

Information and Instructions

This individual Shop Manual is one unit of a series on agricultural wheel type tractors. Contained in it are the necessary specifications and the brief but terse procedural data needed by a mechanic when repairing a tractor on which he has had no previous actual experience.

The material is arranged in a systematic order beginning with an index which is followed immediately by a Table of Condensed Service Specifications. These specifications include dimensions, fits, clearances and timing instructions. Next in order of arrangement is the procedures section.

In the procedures section, the order of presentation starts with the front axle system and steering and proceeds toward the rear axle. The last portion of the procedures section is devoted to the power take-off and power lift

systems. Interspersed where needed in this section are additional tabular specifications pertaining to wear limits, torquing, etc.

HOW TO USE THE INDEX

Suppose you want to know the procedure for R&R (remove and reinstall) of the engine camshaft. Your first step is to look in the index under the main heading of ENGINE until you find the entry "Camshaft." Now read to the right where under the column covering the tractor you are repairing, you will find a number which indicates the beginning paragraph pertaining to the camshaft. To locate this wanted paragraph in the manual, turn the pages until the running index appearing on the top outside corner of each page contains the number you are seeking. In this paragraph you will find the information concerning the removal of the camshaft.

I&T SHOP SERVICE

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SHOP MANUAL

MASSEY-FERGUSON

MODELS

303 - 333 - 404 - 406 - 444 - 1001

Massey-Harris 333 and 444 are agricultural tractors available in standard, high-clearance or tricycle models; MHF303, MF-303, MHF-404 and MF-404 are industrial versions using the same engine, transmission and final drive components as MH-333 and MH-444.

Except for minor differences in sheet metal and accessories, overhaul procedures are identical for all series 303, 333, 404 and 444 tractors unless otherwise indicated in this manual.

MF-406 is equipped with the same engine, transmission and final drive components as MF-303, but is factory

equipped with a high centrally mounted operators platform and front mounted loader. MF-1001 uses the same engine, transmission and final drive components as MF-303 but is factory equipped with a reversed operators' platform and a loader mounted over the drive wheels. The steering axle is at the rear of the unit.

This manual is designed to cover the access and overhaul procedures of all units on the agricultural tractors with procedural reference to major industrial component options. These same procedures can be used for overhaul of the industrial units after any mounted equipment has been removed and access to the components made.

INDEX (By Starting Paragraph)

Tractor Models	303G, 333G 406G 1001G	333LP	303D, 333D 406D 1001D	404G, 444G	444LP	404D, 444D
BELT PULLEY	157	157	157	157	157	157
BRAKES (Disc type brakes).....	152	152	152	152	152	152
(Shoe type brakes).....	153	153	153	153	153	153
CARBURETOR (Gasoline)	61			61		
CLUTCH						
Adjust over-center .....	...	...	...	128	128	128
Adjust spring loaded.....	127	127	127	127	127	127
Overhaul over-center .....	...	...	...	131	131	131
Overhaul spring loaded.....	130	130	130	130	130	130
COOLING SYSTEM						
Overhaul water pump.....	122	122	122	122	122	122
Reseal water pump.....	121	121	121	121	121	121
DIESEL FUEL SYSTEM						
Energy cells .....	...	...	117	...	...	117
Fuel filters .....	...	...	94	...	...	94
Nozzles .....	...	...	97	...	...	97
Timing, PSB pump .....	...	...	112	...	...	112
APE pump .....	...	...	...	...	...	106
DIFFERENTIAL						
With live PTO.....	146	146	146	146	146	146
Without live PTO.....	145	145	145	145	145	145
ENGINE						
Cam followers	44	44	44	44	44	44
Camshaft	49	49	49	49	49	49
Connecting rods and bearings.....	56	56	56	56	56	56
Crankshaft	57	57	57	57	57	57
Cylinder head	37	37	37	37	37	37
Engine removal	36	36	36	36	36	36
Ignition timing	124	124	...	124	124	...
Main bearings	57	57	57	57	57	57
Oil pump	60	60	60	60	60	60
Pistons and sleeves.....	52	52	52	52	52	52
Piston pins	55	55	55	55	55	55
Piston removal	51	51	51	51	51	51

INDEX (By Starting Paragraph) Con't.

Tractor Models	303G, 333G 406G 1001G	333LP	303D, 333D 406D 1001D	404G, 444G	444LP	404D, 444D
Piston rings	52	52	53	52	52	53
Rear oil seal	58	58	58	59	59	59
Rocker arms	45	45	45	46	46	46
Timing gears and cover	47	47	47	47	47	47
Valves and seats	38	38	38A	38	38	38A
Valve guides	39	39	40	39	39	40
Valve tappets	44	44	44	44	44	44
Valve springs	41	41	41	41	41	41
FINAL DRIVE						
Axle shafts	151	151	151	151	151	151
Bull gears	150	150	150	150	150	150
Bull pinions	149	149	149	149	149	149
GOVERNOR (Non-Diesel)	118	118	...	118	118	...
(Diesel) APE pump .....	...	...	...	...	...	110
(Diesel) PSB pump .....	...	...	116	...	...	116
HYDRAULIC LIFT						
Adjustments	167	167	167	167	167	167
Auxiliary valves	177	177	177	177	177	177
Control valve	173	173	173	173	173	173
Mounted cylinder	174	174	174	174	174	174
Lubrication and bleeding	165	165	165	165	165	165
Pump	176	176	176	176	176	176
Remote cylinders	175	175	175	175	175	175
Trouble shooting	166	166	166	166	166	166
LP-GAS SYSTEM						
Adjust carburetor .....	...	63	...	...	66	...
Filter .....	...	74	...	...	74	...
Regulator .....	...	75	...	...	79	...
POWER TAKE-OFF	158	158	158	158	158	158
"REVERS-O-MATIC" DRIVE AND TORQUE CONVERTOR						
Control valve and linkage	132G	...	132G	...	...	...
Lubrication	132A	...	132A	...	...	...
"Revers-O-Matic" drive	132J	...	132J	...	...	...
Tests and adjustments	132C	...	132C	...	...	...
Torque convertor	132M	...	132M	...	...	...
Trouble shooting	132B	...	132B	...	...	...
STEERING GEAR (MANUAL)						
Adjustments	10	10	10	10	10	10
Overhaul	17	17	17	17	17	17
STEERING GEAR (POWER)						
Flow control and relief valve	22	22	22	22	22	22
Gear unit (333 and 444)	29	29	29	29	29	29
(303, 404, 406, 1001)	31	31	31	31	31	31
Lubricating and bleeding	19	19	19	19	19	19
Power cylinder (333 and 444)	27	27	27	27	27	27
(303, 404, 406, 1001)	28	...	28	28	...	28
Pump	23	23	23	23	23	23
Steering control valve	24	24	24	24	24	24
System operating pressure	22	22	22	22	22	22
Trouble shooting	21	21	21	21	21	21
TRANSMISSION						
Bevel pinion shaft	140	140	140	140	140	140
First sliding gear shaft	138	138	138	138	138	138
Input gears and housing	137	137	137	137	137	137
Mainshaft	139	139	139	139	139	139
Reverse idler	141	141	141	141	141	141
Shifter rails and forks	135	135	135	135	135	135
Sliding gear shaft	140	140	140	140	140	140
Top cover	134	134	134	134	134	134

