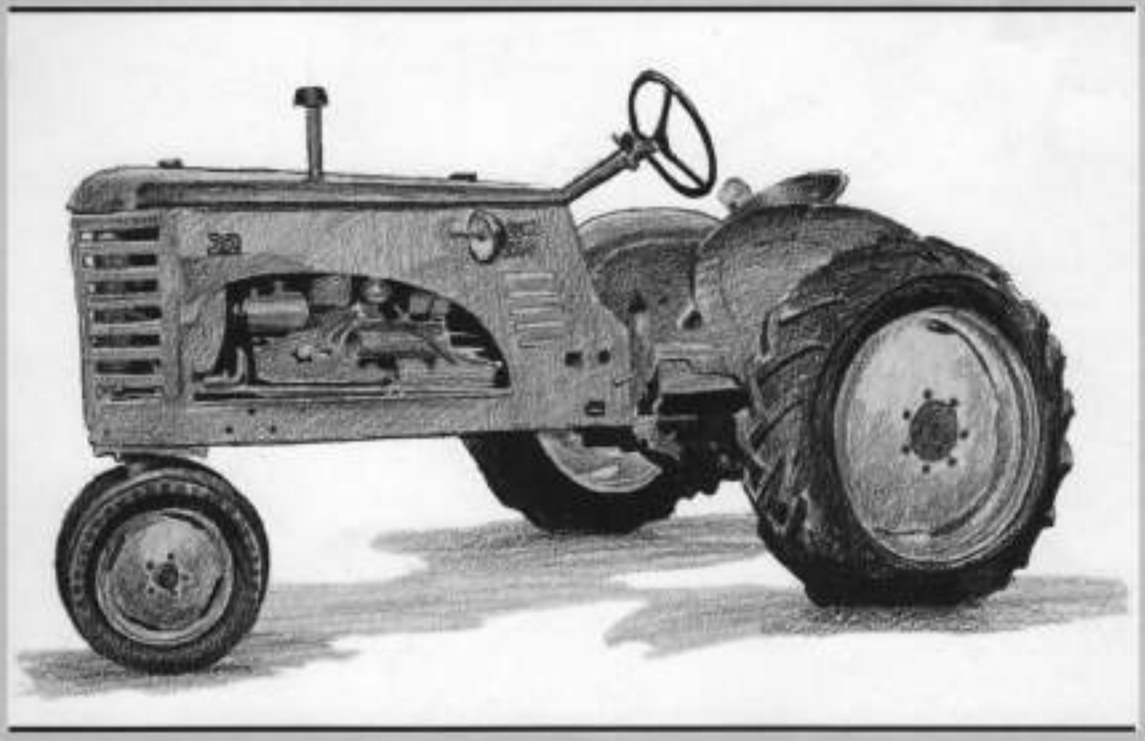
MH-2

T&T SHOP SERVICE™

MASSEY-HARRIS

SHOP MANUAL



- The preferred line of tractor repair manuals since 1948
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TIMELESS COLLECTION EDITION

SHOP MANUAL

MASSEY-HARRIS

20-22-30-44-55-81-82-101-102-201-202-203

IDENTIFICATION

Tractor Model	Fuel Used	Versions Built	Engine Model	Cyls., Bore & Stroke
20G	Gas.	R.C. & Std.	Cont. F124	4—3x4⅜
20K	L. Grade	R.C. & Std.	Cont. F140	4—3⅛x4⅜
22G	Gas.	R.C. & Std.	Cont. F140	4—3⅛x4⅜
22K	L. Grade	R.C. & Std.	Cont. F140	4—3⅛x4⅜
30G	Gas.	R.C. & Std.	Cont. F162	4—3½x4⅜
30K	L. Grade	R.C. & Std.	Cont. F162	4—3½x4⅜
44G	Gas.	R.C. & Std.	M-H H260G	4—3⅞x5½
44K	L. Grade	R.C. & Std.	M-H H260K	4—3⅞x5½
44B	L.P. Gas	R.C. & Std.	M-H H260B	4—3⅞x5½
44D	Diesel	R.C. & Std.	M-H HD260	4—3⅞x5½
44(6)G	Gas.	R.C. & Std.	Cont. F226	6—3⅛x4⅜
55G	Gas.	Std.	M-H J362G	4—4½x6
55K	L. Grade	Std.	M-H J362K	4—4½x6
55B	L.P. Gas	Std.	M-H J362B	4—4½x6
55D	Diesel	Std.	M-H JD362	4—4½x6
81	Gas.	R.C. & Std.	Cont. F124	4—3x4⅜
82	L. Grade	R.C. & Std.	Cont. F124	4—3x4⅜
101	Gas.	R.C. & Std.	Chrys. T57 / Chrys. T81 / Chrys. T105	6—3⅛x4⅜
101 Super	Gas.	R.C. & Std.	Chrys. T96 / Chrys. T116	6—3¼x4⅜
101 Sr.	Gas.	R.C. & Std.	Cont. F226	6—3⅛x4⅜
101 Jr.	Gas.	R.C. & Std.	Cont. F124 / Cont. F140 / Cont. F162	4—3x4⅜ / 4—3⅛x4⅜ / 4—3½x4⅜
102 Sr.	L. Grade	R.C. & Std.	Cont. A244	6—3½x4⅜
102 Jr.	L. Grade	R.C. & Std.	Cont. F140 / Cont. F162	4—3⅛x4⅜ / 4—3½x4⅜
102G Jr.	Gas.	R.C. & Std.	Cont. F124 / Cont. F140 / Cont. F162	4—3x4⅜ / 4—3⅛x4⅜ / 4—3½x4⅜
102G Sr.	Gas.	R.C. & Std.	Cont. F226	6—3½x4⅜
201	Gas.	Std.	Chrys. T100 / Chrys. T120	6—3⅜x4½ / 6—3⅜x4½
202	Gas.	Std.	Cont. M220	6—3¾x4⅜
203	L. Grade	Std.	Cont. M330D	6—4x4⅜
203G	Gas.	Std.	Cont. M330	6—4x4⅜
Pony	Gas.	Axle	Cont. N62	4—2⅞x3½

On models 20, 20K, 22, 22K, 30, 30K, 44, 44K, 44B, 44D, 44(6), 55, 55K, 55B & 55D, the coded suffix letters of serial number are explained below.

A—High altitude engine
B—Butane (LP) fuel
D—Diesel fuel
F—Foot clutch
G—Gasoline
H—Hand clutch
K—Low grade fuel
O—Orchard
R—Row crop
S—Standard
V—Vineyard
W—Wide axle

LOCATION OF SERIAL NUMBERS

Serial numbers are stamped on a plate on the left side of the main frame and are also stamped on the top center of the transmission housing.

BEGINNING TRACTOR SERIAL NUMBERS

Models	101 Sr. Std.	101 Sr. R. C.	101 Jr. Std.	101 Jr. R. C.	102 Jr. Std.	102 Jr. R. C.	203 G.	203	81 Std.	81 R. C.
1938	355,001	255,001	.....	.....	.....	.....	.....	.....	.....	.....
1939	355,603	256,085	377,001	375,001	385,001	387,001	.....	.....	.....	.....
1940	356,792	257,281	377,928	376,158	385,204	387,031	95,001	91,201	.....	.....
1941	358,188	258,769	379,550	395,570	385,450	387,127	95,002	91,541	425,001	400,001
1942	358,869	259,762	379,815	397,637	386,099	387,419	95,162	91,691	425,679	403,168
1943	358,975	260,430	379,855	398,596	386,662	387,601	.....	96,674	.....	.....
1944	359,457	260,796	380,641	500,003	390,008	387,944	95,223	96,807	425,757	403,354
1945	360,927	263,020	382,569	502,434	390,894	388,240	.....	.....	425,780	403,364
1946	362,520	270,001	384,298	503,779	391,913	388,995	95,295	99,689	426,803	.....
1947	.....	.....	.....	.....	.....	.....	95,338	100,120	.....	.....
1948	.....	.....	.....	.....	.....	.....	.....	.....	.....	404,564

Models	82 Std.	82 R. C.	102 Sr. Std.	102 Sr. R. C.	20 R. C.	20 Std.	20K Std.	20K R. C.	22 Std.	22 R. C.
1941	435,001	420,001	365,001	.....	.....	.....	.....	.....	.....	.....
1942	435,279	420,055	365,202	265,001	.....	.....	.....	.....	.....	.....
1943	435,452	.....	366,062	265,044	.....	.....	.....	.....	.....	.....
1944	.....	.....	366,183	265,078	.....	.....	.....	.....	.....	.....
1945	435,459	420,274	367,353	.....	.....	.....	.....	.....	.....	.....
1946	435,738	420,307	.....	.....	1,001	1,001	.....	.....	.....	.....
1947	.....	.....	.....	.....	1,580	1,002	1,001	1,001	.....	.....
1948	.....	.....	.....	.....	3,584	2,230	1,819	1,354	1,001	1,001
1949	.....	.....	.....	.....	.....	.....	.....	.....	1,542	2,096
1950	.....	.....	.....	.....	.....	.....	.....	.....	3,208	4,580
1951	.....	.....	.....	.....	.....	.....	.....	.....	4,533	7,624

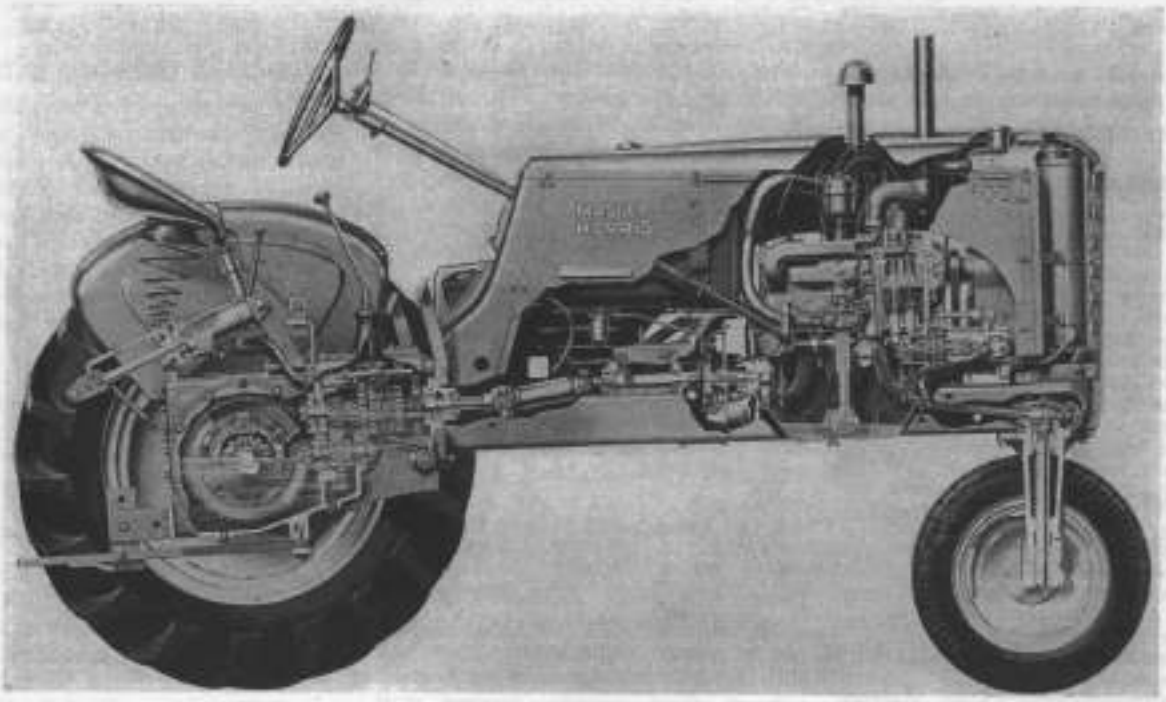
Models	22K Std.	22K R. C.	30 Std.	30 R. C.	30K Std.	30K R. C.	44 Std.	44 R. C.	44K Std.	44K R. C.
1946	.....	.....	1,001	1,001	.....	.....	1,001	1,001	1,001	.....
1947	.....	.....	1,002	1,002	1,001	1,001	1,141	1,002	1,011	1,001
1948	1,001	1,001	2,120	3,396	1,894	1,225	1,871	2,048	1,441	1,079
1949	1,317	1,154	3,194	6,825	3,251	2,010	4,528	5,316	3,598	1,856
1950	1,488	1,336	5,567	9,345	3,531	2,393	9,581	13,822	4,827	2,599
1951	1,570	1,558	7,491	13,816	3,861	2,719	13,726	21,815	6,019	3,329

Models	44D Std.	44D R. C.	44-6 Std.	44-6 R. C.	44 Vineyard	44 Orchard	44D Orchard	44 GRA	44 GSA	55 Std.
1946	.....	.....	.....	1,001	.....	.....	.....	.....	.....	1,001
1947	.....	.....	1,001	1,002	.....	.....	.....	.....	.....	1,116
1948	1,001	.....	2,001	2,983	.....	.....	.....	.....	.....	2,132
1949	1,023	1,001	.....	4,755	.....	.....	.....	.....	.....	3,581
1950	2,180	1,004	2,601	5,255	1,001	1,001	1,001	.....	.....	5,468
1951	3,989	2,483	.....	5,509	.....	1,101	1,002	1,001	1,001	6,399

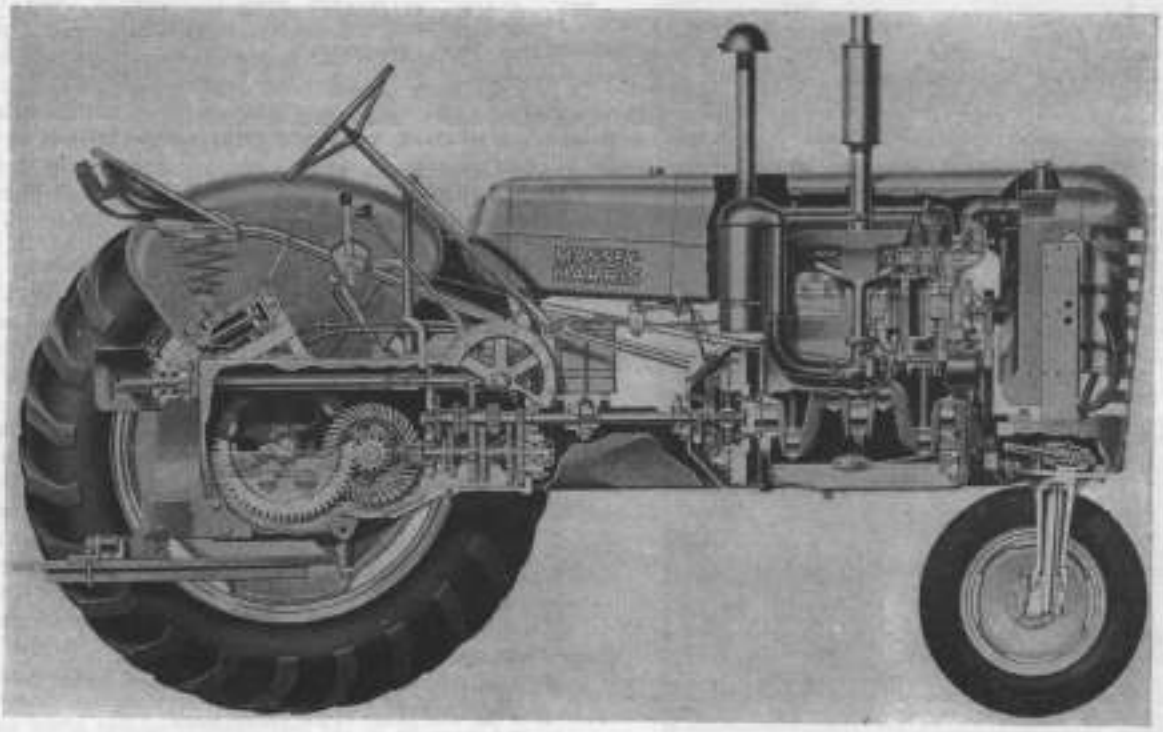
Models	55K Std.	55D Std.	55 Riceland & Hillside	55K Riceland & Hillside	55D Riceland & Hillside	55 Western	55D Western	55 GSA	55 GSHA	55 GSWA
1946	1,001	.....	.....	.....	.....	.....	.....	.....	.....	.....
1947	1,013	.....	.....	.....	.....	.....	.....	.....	.....	.....
1948	1,554	.....	.....	.....	.....	.....	.....	.....	.....	.....
1949	3,033	1,001	1,001	1,001	.....	.....	.....	.....	.....	.....
1950	4,078	1,022	1,035	1,013	1,001	1,001	.....	.....	.....	.....
1951	4,808	2,058	1,216	1,110	1,152	1,002	1,001	1,001	1,001	1,001

INDEX (By Starting Paragraph)

	20, 20K, 22, 22K	30, 30K	Series 44	81, 82	Series 55	101, 101 Super	101 Jr., 101 Sr., 102 Jr., 102 Sr., 102G Jr., 102G Sr.	201	202, 203, 203G
BELT PULLEY	301	300	300	301	302	300	300	302	302
BRAKES (Band or single disc)	282	280	290	282	280	280	280	280	280
(Shoe or double disc)	283	285	285		285				
CARBURETOR (Not LP Gas)	76	76	76	75	76	76	76	76	76
CARBURETOR (LP Gas)			77		77				
CLUTCH									
Adjust over-center			201		201				
Adjust spring loaded	200	200	200	200	200	200	200	200	200
Overhaul over-center			207		207				
Overhaul spring loaded	206	206	206	206	206	206	206	206	206
COOLING SYSTEM									
Overhaul water pump	126	126	128	126	128	127	126	127	126
R&R pump	125	125	125	125	125	125	125	125	125
DIESEL FUEL SYSTEM									
Energy cells			108		108				
Fuel filters			104		104				
Nozzles			105		105				
Preheater			109		109				
Timing, PSB pump			101		103				
APE pump					102				
Trouble shooting			100		100				
DIFFERENTIAL	252	250	250	252	253	250	250	253	253
ENGINE									
Cam followers	39	39	41	39	41	40	39	40	39
Camshaft	48	48	50	48	50	49	48	49	48
Conn. rods & bearings	61	61	63	61	63	62	61	62	61
Crankshaft	64	64	64	64	64	65	64	65	64
Cylinder head	31	31	33	31	33	32	31	32	31
Engine removal	30	30	30	30	30	30	30	30	30
Flywheel	69	69	69	69	69	69	69	69	69
Ignition timing	133	133	134	133	134	135	133	135	133
Injection timing			101		102				
Main bearings	64	64	64	64	64	65	64	65	64
Oil pump	73	73	75	73	75	74	73	74	73
Pistons & cylinders (or sleeves)	55	55	57	55	57	56	55	56	56
Piston pins	61	61	63	61	63	62	61	62	61
Piston removal	54	54	54	54	54	54	54	54	54
Piston rings	58	58	60	58	60	59	58	59	58
Rear oil seal	66	66	68	66	68	67	66	67	66
Rocker arms			42		42				
Timing gears & cover	45	45	46	45	46	47	45	47	45
Valves & seats	34	34	35	34	35	34	34	34	34
Valve guides & springs	37	37	37	37	37	38	37	38	37
Valve tappets	39	39	41	39	41	40	39	40	39
FINAL DRIVE									
Axle shafts	265	262	262	265	268	262	262	268	268
Bull gears		261	261		268	261	261	268	268
Bull pinions		260	260		267	260	260	267	267
GOVERNOR (Non-Diesel)	115	115	117	115	117	116	115	116	115
(Diesel)			110		110				
HYDRAULIC LIFT									
Adjustments	353	353	353		353				
Control valve	364	364	364		364				
"Depth-O-Matic" cylinder	365	365	365						
Lubrication & bleeding	350	350	350		350				
Pump	362	362	362		362				
Remote cylinders	368	368	368		368				
Sequence valve	366	366	366						
Trouble shooting	351	351	351		351				
MECHANICAL LIFT	320	322	322	320		322	322		
LP-GAS SYSTEM									
Adjust carburetor			77		77				
Filter			85		85				
Regulator			86		87				
Trouble shooting			88		88				
POWER TAKE-OFF	313	312	310	313	314	312	312	314	314
STEERING GEAR									
Adjust row crop	8	8	8	6		4	6 & 4		
Adjust standard	17	17	17	15	20	13	13 & 15	20	20
TRANSMISSION OVERHAUL									
Bevel pinion shaft	233	225	225	233	242	215	215	242	242
BP & PTO drive shaft		221	221		241	211	211	241	241
Countershaft	234			234	244			244	244
Main drive gear	232			232	241			241	241
Mainshaft	232A	224	224	232A	242	214	214	242	242
Oil pump		223	223			213	213		
Reverse idler	235	226	226	235	243	216	216	243	243
Shifter rails & forks	231	222	222	231	242	212	212	242	242
Sliding gear shaft	232A	225	225	232A	242	215	215	242	242



MASSEY-HARRIS "22"



MASSEY-HARRIS "44"

CONDENSED SERVICE DATA

Tractor Models	20, 20K, 22, 22K, 81, 82, and some 101 Jr., 102 Jr., 102G Jr.	30, 30K, and some 101 Jr., 102 Jr., 102G Jr.	44(6) 101 Sr. 102G Sr.	44, 44K, 44 L.P. 44 Diesel	55, 55K, 55 L.P. 55 Diesel	101 101 Super 201	102 Sr.	202	203 203G
GENERAL									
Engine Make	Cont.	Cont.	Cont.	Own	Own	Chrysler	Cont.	Cont.	Cont.
Engine Model	F124, F140	F162	F226	H260, HD260	J382, JD382	Note(1)	A244	M290	M330
Cylinders	4	4	6	4	4	6	6	6	6
Bore and Stroke	See IDENTIFICATION table on page MH-40								
Displacement—Cubic Inches	124, 140	162	226	260	382	Note(1)	244	290	330
Compression Ratio, Diesel				15:1	15:1				
Compression Ratio, Gasoline	6.5:1	6.23:1	6.23:1	5.65:1	5.65:1	Note(2)		6.2:1	5.86:1
Compression Ratio, L. P.				8.7:1	8.5:1				
Compression Ratio, Low Grade	5:1	5:1		4.68:1	4.65:1		4.85:1		4.8:1
Pistons Removed From:	Above	Above	Above	Above	Above	Above	Above	Above	Above
Main & Rod Bearings Adjustable?	No	No	No	No	No	No	No	No	No
Main Bearings, Number of	3	3	4	3	3	4	4	7	7
TUNE-UP									
Firing Order	1-3-4-2	1-3-4-2	1-5-3-6-2-4	1-3-4-2	1-3-4-2	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4	1-5-3-6-2-4
Valve Tappet Gap—Intake	0.014H	0.014H	0.014H	0.014H	0.014H	0.008H	0.020H	0.017H	0.017
Valve Tappet Gap—Exhaust	0.014H	0.014H	0.014H	0.014H	0.014H	0.012H	0.020H	0.020H	0.020H
Valve Seat Angle—Intake	30°	30°	30°	Note(8)	Note(8)	45°	30°	30°	30°
Valve Seat Angle—Exhaust	45°	45°	45°	45°	45°	45°	45°	45°	45°
Ignition Distributor Make	Auto-Lite								
Ignition Magneto Make & Model	FM-J4B	FM-J4B	FM-6B				FM-6B		
Ignition Breaker Gap	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
Ignition Timing Full Retard									
Not Low Grade Fuel	⅛ inch BTC to TC			TC	TC	.003 ATC	⅜ inch BTC to TC		
Low Grade Fuel	TC to ⅜ inch ATC			TC	TC		TC to ⅜ inch ATC		
Ignition Timing Full Advance	Refer to ignition timing paragraphs beginning with No. 133								
Distributor Governor Advance	Refer to distributor model number in Std. Units Manual								
Injection Timing	See Diesel Section								
Spark Plug Make	Auto-Lite or Champion								
Model—L. P. Gas	A-L, BT4; Ch. 5 Com.								
Model—Not L. P. Gas	14mm, A-L A7 or Ch. J-8; 18mm, A-L BT8 or Ch. 8 Comm.								
Plug Electrode Gap	0.025	0.025	0.025	0.025	0.025	0.025	0.030	0.025	0.025
Carburetor Make—Not L. P. Gas	Marvel-Schebler or Zenith								
Carburetor Make—L. P. Gas	Ensign								
Model—M.-S.	TSX	TSX	TSX	62AJX9	62AJX10	TRX	TSX	TSX	TSX
Model—Zenith				62AJX9	62AJX10		62AJX9		63AW10
Model—Ensign				XG	XG				
Float Setting—M.-S.	¼	¼	¼			1⅜	¼	¼	¼
Float Setting—Zenith				1 39/64	1 39/64		1 39/64		1⅜
Carburetor Calibration	Refer to full model number in Standard Units Manual								
Governed Speeds	For non-Diesels, refer to table 6; for Diesels, see paragraph 111.								
SIZES-CAPACITIES-CLEARANCES									
(Clearances in thousandths)									
Crankshaft Main Journal Diameter	2.2495	2.2495	2.3745	2.8735	3.2505	Note(9)	2.3745	2.8235	2.8235
Crankpin Diameter	1.937	1.937	2.062	2.4985	2.748	Note(10)	2.062	2.485	2.485
Camshaft Journal Diameter—Front	1.872	1.872	1.872	1.9982	2.1222	1.9985	2.0605	2.1847	2.1847
Journal Diameter—No. 2	1.746	1.746	1.809	1.7482	1.7462	1.967	1.998	2.1223	2.1223
Journal Diameter—No. 3	1.247	1.247	1.746	1.6837	1.6837	1.9355	1.9355	2.0597	2.0597
Journal Diameter—No. 4			1.247			1.248	1.873	1.7473	1.7473
Piston Pin Diameter	.8592	.8592	.8592	1.2499	1.4999	.8592	.8592	1.1091	1.1091
Valve Stem Diameter—Intake	.341	.341	.341	.4348	.4348	.3405	.3395	.404	.404
Valve Stem Diameter—Exhaust	.3386	.3386	.3386	.432	.432	.3405	.3384	.402	.402
Compression Ring Width	⅛	⅛	⅛	⅛	⅛	¼	⅛	⅛	⅛
Oil Ring Width	3/16	¼	¼	¼	¼	5/32	¼	¼	¼
Fifth (Lower) Ring Width				3/16	3/16		⅛		
Main Bearings Running Clearance									
Non-Diesel	1.5-2	1.5-2	1.5-2	1-2.7	1-2.7	1.5-3	1.5-2	2-3	2-3
Diesel				2-3	1.2-3.6				
Rod Bearings Running Clearance									
Non-Diesel	1.5-2	1.5-2	1.5-2	1-2.5	1-2.8	1.5-3	1.5-2	2-3	2-3
Diesel				2-3.5	1.8-3.8				
Piston Skirt Clearance	3	3	3	3	3	2	3	3	3
Crankcase Oil—Quarts	4	4	5	8	10	5	6	6	6
Transmission and Differential—Quarts	Note(3)	Note(4)	Note(5)	Note(6)	68	Note(7)	24	64	64

(1) Model 101 used Chrysler T57, T61 or T105 of 231 cubic inch displacement. Model 101 Super used Chrysler T96 or T115 of 217 cubic inch displacement. Model 201 used Chrysler T100 or T120 of 242 cubic inch displacement.
(2) 6.7:1 for Chrysler T57, T61 and T105; 6.8:1 for other Chrysler models.
(3) Models 20, 20K, 81, 82, 22 and 22K transmission—8 qts. Models 20, 20K, 81 and 82 differential—16 qts. Models 22 and 22K differential—18½ qts. Models 101 Jr., 102 Jr. and 102G Jr. transmission and differential—24 qts.
(4) 24 qts. with pump; 32 qts. without pump.
(5) Model 44(6) with pump, 32 qts.; without pump, 32 qts. Models 101 Sr. and 102G Sr., 24 qts.
(6) 36 qts. with pump; 52 qts. without pump.
(7) Models 101 and 101 Super, 24 qts.; model 201, 64 qts.
(8) 30° for non-Diesels; 45° for Diesels.
(9) 2.2495 for Chrysler models T57, T61 & T105; 2.4995 for other Chrysler models.
(10) 1.937 for Chrysler models T57, T61 & T105; 2.062 for Chrysler models T96 and T115; 2.1245 for Chrysler models T100 and T120.

