between the bevel gear and pinion. A bushing and the hub of a 42 tooth gear are installed in each end of the bevel gear carrier. A bushing and the hub of a 21 tooth gear are installed in the hub of both planet gear carriers. This arrangement provides two adjacent sun gears within each planetary carrier around which the planet gear clusters rotate. Three planet gear clusters, each consisting of a 15 and 36 tooth gear, shaft and roller bearings, mesh with the large (42 tooth) and small (21 tooth) sun gears. The steering brake disc is bolted to the flanged end of the smaller sun gear hub which extends through and beyond the outer edge of the planetary carrier hubs. The sprocket drive pinion shafts extend into the steering planetary and are splined at the inner ends to the large sun gear installed in the bevel gear carrier hub.

(Continued on next page.)




Illust. 1
Steering Planetary and Brakes (Stationary Back-up Shoes Removed).

## GENERAL

### 1. DESCRIPTION - Continued

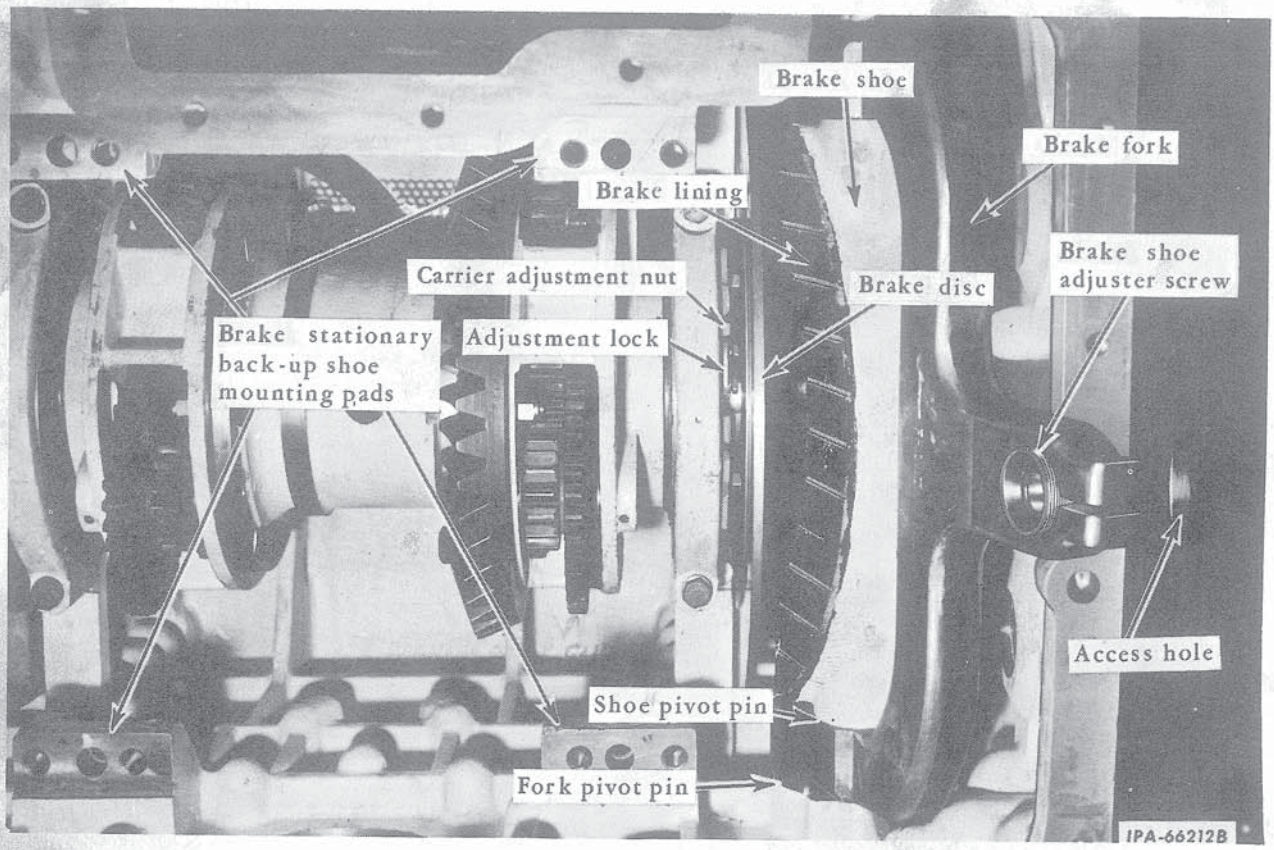
#### Steering Planetary Brakes (Refer to Illust. 2 and 3)

There are two sets of mechanical steering planetary brakes installed in the rear main frame, one on each side of the planetary drive unit (Illust. 1). Each brake assembly consists of a brake disc, an outer brake shoe installed in a movable fork (Illust. 2) and an inner stationary back-up brake shoe (not shown). The stationary, or inner brake shoe is secured to the mounting pads shown. Crescent shaped brake linings, bonded to the stationary shoes and to the inner sides of both movable shoes, make contact with the upper section of the brake disc. Springs installed inside the main frame cover (Illust. 3) apply pressure against the top of each fork, forcing the movable brake shoes against the brake discs. The brake shoes are released with the steering levers which are connected by levers, bellcranks and push rods. When a steering lever is pulled part way, the bellcrank moves the push rod to force the fork away from the brake disc, causing the outer brake shoe to release the sun gear disc brake disc).