CONDENSED SERVICE DATA

Tractor Models	303G, 333G 406G 1001G	333LP	303D, 333D 406D 1001D	404G, 444G	444LP	404D, 444D
	GENERAL					
Engine Make	Own	Own	Own	Own	Own	Own
Engine Model	E208	E208	ED208	H277	H277	HD277
No. Cylinders	4	4	4	4	4	4
Bore—Inches	3 $\frac{1}{8}$	3 $\frac{1}{8}$	3 $\frac{1}{8}$	4	4	4
Stroke—Inches	4 $\frac{7}{8}$	4 $\frac{7}{8}$	4 $\frac{7}{8}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$	5 $\frac{1}{2}$
Displacement—Cubic Inches	208	208	208	277	277	277
Compression Ratio	6.5:1	8.75:1	16.0:1	6.25:1	8.98:1	15.9:1
Cylinder Sleeves	Wet	Wet	Wet	Wet	Wet	Wet
Pistons Removed From?	Above	Above	Above	Above	Above	Above
Main & Rod Brgs. Adjustable?	No	No	No	No	No	No

TUNE-UP

Firing Order	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2
Valve Tappet Gap (Hot)	0.014	0.016	0.014	0.014	0.016	0.014
Intake Valve Face Angle (degrees)	30	30	44	30	30	44
Intake Valve Seat Angle (degrees)	30	30	45	30	30	45
Exhaust Valve Face Angle	44	44	44	44	44	44
Exhaust Valve Seat Angle	45	45	45	45	45	45
Ignition Timing Retard	TDC	TDC	....	TDC	TDC	....
Ignition Advanced Timing	18° BTDC	18° BTDC	....	*	16° BTDC	....
Injection Timing (APE Pump)	....	....	....	....	....	32 $\frac{1}{2}$ ° BTDC
Injection Timing (PSB Pump)	....	....	22° BTDC	....	....	25° BTDC
Flywheel Mark Indicating:						
Ignition Retarded Timing	DC	DC	....	DC	DC	....
Injection Timing (PSB Pump)	....	....	22°	....	....	25°
Injection Timing (APE Pump)	....	....	....	....	....	32 $\frac{1}{2}$ °
Ignition Breaker Contact Gap	0.020	0.020	....	0.020	0.020	....
Carburetor Make	M-S	M-S	....	Zenith	Ensign	....
Model	TSX	TSG	....	62AJX9	Xg	....
Float Setting—Inches	$\frac{1}{4}$	....	....	1 39/64	....	....
Spark Plug Electrode Gap	0.025	0.025	....	0.025	0.025	....
Engine Slow Idle Speed—rpm	480-550	480-550	600-700	480-550	480-550	600-700
Engine Fast Idle Speed—rpm (Max.)	1685†	1685	1700†	1685	1685	1700
Engine Fully Loaded Speed—rpm	1500‡	1500	1500‡	1500	1500	1500

SIZES—CAPACITIES—CLEARANCES

(Clearances in Thousandths)

Crankshaft Journal Diameter	2.624-2.625			2.873-2.874		
Crankpin Diameter	2.248-2.249			2.498-2.500		
Camshaft Journal Diameter:						
No. 1 (Front)	1.9960-1.9965			1.9960-1.9965		
No. 2 (Center)	1.7460-1.7465			1.7460-1.7465		
No. 3 (Rear)	1.6835-1.6840			1.6835-1.6840		
Piston Pin Diameter	1.1091-1.1093			1.2498-1.2500		
Intake Valve Stem Diameter	0.3406-0.3414			0.4344-0.4352		
Exhaust Valve Stem Diameter	0.3382-0.3390			0.4315-0.4325		
Main Bearings, Diameter Clearance	.5-3.2	.5-3.2	.5-3.2	1.5-3.5	1.5-3.5	1.5-3.5
Rod Bearings, Diameter Clearance	.8-2.9	.8-2.9	.8-2.9	.5-2.5	.5-2.5	.5-2.5
Piston Skirt Clearance	3	3	4	3	3	4
Crankshaft End Play	4-6	4-6	4-6	5-8	5-8	5-8
Camshaft End Play	5-9	5-9	5-9	5-9	5-9	5-9
Cooling System—Gallons	4 $\frac{3}{8}$	4 $\frac{3}{8}$	5 $\frac{1}{4}$	5 $\frac{1}{2}$	5 $\frac{1}{4}$	5 $\frac{3}{4}$
Crankcase Oil (Less Filter)—Qts.	7	7	7	7	7	7
Engine Oil Filter Capacity—Qts.	1	1	1	1	1	1
Transmission & Differential Oil—Qts.	52	52	52	52	52	52
Hydraulic System (333 and 444)						
R.C. Without Power Steering—Qts.	12**	12**	12**	12**	12**	12**
Std. Without Power Steering—Qts.	11**	11**	11**	11**	11**	11**

TIGHTENING TORQUES—FT.-LBS.