FRONT SYSTEM AND STEERING

PEDESTAL (SUPPORT ASSEMBLY)

On row crop tractors having a fork mounted single front wheel, the vertical spindle is supported in the pedestal by taper roller bearings. In some dual wheel row crop tractors, the vertical spindle is supported in the pedestal by bushings; in others, the vertical spindle is supported at the bottom on a tapered roller bearing (which also acts as a thrust bearing) and at the top by a bushing. In both single and dual wheel row crop types, the steering gear box is mounted in the top of the pedestal which is bolted to the tractor frame.

All Models

1. **ADJUST PEDESTAL VERTICAL SPINDLE.** All row crop models are provided with a nut at upper end of vertical spindle which functions to retain either a sector, a trunnion or worm wheel to the shaft splines, depending on the type of steering gear installed. The nut in a limited way controls the up and down play of the spindle. To gain access to the nut on some models, it will be necessary to remove the radiator. On all models, it is necessary to first remove the hood and the radiator grille. On models which have a cover plate over the gear, the cover plate is next removed and then the nut can be reached for tightening. On row crop models equipped with the multiple stud type of gear as shown in Fig. MH100, the upper half of the gear housing must be removed. Refer to Figs. MH101 and MH102 for worm and gear or sector types.

2. **OVERHAUL PEDESTAL.** To renew the pedestal bearings and/or bushings, the radiator must be removed but the pedestal can remain in place. Disconnect the steering gear wormshaft at the gear housing and on models equipped with a cover plate at the top of the gear, remove the cover plate. On models equipped with the multiple stud type of gear as shown in Fig. MH100, remove the upper half of the gear housing. Before removing the nut at the top of the vertical spindle, correlation mark the top of the shaft or spindle and the sector or wheel or stud trunnion in order that these parts can be reassembled to the same spline on the spindle. Jack up front of tractor and withdraw the vertical spindle or fork from below.

3. New pedestal bushings are presized and will require no final sizing if carefully installed. Reface thrust washer contact faces of pedestal and vertical spindle if worn or grooved. On single wheel types, renew bearing cones and cups if same are chipped, scored or pitted.

ADJUST ROW CROP STEERING GEAR

Model 101 Early (Worm & wheel type)

4. **WORM SHAFT END PLAY.** On row crop tractors with worm and wheel type gear shown in Fig. MH 101, adjust worm shaft end play by varying shims (5) located under wormshaft bearing cap.

5. **BACKLASH.** The tooth mesh (backlash) is not directly adjustable. The worm wheel however can be relocated on the vertical spindle and thus present unworn teeth to the worm. To reposition the worm wheel on row crop models, it will be necessary to remove the nut (7) which may require removal of the radiator.

Models 81-82-Some 101 & 102 (Ross cam & multiple stud type)

6. **WORM (CAM) SHAFT END PLAY.** On row crop tractors equipped with the Ross cam and multiple stud type gear shown in Fig. MH100, adjust worm (cam) shaft end play by varying the shims (5) located under cap at rear of gear housing.

7. **BACKLASH.** To adjust backlash, first remove the gear unit from the pedestal and proceed as follows: Remove a thin shim (8) from under adjusting pad, then temporarily reinstall the gear unit to the pedestal (including the nut at top of vertical spindle) and check the backlash by rotating the worm (cam) shaft. Adjustment is correct when there is no backlash, yet gear rotates without drag.

Models 20-22-30-44-44(6) (Saginaw worm & sector type)

8. **WORM SHAFT END PLAY.** On row crop tractors equipped with the Saginaw steering gear shown in Fig.

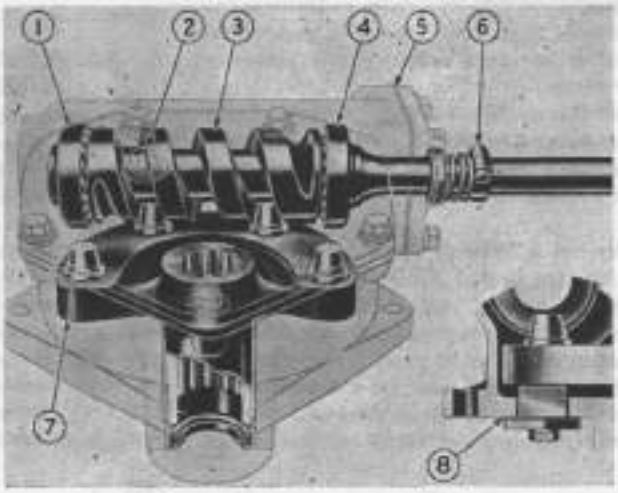


Fig. MH100—Ross cam and stud type steering gear.

1. Worm shaft bearing
2. Filler plug
3. Worm and shaft
4. Worm shaft bearing
5. Adjusting shims
6. Oil seal clamp
7. Trunnion and studs
8. Adjusting shims

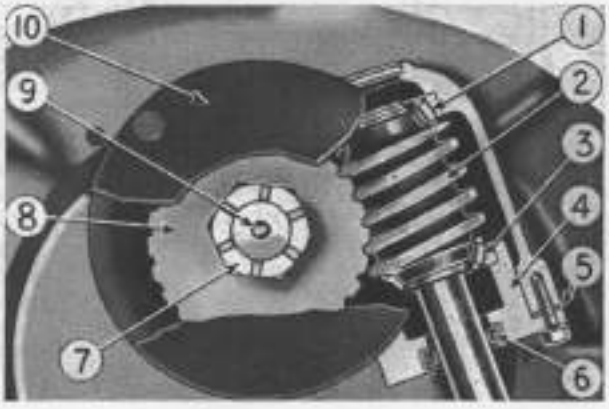


Fig. MH101—Worm and gear type steering gear.

1. Inner bearing
2. Worm
3. Outer bearing
4. Cap and retainer
5. Adjusting shims
6. Oil seal
7. Vertical shaft nut
8. Worm wheel
9. Vertical shaft

MH102, adjust end play by turning adjusting screw (8—Fig. MH102) located at front end of gear housing. Tighten locknut after adjustment is completed.

9. **BACKLASH.** Gear backlash is controlled by the adjuster (9) located at front end of housing. To make this adjustment, first turn wheels straight forward to place 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. Adjust backlash by loosening adjuster plate lock screw (10) and tapping adjuster (9) in direction of the arrow stamped out of the plate. Move adjuster 1/16 inch, check steering backlash and readjust if necessary. The desired adjustment will make it necessary to exert 1½ to 2½ pounds pull on 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.

OVERHAUL ROW CROP GEAR

If the steering gear unit was not removed when overhauling the vertical spindle bearings as outlined in paragraph 2, it will be necessary to do so if the gear unit is to be thoroughly overhauled. In any case, to remove the steering gear it is necessary to first remove the worm wheel, worm sector or trunnion from the vertical spindle and to remove the gear housing cap screws or nuts (C—Fig. MH104) which retain the separate steering gear housing to the top of the pedestal.

Worm & Wheel Type

10. On worm wheel type gear unit shown in Fig. MH101, the wormshaft front bearing cup can be renewed after removing Welch plug from housing. Wormshaft rollers ride directly on worm which must be renewed if roller contacting surfaces of same are pitted, chipped or scored. If same worm wheel is reinstalled, relocate it on splines to bring new teeth into mesh. After gear is installed on tractor, adjust the unit as per paragraphs 4 and 5.

Ross Cam & Stud Type

11. On cam and stud type shown in Fig. MH100, the disassembly procedure is self-evident after examining the unit. Bushing for trunnion shaft is pre-sized and no final sizing of same will be required if new one is carefully installed using a closely piloted drift. Inner cones for camshaft bearings are integral with the camshaft which should be renewed if the bearing surfaces are pitted, chipped or scored. After gear is installed on tractor adjust the unit as per paragraph 6 and 7.

Saginaw Worm & Sector Type

12. Disassembly procedure is self-evident after examining the unit and referring to Fig. MH102. Inner cones for wormshaft bearings are integral with the worm which should be renewed if roller contacting surfaces are pitted, chipped or scored.

In assembling steering gear, it is necessary to match the slightly heavier tooth in center of sector gear with the worm. After installation, adjust gear as described in paragraphs 8 and 9.

ADJUST STANDARD (AXLE) STEERING GEAR

The standard type steering system consists of steering gear unit, tie rods, and drag link. Models 55, 55K, 201, 202, 203 & 203G have a single tie rod and drag link, with gear unit mounted near top of transmission housing as shown in Fig. MH105. On all other models, the gear unit is mounted on top of front axle support in a manner basically similar to the row crop models, but has a central steering gear arm to which is connected two tie rods, one from each knuckle steering arm.

The hood and radiator grille must be removed to gain access to the steering gear on front mounted installations if unit is to be adjusted while mounted in tractor. All adjustments

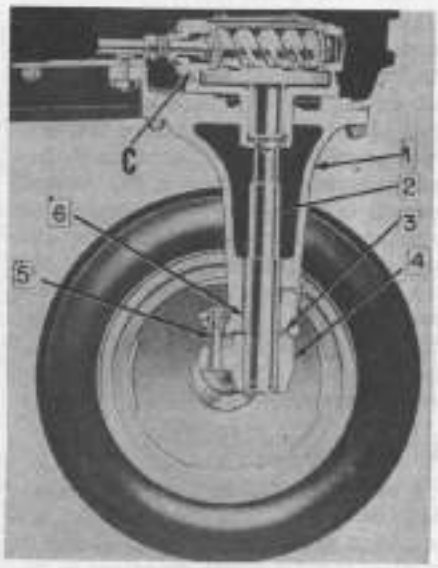


Fig. MH104—Row crop front end (Ross steering gear).

1. Pedestal housing
2. Vertical shaft
3. Thrust washer
4. Spindle assembly
5. Stop screw post
6. Pedestal bushings

Fig. MH105—Massey-Harris model 55 steering gear installation.

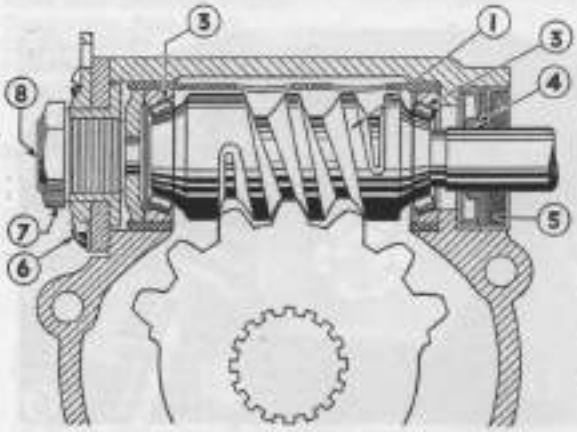
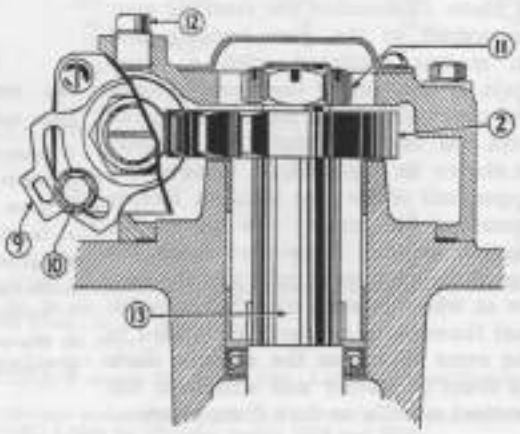


Fig. MH102—Saginaw worm and sector type steering gear top and side views.

1. Worm and shaft
2. Sector gear
3. Worm bearings
4. Oil seal
5. Felt seal
7. Locknut
8. Worm adjusting screw
9. Backlash adjuster



are made with front wheels raised and free, or with tie rods or drag link disconnected to relieve load on steering mechanism.

Early 101 Models (Worm & wheel type)

13. **WORM SHAFT.** Eliminate end play in worm shaft by removing shims (5—Fig. MH101) under end bearing cap (4). Shaft should have no end play but still should turn freely.

14. **BACKLASH.** Backlash between worm and wheel is not directly adjustable but can be reduced by removing the steering arm and reinstalling same on different splines so as to bring unworn teeth into engagement.

Some 81-82-101-102 (Ross cam & multiple stud type)

15. **WORM (CAM) SHAFT.** To adjust end play, release oil seal clamp (6—Fig. MH100) on steering shaft and slide assembly back on shaft. Remove shims (5) under housing end plate until end play is eliminated and shaft still turns freely. Reinstall oil seal after adjustment is complete.

16. **BACKLASH.** Disconnect steering worm shaft coupling and remove steering arm. Unbolt gear housing from top of axle support and remove housing from tractor. To eliminate backlash of studs in cam, remove shims (8) from under adjusting pad until a very slight drag is felt on steering shaft. Shims have different thicknesses-0.003, 0.007 and 0.010 inch.

Some 20-22-30-44-44(6) (Saginaw worm & sector type)

17. **SECTOR SHAFT.** Adjust shaft end play by moving steering arm up on shaft while holding sector down. If all end play cannot be removed in this manner, new thrust washers will have to be installed between sector and steering arm.

18. **WORM SHAFT.** Adjust end play by turning in adjusting screw (8—Fig. MH102) at end of gear housing until end play is removed and shaft turns freely. Tighten locknut after adjustment.

19. **BACKLASH.** Before starting adjustment, turn steering gear to mid-position in order to place center tooth of sector in mesh with worm. This is the only position in the steering gear range where no backlash should be present. Adjust backlash by loosening adjuster plate lock screw (10) and tapping adjuster (9) in direction of arrow stamped out of the plate. Move adjuster 1/16 inch, check steering backlash and readjust if necessary. The desired adjustment will make it necessary to exert 1½ to 2½ pounds pull on wheel rim to move steering wheel through the center or zero backlash position. A spring scale hooked to rim of steering wheel may be used to check this adjustment.

Models 55-201-202-203 (Ross cam and stud type)

The double stud type gear used on the later production model 55 tractors is adjusted in the same manner as the single stud type used in early production except the method of correcting end play in the worm (cam) shaft. On single stud gears the end play is controlled by a threaded plug; whereas, on the double stud type, the adjustment is made by varying shims located under a cap at the top of the gear housing.

20. **WORM (CAM) SHAFT.** On double stud type shown in Fig. MH106, adjust end play of cam shaft by varying the shims (8) located under the upper cover (6). On single stud type shown in Fig. MH107, a threaded plug takes the place of the upper cover and, on these models, turning the plug clockwise reduces the end play.

21. **BACKLASH.** To adjust backlash or mesh of stud to cam, turn steering gear to mid-position (half way between full right and full left turn position) and rotate adjusting screw (21—Fig. MH106 or 23—Fig. MH107) clockwise to reduce backlash. Turn screw anti-clockwise to increase

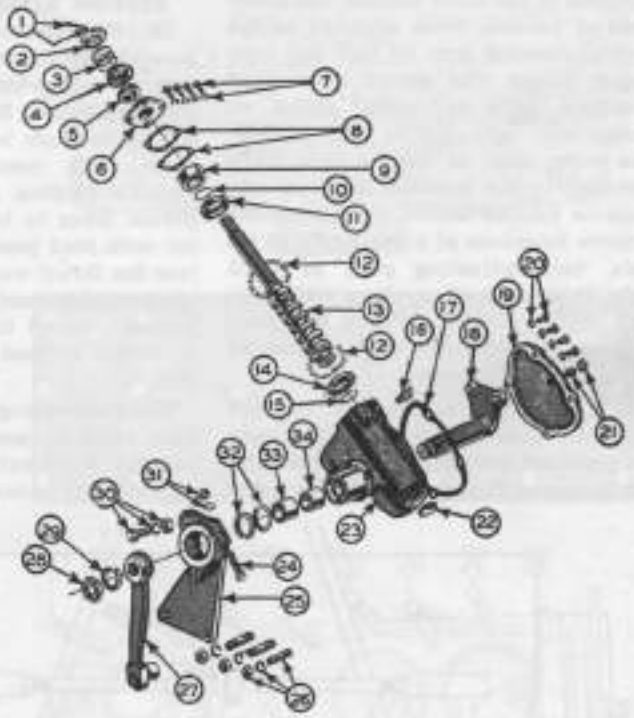


Fig. MH106—Exploded view of Ross dual stud type steering gear. Camshaft end play is adjusted with shims (8).

1. Clamp screw
2. Clamp
3. Spring
4. Cup for cork seal
5. Cork seal
6. Upper cover
8. Shims, .002, .003 and .010
9. Spacer
10. Snap ring
11. Ball cup
12. Ball bearings
13. Worm (cam) & shaft
14. Ball cup
15. Snap ring
17. Gasket
18. Trunnion arm
19. Cover
20. Capscrew
21. Trunnion, adjusting screw and locknut
22. Expansion plug
23. Housing
24. Clamp screw
25. Mounting
27. Steering arm
28. Nut
32. Seal and gasket
33. Bushing—outer trunnion shaft
34. Bushing—inner trunnion shaft

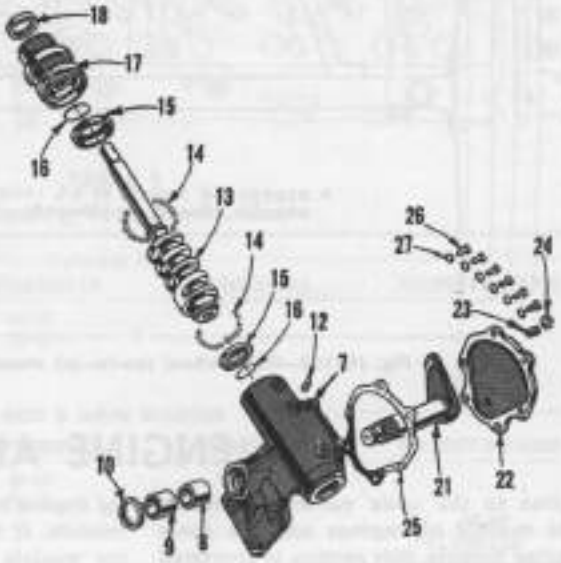


Fig. MH107—Exploded view of Ross single stud type steering gear.

8 & 9. Bushing
10. Oil seal
13. Worm (cam)
14. Ball bearings
15. Ball cup
16. Snap ring
17. Adjusting plug
18. Oil seal
23. Adjusting screw
24. Nut
25. Gasket

backlash. When correctly adjusted there will be a slight drag when the gear is rotated through mid-position but gear will turn freely when it is off the mid-position.

OVERHAUL STANDARD GEAR

Overhaul procedure for steering gear units used on standard type tractors is similar to that outlined for units used on row crop types. Adjustments made after reassembly and reinstallation are as given under "Steering Gear Adjustment" for standard types in paragraphs 13 through 21.

STEERING LINKAGE

22. All standard (axle) models except the 55, 201, 202, and 203 are equipped with two tie rods. On early versions of the other models, the inner ends of tie rods were attached to the central steering arm by ball cap type socket joints. The socket caps were provided with adjusting shims as shown schematically in Fig. MH108. The outer ends of the tie rods were attached to the knuckle arms by adjustable tubular socket type joints. To remove looseness at outer joints of tie rods, turn adjusting plug in until tight, then back off one turn and reinstall cotter pin. To remove looseness at inner joints, vary the number of shims under the caps.

23. On later versions of tractors equipped with two tie rods, the rods are provided with Thompson type rubber mounted ball joints at both ends. This type joint (26—Fig. MH110) is non-adjustable.

24. On early production models 55, 201, 202 and 203, a single tie rod with clevis type ends is used. Excessive wear at rod ends is corrected on these models by renewing the worn parts. Drag link ends are of the ball and tubular socket type and are adjusted by turning adjusting plug in until tight then, backing it off one full turn. Later production tractors are provided with Thompson non-adjustable type rubber mounted ball joints at each end of the tie rod.

25. Toe-in on all models should be 3/16 to ⅜ inch as shown in Fig. MH 108.

REBUSH STEERING KNUCKLES

26. The procedure for rebushing knuckles on standard (axle) type tractors is self-evident after examining the installation. Ends of new bushings should be flush with or just less than flush with machined surfaces on knuckle forging. Also make sure that grease holes in bushing are in register with feed passage in knuckle. Reface the thrust washer contacting faces of knuckles and axle if rough or grooved. Insert thrust washer spacers to obtain up and down play of .002-.004.

When rebushing Lemoine type knuckles, used on some models with adjustable front axles, it may be necessary to also renew the spindles (21—Fig. MH109), which perform the same function as the pivot or king pins on non-adjustable axles.

REBUSH AXLE PIVOT

27. Jack up front end of tractor to take weight off of front axle. Disconnect tie rod ends on center steering arm type linkage or drag link on others. Unbolt axle brace rear pivot and raise tractor far enough to permit removal of axle and brace assembly. Remove bushings from axle main member and also from axle brace pivot bracket.

Renew bushings and reassemble parts in reverse order of removal, using new front and rear pivot pins if necessary.

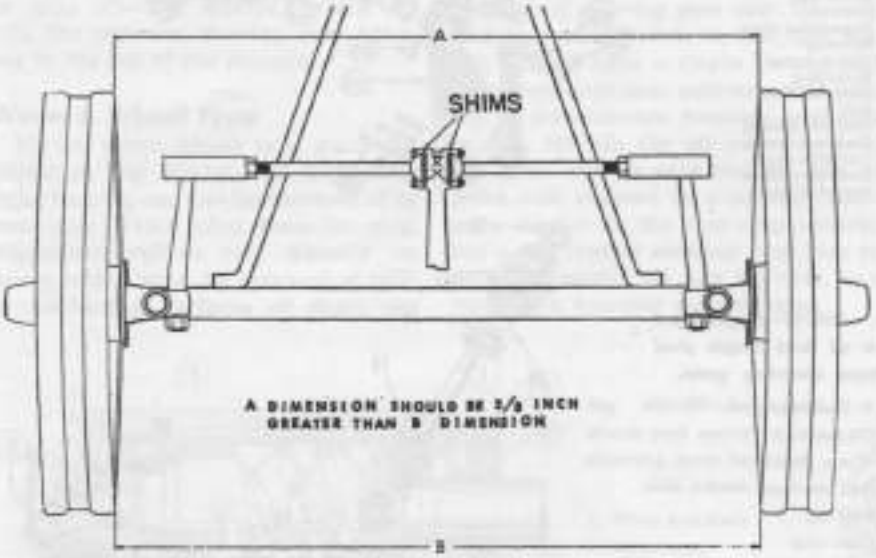


Fig. MH108—Front wheel toe-in—all standard models.

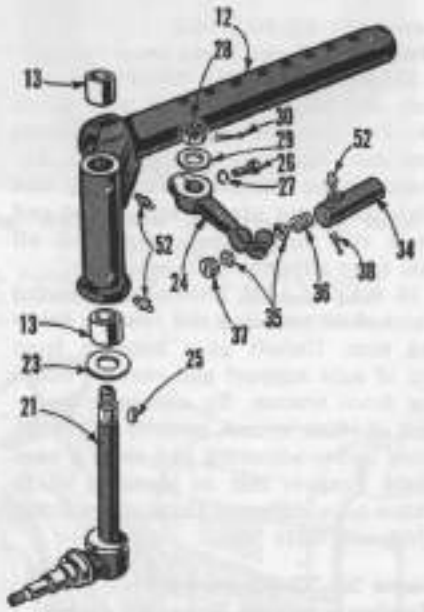


Fig. MH109—Axle extension and Lemoine type knuckle as used on some adjustable axle models.

12. Axle extension	25. Woodruff key
13. Bushing	34. Ball socket
21. Spindle	35. Ball seat
23. Thrust washer	36. Spring
24. Steering arm	37. Adjusting plug

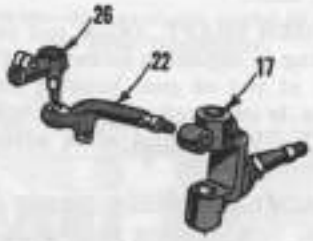


Fig. MH110—Knuckle (17), tie rod end (26) and steering arm (22) as used on some standard models.

ENGINE AND COMPONENTS

Due to the wide variety of makes and models of engines used in some tractor models, this section is arranged by engine make rather than by tractor models. If in doubt as to which tractor models carry which engine, refer to nameplate on tractor and engine or to the identification data printed at the beginning of this manual.

REMOVE AND REINSTALL

All Engines

30. The engine, clutch and clutch housing can be removed as a unit. Drain radiator and, if engine is to be disassembled, also drain block and oil pan. Remove muffler, carburetor air intake, hood, side panels, grille, bottom closure plate and radiator. Disconnect starter cables and generator wires, clutch pedal, throttle rod, choke control and governor control rod or cable if used. Disconnect fuel lines, oil pressure gauge tubing, temperature gauge bulb and any brackets attached to clutch housing. Disconnect drive coupling between clutch and transmission shafts. Separate steering shaft lower joint, on applicable models, and swing shaft away from engine. Remove engine mounting bolts and move engine forward slightly to separate drive coupling. Attach suitable bracket for lifting, and remove engine. To install engine, reverse removal procedure.

CYLINDER HEAD

Continental Engines

31. Drain radiator and remove hood, side panels, distributor, distributor drive shaft, spark plugs and upper radiator hose. Remove cylinder head stud nuts and remove head. Reverse removal procedure to install head. Retighten nuts to the correct torque, with engine warm. Refer to Table 1 for torque values. Tighten head nuts in sequence shown in Figs. MH120 or 121.

Chrysler Engines

32. Follow same procedure as Continental except distributor is not disturbed. Engines equipped with aluminum cylinder heads are run and allowed to cool before final tightening. Refer to Table 1 for torque values. Tighten head in sequence shown in Fig. MH122.