#### Pivot Brakes (Illust. 1 and 4)

The pivot brakes are multiple-disc type and are oil cooled by the oil in the rear main frame. They are separately housed outside of the steering-planetary compartment in each side of the rear main frame. Each brake consists of ten lined brake middle discs splined to the sprocket drive pinion shaft and eight intermediate disc held by the brake studs with an actuating disc assembly between them. Each disc assembly contains two actuator discs connected by three springs and held slightly apart by five balls trapped in matching inclined pockets or ramps. Each actuator disc is connected to the brake actuating cable (Illust. 3) by a link.

When the brake actuating cable is pulled, it causes the two actuator discs to rotate slightly




Illust. 2
Steering Planetary Brakes (Stationary Back-up Shoes Removed).



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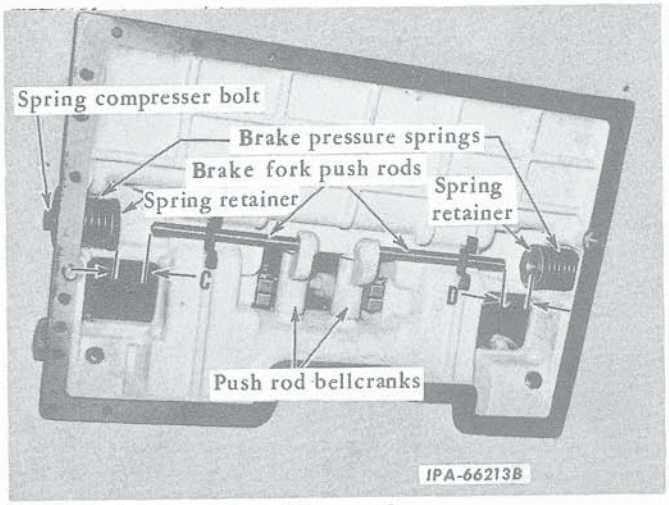
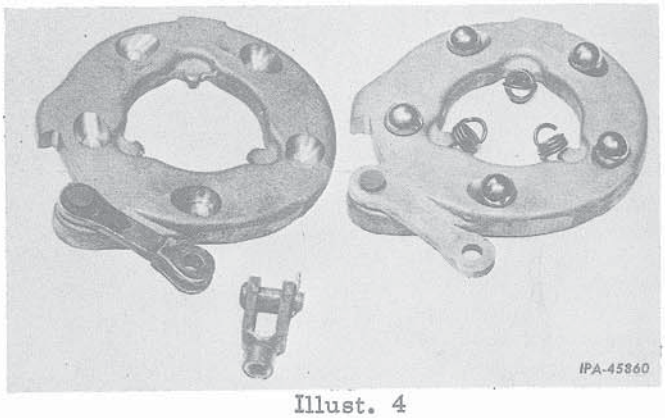
## GENERAL




Illust. 3
Rear Main Frame Cover




Illust. 4
Pivot Brake Actuating Disc Assembly.

in opposite directions. This forces the five balls to roll toward the shallow end of the ramps, spreading the actuator discs apart and squeezing the lined brake middle discs against the stationary intermediate discs. On contact, the rotating lined brake discs cause one of the actuator discs to rotate a little further; thus, applying the brake tighter and providing a self-energizing action. The same action occurs in either forward or reverse travel. The ends of the brake actuating cables are equipped with over-ride slots which permit the steering levers to be pulled back part way (disengaging sun gear brake disc) without applying the pivot brakes. Further travel of the steering lever applies the pivot brake.

### Steering Boosters

The hydraulic steering boosters eliminate the effort to disengage the steering brake discs. The boosters are mounted on the rear main frame cover. They are controlled independently by the steering hand levers and actuated by the oil in the rear main frame on power shift units or by the oil in the clutch system on gear drive units.

### Operation

With the steering lever in the forward (applied) position, the steering brake holds the sun gear disc with attached sun gear stationary. Rotation of the bevel gear by the transmission pinion carries with it the bevel gear carrier and planetary carriers. This forces the planet gear clusters and their carrier to orbit around the stationary sun gear to which the larger planet gears are meshed. The smaller planet gears, in turn, rotate the sprocket drive pinion shaft sun gear which is splined to the shaft, resulting in a power output.