Cylinder Head Bolts	100-110	100-110	100-110	130-140	130-140	130-140
Manifold Bolts	25-30	25-30	25-30	25-30	25-30	25-30
Connecting Rod Bolts	70-75	70-75	70-75	85-95	85-95	85-95
Main Bearing Bolts	85-95	85-95	85-95	100-110	100-110	130-140

*18° except for high altitude gasoline tractors which is 16° BTDC.

**Add 1 quart for tractors with power steering.

†2200 rpm on "Revers-O-Matic" equipped tractors.

‡2000 rpm on "Revers-O-Matic" equipped tractors.

FRONT SYSTEM

TRICYCLE PEDESTAL (SUPPORT ASSEMBLY) Series 333 and 444 (Manual Steering)

On manual steering, tricycle tractors having a fork mounted single front wheel, the

vertical spindle is supported at upper and lower ends by taper roller bearings. On dual wheel tricycle models, the vertical spindle is supported by a taper roller bearing at lower end and by two bushings at upper end.

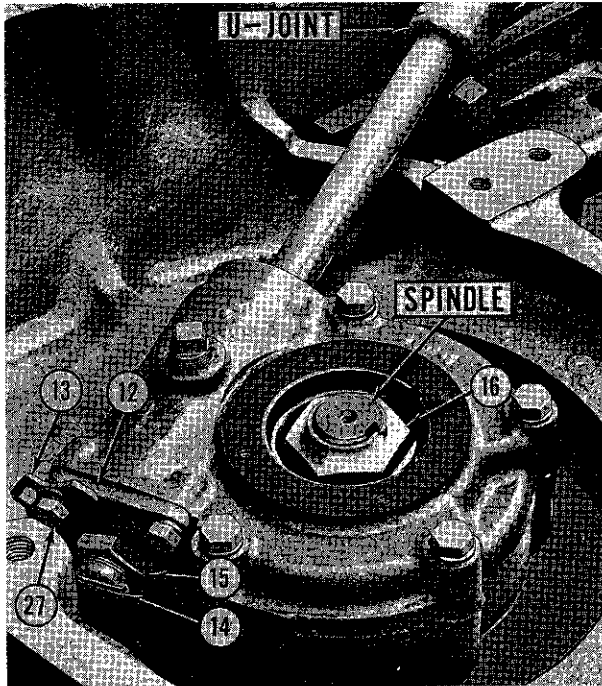


Fig. MH750 — Massey-Harris 333 and 444 row crop type manual steering gear installation. Spindle end play is adjusted with nut (16). Steering gear can be adjusted without removing radiator.

- 12. End cover
- 13. Backlash adjuster plate
- 14. Adjusting screw
- 15. Jam nut
- 16. Nut
- 27. Lock screw

1. ADJUST PEDESTAL VERTICAL SPINDLE. Tricycle models are equipped with a nut (16—Fig. MH750) at upper end of vertical spindle which functions to retain the steering sector to the spindle shaft splines. The nut (16) should be tightened until the vertical spindle shaft bearings are slightly pre-loaded. To gain access to the nut, it will be necessary to remove hood, grille and steering gear housing cover.

2. OVERHAUL PEDESTAL (SUPPORT). To renew the pedestal bearings and/or bushings, the radiator must be removed but the pedestal can remain in place. Disconnect the steering shaft front universal joint and remove the gear housing top cover. Remove nut (16—Fig. MH750) and unbolt steering gear housing from pedestal. Correlation mark the top of the vertical spindle shaft and the sector so that sector can be reassembled to same spline on spindle. Raise front of tractor and withdraw spindle or wheel fork from below. Lift gear unit from tractor.

The need and procedure for additional work will be evident after an examination of the removed unit and reference to Fig. MH751. Pedestal bushings are normally pre-sized and will not require additional reaming if properly installed.

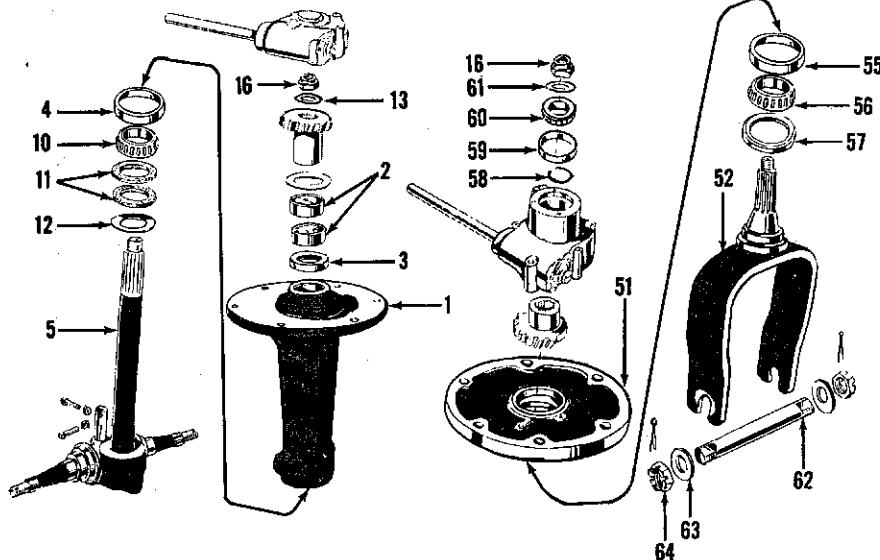


Fig. MH751—Exploded view of series 333 and 444 manual steering single wheel and dual wheel tricycle spindles and associated parts.