Massey-Harris Engines

33. Drain radiator, and remove hood and side panels. Remove coolant temperature indicator bulb, upper radiator hose, rocker arm cover, rocker arm and shaft assembly, and oil tube. Remove push rods and cylinder head stud nuts. On Diesel engines, disconnect lines from spray nozzles. Remove cylinder head. Refer to Table 1 for torque values. Tighten head in the sequence shown in Fig. MH123.

VALVES & SEATS

Continental and Chrysler Engines

34. Inlet and exhaust valves are not interchangeable. Exhaust valves seat on ring type inserts. Reface valves and

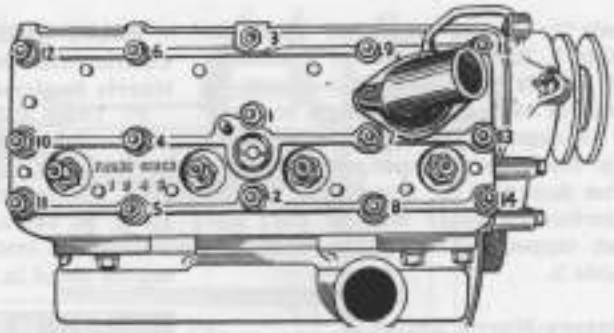


Fig. MH120—Continental 4-cylinder head nut tightening sequence.

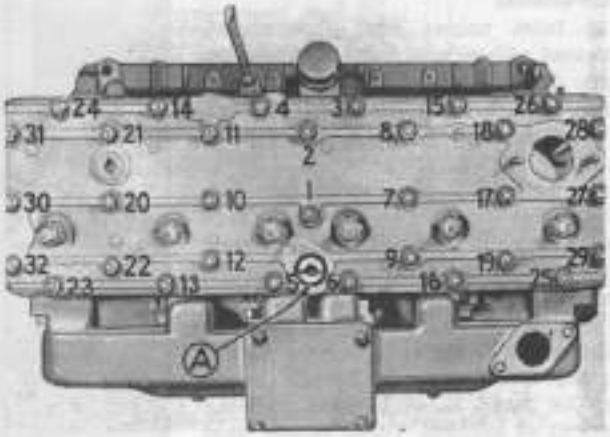


Fig. MH121—Continental 6-cylinder head nut tightening sequence.

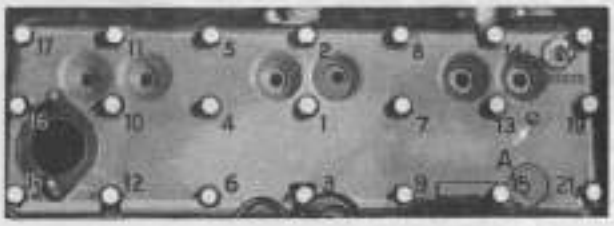


Fig. MH122—Chrysler 6-cylinder head screw tightening sequence.

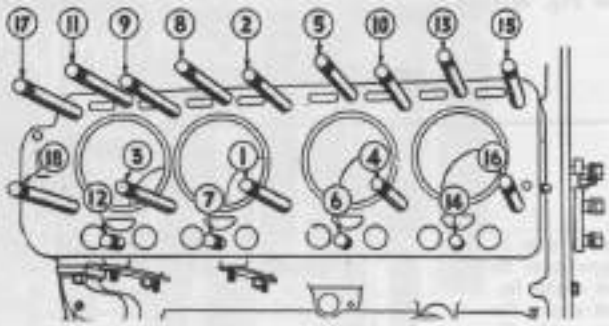


Fig. MH123—Massey-Harris cylinder head nut tightening sequence.

TABLE 1
Tightening Torques, Ft.-Lbs.

	Cylinder Head		
	CONTINENTAL	CHRYSLER	MASSEY-HARRIS
3/8 inch stud	40-45		
7/16 inch stud	70-75	52-57	
7/16 inch cap screw		65-70	
1/2 inch stud			130-140
	ROD & MAIN BEARING		
	CONTINENTAL	CHRYSLER	MASSEY-HARRIS
3/8 inch bolt or stud	40-45	45-50	
7/16 inch bolt or stud	70-75	80-85	
1/2 inch bolt or stud			85-95
9/16 inch bolt or stud			100-110

seats to proper angle as given in Table 2. Exhaust valves of Continental Models M290 and M330 should be faced at 44 degrees and seats in block at 45 degrees, to insure proper seating. These valves must **not** be lapped after facing or the desired one degree interference angle will be lost. Adjust tappet gap to values listed in Table 2.

Massey-Harris Diesel & Non-Diesel

35. Inlet valves are conventional. Exhaust valves seat on ring type inserts. The construction of the "Roto" (free valve type) exhaust valves used in some of these engines allows valve to rotate slightly when it closes, causing a lapping action which prevents deposit formations between valve face and seat and reduces sticking and burning. Exhaust valves of Diesels and non-Diesels should be faced at 44 degrees angle and seats in cylinder head at 45 degrees, to insure proper seating. Inlet valves on Diesels should also be faced at 44 degrees and the seats at 45 degrees. These valves must **not** be lapped after facing or the desired one degree interference angle will be lost. Adjust tappet gaps to values listed in Table 2.

35A. On Massey-Harris engines, the exhaust valve rotator cups should be checked for gap clearance whenever the valves are reseated. Refer to Standard Units Manual for procdure. See Fig. MH124.

VALVE GUIDES AND SPRINGS

Continental and Massey-Harris Engines

37. Valve guides are a press fit and can be driven out if renewal is necessary. Renew valve guides if guide-to-stem clearance exceeds the values given in Table 2. New valve guides should be installed to the relative depths listed in Table 2 and reamed to provide the proper clearance. Inlet and exhaust valve springs are interchangeable. Renew springs which are rusted, distorted or do not meet load test given in Table 2.

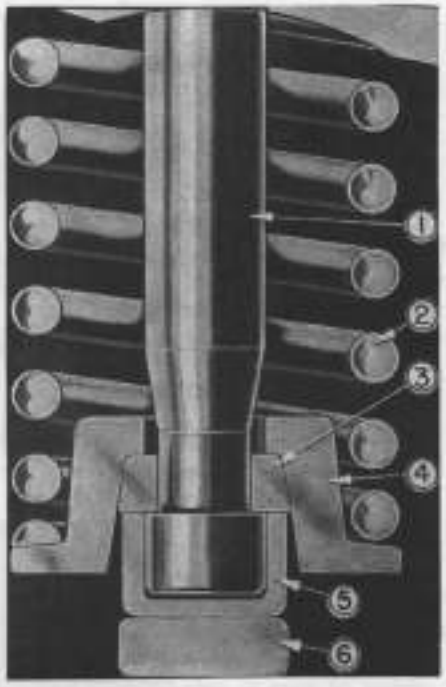


Fig. MH124—Roto valve arrangement.

1. Valve stem
2. Valve spring
3. Retainer lock
4. Spring retainer
5. Valve stem cap
6. Valve tappet

Chrysler Engines

38. Valve guides may be removed by driving guides down and breaking off lower portion to permit removal without disturbing valve tappets. Inlet guides are installed with tapered end up and exhaust guides with tapered end down. Install and ream guides in accordance with dimensions given in Table 2. Valve springs which are rusted, etched, distorted or do not meet load test given in Table 2 should be renewed. Springs are installed with close coiled ends up.

VALVE TAPPETS

Continental

39. Self locking or locknut, barrel type tappets are used and can be removed from the top without disturbing camshaft or cylinder head, by first removing the valve chamber cover, screwing the tappet adjusting screw completely down and removing the valve spring. While holding the valve up, remove tappet screw and lock nut from barrel and lift barrel out of its bore. Only standard size tappets are available for renewal. Engine Models M290 and M330 have replaceable tappet bushings in cylinder block. Tappets of other models ride directly in bores cut in the block. I&T suggested clearance of tappet body in bore is

TABLE 2
Valve System Data

	CONTINENTAL				CHRYSLER		MASSEY-HARRIS		
	A-244	F-124, F-140, F-162	F-226	M-290 M-330	T-57, T-81, T-86, T-105 T-116	T-100, T-120	H-260	HD-260 JD-382	J-382
Tappet gap, In.	.020H	.014H	.014H	.017H	.008H	.008H	.014H	.014H	.014H
Tappet gap, Ex.	.020H	.014H	.014H	.020H	.012H	.012H	.014H	.014H	.014H
Seat angle, In.	30°	30°	30°	30°	45°	45°	30°	45°	30°
Seat angle, Ex.	45°	45°	45°	45°	45°	45°	45°	45°	45°
Face angle, In.	30°	30°	30°	30°	45°	45°	30°	44°	30°
Face angle, Ex.	45°	45°	45°	44°	45°	45°	44°	44°	44°
Seat width, In.	1/16	1/16	1/16	1/16	3/32	3/32	3/32	3/32	3/32
Seat width, Ex.	5/64	5/64	5/64	5/64	3/32	3/32	3/32	3/32	3/32
Stem diam., In.	.339-.340	.3406-.3414	.3406-.3414	.4035-.4047	.340-.341	.340-.341	.4344-.4352	.4344-.4352	.4344-.4352
Stem diam., Ex.	.3380-.3388	.3382-.3390	.3382-.3390	.4017-.4024	.340-.341	.340-.341	.4315-.4325	.4315-.4325	.4315-.4325
Guid I.D., In.	.3422-.3432	.3422-.3432	.3422-.3432	.4057-.4062	.342-.343	.342-.343	.4360-.4365	.4360-.4365	.4360-.4365
Guid I.D., Ex.	.3422-.3432	.3422-.3432	.3422-.3432	.4057-.4062	.344-.345	.344-.345	.4360-.4365	.4360-.4365	.4360-.4365
Stem to guide clearance, In.	.001-.0026	.0008-.0026	.0008-.0026	.001-.0026	.002	.002	.0008-.0021	.0008-.0021	.0008-.0021
Stem to guide clearance, Ex.	.0035-.0045	.0032-.005	.0032-.005	.0033-.0045	.004	.004	.0035-.005	.0035-.005	.0035-.005
Distance from port end of guide to gskt. surface of cyl. head or block, In.	1 9/16	1 15/32	1 7/32	1¼	⅞	⅞	⅝(1)	⅝(1)	⅝(1)
Distance from port end of guide to gskt. surface of cyl. head or block, Ex.	1¼	1 15/32	1 7/32	1 9/16	⅞	⅞	⅝(1)	⅝(1)	⅝(1)
Spring lbs. test @ length, inches	53-59 @ 1⅞	47-53 1 45/64	42.5-47.5 1 21/32	53-59 1⅞	34-38 1¾	40-45 1¾	53-59 1⅞	53-59 1⅞	53-59 1⅞

(1) Distance from top of guide to valve spring seat on top of cylinder head.

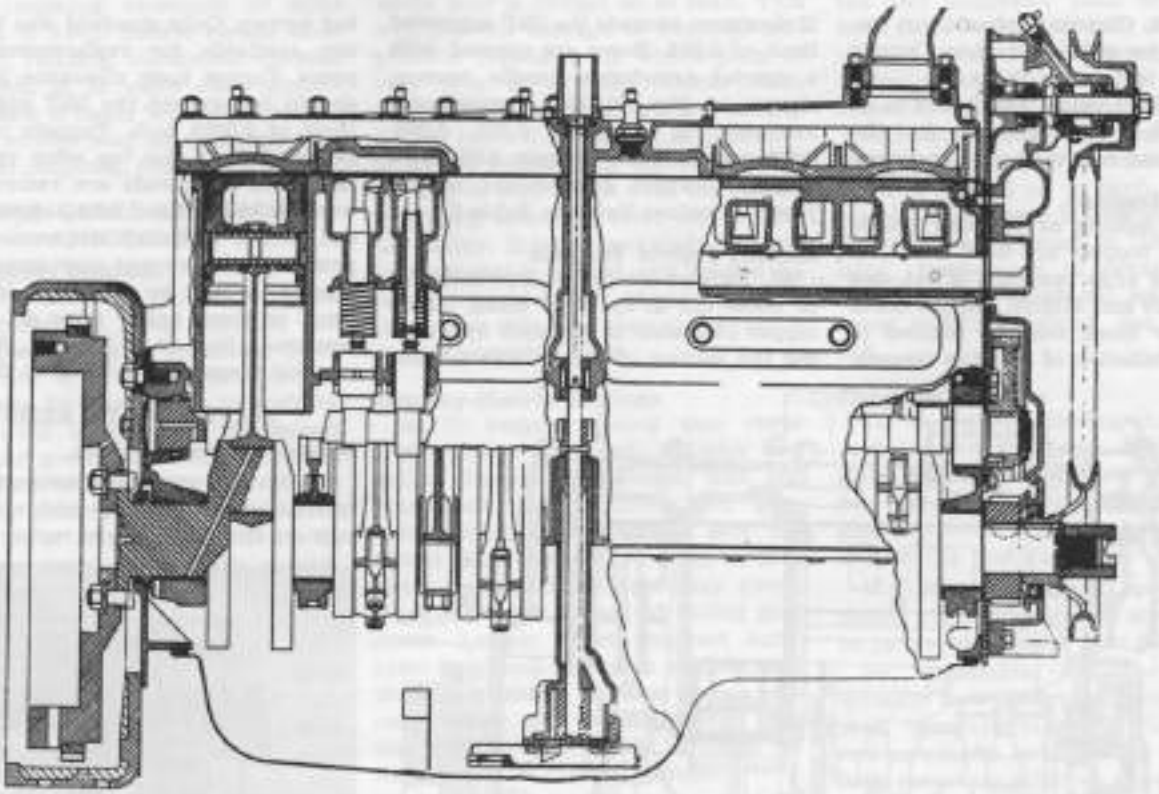


Fig. MH127—Continental M220-M330 six cylinder engine cross section. These models have a 7 bearing crankshaft.

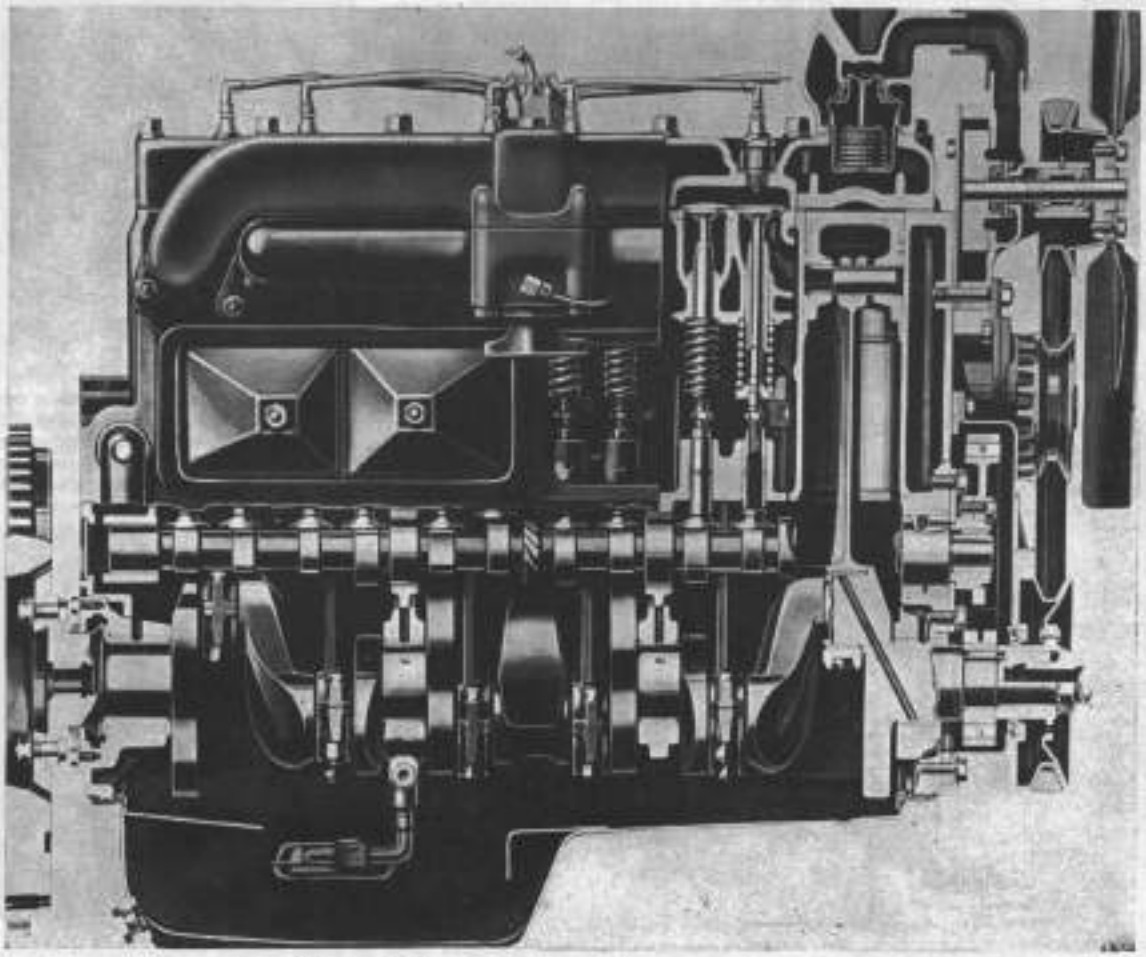


Fig. MH128—Chrysler 6 cylinder engine cross section side view.

0.001-0.0015. Clearance should not exceed 0.004 for quiet operation. Correct tappet gap is listed in Table 2.

NOTE: If all valve tappets are to be removed, it is recommended that the cylinder head and valves be removed.

Chrysler Engines

40. Self locking or locknut, mushroom type tappets are used and may be removed after camshaft is out. See Figs. MH128 and MH129. Tappet bores in cylinder block may be reamed to permit installation of oversize tappets, if clearance exceeds the I&T suggested limit of 0.002. Bores are reamed with a special detachable handle reamer, shown in Fig. MH130. Tappets are available in standard, 0.001, 0.008, 0.030 and on some models, 0.060 inch oversize. Tappet gaps should be adjusted to values listed in Table 2.

Massey-Harris Engines

41. Tappets are barrel type and ride in bores cut in cylinder block. Valve tappet clearance is adjusted by varying the setting of rocker arm adjusting screws. Only standard size tappets are available for replacement purposes. Tappet body clearance in bore should not exceed the I&T suggested limit of 0.0025 inch. Tappets may be removed from the top after cylinder head and push rods are removed. A wooden rod forced into tappet push rod socket will facilitate removal. If gum deposits prevent easy removal of tappets, it will be necessary to push them up from below after oil pan is removed. See Fig. MH131. Recommended tappet gap is listed in Table 2.

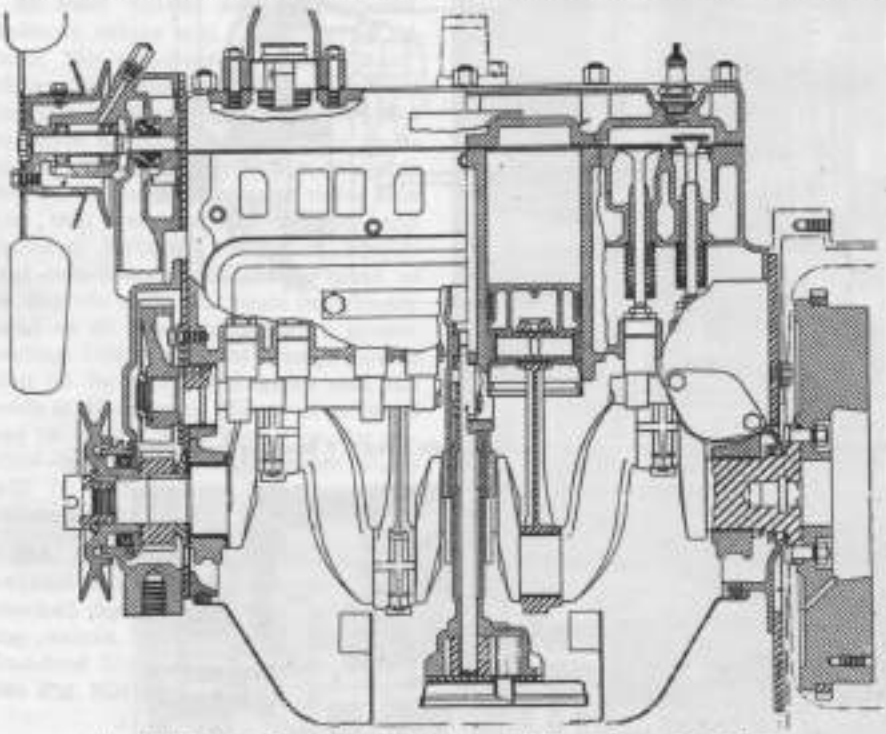


Fig. MH128A—Continental F124-F140 and F162 engine cross section.

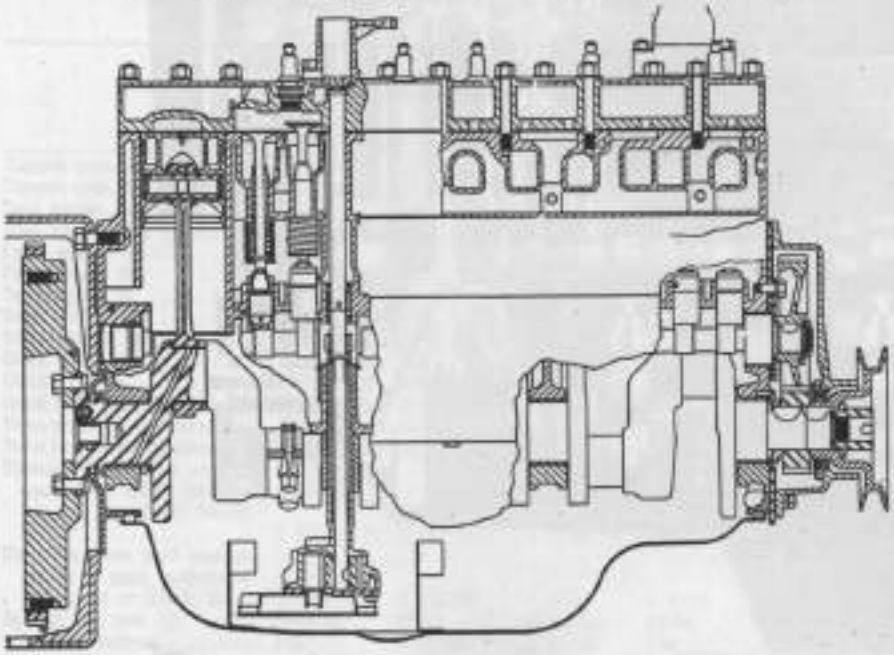


Fig. MH128B—Continental A244-F226 six cylinder engine cross section. These models have a 4 bearing crankshaft.

VALVE ROCKER ARMS

Massey-Harris Engines

42. Rocker arms are pressed steel type which ride directly without bushings on the single piece rocker shaft.

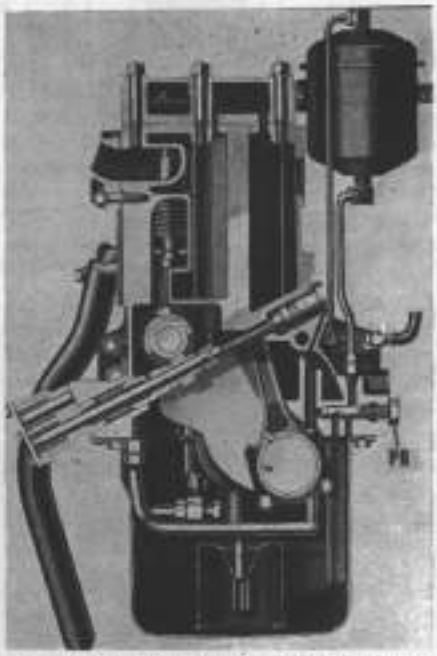


Fig. MH129—Chrysler 6 cylinder engine cross section front view showing angularly disposed transverse shaft which drives oil pump and distributor at opposite ends. Main bearings and rod bearings are non-adjustable precision type shells. Tappets are mushroom type.

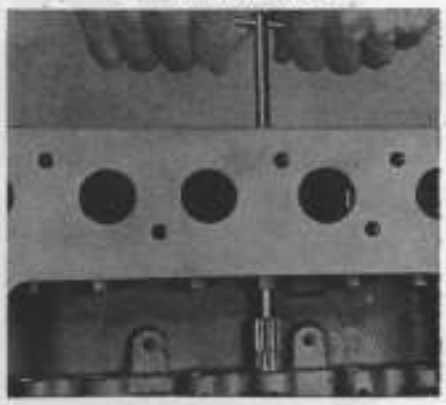


Fig. MH130—Tappet bore reamer being used to prepare Chrysler engine for installation of oversize tappets.

Desired running clearance of arms on shaft is 0.001. Renew rocker arms if shaft running clearance exceeds 0.006 inch, or if valve stem contact button face is badly worn. Tappet adjusting screws may be renewed separately if required. See Fig. MH131.

TIMING GEARS (OR CHAIN) AND COVER

Continental Engines

45. To remove the timing gear cover first remove the hood, radiator, and grille. Loosen engine mounting bolts, raise front end of engine approximately one inch and block in position. Remove fan blades, belt, crankshaft pulley and governor. Remove nuts and cap screws which hold cover to engine and remove cover. Note which cap screws or studs are provided with copper washers and replace accordingly. Check gear timing marks to insure replacement in correct position, Fig. MH132.

45A. Remove timing gears, using suitable puller. Timing gear backlash should not exceed the I&T suggested limit of 0.002 to 0.005 inch. If gear backlash is excessive, renew the gears. Oversize gears are available. When installing the cam gear, use a heavy bar to buck up the camshaft while gear is drifted on to shaft. This will prevent damage to bearings and possible loosening of Welch plug at rear face of cylinder block. Mesh punch marks on gears for valve timing. Renew crankshaft oil seal in gear cover before reinstalling. Make sure that oil seal is concentric with crankshaft by loosely attaching cover and installing pulley. Rotate crankshaft by hand until oil seal is aligned, and tighten the cover screws. Install remaining parts in reverse order of removal. Retighten engine mounting bolts.

Massey-Harris Engines

46. To remove timing gear cover first remove the hood, radiator and grille. Remove fan blades, belt and crankshaft pulley. Disconnect governor linkage at governor arm. On model 44 remove hydraulic system pump, or pump and auxiliary cover, from upper left corner of timing gear cover. Loosen engine support bolts, raise front end of engine slightly, and block in position. Remove timing gear case cover and check timing gear marks as per Fig. MH133 to insure reinstallation in correct position.

46A. Remove governor unit from front of camshaft gear and remove gears. Gear backlash should not exceed the I&T suggested limit of 0.002 to 0.005 inch. Crankshaft gear is available in 1, 2, 3, 4, 5 or 6 thousandths of undersize and oversize of the pitch diameter and are marked accordingly. When installing the cam gear, buck up the camshaft with a heavy bar if gear is being drifted on to shaft. If Diesel injector pump gear is renewed, retime the pump as outlined in "Diesel Section". Reassemble in reverse order, renewing crankshaft oil seal in gear cover before installing. See Fig. MH 134.