As the steering lever for one side of the tractor is pulled to the rear (released) position, the steering brake releases the brake disc and small sun gear. Rotation of the bevel gear carrier and planet gear carrier continues. The planet gear carrier induces its rotary motion to the three planet gear clusters which freewheel on their axis and cause the sun gear and disc to rotate in the opposite direction. In a wide gradual turn, the planet gears also freewheel around the larger sun gear, causing the sprocket drive pinion shaft to idle. There is no power output to the pinion shaft. The only reason the sprocket drive pinion shaft turns is that it is being dragged around by the opposite track.

In a pivot turn, however, the steering lever is pulled further to the rear, applying the pivot brake to the sprocket drive pinion shaft. This holds the larger sun gear stationary and allows that end of the planetary drive to freewheel around the sun gears and brake disc. The amount of pressure applied to the pivot brake determines the degree of the turn and the action of the gears in the steering planetary.

One brake pedal, equipped with a pawl and ratchet lock, applies both pivot brakes at the same time without moving the steering levers. Two pulleys (one movable and the other stationary), a cable assembly connected to two brake actuating bellcranks, and a pull rod connected to the brake pedal provide the brake operating linkage. When the foot brake is depressed, the pull rod pivots the movable pulley forward, causing the cable to pull the actuating bellcranks upward to apply the brakes.

GENERAL

## 2. SPECIFICATIONS

### Steering Planetary

| | |
|---|---|
| Bevel gear carrier, inches: | |
| Bushing ID (assembled) | 2.754 - 2.753 |
| Thrust washer thickness | .091-.093 |
| Large sun gear (42 teeth) hub OD, inches | 2.748-2.746 |
| Planet gear carrier, inches: | |
| Bushings ID (assembled) | 4.815 - 4.813 |
| Small sun gear (21 teeth) disc hub OD, inches | 4.808 - 4.805 |
| Disc thickness, inch | 250 |
| Planet gear cluster (small gear, 15 teeth, large gear, 36 teeth), inches: | |
| Bore diameter | 1.3135 - 1.3129 |
| Thrust washer thickness: | |
| Bronze | .0383 - .0423 |
| Steel | .0329 |
| Planet gear cluster shaft diameter, inches | 1.000 - .9996 |
| Backlash, bevel gear with transmission pinion, inch | .008 - .011 |

### Steering Planetary Brakes

| | |
|---|---|
| Number of linings used (each brake) | 2 |
| Lining thickness to depth of grooves, inch | 1/8 |
| Bellcrank push rod outer lever: | |
| Shaft OD, inches | 1.000 - .999 |
| Bushing ID (assembled), inches | 1.0004 - 1.0024 |
| Brake fork push rod bellcrank bushing ID (assembled), inches | 1.0055 - 1.0015 |
| Brake fork push rod bellcrank shaft diameter, inches | 1.000 - .998 |
| Brake fork push rod bellcrank thrust washer thickness, inch | .0383 - .0423 |
| Bellcrank push rod length, inches | 2.680 |
| Bellcrank push rod lever washer thickness, inch (early machines only) | .0383 - .0423 |
| Steering brake pressure spring: | |
| Free length, inches | 5.29 |
| Test length, inches | 3.80 |
| Test load, lbs. | 720 |
| Steering brake bellcrank return spring: | |
| Free length, inches | 3.40 |
| Test length, inches | 2 |
| Test load, lbs. | 35 |
| Steering brake hand lever return spring: | |
| Free length, inches | 4.061 |
| Test length, inches | 4.30 |
| Test load, lbs | 50 |
| Free length, inches | 3.882 |
| Test length, inches | 4.30 |
| Test load, lbs | 35 |

### Pivot Brakes

| | |
|---|---|
| Type | Multiple-disc, mechanical |
| How applied | Steering levers or foot pedal |
| Mounting | On sprocket drive pinion shaft |
| Number of friction surfaces, each side of actuator discs | 10 |
| Number of discs, each side of actuator discs: | |
| Middle disc (lined) | 5 |
| Intermediate disc (steel) | 4 |
| Disc and lining thickness, inch | .108 - .112 |
| Intermediate disc thickness, inch | .065 - .069 |
| Actuating disc balls diameter, inch | 7/8 7/8 |



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| | |
|---|---|
| Brake pedal return spring: | |
| Free length, inches | 9.61 |
| Test length, inches | 13-1/16 |
| Test load, lbs. | 40 |
| Brake actuating cable return spring: | |
| Free length, inches | 3.76 |
| Test length, inches | 1.93 |
| Test load, lbs. | 20 |
| Free length, inches | 3.10 |
| Test length, inches | 1.93 |
| Test load, lbs | 40 |
| Brake actuating disc extension spring:* | |
| Free length, inches | 15/16 |
| Test length, inches | 1-1/16 |
| Test load, lbs. | 20-28 |
| Pivot brake actuating bell crank: | |
| Shaft OD, inches | 1.248 - 1.246 |
| Bushing ID (assembled), inches | 1.2530 - 1.2486 |