- | | | |
|---|--|---|
| <ul style="list-style-type: none"> 1. Support (dual wheels) 2. Bushings 3. Oil seal 4. Bearing cup 5. Dual wheel spindle 10. Bearing cone 11. Felt washers | <ul style="list-style-type: none"> 12. Felt washer retainer 13. Lock washer 16. Nut 51. Support (single wheel) 52. Single wheel spindle (fork) 55. Bearing cup 56. Bearing cone | <ul style="list-style-type: none"> 57. Oil seal 58. Snap ring 59. Bearing cup 60. Bearing cone 61. Lock washer 62. Axle 63. Eccentric washers 64. Nut |
|---|--|---|

Series 333 and 444 (Power Steering)

On dual wheel tricycle tractors equipped with power steering, the end thrust of the vertical spindle is taken by a needle thrust bearing (11—Fig. MH753) and the nylon and steel thrust assembly (6 & 7). Early models were equipped with a ball type thrust bearing (9) and a washer (8) in place of the nylon and steel thrust assembly, but when service is required, install a new type nylon and steel assembly (6 & 7).

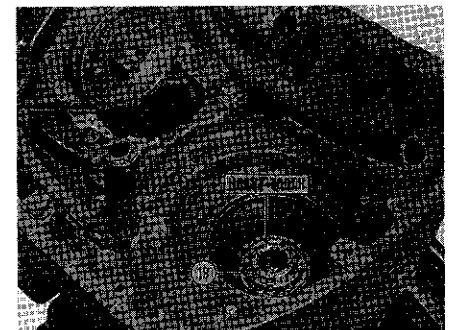


Fig. MH752—The spanner nut (19) should be tightened to 30-50 in.-lbs. of torque.

3. ADJUST PEDESTAL VERTICAL SPINDLE. Tricycle models are equipped with a spanner type nut (19—Fig. MH752) which, in a limited way, controls the up and down play of the spindle. To gain access to the nut, it will be first necessary to remove the steering gear assembly using paragraph 34 as a general guide. The nut should be tightened to 30-50 In.-Lbs. of torque. After adjustment is complete bend a tab of the lock washer (18—Fig. MH753) into each slot in the nut.

4. OVERHAUL PEDESTAL (SUPPORT). To overhaul the pedestal assembly it is first necessary to remove the steering gear unit as outlined in paragraph 34. Unbolt and remove the pedestal from the tractor frame. Disassembly and overhaul procedures for the removed unit will be evident after an examination of the unit and reference to Fig. MH753.

On early models, if the lower thrust assembly is a ball type, both the bearing (9) and the washer (8) should be discarded and the late production nylon and steel thrust assembly (6 & 7) should be installed.

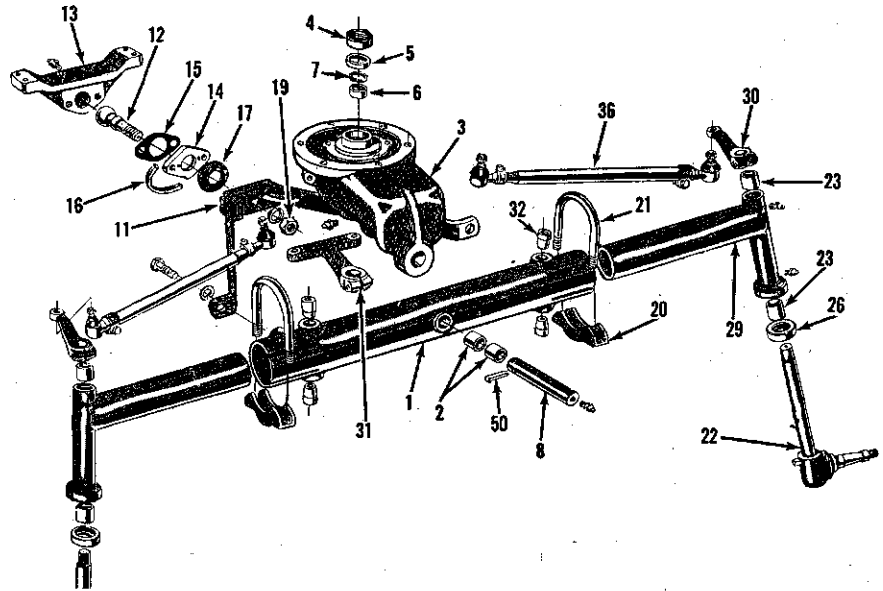


Fig. MH754—Exploded view of the adjustable front axle used on 333 and 444 tractors.