Chrysler Engines

47. To remove timing chain cover first remove the hood, radiator and grille. Remove crankshaft pulley and fan blades. Support front end of engine and remove engine front support and timing chain cover.

47A. Remove camshaft sprocket and timing chain. Crankshaft sprocket can be removed, using a gear puller.

To reassemble, install crankshaft sprocket and temporarily attach camshaft sprocket to shaft. Turn crank and camshafts until timing marks on both sprockets align as shown in Fig. MH135. Remove camshaft sprocket and place timing chain around both sprockets.

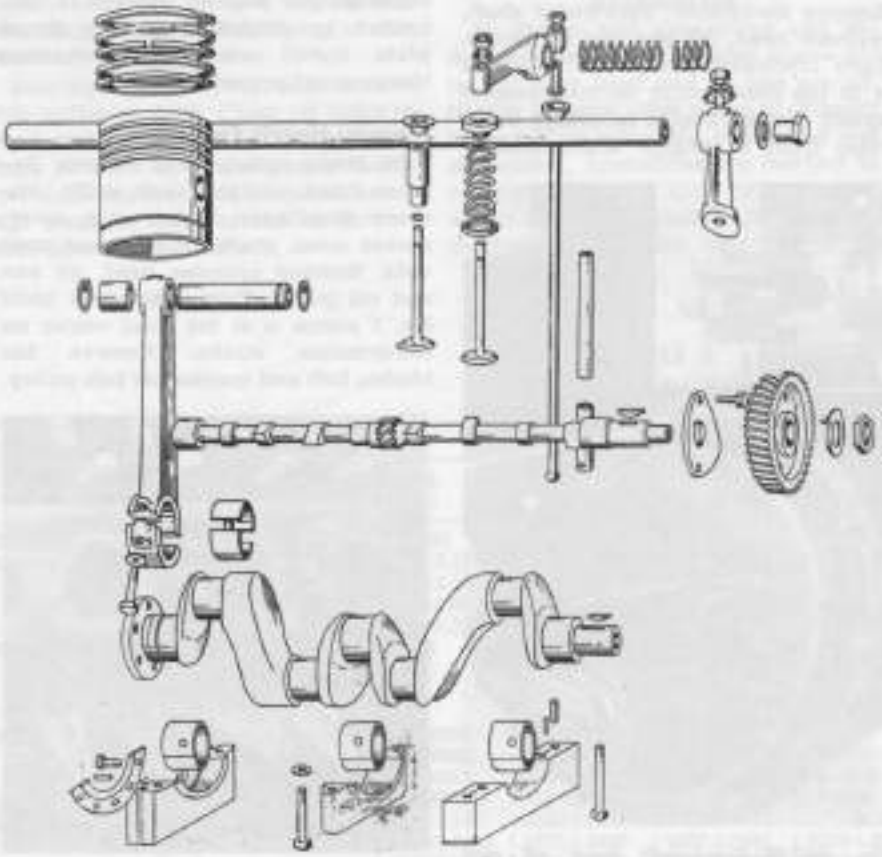


Fig. MH131—Massey-Harris engine parts on later engines. Rod cap is retained with bolts instead of screws as shown.

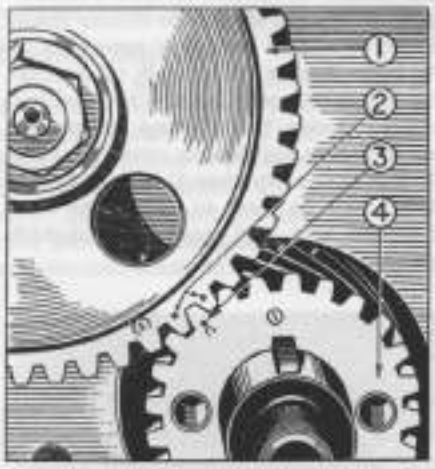


Fig. MH132—Continental timing gear markings.

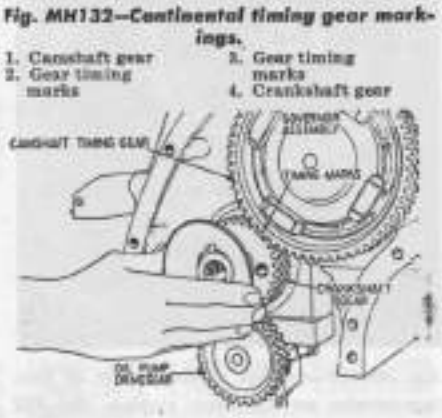


Fig. MH133—Massey-Harris timing gear marks and oil pump drive gear.

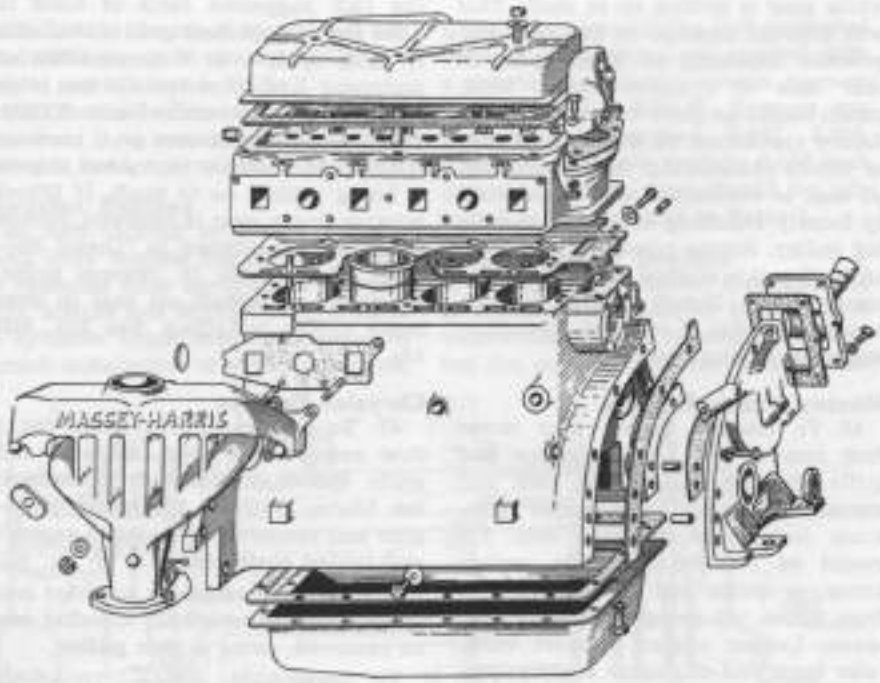


Fig. MH134—Massey-Harris engine parts. The details of the adaptor cover bolted to left side of timing gear cover differ on various models.

Reinstall camshaft sprocket, maintaining timing mark alignment. The screw holes in camshaft sprocket flange are offset to insure correct installation. Maximum allowable timing chain slack measured between sprockets is ¾ inch. Renew crankshaft oil seal in timing case cover before reinstalling cover. Center the oil seal on crankshaft before tightening cover. Special Tool, Crysler Number C-522 (Fig. MH 140), may be used to center oil seal. Remove tool and install crankshaft pulley.

Fig. MH135—Correct arrangement of timing marks on Chrysler engine. On T57 engines, screw (4) must be removed before front main bearing cap can be removed.

CAMSHAFT R & R

Continental Engines

48. To remove the camshaft first remove the hood, radiator and grille. Remove distributor, distributor shaft, cylinder head, oil pan and oil pump. Turn crankshaft until No. 1 piston is at top dead center on compression stroke. Loosen engine mounting bolts, raise front of engine approximately one inch and block in position. Remove fan blades, belt and crankshaft pulley. Remove timing gear cover and check gear timing marks to insure correct reinstallation.

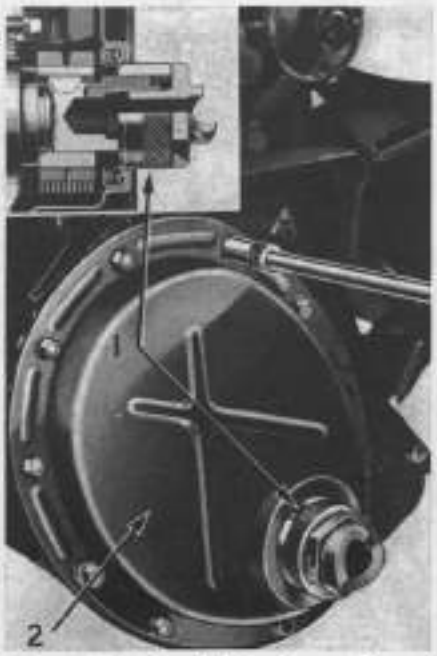


Fig. MH140—Crankshaft front oil seal aligning tool being used on Chrysler engine.

48A. Remove valve cover plates, raise valves, and hold in position with wedges under heads as shown in Fig. MH141. Lift tappets off camshaft and hold in up position with clothes pins as shown. Remove cap screws holding camshaft thrust plate in place and pull camshaft and gear unit out of engine. Camshaft end play is maintained between 0.004 and 0.006 by the thrust plate. If end play is excessive, it may be corrected by installing a new thrust plate. Install camshaft by reversing the removal procedure.

Chrysler Engines

49. To remove camshaft, first remove timing chain as outlined in paragraphs 47 & 47A. Remove distributor, distributor shaft, oil pump and cylinder head. Remove valve cover plates, raise valves and hold in position with wedges as shown in Fig. MH141. Lift tappets off camshaft and hold in up position with spring type clothes pins as shown. Remove camshaft thrust plate from front of block and withdraw shaft from engine. The recommended camshaft end play of .002-.006 is controlled by thickness of the thrust plate. Install camshaft by reversing the removal procedure.

Massey-Harris Engines

50. Drain radiator and oil pan. Remove hood, radiator, and grille. Remove distributor, rocker arm cover, rocker arms, shaft, oil tube and push rods. Remove cylinder head, oil pan and oil pump. Turn crankshaft until No. 1 piston is at top dead center on compression stroke. Remove fan blades, belt and crankshaft belt pulley.

Fig. MH141—Engine valves and tappets raised for camshaft removal.

Disconnect governor linkage at governor arm. Loosen engine mounting bolts, raise front end of engine slightly, and block in position.

Remove timing gear case cover and check timing gear marks to insure reinstallation in correct position. Push tappets up from below to clear camshaft. If tappets will not stay in up position, it may be necessary to force a wooden rod into tappet push rod socket and lift it out of engine. Remove cap screws holding camshaft thrust plate in place and pull shaft and gear assembly out of engine. Camshaft end play of 0.006 to 0.010 inch is controlled by a thrust plate. Renew crankshaft oil seal before timing gear cover is reinstalled. Reassemble other parts in reverse order of removal.

CAMSHAFT BEARINGS

Continental Engines

51. Do not attempt renewal of the camshaft bearings if equipment necessary to line ream bearings is not available. The four cylinder engine camshaft is supported by three bearings; and the six cylinder engine camshaft by four. To renew the camshaft bearings it is first necessary to remove the engine and the camshaft as outlined in paragraphs 30 and 48. Remove clutch from flywheel and flywheel from crankshaft. Remove engine rear mounting plate and Welch plug at rear camshaft bearing.

Bearings are removed with a suitable puller or drift. Clean oil holes in block and align holes in bearing with those in block to insure proper lubrication. Newly installed camshaft bearings must be line reamed to dimensions specified in Table 3.

Chrysler Engines

52. Camshaft is supported by three steel-backed, babbit-lined, precision type bearings. Rear journal of shaft rides directly in a bore in engine block; no separate bearing is provided. If camshaft bearing to journal clearance is greater than shown in Table 3, new bearings should be installed. Excessive clearance will cause a loss of engine oil pressure. To renew camshaft bearings it is necessary to first remove the camshaft as outlined in paragraph 49. Because the rear journal rides directly in the block it is not necessary to remove the flywheel unless there is an oil leak at the Welch plug in block at shaft rear journal.

Camshaft bearings may be removed with a suitable puller or bearing drift, and installed by pressing or driving with a close fitting piloted arbor or drift. Replacement bearings are finished to size and do not require fitting or final sizing. NOTE: Clear oil holes in engine block and align oil holes in bearings with those in the block.

Massey-Harris

53. Camshaft rides on three bearing surfaces bored directly in the iron cylinder block; replaceable bearings are not provided.

R & R ROD AND PISTON ASSEMBLIES

54. Piston and connecting rod assemblies are removed from above after cylinder head and oil pan are off. NOTE: Remove ridge at top of cylinder bores before removing piston and rod assemblies. Assemblies are marked to correspond with the cylinders in which they are installed. New or unmarked pistons and rods should be marked before installation or removal. Connecting rods are installed with oil spurt holes toward the right or camshaft side of engine. Slotted skirt pistons are installed with slotted piston faces opposite camshaft side. Connecting rod cap bolt torque values are given in Table 1.

PISTONS AND CYLINDERS OR SLEEVES

Continental Engines

55. Cast iron pistons are used and are available for renewal in standard and various oversizes to fit honed or rebored cylinders. On some models, semi-finished pistons are also available. Piston skirts, which are slightly out of round, can be corrected by light tapping with a rawhide mallet. NOTE: Extreme care is required for this operation, and piston must be carefully examined for cracks after truing. Pistons are fitted with piston pins out. Piston fit is checked by placing a feeler blade between the piston thrust face, which is at a right angle to the piston pin, and the cylinder wall, as shown in Fig. MH142. Feeler gage size and the spring scale tension required to withdraw the feeler is given in Table 4. If cylinder bore to piston clearance is more than 0.010 inch the bore should be reconditioned and a suitable oversize piston installed.

Chrysler Engines

56. Cam ground, aluminum alloy, four-ring pistons are used and are available in standard and various oversizes to fit honed or rebored cylinders. Semi-finished pistons are also available. Semi-finished pistons must be cam ground to size and are not under any circumstances to be finished round.

TABLE 3
Camshaft and Bearings

	CONTINENTAL				CHRYSLER	MASSEY-HARRIS	
	M290, M330	A-244	F-124, F-140, F-162	F-226	All Models	H-260 HD-263	J-382 JD-382
Camshaft end play	.004-.006	.004-.006	.004-.006	.004-.006	.002-.006	.005-.010	.006-.010
Bearing inside diameter No. 1	2.1865-2.1870	2.0625-2.0630	1.8745-1.8755	1.8745-1.8755	2.0000-2.0010	2.0000	2.1250
No. 2	2.1240-2.1245	2.0000-2.0005	1.7495-1.7502	1.8115-1.8125	1.9685-1.9695	1.7500	1.7500
No. 3	2.0615-2.0620	1.9375-1.9380	1.2495-1.2505	1.7485-1.7502	1.9370-1.9380	1.6875	1.6875
No. 4	1.7490-1.7495	1.8750-1.8755		1.2485-1.2502	1.2495-1.2505		
Bearing length No. 1	1 3/32	1⅛	1	1	1 3/32	1 7/16	1⅛
No. 2	1	¾	1⅛	15/16		1 1/16	2⅛
No. 3	1	¾	1 5/32	1⅛		1⅛	1⅞
No. 4	1¼	1		1 5/32	1⅛		
Journal running clearance No. 1	.0015-.0025	.0015-.003	.002-.004	.002-.004	.002-.004	.0035-.004	.0025-.003
No. 2	.0015-.0025	.0015-.003	.003-.004	.002-.004	.002-.004	.0035-.004	.0035-.004
No. 3	.0015-.0025	.0015-.003	.002-.004	.003-.0045	.002-.004	.0035-.004	.0035-.004
No. 4	.0015-.0025	.0015-.003		.002-.004	.002-.004		
Journal diameter No. 1	2.1845-2.185	2.0600-2.0610	1.8715-1.8725	1.8715-1.8725	1.9980-1.9980	1.9960-1.9965	2.1225-2.1220
No. 2	2.1220-2.1225	1.9875-1.9885	1.7457-1.7465	1.8085-1.8095	1.9665-1.9675	1.7460-1.7465	1.7465-1.7460
No. 3	2.0595-2.060	1.9350-1.9360	1.2465-1.2475	1.7457-1.7465	1.9350-1.936	1.6835-1.6840	1.6840-1.6835
No. 4	1.7470-1.7475	1.8725-1.8735		1.2465-1.2475	1.2475-1.2485		

Fig. MH142—Checking piston fit.

Pistons are fitted with piston pins out. Piston clearance is checked in the same manner described for Continental engines.

Massey-Harris Engines

57. Cam ground, aluminum alloy pistons are used and are available in standard size only. NOTE: Four-ring pistons are used on Models 44 & 44K engine serial number 1143 and up, also on Models 55 & 55K engine serial number 1132 and up. If piston clearance is more than 0.010 inch, the piston and sleeve should be renewed. New cylinder sleeves and pistons with fitted pins and rings are available as complete assemblies. Piston fit may be checked with a feeler gage in the manner described in paragraph 55. Feeler gage size and withdrawal tension are given in Table 4.

57A. Remove sleeves from top of engine, using a suitable puller. Remove any accumulations of cooling system sediment from engine water jacket and sleeve seating surfaces. Remove any foreign matter or burrs which may prevent proper sleeve seating. When fully seated, top of sleeve should stand .001-.004 above face of cylinder block. After sleeve fit is checked, remove sleeve, clean seal grooves, and install new seals. Lightly coat only the outside faces of seal rings with hydraulic fluid and install sleeve. Align relief slots at bottom of sleeve to prevent fouling against the connecting rods. When slots at bottom are properly aligned, the marks on upper faces will be as shown in Fig. MH143. After engine is assembled and before oil pan is reinstalled, fill cooling system with cold water and check for water leaks at lower ends of sleeves.

PISTON RINGS

Continental Engines

58. Check side clearances of new piston rings, as shown in Fig. MH144. If side clearance is more than the wear limits given in Table 4, a new piston must be used. Insufficient ring side clearance may be corrected by lapping ring to correct thickness. Ring gap clearance is checked with ring placed in cylinder bore, as shown in Fig. MH145. If necessary, file ring ends for correct gap clearance, keeping ring ends square. Standard size piston rings

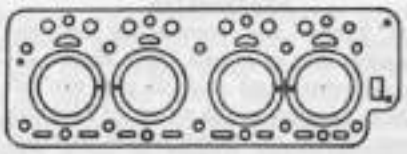


Fig. MH143—Massey-Harris cylinder sleeves are installed properly when "dots" on upper flange of sleeves are in the position shown.

Fig. MH144—Checking piston ring side clearance.

Fig. MH145—Checking ring gap.

TABLE 4

Pistons, Pins and Rings

(Clearances in thousandths)

	CONTINENTAL				CHRYSLER	MASSEY-HARRIS			
	A-244	F-124, F-140	F-162	F-226	M-290, M-330	All Models	H-260	HD-260	I-382	ID-382
Piston skirt clearance	3	3	3	3	3	2	3	3	3	3
Feeler thickness (1)	3	3	3	3	3	2	3	3	3	3
Spring scale pull (1)	10-15	5-10	5-10	5-10	5-10	8-10	5-10	5-10	5-10	5-10
Top comp. ring width	⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛
End gap	10-15	8-13	5-15	5-15	10-15	7-15	11	9-17	11	12-20
Side clearance	3-5	1.5-3.5	1.5-2.5	1.5-2.5	2.5-4.5	1.5-3	4-6	2.5	4-6	4-6
Other comp. ring width	⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛	⅛
End gap	10-15	8-13	5-15	5-15	10-15	7-15	11	9-17	11	9-17
Side clearance	3-5	1-3	1.5-2.5	1.5-2.5	2.5-4.5	1.5-3	3-5	2-5	3-5	3-5
Oil ring width	¼	3/16	¼	⅛	¼	5/32	¼	¼	¼	¼
End gap	10-15	8-13	9-15	10-20	10-15	7-15	13	9-17	14	10-20
Side clearance	3-5	1-2.5	1.5-2.5	1.5-2.5	1-2.5	1.5-3	3-5	2	3-5	3-5
Fifth comp. ring width	⅛						3/16(2)	3/16	3/16(3)	3/16
End gap	10-15						11(2)	10-20	11(3)	9-17
Side clearance	1.5-2.5						3-5(2)	2.5	3-5(3)	3-5
Piston pin diameter	.8592	.8592	.8592	.8592	1.1091	.8592	1.2499	1.2499	1.4999	1.4999
Fit in piston	Light push fit									
Clearance in rod bush.	.3	.3	.3	.3	.4	.3	.4	.4	.5	.5

(1) Use a ⅛ inch wide feeler
(2) Not used after serial 1142
(3) Not used after serial 1131

are recommended for renewal, unless cylinder bore is reconditioned to some standard oversize. Tapered compression rings are installed with the narrow side up. New piston rings are marked to identify the top side. Piston ring sizes and clearances are given in Table 4. Piston rings are available in standard and various oversizes.

Chrysler Engines

59. Piston rings are fitted in same manner as described for Continental engines in paragraph 58. Piston rings are available in standard and various oversizes. Refer to Table 4 for gap and side clearance.

Massey-Harris Engines

60. Piston rings are fitted as described in paragraph 58 and are available in standard size only. Excessive wear is corrected by installing new cylinder sleeve, piston and rings assemblies. Refer to Table 4.

CONNECTING RODS AND BEARINGS, PISTON PINS AND BUSHINGS

Continental Engines

61. Connecting rod bearings are of the non-adjustable, slip-in, precision shell type, held in position by lock tabs fitted into cut-outs in connecting rod and cap. Correct bearing wear by installing new bearing shells, which can be accomplished without removing the rod. Bearing inserts are available in standard, 0.002, 0.020 and 0.040 inch undersizes. Connecting rods and bearing inserts used in even numbered cylinders, differ from those used in the uneven numbers.

The floating piston pin is retained in piston by spring steel lock rings, which should be renewed if piston pin is removed for any reason. The piston pin bushing in the connecting rod may be renewed. Piston pins are available in standard, 0.003 and 0.005 inch oversizes. See Table 4 for dimensions.

Chrysler Engines

62. Slip-in precision shell type non-adjustable bearings are used and are available in standard, 0.002, 0.010 and 0.012 inch undersize. Connecting rods used in even number cylinders differ from those used in uneven numbers.

Floating piston pins are retained in piston by spring steel lock rings. Piston pins are available in standard, 0.003, 0.005 and 0.008 inch oversize. Refer to Table 4 for dimensions and clearances.

Massey-Harris Engines

63. Slip-in precision shell type non-adjustable bearings are dowelled in connecting rod caps. New bearing inserts are available in standard, 0.002, 0.020 and 0.040 inch undersize for non-Diesels; standard, 0.002, 0.010 and 0.020 for Diesels. Connecting rods and bearings are identical in all cylinders.

Floating piston pins are retained in pistons by spring steel lock rings. Piston pins are available in standard, and oversizes of 0.003 and 0.005. Refer to Table 4 for dimensions and clearances.

CRANKSHAFT AND MAIN BEARINGS

Continental and Massey-Harris

64. The four cylinder engine crankshaft is supported by three bearings and the six cylinder engine crankshaft by four or seven bearings according to engine model. If shaft journals or pins of crankshaft are scored, tapered, oval, or undersize, beyond the I&T suggested limits given in Table 5, shaft must be reconditioned or renewed before new bearings are installed. Crankshaft bearings are slip-in precision shell type. Bearing wear may be corrected by renewing bearing insert shells without R & R of crankshaft or engine. Make sure that oil holes are open. New bearing inserts are available in standard, 0.002, 0.020 and 0.040 inch undersize for non-Diesels; standard, 0.002, 0.010 and 0.020 for Diesels.

Crankshaft end play is controlled by two thrust washers and a series of shim washers as shown in Fig. MH150. One thrust plate is located on the front journal of the crankshaft behind the front main bearing, the other between the rear face of the crank gear and the front face of the front main bearing. End play is adjusted by varying the shim washers. None of the main bearings are flanged. Refer to Table 5 for dimensions and clearances.

Chrysler Engines

65. The crankshaft is supported on four non-adjustable, slip-in, precision shell type, bearings, which are kept in position by lock tabs. Main bearings are available in standard, 0.002, 0.010 and 0.012 inch undersize. Refer to Table 5 for crankshaft dimensions and clearances. Recondition or renew crankshafts that do not conform with

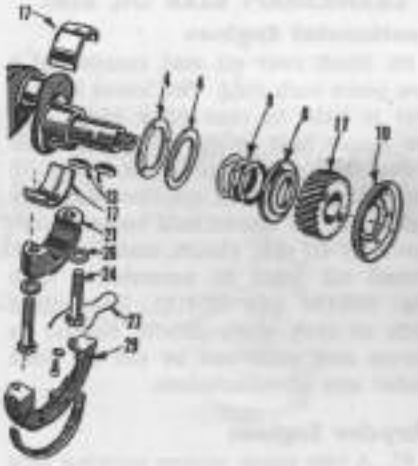


Fig. MH150—Continental engine crankshaft, front main bearing and seal.

4. Thrust washers
6. Thrust plate
8. Shims
10. Oil slinger
11. Gear
18. Woodruff keys
17. Bearing insert
21. Bearing cap
27. Lock wire
29. Filler block

TABLE 5

Crankshaft, Main Bearings, Rod Bearings

(Clearances in thousandths)

	CONTINENTAL			CHRYSLER			MASSEY-HARRIS			
	A-244, F-226	F124, F-140, F-162	M-298, M-330	T57, T-81, T-105	T-96, T-116	T-100, T-120	H-260	HD-260	J-302	JD-302
Rod bearing										
Running clearance	1.5-2	1.5-2	2-3	1.5-3	1.5-3	1.5-3	1-2.5	2-3.5	1-2.8	1.8-3.8
Side play	6-10	6-10	6-10	5-11	5-11	5-11	6-10	6-10	6-10	6-10
Crankpin diameter	2.062	1.937	2.485	1.937	2.062	2.1245	2.4985	2.4985	2.748	2.748
Main bearing										
Running clearance	1.5-2	1.5-2	2-3	1.5-3	1.5-3	1.5-3	1-2.7	2-3	1-2.7	1.2-3.6
Main journal diameter	2.3745	2.2485	2.6235	2.2485	2.4985	2.4985	2.8735	2.8735	3.2505	3.2505
Crankshaft end play	4-6	4-6	4-6	4-8	4-8	4-8	6-10	6-10	6-10	6-10

the dimensions given in Table 5. Bearing wear may be corrected by renewing bearing insert shells without R & R of crankshaft or engine.

If front main bearing cap of model T57 engines is to be removed, it will be necessary to remove timing case to uncover the screw which holds front gasket oil seal plate to timing case plate (4—Fig. MH135). This plate prevents removal of front bearing cap. Crankshaft end play is controlled by the flange on both ends of rear main bearing. Correct excessive end play by renewing bearing or reduce flange thickness if play is insufficient.

Replacement bearing caps are furnished with 1/64 inch larger stud holes and 1/16 inch shorter cap depth to permit fitting and alignment. This provision is necessary due to engine block bearing bores being line bored during manufacture, and it may be necessary to shim and fit replacement caps for proper alignment.