### Hydraulic Steering

| | |
|---|---|
| Housing inside diameter, inches | 2.250 - 2.253 |
| Booster piston, inches: | |
| Outside diameter | 2.247 - 2.249 |
| Inside diameter | .9990 - 1.0000 |
| Rod diameter | .998 - 1.000 |
| Piston support inside diameter, inches | 1.001 - 1.004 |
| Piston valve return spring: | |
| Free length, inches | 3.30 |
| Test length, inches | 2.50 |
| Test load, lbs. | 5.6 |
| Booster piston return spring: | |
| Free length, inches | 10.33 |
| Test length, inches | 12.10 |
| Test load, lbs. | 50 |
| Piston sealing ring gap (assembled in housing) inch | .001 - .006 |

### Special Nut and Bolt Torque Data (Foot-pounds)
### (Torques given are for bolts and nuts lubricated with SAE-30 engine oil.)

| | |
|---|---|
| Bevel gear dowel bolts | 80 - 90 |
| Bevel gear carrier bolts | 80 - 90 |
| Planet carrier dowel bolts | 80 - 90 |
| Pivot brake stud | 125 maximum |
| Pivot brake stud nut | 75 maximum |
| Sprocket drive carrier stud nuts and cap screws | 290 - 320 |
| Foot brake idler pulley stud shaft | 290 - 320 |
| Foot brake moveable pulley support stud | 290 - 320 |

*Specifications measured from inside to inside of end loops.

GENERAL

## 3. CHECKING MECHANICAL PROBLEMS - Continued

| PROBABLE CAUSE | REMEDY |
|---|---|
| **Tractor Does Not Move** | |
| 1. Brake pedal locked | Release brake pedal from latching pawls. |
| 2. Engine clutch faulty (if equipped) | Refer to "ENGINE CLUTCH" Section. |
| 3. Transmission faulty | Refer to "TRANSMISSION" Section. |
| 4. Steering planetary brakes slip, levers have no free play due to improperly adjusted brake shoes or worn linings | Adjust brake shoes or replace linings. |
| 5. Steering planetary brakes slip due to weak, broken or improperly tensioned brake spring | Adjust or replace brake spring. |
| **Tractor Moves with Pivot Brakes Locked (Brakes Do Not Hold)** | |
| 1. Brake disc lining worn | Install new discs. |
| 2. Brakes out of adjustment | Adjust pivot brakes. |
| 3. Pivot brake linkage disconnected or broken | Repair or replace linkage parts. |
| **Tractor Does Not Turn (Steering Planetary Brake Does Not Disengage)** | |
| 1. Excessive steering lever free play | Adjust clutch shoes. |
| 2. Worn, disconnected or improperly adjusted linkage | Repair or adjust. |
| 3. Bent or warped sun gear disc | Replace. |
| **Tractor Will Not Make Pivot Turn** | |
| 1. Steering planetary brake does not disengage | Refer to "Tractor Does Not Turn" problem above. |
| 2. Pivot brake does not hold | Refer to "Tractor Moves with Pivot Brakes Locked" problem above. |
| **Tractor Creeps to One Side** | |
| 1. Track chain loose on one side | Adjust track chain tension. (Refer to "TRACKS AND TRACK FRAME" Section.) |
| 2. Track frame bent or misaligned | Correct or replace parts as necessary. |
| 3. Steering planetary brake on one side slips | Adjust brake shoes. |
| **Tractor Loses Pulling Power** | |
| 1. Pivot brakes drag | Adjust brakes. |
| 2. Steering planetary brakes slip | Adjust for correct steering lever free play. |
| 3. Engine clutch slips (if equipped) | Refer to "ENGINE CLUTCH" Section. |
| **Steering Planetary Brakes Overheat** | |
| 1. Improper use of brake pedal | Pivot brake pedal should never be applied unless steering planetary brakes or engine clutch is disengaged. |
| 2. Steering planetary brakes slip: | |
| (a) Brake shoes out of adjustment or linings worn | Adjust or reline shoes. |
| (b) Brake spring improperly tensioned | Adjust brake spring tension. |
| 3. Bent or warped sun gear disc | Replace. |
| **Pivot Brakes Overheat** | |
| 1. Pivot brekes drag | Adjust brakes. |
| 2. Steering planetary brake does not disengage | Refer to "Tractor Does Not Turn" problem above. |
| 3. Binding in brake controls | Free controls and lubricate with light oil. |



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