- | | | | |
|------------------------------|------------------------------|-------------------|-------------------------|
| 1. Axle main (center) member | 8. Axle pivot pin | 15. Shims | 26. Thrust bearing |
| 2. Bushings | 11. Axle brace (radius rod) | 16. Dust seal | 29. Axle extension |
| 3. Support | 12. Axle brace pivot ball | 17. Seal retainer | 30. Steering arm |
| 4. Bushing | 13. Axle brace pivot bracket | 19. Nut | 31. Center steering arm |
| 5. Oil seal | 14. Retainer plate | 20. Axle clamp | 32. Axle wedge |
| 6. Needle bearing | | 21. "U" bolt | 36. Tie-rods |
| 7. Oil seal | | 22. Spindle | 50. Groov pin |
| | | 23. Bushings | |

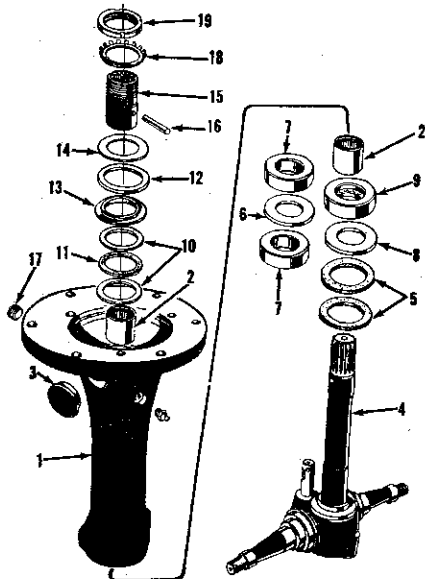


Fig. MH753—Exploded view of series 333 and 444 power steering dual wheel tricycle spindle and associated parts. The late nylon and steel thrust washer assembly (6 and 7) should be substituted for the early ball bearing type (8 and 9).

- | | |
|--------------------|-----------------------------|
| 1. Support | 11. Thrust bearing |
| 2. Needle bearings | 12. Felt washer |
| 3. Cover | 13. Retainer |
| 4. Spindle | 14. Spacer |
| 5. Felt washers | 15. Spindle coupling sleeve |
| 6. Nylon washer | 16. Groov pin |
| 7. Steel washers | 17. Groov pin plug |
| 8. Thrust washer | 18. Lock washer |
| 9. Thrust bearing | 19. Spanner nut |
| 10. Thrust washers | |

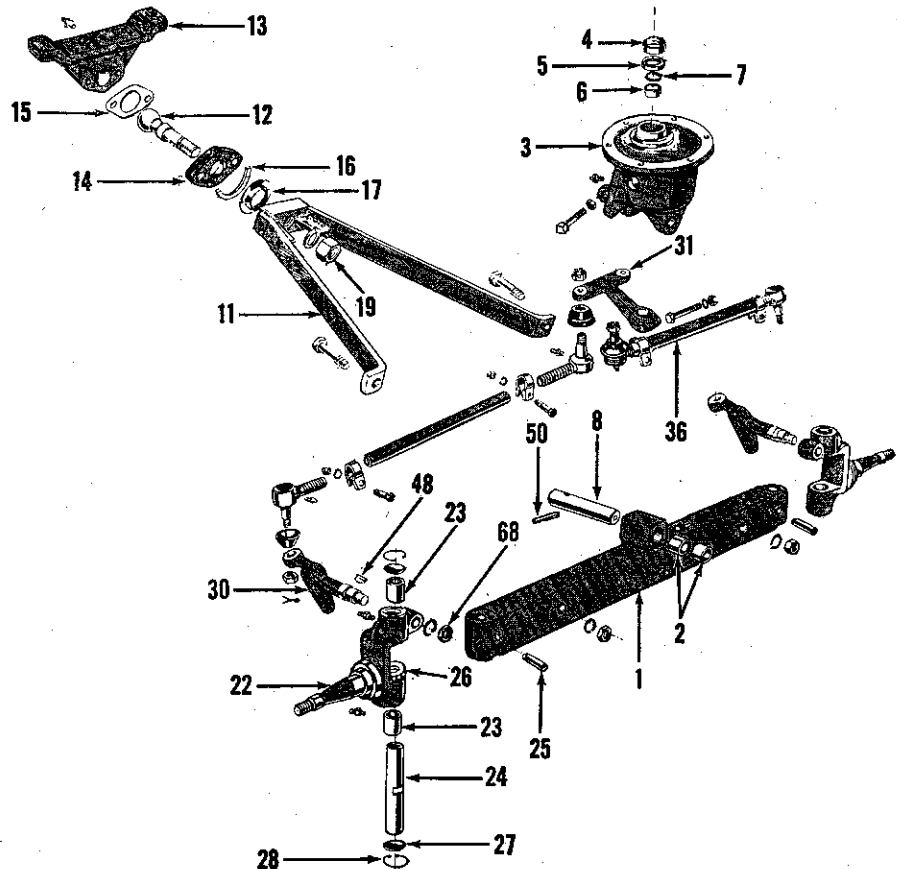


Fig. MH755—Exploded view of the standard non-adjustable front axle used on series 333 and 444 tractors. 444 Rice models are similar except for the differences shown in Fig. MH757. Only manual steering tractors use parts (4, 5, 6 and 7). Refer to Fig. MH754 for legend not listed below.

- | | | |
|-----------------------|----------------------|------------------|
| 24. Spindle pivot pin | 27. Pivot pin covers | 48. Woodruff key |
| 25. Lock pin | 28. Snap ring | 68. Nut |

Before reinstalling the gear unit, tighten the spanner nut (19—Fig. MH752) to 30-50 In.-Lbs. of torque and bend a tab of the lock washer into each of the slots in the nut.

STEERING KNUCKLES

All Except Tricycle Models

5. The procedure for removing the knuckles on 404 and early 303, and standard axle type 333 and 444 tractors is evident after an examination of the unit and reference to Fig. MH755 or 757A.

Ends of new knuckle bushings should be flush with or just less than flush with the machined surfaces of the knuckle forging. Make certain that the grease holes in the bushings are in register with the passages in knuckle.

Model 303 tractors after serial No. 1194, and all 406 and 1001 tractors are equipped with spindles of the type shown in Fig. MH756. Spindle rotates in needle bearings (23) instead of the conventional bushing. The needle bearings can be renewed with a suitable drift after removing steering arm (30), spindle (22) and the old bearings, from axle center member (1). Thrust bearing (26) consists of a sleeve, seal and bearing as shown. Thrust bearing components are renewable individually.