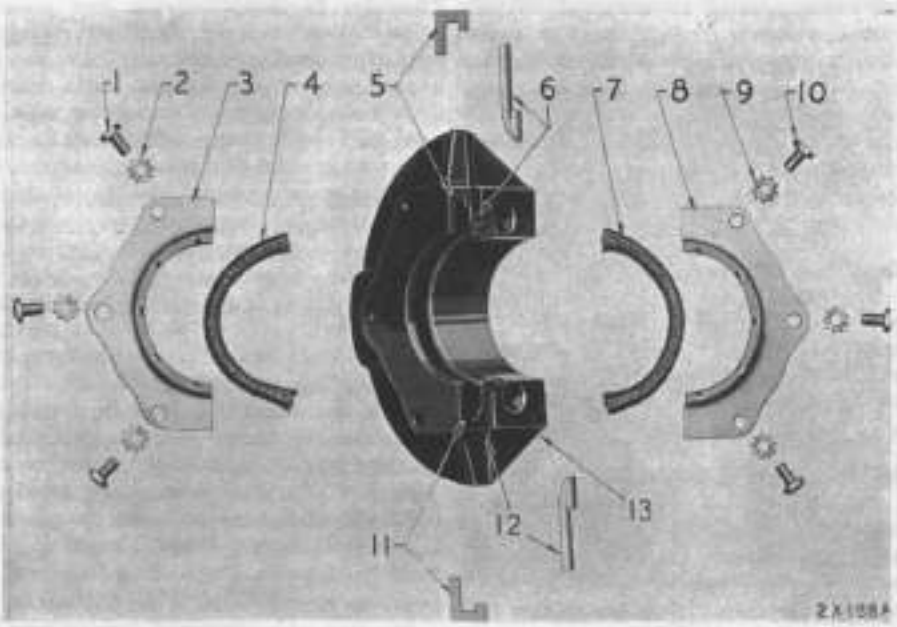


Fig. MH152—Chrysler crankshaft rear oil seal details.

1-10. Seal retainer screws
3-8. Packing retainer
4-7. Seal packing
5-11. Bearing cap gasket
6-12. Bearing cap gasket
2-9. Lockwashers

CRANKSHAFT REAR OIL SEAL

Continental Engines

66. Shaft rear oil seal consists of a two piece cork ring. The lower half of seal is held in rear filler block and the upper half in the oil guard. The lower seal can be renewed when oil pan and filler block are removed. Replacement of upper half requires removal of oil pan, clutch, and flywheel. Install oil seals in accordance with Fig. MH150 and MH151. Protruding ends of cork seals should extend as shown and must not be cut off flush under any circumstances.

Chrysler Engines

67. A two piece, woven packing ring type seal is used for the shaft seal Fig. MH152. The upper half of the ring seal is held by a retainer which is attached to engine block with screws and the lower half in a similar retainer is mounted on rear face of rear main bearing cap. The upper and lower halves can be renewed after flywheel is off without disturbing oil pan. Lower oil seal in main bearing cap, can be renewed without disturbing flywheel.

If new seal packing is installed in retainers, overlapping ends must be cut off flush with mating surfaces of bearing cap and engine block. Do not pull packing out of retainer when trimming. Rear main bearing cap oil seal consists of gaskets and seals located between contacting surfaces of rear main bearing cap and engine block.

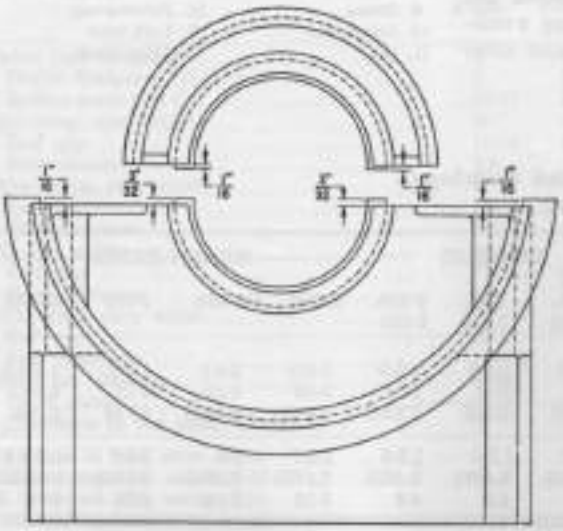


Fig. MH151—Continental crankshaft rear oil seal details.

Massey-Harris Engines

68. The crankshaft oil seal is a two piece neoprene ring held in place by two retainers. The lower retainer is shown in Fig. MH131. Replacement seal halves are cut to correct length and are installed without trimming or cutting. Upper and lower seal halves can be renewed after flywheel is off without disturbing oil pan. Lower oil seal in main bearing cap, can be renewed without disturbing flywheel. The rear main bearing cap is sealed by packing forced into space between crankcase and grooves cut into sides of bearing cap.

FLYWHEEL

69. Flywheel can be removed after clutch is out. Flywheel mounting bolt holes are offset to assure correct flywheel reinstallation. The flange on crankshaft and the flywheel may be marked to facilitate reinstallation. Flywheel run-out must not exceed 0.004 inch at the rear face. The flywheel ring gear may be renewed by the conventional heating and expansion method. Note location of gear tooth faces, to assure installation of gear in proper direction.

OIL PAN

Continental Engines

70. The oil pan of some models is provided with a removable cover to permit cleaning oil pump screen without disturbing oil pan. The oil pan gaskets extend under front and rear bearing filler blocks, making it necessary to remove these blocks if gasket renewal

is required. Filler block-to-oil pan strip gaskets are used at front and rear. These gaskets are placed in the lower grooves of filler blocks, shellacked in place, and trimmed according to dimensions given in Fig. MH151, before filler blocks are installed. Coat the outer surface of gasket lightly with graphite grease to prevent tearing when oil pan is installed.

Chrysler Engines

71. Oil pan must be removed to clean pump screen. Oil pan end gaskets should extend ⅛ to ¼ inch above oil pan as shown in Fig. MH153. Protruding ends of gaskets must not be trimmed flush with oil pan under any circumstances.

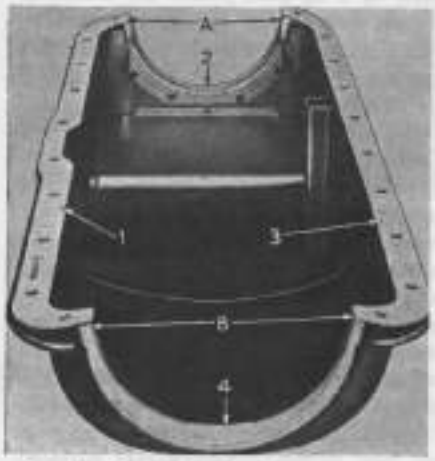


Fig. MH153—Chrysler oil pan gaskets.
1-3. Side gaskets 2-4. End gaskets
A-B. End gasket lips

Massey-Harris Engines

72. Removable oil pan cover plates are provided to permit oil pump screen cleaning without disturbing oil pan. Oil pan gaskets are regular flat type and may be shellacked to pan to facilitate installation.

OIL PUMP

Continental Engines

73. The internally located engine oil pump shown in Figs. MH 127, 128A & 128B, is geared to camshaft and also serves to drive the ignition distributor. Oil pump can be removed after oil pan is dropped. Oil pressure is regulated by an externally accessible spring controlled by-pass valve, located on right side of engine block. Regulator plunger and spring may be removed after regulator cap is unscrewed and removed. If oil pump parts are worn, it is advisable to renew the complete pump. Ignition distributor must be retimed if oil pump is removed and reinstalled.

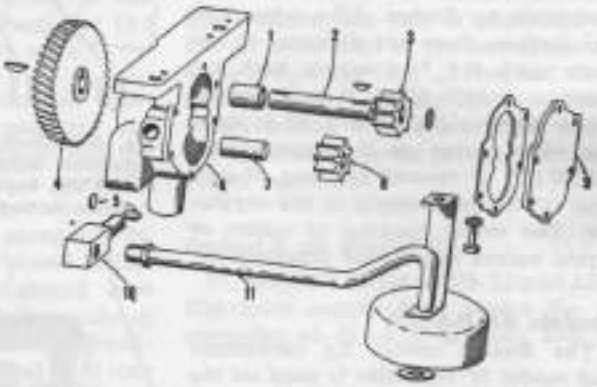
Chrysler Engines

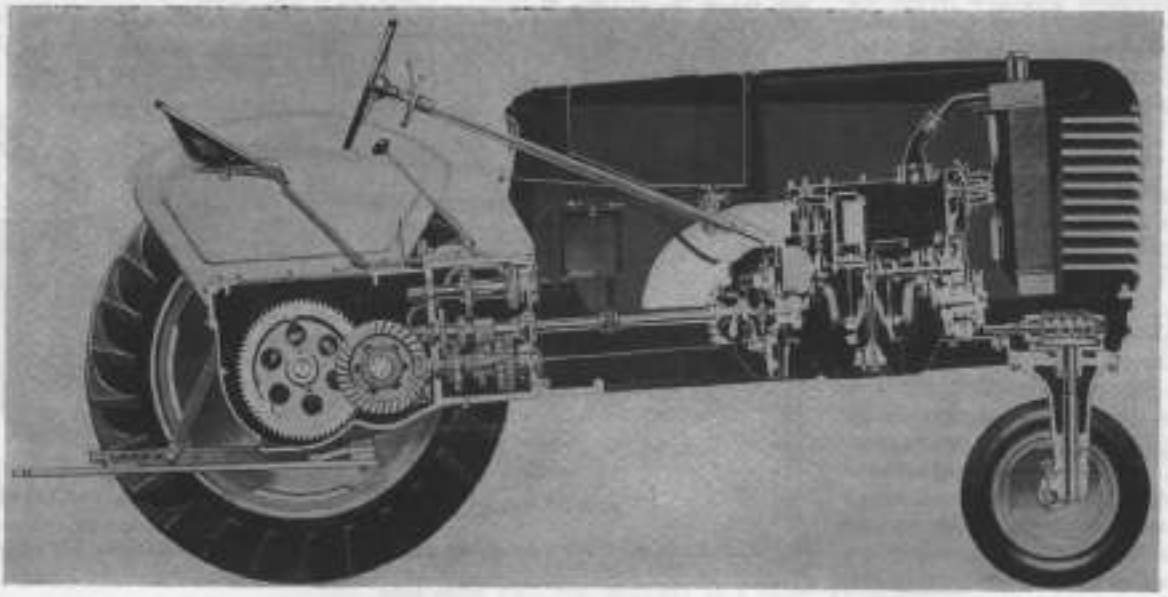
74. Oil pump is externally mounted on right side of engine, and may be removed without disturbing oil pan. Refer to Fig. MH129. The oil pressure regulator (PR) is located on engine left side and is externally accessible. Oil pressure may be varied by installing springs of different loading. These springs are available in standard, heavy and light load ratings. Oil pan must be dropped to clean pump screen. Refer to Fig. MH128.

Massey-Harris Engines

75. The oil pump Fig. MH154, is located internally, under crankshaft front main bearing cap, and is driven by timing gears. It is necessary to drop oil pan to remove oil pump. Oil pressure regulator is a part of oil pump body casting, and is of conventional spring controlled type. A removable cover is provided on bottom of oil pan to facilitate cleaning pump screen.

Fig. MH154—Massey-Harris oil pump.
1. Shaft bushing
2. Drive gear shaft
3. Drive gear in pump
4. Drive gear (outer)
5. Expansion plugs
6. Pump body
7. Driven gear shaft
8. Driven gear
9. Cover
10. Pump fitting
11. Strainer tube





Massey-Harris "101 Jr." Row Crop

CARBURETOR SYSTEM

GASOLINE & DISTILLATE CARBURETOR

76. Gasoline and distillate carburetors are of the conventional updraft type with throttle and choke controls. Refer to the actual carburetor for make and model number then to the STANDARD UNITS MANUAL where under the particular model number will be found a description of the unit and the necessary servicing data, including the calibration. Distillate powered engines are furnished with manifold heat controls and covers to assure greater heat for the proper vaporization of low grade fuels.

ADJUST LP-GAS CARBURETOR

Models 44 and 55 tractors are available with LP-gas carburetors designed and built by Ensign. Like other LP-gas systems these are designed to operate with the fuel supply tank not more than 80% filled. It is important when starting the 44 and 55 to open the vapor valve on the supply tank SLOWLY; if opened too fast, it will shut off the fuel supply to the regulator. Too rapid opening of vapor or liquid valves may cause freezing.

Models 44LP-55LP

The Ensign model Xg carburetor and model W regulator is used on the model 44LP tractors; model 55LP tractors are equipped with the model Xg carburetor and the model R regulator. Each combination has 3 points of mixture adjustment plus an idle stop screw. Refer to Fig. MH160 *and* MH161.

77. **IDLE STOP SCREW.** Idle stop screw (9) on the carburetor throttle lever should be adjusted to provide a slow idle speed of 500 rpm.

78. **STARTING SCREW.** After the engine is started bring the throttle to the ½ to ¾ open position and with the choke **closed** turn starting screw (11) until highest engine speed is obtained. A slightly richer adjustment (counter-clockwise until speed drops slightly) may be desirable for a particular fuel or operating condition. Average adjustment is one turn open for model 44LP; 1½ turns for model 55LP.

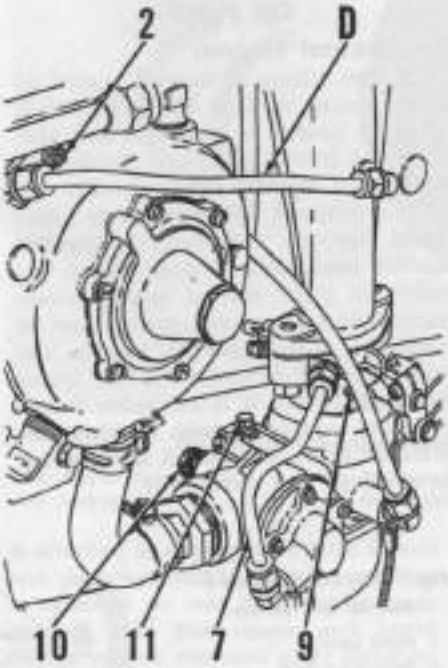


Fig. MH160—Model 44LP carburetor and regulator layout. Carburetor is Ensign model Xg, regulator is Ensign model W. Refer to legend under Fig. MH161.

79. **IDLE MIXTURE SCREW.** With choke **open**, engine warm and idle stop screw set, adjust Idle Mixture Screw (2) on regulator until best idle is obtained. An average adjustment is 1½ turns open on both models.

80. **ECONOMIZER & LOAD SCREW.** *In the Xg Ensign carburetor, the so called load screw primarily controls the partial load mixture. The richer mixture needed for full power is supplied by a by-pass power jet which is opened and closed by the economizer diaphragm spring and the manifold vacuum as shown in Fig. MH* 162. *When the manifold vacuum drops below 4-6 inches Hg which will occur at full load (wide open carburetor throttle) the diaphragm spring opens the non-adjustable power jet. When the manifold vacuum is higher than 10-13 inches Hg which will occur at no load or light load regardless of rpm, the diaphragm spring is overridden by the higher vacuum and the jet is closed off at which time the mixture is controlled by the load screw and idle screw to*

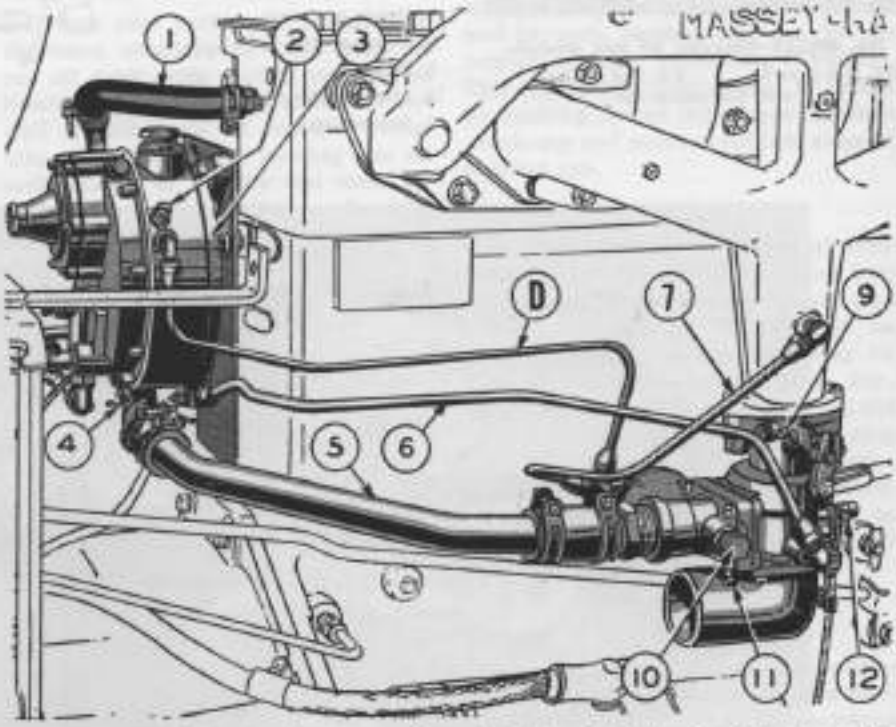


Fig. MH161—Model 55LP carburetor and regulator layout. Carburetor is Ensign model Xg, regulator is Ensign model R.

D. Idle line
2. Idle mixture screw
7. Economizer (suction) line
9. Idle stop screw
10. Load screw
11. Starting screw

provide economizer action. In the Xg carburetor the vacuum controlled valve attached to the economizer diaphragm enriches the mixture and is actually a power jet system.

81. ADJUSTMENT WITHOUT LOAD. Average adjustment of the load screw (10—Figs. MH160 or 161) as recommended by Massey-Harris is 3 turns open for the 44LP and 3 1/3 turns open for the 55LP. However, to accurately set the load screw and regulator for the fuel and operating conditions as found in a certain locality, the Massey-Harris recommendations are as described in paragraph 82.

82. Disconnect idle line (D) at the manifold on the 44LP; at the regulator or economizer (whichever is the easiest) on the 55LP, and then plug the line and the connection. Set idle stop screw (9) on carburetor throttle to open butterfly valve about ¼ open or to point where 1350 engine rpm is obtained. (Have hand throttle lever at quadrant forward so governor does not regulate idle speed.)

Adjust load screw (10) until maximum engine speed is obtained for this throttle setting then reset the idle stop screw (9) to produce 1350 rpm. Now adjust load screw in the lean direction (clockwise when looking at hexagon end of screw) until the engine loses 80 rpm on model 44LP; 100 rpm on 55LP. Unplug line and connection and reconnect line. Readjust the idle mixture screw (2) and reset the idle stop screw (9).

83. ENSIGN METHOD WITHOUT LOAD. First carefully adjust the idle mixture screw as in paragraph 79. Disconnect the economizer to manifold suction line (7) and plug the intake manifold connection. (On model 44 the line (7) connects to the manifold vacuum at the carburetor flange.) Run engine at high idle speed with hand throttle in position where governor does not regulate the rpm. Adjust load screw (10) to obtain maximum rpm, note its position then carefully rotate in lean direction until rpm just begins to fall. Rotate the screw to the mid-point of these two positions and tighten the locknut. Unplug the manifold or flange connection and reconnect the economizer suction line. The power valve and jet are fully open when using this method.

84. ANALYZER & VACUUM GAGE METHOD. In this method the engine is operated with the carburetor throttle wide open and with sufficient load on the engine to hold the rpm to maximum operating speed (1350) or 300 to 500 rpm slower than maximum operating rpm. One method of loading the engine is to disconnect or short out two or more spark plug wires. Do not disconnect any lines. Set the load screw (10) to give a reading of 12.8 on the analyzer gasoline scale or 14.3 on an analyzer with LPG scale.

84A. Check the part throttle (partial load) mixture by reducing the opening of the throttle valve and the load on the engine until a manifold vacuum of 10-13 inches is obtained at the same rpm as used in paragraph 84. The power jet should be closed at this time and the analyzer should now read 13.8-14.5 on the gasoline scale or 14.9-15.5 on the LPG scale. If readings are lower than specified, fuel may be leaking past the power valve; if higher than specified, the power jet orifice may be too small.

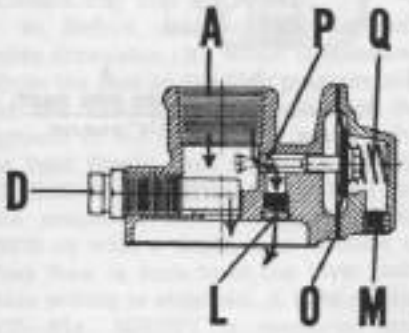


Fig. MH162—Sectional view of economizer used on Ensign model Xg carburetor.

A. Fuel inlet
D. Load adjusting screw
L. Orifice
M. Vacuum connection
O. Diaphragm
P. Fuel passage
Q. Spring

LP-GAS FILTER

85. Filters used on these systems are subjected to pressures as high as 150 psi and should be able to stand this pressure without leakage. Unit should be drained periodically at the blow off cock (L—Fig. MH163). When major engine work is being performed it is advisable to remove the lower part of the filter, thoroughly clean the interior and renew the felt cartridge if same is not in good condition.

LP-GAS REGULATOR

Ensign W on Model 44

86. HOW IT OPERATES. Fuel from the supply tank enters the regulating unit inlet (A—Fig. MH164) at a tank pressure of 25 to 80 psi and is reduced from tank pressure to about 4 psi at the high pressure reducing valve (C) after passing through the strainer (B). Flow through high pressure reducing valve is controlled by the adjacent spring and diaphragm. When the liquid fuel enters the vaporizing chamber (D) via the valve (C) it expands rapidly and is converted from a liquid to a gas by heat from the water jacket (E) which is connected to the coolant system of the engine. The vaporized gas then passes (at a pressure slightly below atmosphere pressure) via the low-pressure reducing valve (F) into the low-pressure chamber (G) where it is drawn off to the carburetor via outlet (H). The low pressure reducing valve is controlled by the larger diaphragm (T) and small spring.

Fuel for the idling range of the engine is supplied from a separate outlet (J) which is connected by tubing to a separate idle fuel connection on the carburetor. Adjustment of the carburetor idle mixture is controlled by the idle fuel screw (K) and the calibrated orifice (L) in the regulator. The balance line (M) is connected to the air inlet horn of the carburetor so as to reduce the flow of fuel and thus prevent over-richening of the mixture which would otherwise result when the air cleaner or air inlet system becomes restricted.

Ensign R on Model 55

87. HOW IT OPERATES. Liquid LP-Gas from supply tank enters the R regulator at (1—Fig. MH165) and is

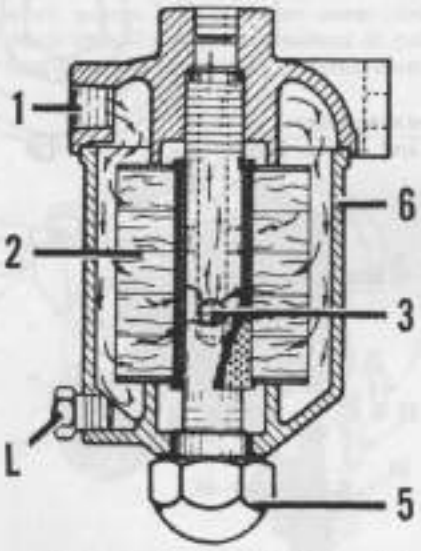


Fig. MH163—Section through LP-Gas filter used on models 44 and 55.

L. Drain plug
1. Fuel inlet
2. Filter cartridge
3. Outlet passage
5. Stud nut
6. Filter bowl

reduced from tank pressure to about 4 psi at high pressure reducing valve (3) after passing through the strainer (2). Flow through high pressure valve is controlled by diaphragm (4), lever (5) and spring (6). When the liquid fuel enters the vaporizer coil (7) it expands rapidly and is converted from a liquid to a gas by heat from the engine coolant system water which surrounds the vaporizing coil. The vaporized gas then passes (at a pressure slightly below atmospheric pressure) via the main (low pressure) valve (8) to the carburetor via the outlet (9). Control of the outlet pressure is obtained by operation of the large diaphragm (10), pin (11) and spring (12).

Fuel for the idling range of the engine is supplied by a separate outlet (15) via tube (16) from vapor reserve chamber (17) which is supplied by port (19). Outlet (15) is connected by tubing to a separate connection on the carburetor. Adjustment of the carburetor idle mixture is controlled by the idle fuel screw (20). A tube connects the atmospheric vent (21), to a pitot tube in the carburetor air horn so as to reduce the flow of fuel and thus prevent over-richening of the mixture which would otherwise result when the air cleaner or air inlet system becomes restricted.

TROUBLESHOOTING

These procedures apply to all model W Ensign regulators and to model R regulators produced after regulator serial 148372.

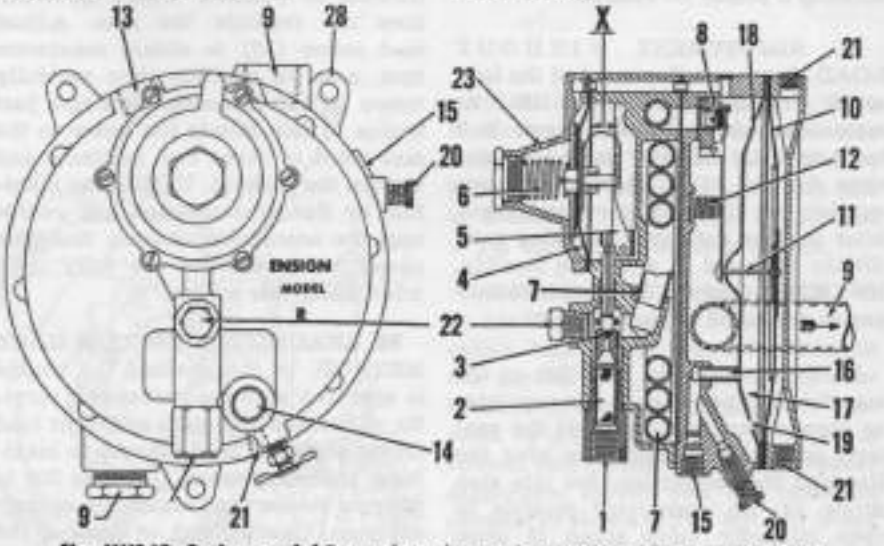


Fig. MH165—Ensign model R regulator as used on Massey-Harris model 55LP.