6. The procedure for removing the spindles on hi-arch (adjustable) axle type 333 and 444 tractors is evident after an examination of the unit and reference to Fig. MH754.

Ends of new knuckle bushings should be flush with or just less than flush with the machined surfaces of the axle extension. Make certain that the grease hole in the bushings are in register with the passages in the axle extension.

It may be necessary to also renew the spindles which perform the same function as the pivot or king pins on standard non-adjustable axles.

AXLE PIVOT

All Except Tricycle Models

7. To renew the axle pivot bushings (2—Figs. MH754, 755, 756 or 757A), first jack up the front of the tractor to take the weight off the front axle. Drive out the axle pivot retaining groove pin; then, drive the axle pivot pin out. Bushings can be renewed using a suitable puller.

Reassembly is reverse of the disassembly procedure.

AXLE BRACE (RADIUS ROD) PIVOT

All Except Tricycle Models and Series 444 Rice

8. To adjust the axle brace pivot ball clearance in its socket, first jack up the front of the tractor to take the weight off the front axle. Loosen or remove the two cap screws retaining the retainer plate (14—Figs. MH754, 755, 756 or 757A) to pivot bracket (13). The addition or removal of shims (15) between the pivot bracket and the re-

taining plate will increase or decrease the clearance between the pivot ball and the socket. These shims are available in thicknesses of 0.015, 0.030 and 0.060.

NOTE: It may be necessary, in some cases, to loosen or remove the capscrews attaching the pivot bracket to the tractor frame and move the bracket away from the pivot ball and retainer in order to remove or add adjusting shims.

Series 444 Rice

8A. To renew the bushing (18—Fig. MH757) and/or thrust washers (18Z), first jack up the front of the tractor to remove weight from the front axle. Remove the retaining nut (19) then unbolt and remove the brace (13).

Castellated nut (19) should be turned on the threaded section of the pivot pin until tight, then back-off approximately 1/6-turn and install the locking cotter pin.

TIE RODS AND DRAG LINK

All Except Tricycle Models

9. Tie rods are provided with automotive type, ball joint tie rod ends. The tie rod ends are not adjustable for wear.

On series 303, 404, 406 and 1001 the forward end of the drag link is provided with an automotive type, ball joint end similar to those used on the tie rods. The drag link rear end is of the ball and tubular socket type and is adjusted by turning adjusting plug in until tight, then backing it off one full turn and installing the cotter pin.

Recommend toe-in of front wheels for all models is 3/8-inch.

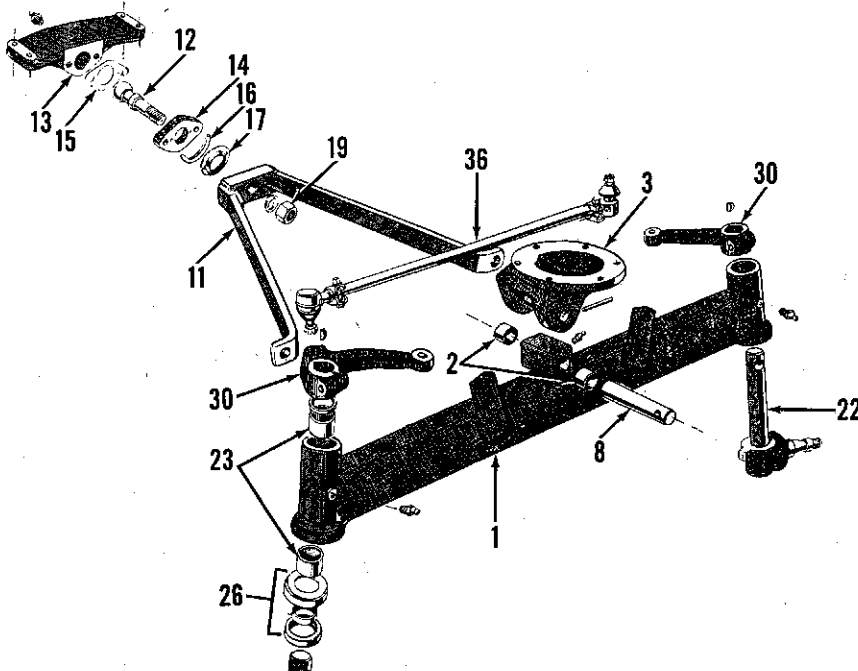


Fig. MH756 — Exploded view of steering axle used on late 303 and all 406 and 1001 models. Refer to Fig. MH754 for legend.

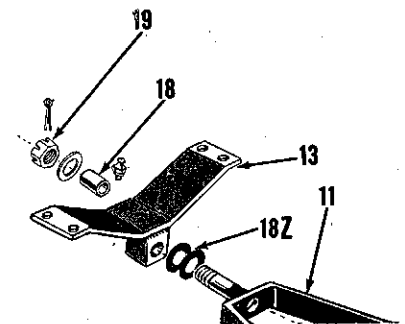


Fig. MH757 — Pivot bracket, axle brace and attaching parts used on 444 Rice tractors. Remainder of assembly is similar to Fig. MH755.