1. Fuel inlet
2. Filter screen
3. High pressure valve
4. Inlet pressure diaphragm
5. Inlet diaphragm lever
6. Inlet diaphragm spring
7. Vaporizer coil
8. Main low pressure valve
9. Outlet to carburetor valve
10. Outlet pressure diaphragm
11. Push pin
12. Outlet diaphragm spring
13. Water inlet
14. Water outlet
15. Idling fuel outlet
17. Vapor reserve chamber
18. Partition plate
19. Orifice
20. Idle fuel adjustment
21. Atmospheric vent
22. Regulator cover

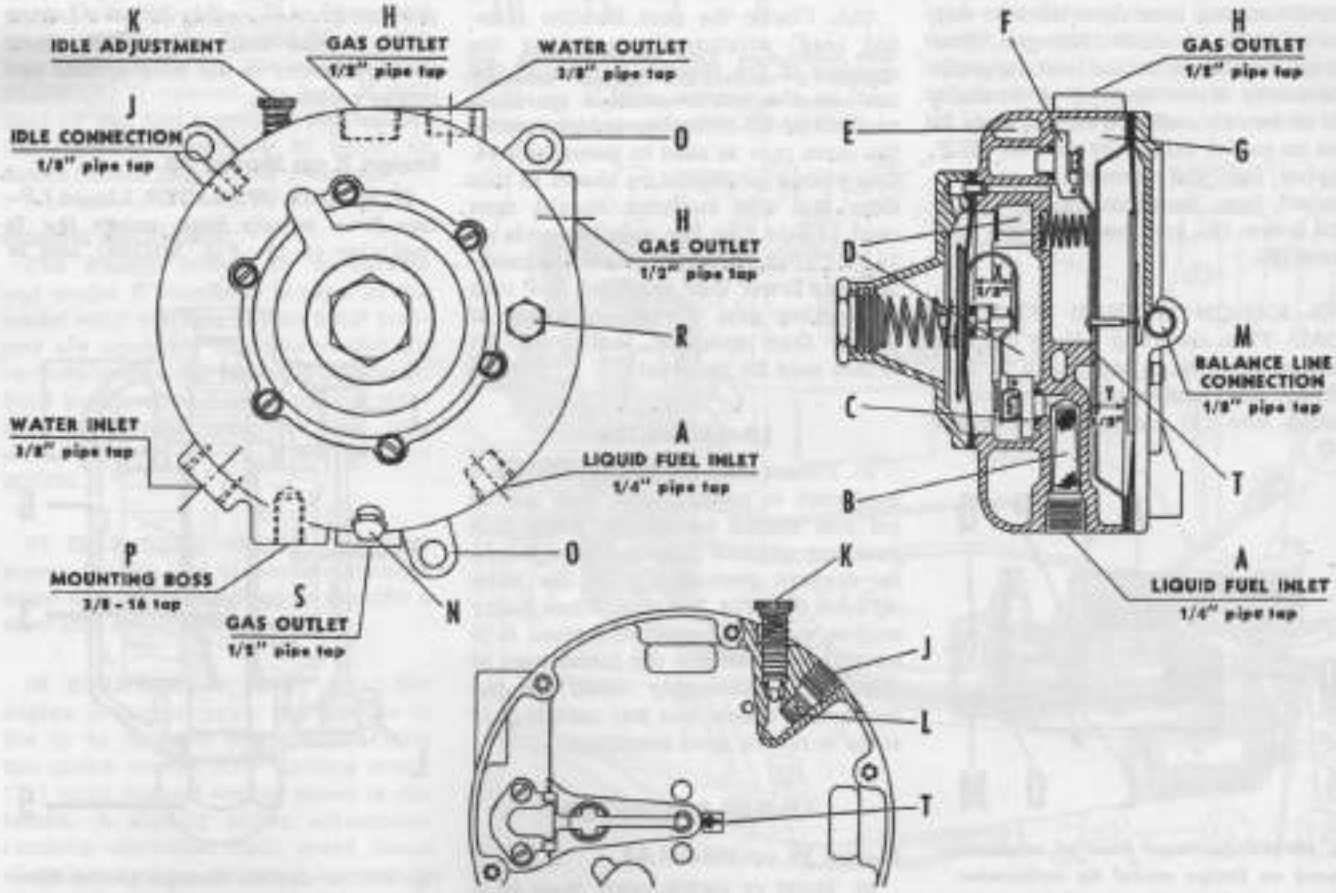


Fig. MH164—Ensign model W regulator as used on Massey-Harris model 44LP.

B. Strainer
C. High pressure valve
D. Vaporizing chamber
E. Water jacket
F. Low pressure valve
G. Low pressure chamber
L. Idle orifice
N. Drain
O. Support lugs
T. Boss

88. **SYMPTOM**—Engine will not idle with Idle Mixture Adjustment Screw in any position.

CAUSE AND CORRECTION — A leaking valve or gasket is the cause of the trouble. Look for leaking low pressure valve caused by deposits on valve or seat. To correct the trouble wash the valve and seat in gasoline or other petroleum solvent.

If foregoing remedy does not correct the trouble check for leak at high pressure valve by connecting a low reading (0 to 20 psi) pressure gage at point (22) on model R regulator or at point (R) on the model W regulator. If the pressure increases after a warm engine is stopped, it proves a leak in the high pressure valve. Normal pressure is 3½-5 psi on model W, 4-5 psi on model R except where this model is connected to the engine oil pressure circuit. On model R with oil pressure control, the normal pressure should be 1-2 psi with engine stopped and 8.5-10 with engine running.

89. **SYMPTOM**—Cold regulator shows moisture and frost after standing.

CAUSE AND CORRECTION—Trouble is due either to leaking valves as per paragraph 88 or the valve levers are not properly set. For information on setting of valve lever refer to paragraph 91.

REGULATOR OVERHAUL

If an approved station is not available the model R (without oil pressure attachment) regulator and the model W can be overhauled as outlined in paragraphs 90 and 91.

90. Remove the unit from the engine and completely disassemble using Figs. MH164 and MH165 as references. Thoroughly wash all parts and blow out all passages with compressed air. Inspect each part carefully and discard any that are worn.

91. Before reassembling the unit note dimension (X) which is measured from the face on the high pressure side of the casting to the inside of the groove in the valve lever when valve is held firmly shut as shown in Fig. MH166. If dimension (X), which can be measured with Ensign gage No. 8276 or with a depth rule is more or less than ½ inch bend the lever until this setting is obtained. A boss or post (T—Fig. MH167) is machined and marked with an arrow to assist in setting the lever. Be sure to center the lever on the arrow before tightening the screws holding the valve block. The top of the lever should be flush with the top of the boss or post (T).

Fig. MH166—Using Ensign gage No. 8276 to measure dimension (X) on a model W regulator. Dimension (X) is shown in Fig. MH164.

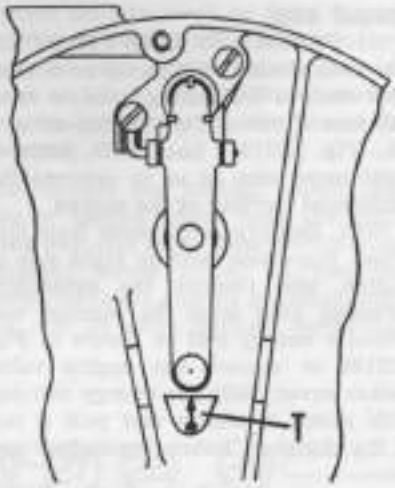


Fig. MH167—Ensign model R regulator. Port boss (T), which is marked with the arrow, is used for the purpose of setting the low-pressure valve lever.

DIESEL SYSTEM

WARNING—The extreme pressure of the nozzle spray can cause the fuel to penetrate human flesh. Avoid this source of danger when checking the nozzles, by directing the spray away from your person.

GENERAL TROUBLESHOOTING

100. The data below, supplied through courtesy of American Bosch Company, should be helpful in shooting trouble on models 44 and 55 Diesel tractors.

TROUBLE—Engine does not idle well; erratic fluctuations.

CAUSE—Could be caused by faulty nozzle or nozzles, also by pump overflow valve remaining in open position. The overflow valve should be removed and washed in cleaning solvent.

TROUBLE—Intermittent or continuous puffs of black smoke from exhaust.

CAUSE—Likely to be caused by faulty nozzle or nozzles. Improper engine operating temperature.

TROUBLE—Fuel oil builds up (dilution) in the engine crankcase.

CAUSE—The trouble could lie in a ruptured or leaking throttle needle diaphragm, or leaking gasket under delivery valve, or badly worn plunger: but in any of these cases the remedy would be replacement of the complete hydraulic head as a unit assembly, by competent personnel.

TROUBLE—Sudden heavy black smoke under all loads.

CAUSE—This calls for removal of the entire injection pump assembly for handling by competent personnel. The difficulty possibly lies in a stuck displacer piston. Other possible causes are improperly adjusted smoke cam or dilution of fuel by engine oil being by-passed by a damaged distributor head filter.

TROUBLE—Poor fuel economy.

CAUSE—Water temperature too low. Check thermostat for proper functional control. At the same time check the entire system for fuel leakage.

TROUBLE—Engine low in power.

CAUSE—Filter between supply pump and injection pump may be clogged; or, a faulty supply pump. Due to type of fuel used, it may be necessary to advance the timing. Under no circumstances should this advance exceed 4° B.T.D.C.

TROUBLE—Engine R.P.M. too low at full throttle position.

CAUSE—Could be caused by improper setting of throttle linkage. Remove pump control lever cover and check if full travel is obtained at full load position of throttle control lever.

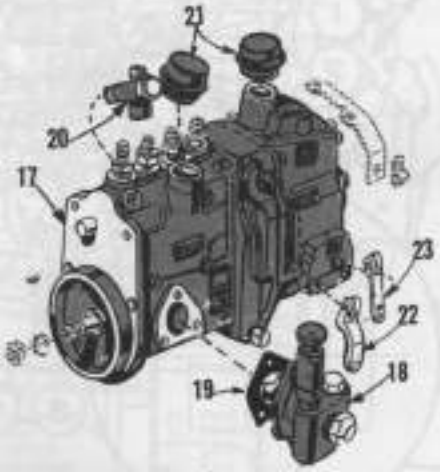


Fig. MH180—Bosch type APE injection pump and associated parts.

18. Supply pump and primer
19. Overflow valve
21. Breather cap
22. Shut-off lever
23. Governor lever

INJECTION PUMP

Two different models of American Bosch fuel injection pump have been used on the model 44D tractor. Early production tractors were equipped with the PSA pump; latest tractors with the PSB pump. Massey-Harris service personnel advise that all PSA pumps have been changed over to PSB type. Model 55 tractors are equipped with either a PSB or an APE pump.

On all of the mentioned pump models, the primary fuel supply pump and the engine speed governor are integral with the injection pump unit. The APE pump is a 4 plunger type; the PSA and PSB, are single plunger type. The APE pump rotates at ½ crankshaft speed; PSB and PSA pumps rotate at crankshaft speed. To distinguish the various models of Bosch pumps refer to Figs. MH180, MH181, MH182.

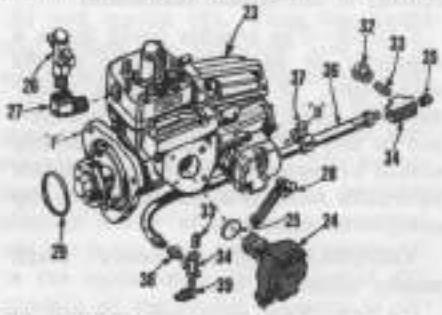


Fig. MH181—Bosch type PSB injection pump and associated parts.

24. Supply pump
25. "O" ring
26. Valve assy.
28. Throttle lever
29. "O" ring
32. Reducer

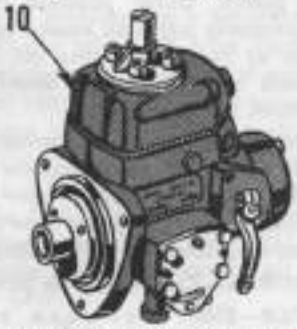


Fig. MH182—Bosch PSA pump.

Model 44D

101. **CHECK AND TIME PSB PUMP.** To check timing with pump on engine, first remove the timing window from left face of pump. Tie the shut-off arm (A—Fig. MH185) back with piece of light gage wire so as to prevent the accidental starting of the engine.

101A. Remove small cover from flywheel inspection port on right side of engine, also remove the externally threaded plug from the number one cylinder energy cell as shown in Fig. MH186 or remove the engine valve rocker cover. Grip the energy cell cap with pliers as shown and pull it out of the chamber. Rotate crankshaft until air is felt escaping from the energy cell opening or until both valves of number one cylinder are closed, then slowly until the flywheel mark indicating 22 degrees before top center is aligned with the pointer pin at the inspection port in flywheel housing. Each mark on flywheel equals one degree.

101B. At this time the line mark (7—Fig. MH185) on the injection pump drive hub should be aligned or in register with the pointer (6) extending from the front face of the pump. At the same time the "O" mark in the pump window should be within ⅜ inch either way of being in regis-

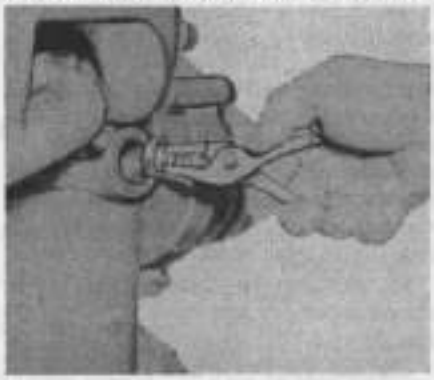
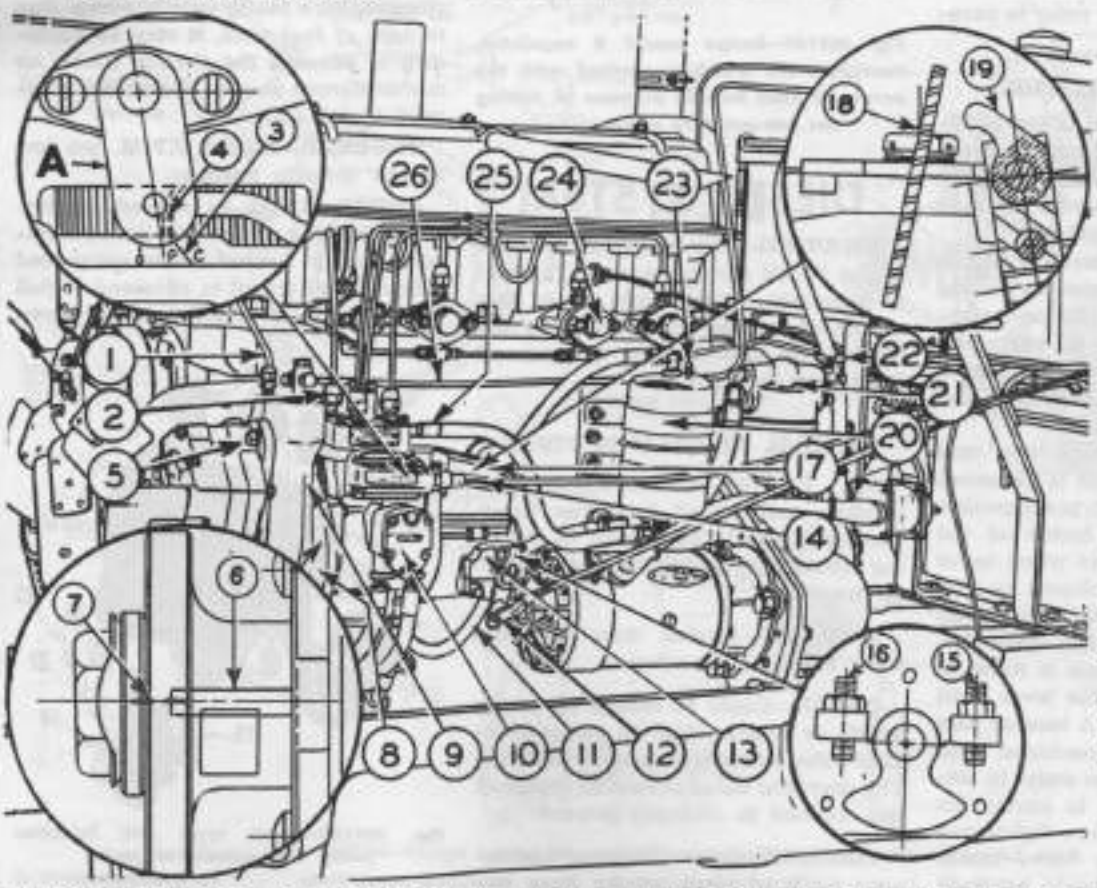


Fig. MH186—Removing energy cell cap from Massey-Harris models 44 & 55 Diesels.



A. Shut-off arm
1. No. 1 cyl. outlet
2. Port closing line mark on window
4. Marked tooth on gear
5. Hydraulic pump
6. Pointer on pump
7. Port closing line mark on drive hub
8. Adapter
9. Timing inspection hole
10. Fuel supply (primary) pump
11. Lube oil line to pump
12. Operating lever
13. Cover
14. Fuel shut-off
15. High speed adjusting screw
16. Low idle speed adjusting screw
17. Governor
18. Fuel limiting stop plate
19. Smoke cam
20. Secondary filter
21. Primary filter
22. Hand primer shut-off valve
23. Plug on filter
24. Injector
25. Fuel inlet
26. Over flow line to tank.

Fig. MH185—Bosch PSB pump installation on Massey-Harris model 44 Diesel. The PSB pump is also used on some model 55 tractors.

ter with the line mark (4) machined on the apex of one of the teeth in the plunger drive gear. To view these marks it will be necessary to remove either a small cover plate or a threaded cap or connection from the pump adapter (8). If marks do not align as mentioned loosen the pump flange mounting bolts and swing pump through range provided by elongated holes in pump body flange. If elongated holes do not provide enough range to bring marks into register pump should be removed and the gear re-meshed.

Model 55

102. **CHECK AND TIME APE PUMP.** All APE pumps have the nozzle outlet connections arranged in tandem. To check timing first make sure the fuel cut-off control (8—Fig. MH188) is in the closed position to prevent accidental starting of the engine. Remove small cover from flywheel inspection port (16) on side of engine and the external plug from the number one cylinder energy cell as shown in Fig. MH186. Grip the energy cell cap with pliers as shown and pull it out of the chamber. In some cases it may be more convenient to remove the engine valve rocker cover than to remove the energy cell.

Rotate crankshaft until air is felt escaping from the energy cell opening then slowly until the flywheel mark indicating 32 degrees before top center is aligned with the pointer pin as shown in Fig. MH190. On some engines this point on the flywheel is stamped "INJ". Remove ¼ inch pipe plug (3—Fig. MH188) from pump to timing gear case adapter and note whether the line mark on front flange of pump is registered with a similar mark on the pump drive hub as shown at (1) in Fig. MH192. If marks do not align as shown, the timing is incorrect.

To correct the timing, loosen the bolts or screws which hold the gear to the hub and move gear (which has elongated screw holes) to position where marks are aligned as mentioned. This can be done without removing the injection pump by first removing the small cover from the front of the adapter if no hydraulic pump is installed on the engine, or, by removing the hydraulic pump when so equipped.

103. **CHECK AND TIME PSB PUMP.** Some model 55D tractors are equipped with this pump which is driven at crankshaft speed instead of camshaft speed for the APE pump. To check timing with pump on engine, first remove the timing window from left face of pump. Tie the shut-off arm (A—Fig. MH185) back with piece of light gage wire so as to prevent accidental starting of the engine. Remove small cover from flywheel inspection port, also remove externally threaded plug from number one cylinder energy cell or remove valve rocker cover. Grip the energy cell cap with pliers as shown in Fig. MH186 and pull it out of the chamber.

Rotate crankshaft until air is felt escaping from energy cell opening or until both valves of number one cylinder are closed then slowly until the

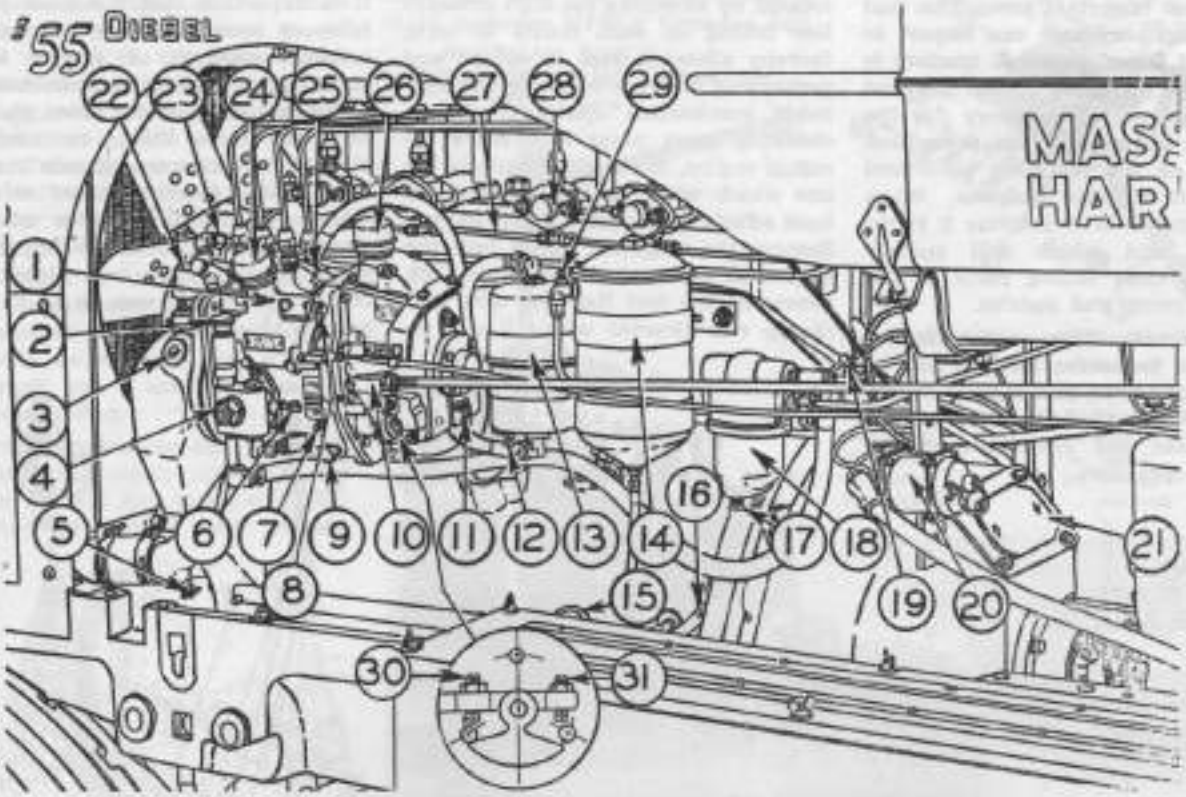


Fig. MH188—Bosch APE pump installation on Massey-Harris model 55 Diesel.

1. Fuel injection pump
2. Hand primer
3. Inspection plug for timing marks on pump drive hub
4. Fuel supply pump
5. Radiator drain cock
6. Injection pump oil level cock
7. Pump drain plug
8. Shut-off control or fuel stop
9. Drain plug, governor unit
10. Throttle control
11. Level cock for lubricating oil (governor unit)
12. Secondary filter drain plug
13. Secondary filter
14. Engine oil filter
15. Engine oil bayonet gage
16. Inspection hole for flywheel marking
17. Drain plug primary filter
18. Primary filter
19. Shut-off valve for hand primer
20. Solenoid switch
21. Clutch inspection cover
22. Engine oil filler
23. Fuel return line to tank
24. Lubricating oil filler cap (injection unit)
25. Fuel inlet line
26. Governor oil filler
27. Leak-off lines
28. Fuel injector
29. Air bleed and filler plug
30. High idle speed adjusting screw
31. Low idle speed adjusting screw

flywheel mark indicating 32 degrees before top center is aligned with the pointer pin as shown in Fig. MH190. On some engines this point on the flywheel is stamped "INJ". Remove ¼ inch pipe plug from pump to timing gear case adapter. At this time the line mark (7—Fig. MH185) on the pump drive hub should be in register with the pointer (6) extending from the front face of the pump. The "O" mark in the pump window should also be within ⅜ inch of being in register with the line mark (4) machined on the apex of one of the teeth in the plunger drive gear as shown. Latest PSB pumps do not have the "PC" mark shown. If marks do not align as mentioned the timing is incorrect.

To correct the timing, loosen the bolts which hold the pump to the engine and swing pump through the range provided by the elongated holes in the pump body mounting flange. If elongated holes do not provide enough range to bring marks into register the pump should be removed and gear re-meshed.

FUEL FILTERS

104. Most important precaution that repair shop personnel can impart to owners of Diesel powered tractors is to urge the owner to "drain the first stage or primary filter every day the engine is operated". This precaution is based on the fact that all Diesel fuels contain some sulphur. When water is mixed with sulphur it forms sulphuric acid which will quickly erode the close fitting parts of the injection pump and nozzles.

The primary filter which is the closest one to the fuel supply tank in the Massey-Harris fuel supply circuit should be drained daily. It should be disassembled and cleaned every 60 hours of operation.

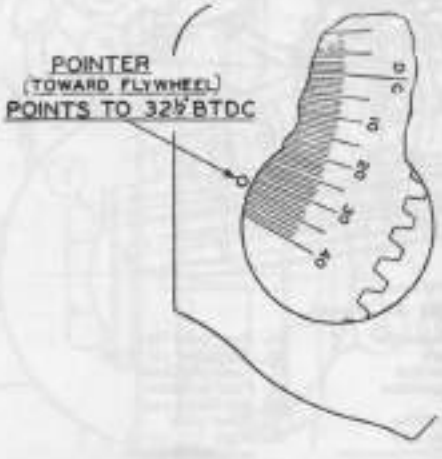


Fig. MH190—Massey-Harris model 55 tractor engine flywheel marks.

The system should be primed each time the primary filter is disassembled. This is accomplished by simply loosening the connection ahead of the filter to bleed out the air.

Also included in the fuel supply system is a wire mesh filter in the fuel tank filler inlet, a sediment bowl at the bottom of the supply tank, and the secondary filter located between the primary or transfer fuel pump and the injection pump. All of these filters should be checked periodically in accordance with the tractor manufacturer's instruction books.

DIESEL NOZZLE UNITS

Unless the shop is equipped with the necessary nozzle tester, servicing of the nozzles should be confined to the minor work described in paragraph 107. A proper job of servicing the nozzle tip as described in paragraph 107 requires the use of Bosch Centering Sleeve No. TSE773.

105. **LOCATING FAULTY NOZZLE.** If one engine cylinder is misfiring it is reasonable to suspect a faulty nozzle. Generally, a faulty nozzle can be located by loosening the high pressure line fitting on each nozzle in turn; thereby allowing fuel to escape and preventing it from entering the cylinder combustion chamber. As in checking spark plugs in a spark ignition engine, the faulty nozzle is the one which when its line is loosened, least affects the running of the engine. Remove the suspected nozzle from the engine as outlined in paragraph 106, reconnect the fuel line and with discharge end directed where it will do no harm, crank the engine and observe the spray pattern as shown in Fig. MH195.