- 11. Axle Brace
- 13. Pivot Bracket
- 18. Bushing
- 18Z. Washers
- 19. Nut

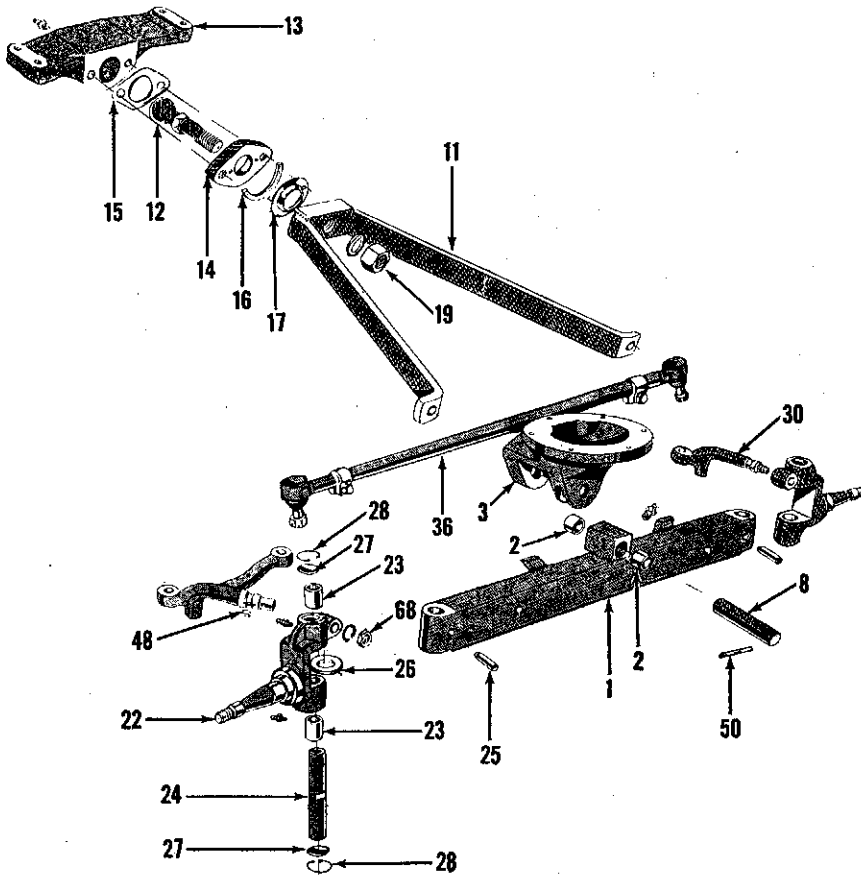


Fig. MH757A — Exploded view of the front axle used on 404 and early 303. Refer to Fig. MH754 for legend.

connect drag link to relieve load from steering gear. Vary the number of shims (8—Fig. MH759) which are located between upper cover (6) and housing (23) until wormshaft has a very slight rotational drag.

13. BACKLASH. To adjust the mesh position (or backlash) between the wormshaft and the lever studs, first raise steering axle or disconnect drag link to relieve load from steering gear. Turn steering wheel to mid-position (half way between full right and full left turn), loosen jam nut and turn adjusting screw (21—Fig. MH 759) either way as required to obtain a slight drag when the steering gear is rotated through the mid-position. The gear unit should turn freely in all other positions. Tighten the jam nut when adjustment is complete.

13A. STEERING ARM STOPS. To adjust the steering arm stops on industrial tractors so equipped, refer to Fig. MH760, remove the Pitman arm and turn the stop screws completely into the mounting bracket. Turn the steering gear to the mid or straight ahead position, then reinstall Pitman arm so that arm is centered between the two stop screws. Move the front wheels to the straight ahead position and without moving Pitman arm or front wheels, adjust the length of the drag link if necessary and reconnect drag link to Pitman arm.

Turn steering wheel until right front wheel is turned 30 degrees from straight ahead position, then adjust stop screw (S) to limit the Pitman arm travel at that point. Turn steering wheel until left front wheel is turned 30 degrees from straight ahead position, then adjust stop screw (T) to limit the Pitman arm travel at that point.

MANUAL STEERING GEAR

ADJUSTMENTS

Series 333 and 444

10. WORMSHAFT END PLAY. To adjust the wormshaft end play, remove hood and grille and raise front of tractor to remove load from steering gear. Loosen jam nut (15—Fig. MH758) and tighten adjusting screw (14) to remove all end play without causing any binding when wormshaft is turned through its entire range. When adjustment is complete, tighten jam nut (15) securely.

11. BACKLASH. To adjust the steering gear backlash, remove hood and grille and raise front of tractor to remove load from steering gear. Place wheels in the straight ahead position to place the thicker center tooth of sector in mesh with worm. This is the

only position in the steering gear range where no backlash should be present. To make the adjustment, loosen lock screw (27—Fig. MH758) and tap the adjuster (13) about $\frac{1}{8}$ inch in the direction of the arrow stamped out of the plate.

Check the backlash and readjust if necessary. The desired adjustment will make it necessary to exert 1½-2½ pounds pull on steering wheel rim to move steering wheel through the center or zero backlash position. A spring scale hooked to the rim of the steering wheel may be used to check the adjustment.

Series 303-404-406-1001

12. WORM (CAM) SHAFT END PLAY. To adjust the wormshaft end play, first raise steering axle or dis-

REMOVE AND REINSTALL

Series 333 and 444 Tricycle Models

14. To remove the steering gear, remove the hood, grille and radiator. Disconnect the steering shaft front universal joint. Remove the steering gear housing cover and the nut (16—Fig. MH758) retaining sector to the vertical spindle shaft. Correlation mark the top of the vertical spindle shaft and the sector so that the sector can be reassembled to the same spline on the spindle. Unbolt the gear housing from the pedestal and remove the steering gear housing from the tractor.