If the spray pattern is ragged it is likely that the nozzle is the cause of the misfiring but to prove the diagnosis, install a new or rebuilt nozzle or a nozzle from a cylinder which is firing regularly. If the cylinder fires regularly with the other nozzle, the condemned nozzle should be serviced as per paragraph 107. If cleaning and/or tip (body) renewal does not restore the nozzle, it should be overhauled by a shop equipped to handle such work.

106. **R & R NOZZLE.** Before loosening any lines, wash connection with fuel oil or kerosene. After disconnecting high pressure and leak-off lines, cover open ends with tape or composition caps to prevent entrance of dirt. Remove nozzle holder stud nuts and carefully pull nozzle from head being careful not to strike end of nozzle against any hard surface.

Thoroughly clean the nozzle recess in the cylinder head before reinserting the nozzle holder assembly. It is important that the seating surfaces of recess be free of even the smallest particle of carbon which could cause the unit to be cocked and result in blowby of hot gases. No hard or sharp tools should be used for cleaning. Bosch recommends the use of a wooden dowel or brass bar stock which can be shaped for effective cleaning. Do not reuse the copper ring gasket, install a new one. Tighten the nozzle holder stud nuts to 14-16 foot-pounds torque.

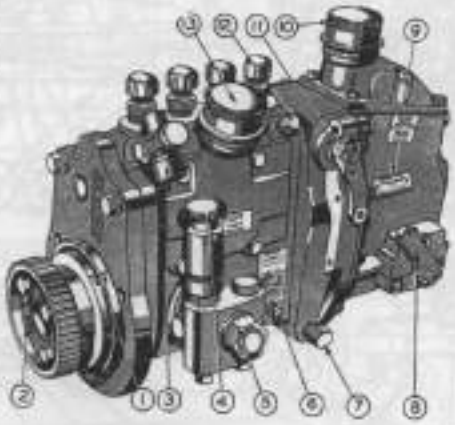


Fig. MH192—Three-quarter view of Bosch APE pump as used on Massey-Harris model 55 Diesel.

1. Timing marks
2. Slotted holes for timing
3. Fuel return to tank
4. Hand primer
5. Fuel supply pump
7. Governor drain
8. Throttle control
9. Governor compartment
10. Oil filler for governor
11. Fuel shut-off
12. Fuel inlet
13. Oil filler for main compartment

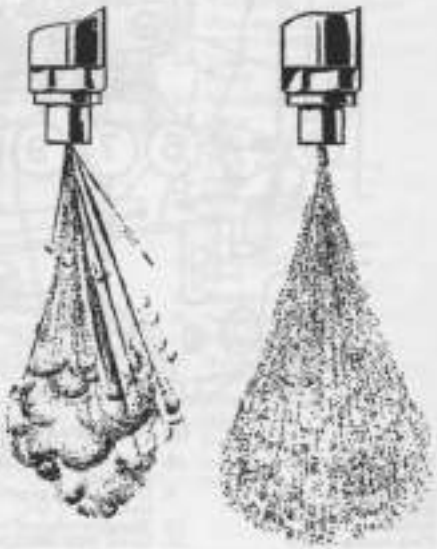


Fig. MH195—Spray patterns of a standard pintle type nozzle. Left: A poor spray pattern. Right: Ideal spray pattern.

107. **MINOR SERVICING OF NOZZLE.** Hard or sharp tools, emery cloth, crocus cloth, grinding compounds or abrasives of any kind should NEVER be used in the cleaning of nozzles.

Carefully clamp nozzle holder in vise and remove the nozzle cap nut as shown in Fig. MH198 and remove the spray nozzle consisting of the body or tip (T) and the valve (V). Soak the nozzle in fuel oil, acetone, carbon-tetrachloride or similar carbon solvent being careful not to permit any of the polished surfaces of valve or tip to come into contact with any hard substance.

All surfaces of the nozzle valve (pintle) should be bright and shiny except the contact line of the beveled seating surface. Polish the valve (pintle) with mutton tallow used on a soft cloth or felt pad. The valve may be held by its stem in a revolving chuck during this operation. A piece of soft wood well soaked in oil, or a brass wire brush, will be helpful in removing carbon from the valve.

The inside of the nozzle body (tip) can be cleaned by forming a piece of soft wood to a point which will correspond to the angle of the nozzle valve (pintle) seat. The wood should be well soaked in oil. Some Bosch mechanics use an ignition distributor felt oiling wick instead of the soft wood for cleaning the pintle seat in the tip. Delco-Remy part DR804076 is suitable for the purpose. Form the end of the wick and coat the formed end with tallow for polishing.

The orifice at the end of the tip can be cleaned with a wood splinter. Outer surface of the nozzle body or tip should be cleaned with a brass wire brush and a soft cloth soaked in carbon solvent.

Before reassembling the nozzle to the holder, thoroughly rinse all parts in clean fuel oil and make sure that all carbon is removed from the cap nut. It is desirable that the nozzle tip or body be perfectly centered in the cap nut. A centering sleeve American Bosch tool TSE 773 (Fig. MH199) is available and should be used for this purpose. Avoid over-tightening of the cap nut.

Further disassembly of the nozzle holder should not be attempted except in an emergency or when a nozzle testing device is available for readjustment of the opening pressure. Recommended opening pressure for new nozzles is 1900-1950 psi; for old holders and nozzle or old holder and new nozzle tip 1750-1850 psi.

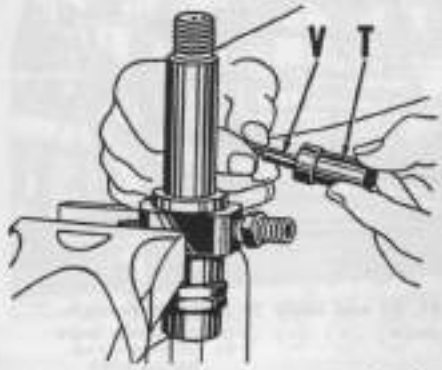


Fig. MH198—Removing Massey-Harris Diesel engine spray nozzle tip (T) and the valve (V).

DIESEL ENERGY CELLS

108. **R & R AND CLEAN.** When the engine smokes excessively or fuel consumption is above normal the cause may be sometimes traced to an excessive amount of carbon deposit in the energy cells. An emergency job of cleaning the cells Fig. MH200 can be done by removing the cell cap (99) and using a hooked wire to form a scraper.

To remove complete energy cell first remove the threaded plug and take out the retainer and cell cap as shown in Fig. MH186. If the energy cell will not come out with the fingers, screw a 15/16 diameter NF20-2 threaded bolt into the threaded end of the energy cell. A nut and collar on the bolt will make it function as a puller. If no puller is available remove the injection nozzle and use a brass rod to drift the energy cell out of cylinder head.

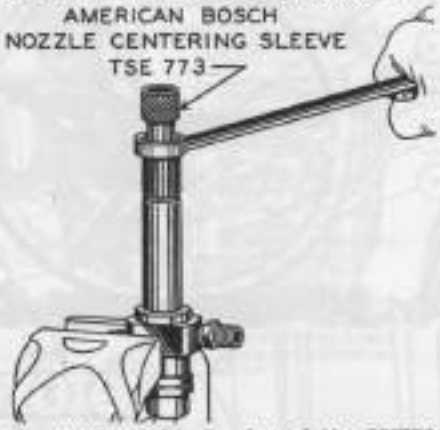


Fig. MH199—Using Bosch tool No. TSE773 to center nozzle tip in the cap nut.

DIESEL PREHEATER

109. To assist in cold weather starting, the inlet manifold is equipped with an electrically operated preheater. Included in the preheater set up is a special spark plug (39—Fig. MH204) and a separate ignition coil. Disassembly procedure for the preheater is self-evident. Malfunctioning of the unit is usually caused by fouling or grounding of the spark plug. Recommended preheater plug is AC F1 or equivalent. Plug is available under Massey-Harris parts number 761923M1.

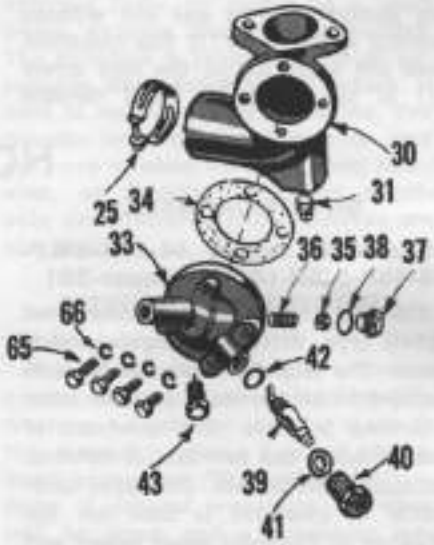


Fig. MH204—Massey-Harris Diesel engine manifold preheater.

30. Elbow
33. Air heater body
34. Gasket
35. Filter
36. Spring
37. Nozzle body
38. Washer
39. Spark plug
40. Nut
41. Gasket
42. Ground electrode

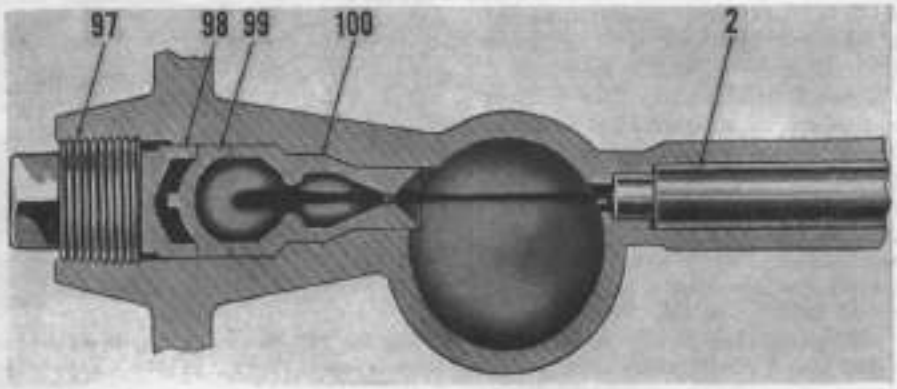


Fig. MH200—Energy cell (pre-combustion chamber) is located in each cylinder and opposite to the nozzle.

2. Nozzle 98. Retainer 99. Cell cap 100. Energy cell

DIESEL ENGINE GOVERNOR

Models 44D-55D (APE & PSB Pumps)

110. **ADJUST LINKAGE.** Before adjusting the governor, make sure that the throttle linkage is so adjusted that it will provide full travel of the governor lever on the injection pump but avoids overloading the governor lever which would result from too much over-travel of the throttle linkage.

110A. To check and adjust the throttle linkage, hold the injection pump governor (throttle) arm (10—Fig. MH 188) in the full forward position and the hand throttle in the full forward position. Remove clevis pin at governor lever clevis. If idle stop screw (1—Fig. MH205) on hand throttle lever is correctly adjusted, the clevis pin should slide in and out without moving either lever. If this condition does not exist, adjust the stop screw (1) at the operator's hand throttle until free entry of clevis is obtained.

110B. To check and adjust high idle portion of linkage, proceed as in paragraph 110A except hold the governor lever and throttle lever in the rear or full throttle position and adjust stop screw (2) instead of screw (1).

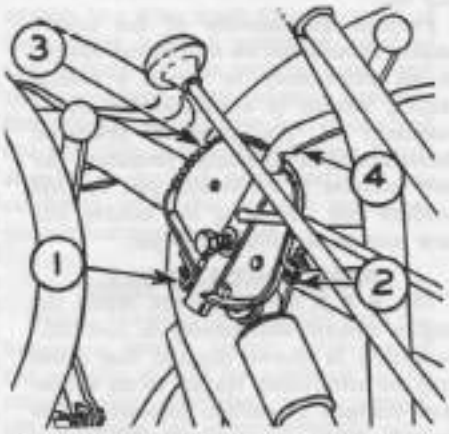


Fig. MH205—Massey-Harris Diesel engine hand throttle.

1. Low idle stop screw
2. High idle stop screw
3. Quadrant
4. Throttle lever

111. **ADJUST GOVERNOR STOPS.** Governor should produce the speeds listed below. To reset governor, first correlation mark the governor throttle arm (10—Fig. MH188) on injection pump and the shaft to which it is attached, so as to assure correct reassembly. Remove the three screws and the two piece cover. Adjust screws (30) and (31) until recommended low and high idle speeds are obtained. Install a new seal when adjustment is completed.

Check adjustment of linkage as per paragraphs 110A, 110B to prevent excessive loading of the governor lever.

Speed Settings
Models 44D and 55D

Low Idle Engine	500 to 700
44D Low Idle B.P.	329 to 445
55D Low Idle B.P.	270 to 375
High Idle Engine	1500 to 1520
44D High Idle B.P.	960 to 970
55D High Idle B.P.	810 to 822

NON-DIESEL GOVERNOR

GOVERNOR DETAILS

All models except 44-44K-44LP-55-55K-55LP-101-101 Super-201

115. The governor is a variable speed flyball type, driven by engine timing gears. The throttle lever quadrant is notched to hold lever in position after a setting is made. The quadrant of some models has two sets of notches. On such installations, the upper two-thirds of quadrant is used for the drawbar or Standard speed range; and the raised set of notches on the lower part of quadrant, for the Twin-Power or belt pulley speed range. The first of the raised set of notches acts as a throttle lever stop, making it necessary to raise the throttle lever to move it into the higher speed range. Models which do not have raised quadrant notches are provided with either a governor speed control system which is linked to transmission gear shifting mechanism or a manually operated control lever. Those models which have a transmission shift lever operated Twin-Power control, cannot be operated in the highest throttle speed range if transmission gears are shifted into any position other than high speed or belt pulley position. Those having a manual control lever cannot be shifted into Twin-Power unless transmission gears are in neutral position. The governor mounting bracket is provided with slotted holes to permit gear backlash adjustment.

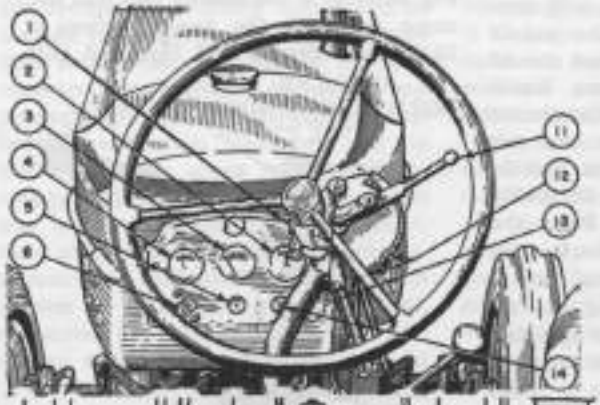


Fig. MH 206—Typical Massey - Harris instrument panel and governor quadrant.

1. Quadrant clamp
2. Ammeter
3. Oil pressure gauge
4. Heat indicator
5. Ignition switch
6. Starter switch
11. Throttle lever
12. Raised quadrant notches
13. Choke button
14. Light switch

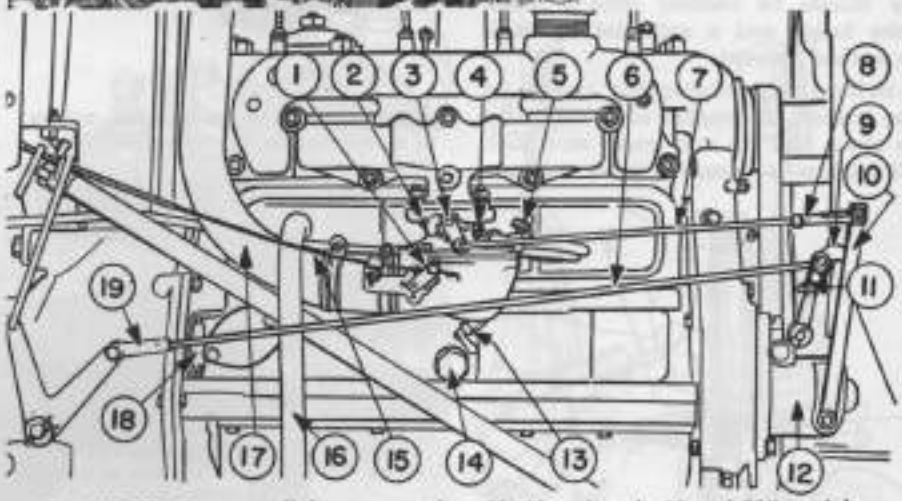


Fig. MH 207—Governor linkage as used on 81, 82 and early 20 and 20K models.

1. Choke lever
2. Throttle stop screw
3. Arm
4. Idle mixture adjustment
5. Main jet adjustment
6. Hand throttle rod
7. Governor to carburetor link
8. Clevis
9. Governor lever
10. Governor arm
11. Speed adjusting screw
12. Governor
13. Carburetor drain
14. Oil pressure adjusting screw
15. Choke wire
16. Crankcase vent
17. Air intake tube
18. Timing hole
19. Throttle rod

TABLE 6

Governed Speeds in RPM

TRACTOR MODELS	SPEED RANGE	CRANKSHAFT Load	CRANKSHAFT No Load	BELT PULLEY Load	BELT PULLEY No Load	POWER TAKE-OFF Load	POWER TAKE-OFF No Load
20, 20K	Std.	1500	1640	1020	1115	551	603
20, 20K	T.P.	1800	1910	1224	1292	661	695
22, 22K	Std.	1500	1724	1020	1172	551	633
22, 22K	T.P.	1800	1951	1224	1327	661	759
30, 30K	Std.	1500	1724	698	802	551	633
30, 30K	T.P.	1800	1951	938	907		
44, 44K, 44LP	Std.	1350	1515	883	987	534	599
44(6)	Std.	1500	1724	698	802	551	633
44(6)	T.P.	1800	1990	838	922		
55, 55K	Std.	1350	1515	730	819	521	585
81, 82	Std.	1500	1640	1020	1115	551	603
81, 82	T.P.	1800	1910	1224	1292	661	695
101 Jr., 102G Jr.	Std.	1500	1840	698	762	557	585
101 Jr., 102G Jr.	T.P.	1800	1910	837	888		695
102 Jr., 101 Sr., 102G Sr.	Std.	1500	1840	698	762	557	585
102 Jr., 101 Sr., 102G Sr.	T.P.	1800	1910	837	888		695
101, 101 Super	Std.	1500	1685	698	780		590
101, 101 Super	T.P.	1800	1940	837	898		705
102 Sr.	Std.	1600	1720	745	800	587	615
102 Sr.	T.P.	1900	2000	885	930	697	960
201	Std.	1700	1885	713	900	542	600
201	T.P.	2000	2140	839	1000	637	680
202, 203, 203G	Std.	1700	1900	690	871	542	605
202, 203, 203G	T.P.	2000	2125	810	985	637	676

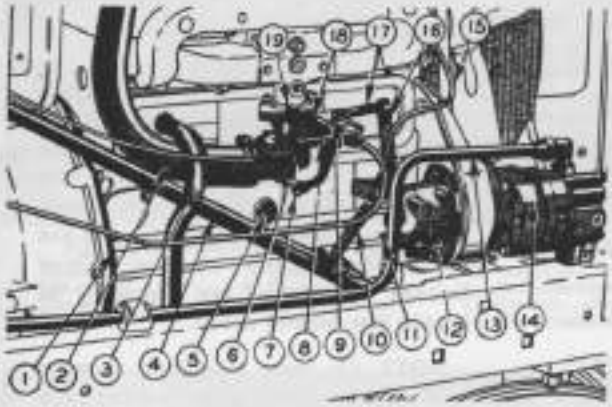


Fig. MH 208 — Governor linkage as used on models 22 and 22K. Late model 20 and 20K linkage is similar.

1. Crankcase ventilator
2. Oil pressure relief valve plug
3. Choke lever
4. Carburetor drain plug
5. Governor to carburetor rod
6. High speed adjusting needle
7. Governor spring
8. Bumper spring adjusting screw
9. Governor
10. Hydraulic outlet line
11. Hydraulic pump
12. Governor oil line
13. Governor arm
14. Adjusting yoke and lock nut
15. Idle adjusting needle
16. Idle speed adjusting screw

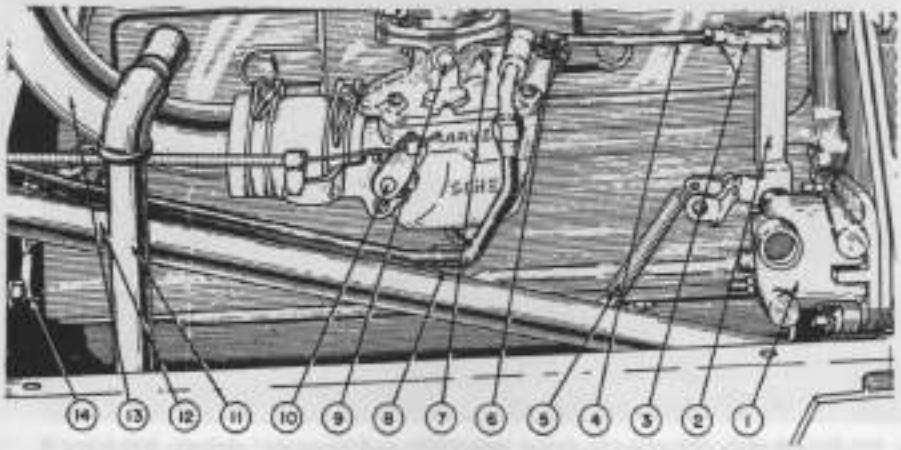


Fig. MH 209—Typical governor linkage as used on early 30, 30K and 44 (6) models.

1. Governor
2. Governor arm
3. Adjusting clevis
4. Link rod
5. Governor spring
6. Main jet adj.
7. Idle jet adj.
8. Relief valve plug
9. Throttle shaft
10. Choke lever
11. Crankcase vent.
12. Hand throttle rod

Models 101-101 Super-201

116. The governor, which is similar to those listed in paragraph 115, is fan belt driven. Governor and throttle controls are also similar. Models 101 and 101 Super have a governor control linked to transmission gear shifter mechanism and model 201 has a separate hand operated governor control. The governor mounting bracket is provided with slotted holes to permit belt adjustment. Holes are slotted horizontally, and it is important that bracket be moved an equal distance in both slots to prevent binding of governor arms.

Models 44-44K-44LP-55-55K-55LP

117. The governor weights and actuating parts are mounted internally, on front face of camshaft timing gear. Governor action is transmitted to an external lever by means of a shaft which extends from engine casting. The governor is provided with an adjustable dampening spring which is used to stabilize governor action. The throttle lever quadrant may or may not have a raised set of notches; however, as Standard drawbar speeds only are available, raised notches are not used.

GOVERNOR ADJUSTMENT

All Models

Due to the wide variety of governor control linkage used on the various tractors, no attempt will be made in this manual to give a detailed adjustment procedure for specific applications. A general procedure, however, will be given, and a competent mechanic should be able to perform the work satisfactorily. With the aid of the accompanying illustrations, completely familiarize yourself with the specific application at hand, before attempting any adjustments. Recommended governed speeds are given in Table 6.

On most models, the governor control quadrant is equipped with two sets of notches; the raised set is used

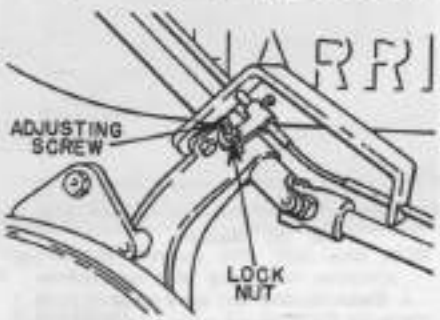


Fig. MH 210—Governor stop screw as used on early 30, 30K and 44 (6) models.

for Twin-Power (belt pulley) speed range; the other set, for Standard (drawbar) speed range. On some models, one control rod and one adjusting screw are used for the Standard (drawbar) speed range, and another control rod and adjusting screw are used for the Twin-Power (belt pulley) speed range. When making adjustments on these models, make certain that proper rod and screw are used.

118. Before starting the engine, the first step in the adjusting procedure is to synchronize the governor to carburetor linkage as follows: Disconnect the governor-to-carburetor rod, adjust the length of the rod so that carburetor throttle butterfly is wide open when governor flyweights are completely in and reconnect the rod. NOTE: The length of this rod should not be changed when making any subsequent adjustments.

118A. Start engine and run until engine is at normal operating temperature. Move hand control lever to a point where maximum Standard (drawbar) speed will be obtained. On models equipped with two sets of notches on the quadrant, this setting will be the last notch in the lower set. Check engine speed using the Standard speed range data given in Table 6. If speed is not as specified, change the governor spring tension by making whatever linkage changes as are necessary to obtain the desired operating speed. On some models, this adjustment is accomplished by changing the relative position of the quadrant with respect to its mounting; on others, by changing the effective length of the governor control rod; and on still others, by means of an adjusting screw. For example: On models with linkage as shown in Fig. MH207, adjust the length of rod (19) to obtain the desired speed. On models shown in Fig. MH215, turn screw (14) to change the speed. On some other models, loosen set screw at rear end of control rod and move rod forward or rearward to change the speed. On models equipped with a control rod stop screw, adjust the screw until the screw just contacts the stop boss.

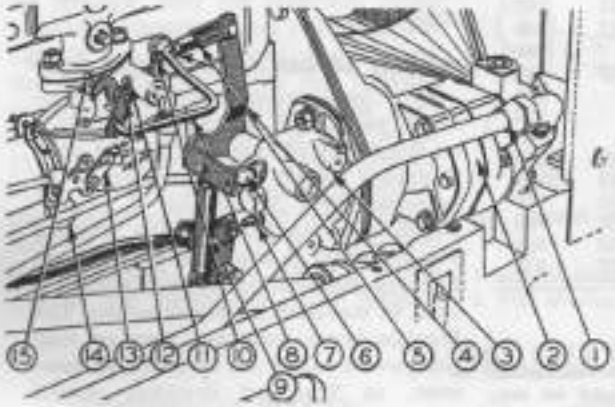


Fig. MH 211 — Typical governor linkage as used on late 30 and 30K models.

1. Hydraulic line
2. Hydraulic pump
3. Governor
4. Governor arm
5. Adjusting yoke and lock nut
6. Governor oil line
7. Bumper spring adjusting screw
8. Governor to carburetor rod
9. Governor spring
10. Main jet adjustment
11. Idling jet adjustment
12. Butterfly valve shaft
13. Choke lever
14. Oil pressure relief valve plug

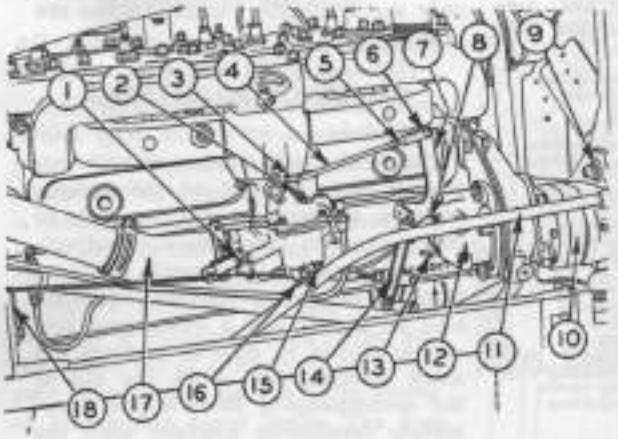


Fig. MH 212—Governor linkage as used on late model 44 (6) tractors.