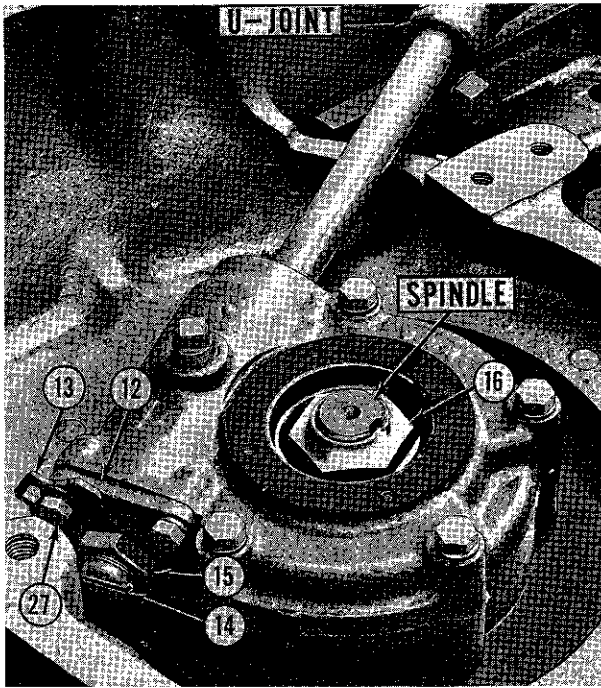


Fig. MH758 — Tricycle type manual steering gear installation. Worm shaft end play is adjusted by screw (14). Steering gear backlash adjuster is shown at (13).

- 12. End cover
- 13. Backlash adjuster plate
- 14. Adjusting screw
- 15. Jam nut
- 16. Nut
- 27. Lock nut

When reinstalling the steering gear unit, make certain that the previously affixed correlation marks on the vertical spindle shaft and the sector are in register. Adjust the vertical spindle end play as outlined in paragraph 1.

If a new sector was installed or for some reason there were no correlation marks affixed prior to removal, it will be necessary to proceed as follows: Turn the wormshaft to the extreme right and to the extreme left, then

position it in the mid-point of these two positions. Turn the wheels to the straight ahead position and install the gear unit. NOTE: The above procedure will serve to position the slightly heavier center tooth of the sector gear in mesh with the worm. Adjust the end play as outlined in paragraph 1.

Series 333 and 444 Except Tricycle Models

15. To remove the steering gear, remove the hood, grille and radiator. Disconnect the steering shaft front universal joint from the worm shaft and the center steering arm from the sector shaft. Unbolt the steering gear unit from the axle support and remove the unit from the tractor.

When reinstalling, reverse the removal procedure. The sector shaft is notched to provide clearance for the center steering arm clamp bolt; therefore, allowing the center steering arm to be installed in only one position.

Series 303-404-406-1001

16. To remove the steering gear disconnect the drag link from the steering arm and the lower universal joint from the worm shaft. Unbolt and withdraw the gear unit from the tractor.

When reinstalling, reverse the removal procedure.

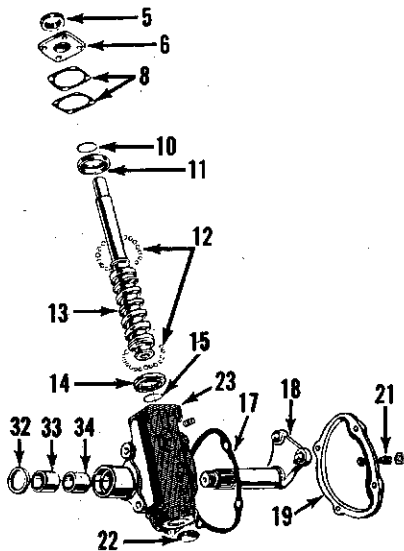


Fig. MH759—Exploded view of the dual stud type steering gear used on 303 and 404 tractors. A single stud unit of similar design is used on 406 and 1001. Camshaft end play is adjusted with shims (8).

- 6. Upper cover
- 8. Shims (0.002, 0.003 & 0.010)
- 13. Worm (cam) shaft
- 18. Trunnion arm
- 19. Cover
- 21. Trunnion adjusting screw

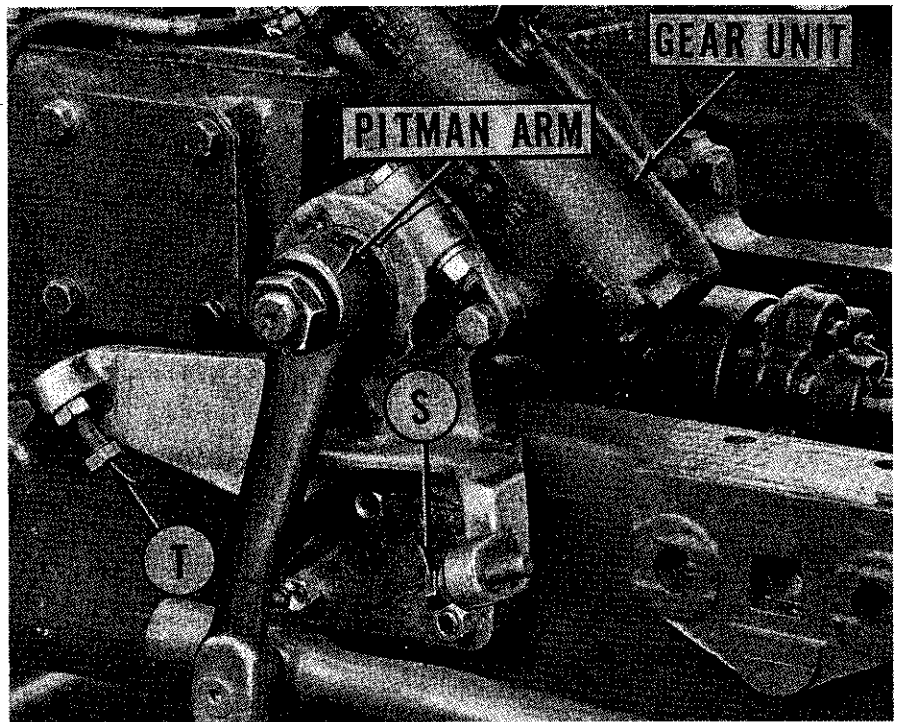


Fig. MH760 — Steering gear installation on 303 and 404 tractors. Stop screws (S and T) control turning radius of front wheels. Some later tractors may not be provided with these adjustable stops.

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