1. Choke lever
2. Idling jet adjustment
3. Arm on butterfly shaft
4. Governor to carburetor rod
5. Lock nut
6. Adjusting yoke
7. Governor arm
8. Oil line to governor
10. Hydraulic pump
11. High pressure line
12. Governor
13. Bumper spring adjusting screw
14. Governor spring
15. Carburetor drain
16. Main jet adjustment
17. Air cleaner tube
18. Timing mark cover

118B. On models where Twin-Power speed range is specified in Table 6, lift the control lever up and onto the raised set of quadrant notches and pull the lever down all the way. Check the Twin-Power speed. If speed is not as specified, make whatever minor linkage changes as are necessary to obtain the desired speed.

NOTE: On some models, it may be necessary to arrive at somewhat of a compromise between the Standard and Twin-Power speed range.

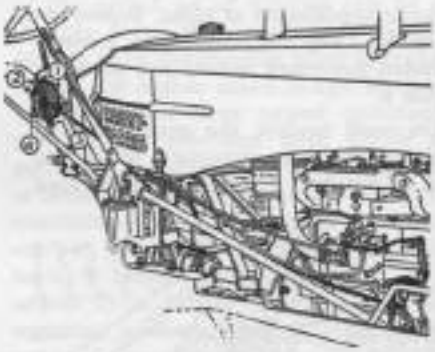


Fig. MH 213—Typical governor stop screw arrangement as used on late 30, 30K and 44 (6) models.

1. Standard (drawbar) speed range
2. Twin-power (belt pulley) speed range
3. High idle stop screw
4. Low idle stop screw

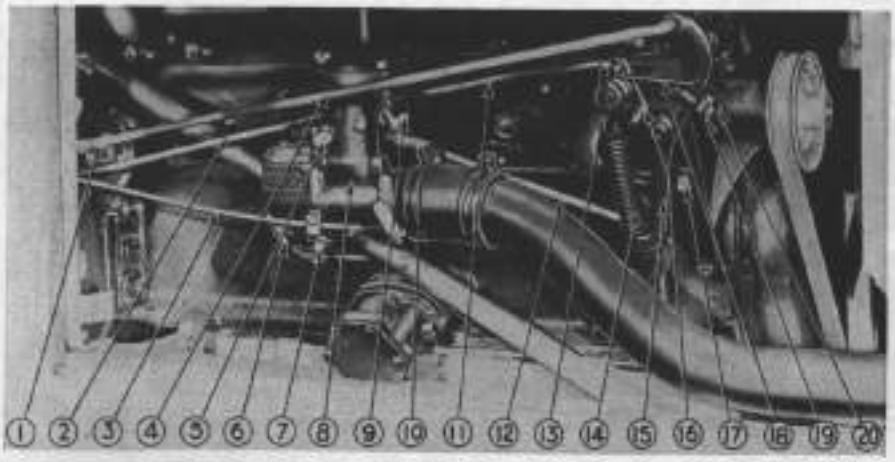


Fig. MH 214—Models 101 and 101 Super carburetor and governor controls. Governor is belt driven.

1. Adjustment clevis
2. T.P. control rod
3. Choke wire
4. Hand throttle rod
5. Idle jet adjust.
6. Drain plug
7. Main jet adjust.
8. Carburetor
9. Idle speed screw
10. Adjusting clevis
11. T. P. control rod
12. Link rod
13. Governor arm
14. Governor spring
15. Governor lever
16. Stop block
17. Drain plug
18. Governor lever link
19. Standard adj. screw
20. T.P. adj. screw

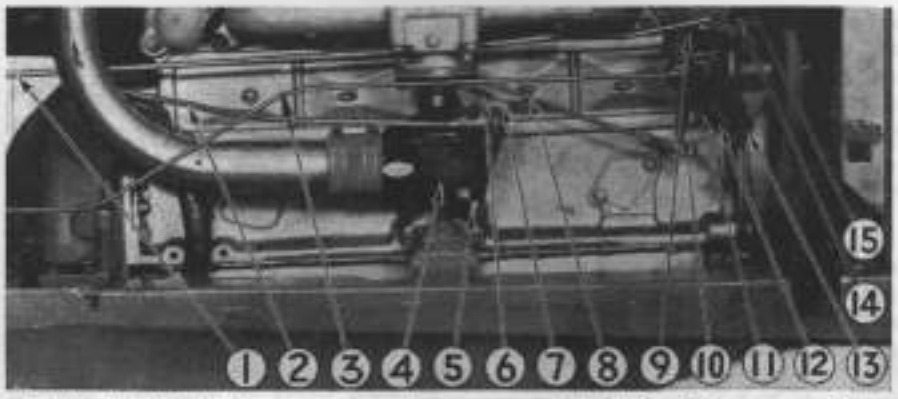


Fig. MH 215—Model 201 carburetor and governor controls. Notice that governor is belt driven.

1. Hand throttle rod
2. Fuel line
3. T.P. control rod
4. Carburetor
5. Drain plug
6. Idle jet adjust.
7. Main jet adjust.
8. Link rod
9. Speed stop block
10. Governor arm
11. Drain plug
12. Governor spring
13. Governor lever
14. Standard adj. screw
15. T.P. adj. screw

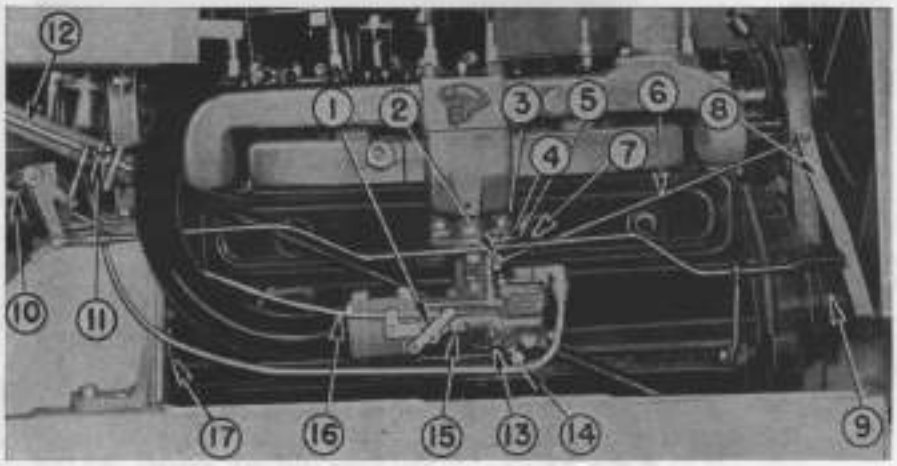


Fig. MH 216—Models 101 Sr. and 102G. Sr. carburetor and governor controls.

1. Choke lever
2. Idle jet adj.
3. Throttle valve arm
4. Ball joint
5. Locknut
6. Link rod
7. Crankcase vent.
8. Governor arm
9. Governor
10. Governor spool adj.
11. Throttle rod arm
12. Hand throttle rod
13. Drain plug
14. Main jet adj.
15. Relief valve plug
16. Choke wire

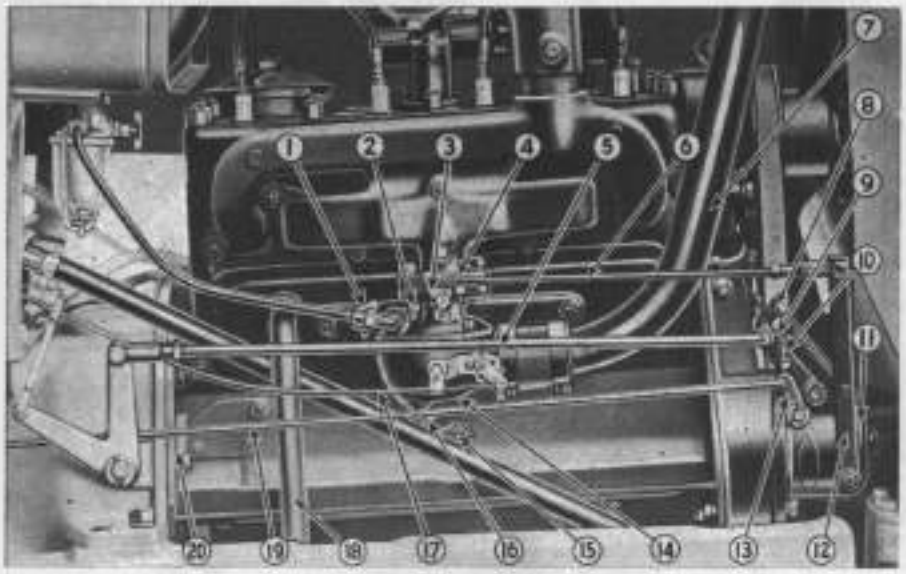


Fig. MH 218—Models 101 Jr., 102 Jr., 102G. Jr., governor and carburetor controls.

1. Main jet adj.
2. Idle jet adj.
3. Throttle lever
4. Idle adj. screw
5. Hand throttle rod
6. Link rod
7. Air inlet tube
8. Governor lever
9. T.P. adj. screw
10. Standard adj. screw
11. Governor
12. Governor arm
13. Stop block
14. Carburetor
15. Relief valve plug
16. Drain plug
17. Choke wire
18. Crankcase vent.
19. T.P. control rod
20. Timing hole cover

118C. Move control lever to obtain minimum engine speed and check the engine low idle rpm. Adjust the idle (throttle stop) screw to obtain the desired speed.

118D. After completing the previously mentioned adjustments, move control lever through full governed speed range and observe for any surging tendency. Surging, hunting or unsteady running can be eliminated on some models by turning the bumper spring adjusting screw; on others, by relocating the governor spring in a different hole in the governor lever.

GOVERNOR OVERHAUL

All Models Except 44-44K-44LP-55-55K-55LP

Several different models of Novi, Pierce and Handy governors have been used. Since the disassembly procedure for each governor is different, a general procedure for all cannot be established. The following paragraphs 119, 120 and 121 give a brief description of each make of governor.

When the unit is disassembled, perform the inspection of parts as outlined in paragraph 122.

Governor mounting holes are slotted to provide drive gear or belt adjustment. On the gear driven type, move the governor housing in or out to provide some backlash between the camshaft and governor drive gears. On belt driven governors, move governor housing in or out to obtain the desired belt adjustment; the holes are slotted horizontally, and it is important that bracket be moved an equal distance in both slots to prevent binding of governor arms.

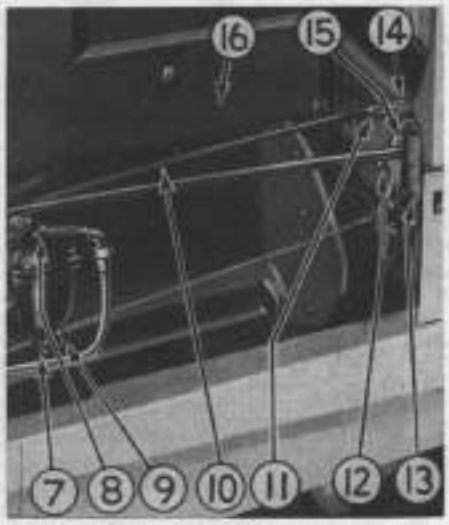


Fig. MN219—Models 202, 203, and 203Q carburetor and governor controls.

7. Main jet adj.
8. Idle jet adj.
9. Drain plug
10. Link rod
11. Stop block
12. T.P. adj. screw
13. Standard adj. screw
14. Governor arm
15. Governor lever
16. Manifold cover

119. **PIERCE GOVERNOR.** An exploded view of a typical Pierce governor is shown in Fig. MH225. The spider shaft is mounted on a ball bearing (15) at drive or base end and in a bushing (4) at the body end. Travel of the sleeve (26) on spider shaft, from weights-closed to weights-open position, is limited by the stop tips on the weights. These tips contact the weight carrier or spider (20) at weights full-open position. To increase this travel, the contacting surface of the tips can be ground off. Grind off only enough stock to obtain the desired sleeve travel. Exact measurement of travel for each model governor is not available but the travel is usually ¼ inch.

A governor repair kit is available for reconditioning the unit.

120. **NOVI GOVERNORS.** An exploded view of a typical Novi governor is shown in Fig. MH226. The steel balls (30) which act as centrifugal weights are driven by the slotted plate (20) which is fastened to the drive shaft. The balls are backed up by the outer race (22), and their centrifugal action forces the cup shaped inner race (24), thrust bearing (25) and race (26) to slide on shaft and contact the fork (15) on lever shaft.

Travel of the inner race, thrust bearing and fork base on the drive shaft is limited by the washers (27 & 28) on the shaft. Travel can be reduced by the addition of shims in front of the washers. Full travel should be 0.230-0.240 on Massey-Harris numbers 6666A and 6667A used on models 101Sr. and 102Sr. and 0.220-0.230 on all other models.

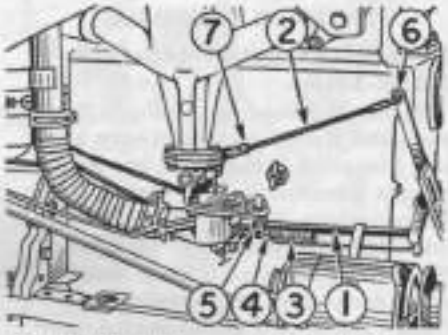


Fig. MH 220—Early model 44 and 55 non-Diesel governor linkage.

1. Control rod
2. Link rod
3. Lever spring
5. Anchor lug
6. Ball and socket
7. Locknut

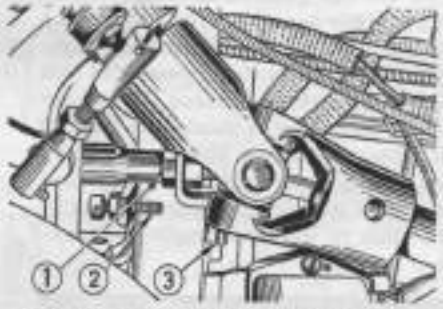


Fig. MH 221—Early model 44 and 55 non-Diesel throttle linkage.

1. Control rod clevis
2. Stop screw
3. Control rod stop

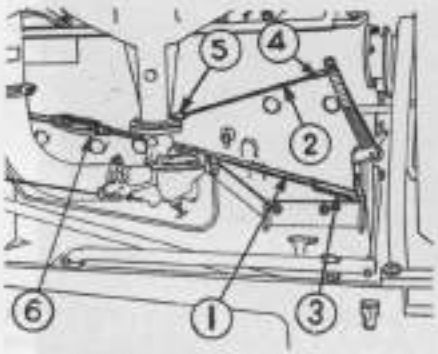


Fig. MH 222—Late model 44 and 55 non-Diesel governor linkage.

1. Governor control rod
2. Governor to carburetor linkage rod
3. Control rod to bell crank spring
4. Ball and socket joint
5. Lock nut on clevis
6. Turnbuckle for adjusting throttle control rod

Fig. MH222A—Model 102 Sr. carburetor and governor installation.

1. Choke lever
2. Idle jet adj.
3. Throttle valve arm
4. Ball joint
5. Locknut
6. Link rod
7. Crankcase vent.
8. Governor arm
9. Governor
10. Governor speed adj.
11. Throttle rod arm
12. Hand throttle rod
13. Drain plug
14. Main jet adj.
15. Relief valve plug

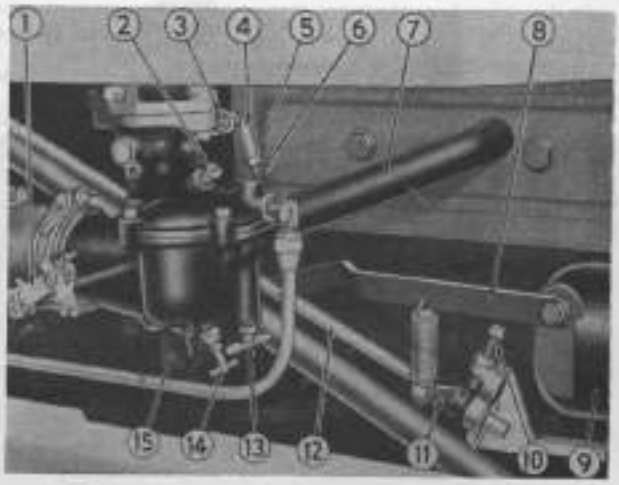
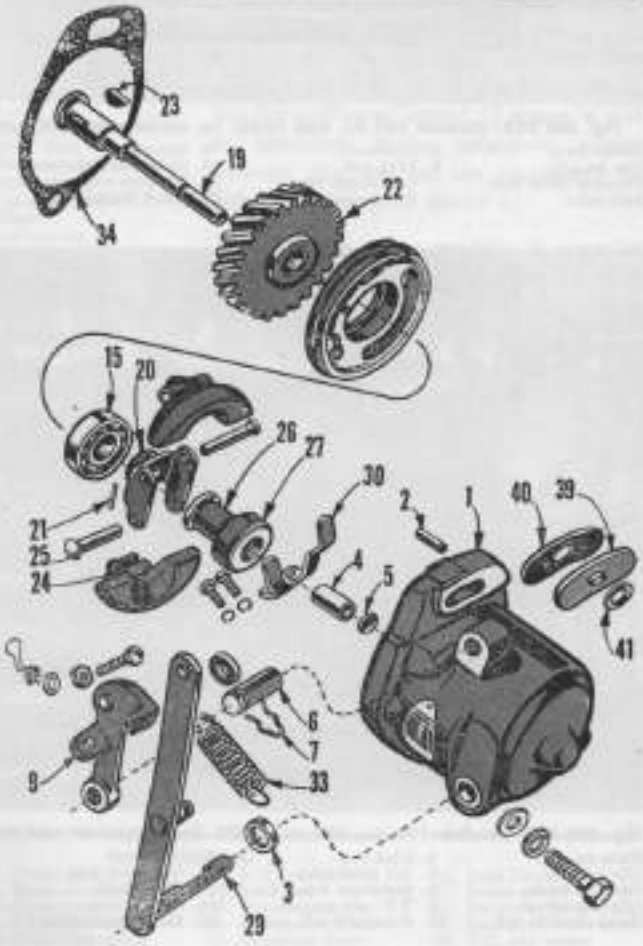


Fig. MH 225—Exploded view of typical Pierce flyweight type governor.

1. Body
2. Pin
3. Oil seal
4. Bushing
5. Thrust disc
6. Adjusting lever shaft
7. Hair pin
9. Adjusting lever
15. Bearing
19. Spider shaft
20. Spider
21. Groov pin
22. Drive gear
23. Woodruff key
24. Weight
25. Weight pin
26. Thrust sleeve
27. Bearing
28. Throttle shaft
30. Shifter fork
33. Control spring
34. Gasket
39. Plate washer
40. Gasket
41. Washer



A thrust disc (5) is installed in the body prior to installation of body bushing (4). This washer takes the thrust of the helical drive gear. I & T recommended end play of drive shaft is 0.004-0.020.

Spring-loaded type oil seals should be installed with lip of seal facing inward.

Lever shaft bushings can be driven out of the body after removal of the expansion plug. Removal of the drive shaft body bushing (4) requires use of an Ezy-Out type puller. I&T recommended clearance of drive shaft in body bushing is 0.004-0.005 and clearance of lever shaft in bushing or bore of body is 0.003-0.004.

121. **HANDY GOVERNOR.** Details of the Handy governor are similar to those of the Pierce. A cross-sectional view of a typical Handy governor is shown in Fig. MH227. Note that the rockshaft (16) is mounted in a roller bearing (27) at the lever end and the lever (13) is retained to rockshaft by a tapered pin.

122. **GOVERNOR INSPECTION.** After disassembly of a governor unit, clean all parts and inspect as follows:

WEIGHTS. Inspect for wear or flat spots on the surface which contacts the thrust sleeve. If weights are renewed, check sleeve travel. Check hinge pin holes for wear; weights should be free on pins but not sloppy.

BALLS. Inspect for flat spots and pits.

WEIGHT PINS. Check pins for excessive wear.

LOWER RACE. Inspect the race for grooves or roughness on the ball-contacting surface.

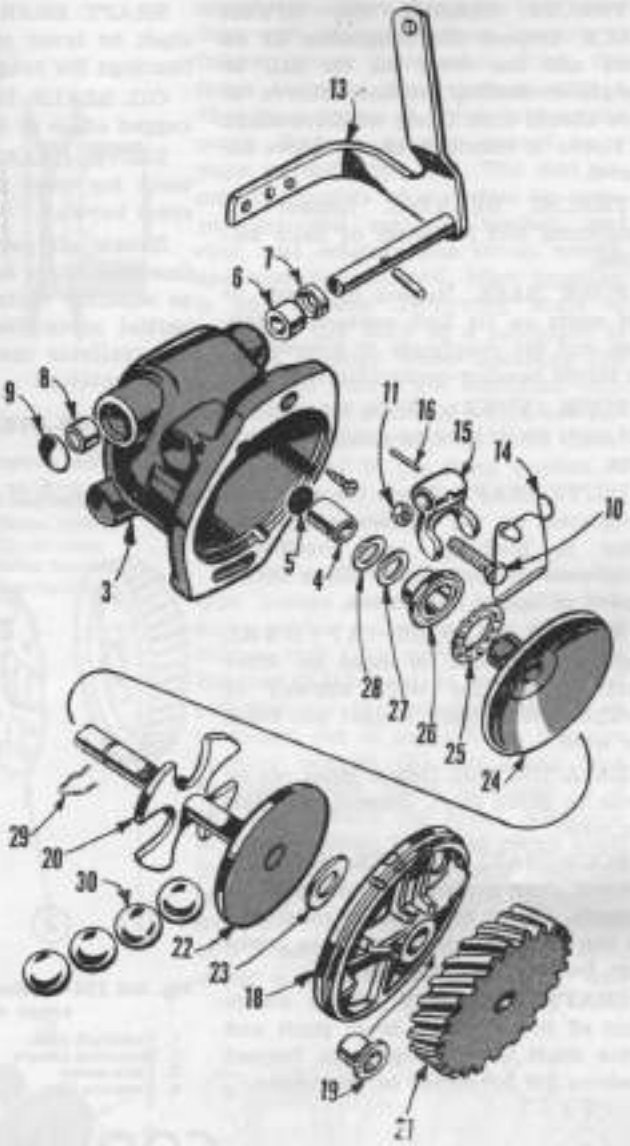


Fig. MH 226—Exploded view of typical Novi flyball type governor.

3. Body
4. Bushing
5. Thrust disc
6. Needle bearing
7. Oil seal
8. Bushing
9. Expansion plug
10. Bumper spring adjusting screw
11. Nut
13. Shaft and lever
14. Bumper spring
15. Fork
16. Groov pin
18. Base
19. Bushing
20. Plate and drive shaft
21. Drive gear
22. Ball race
23. Thrust washer
24. Inner ball race
25. Thrust bearing
26. Thrust bearing race
27 & 28. Spacer washers
29. Clip
30. Ball

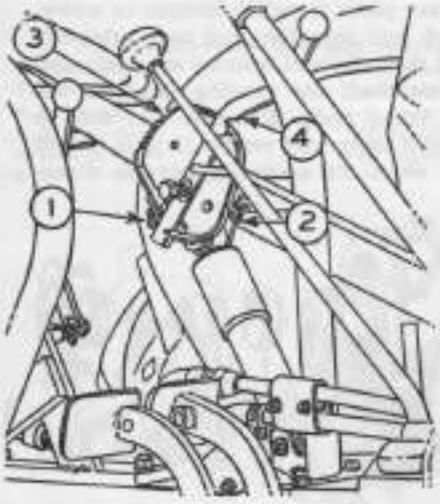


Fig. MH225A—Late model 44 and 55 non-Diesel throttle linkage and stops.

1. Low idle stop screw
2. High idle stop screw
3. Throttle quadrant
4. Throttle lever

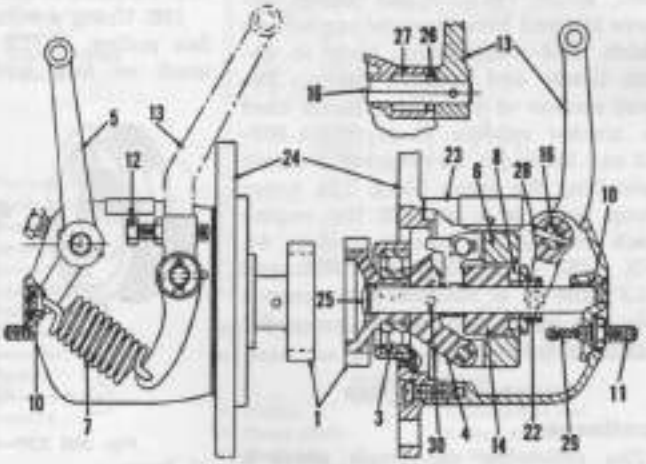


Fig. MH 227—Sectional views of typical Handy governor. Any slight differences is construction are evident after an examination of the unit.

1. Governor drive gear
2. Drive shaft bearing
4. Weight carrier
5. Operating lever
6. Governor weights
7. Governor spring
8. Thrust bearing
10. Body bushing
11. Bumper spring screw
12. Control lever screw
13. Manual control lever
14. Operating fork riser
16. Rockshaft
22. Fork base & bushing
23. Governor body
24. Governor base
25. Governor drive shaft
26. Packing & bearing retainer
27. Fork shaft bearing
28. Fork taper pin
29. Fork bumper spring
30. Weight carrier pin

THRUST SLEEVE OR UPPER RACE. Inspect for roughness in its bore and for wear on its ball or weight-contacting surface. Sleeve or race should slide freely on drive shaft. If sleeve is renewed, check sleeve for travel.

THRUST BEARING. Inspect for roughness and for wear of balls and races.

FORK BASE. Inspect for wear or flat spots on its fork-contacting surface and for roughness or grooves on its thrust bearing-contacting surface.

FORK (YOKE). Check for wear or flat spots on its bearing-contacting surface.

DRIVE SHAFT. Check for wear and roughness on the surface which rotates in bushings and check for roughness of surface on which thrust sleeve or upper race slides.

WEIGHT CARRIER (SPIDER). Carrier must not be loose on drive shaft. Check for worn keyway or lockpin hole. Check weight pin holes for wear.

BALL DRIVER. Driver must not be loose on drive shaft. Inspect ball slots for wear.

ROCKSHAFT (LEVER SHAFT). Inspect fork-mounting pin holes or threads. Check for wear or roughness on the surfaces which rotate in bushings, bearings or body bore.

SHAFT BUSHINGS. Check clearance of rockshaft or lever shaft and drive shaft in their bushings. Inspect bushing for looseness in body bore.

SHAFT BEARINGS. Inspect rockshaft or lever shaft and drive shaft bearings for roughness or wear.

OIL SEALS. Inspect seals for tears, ragged edges or deterioration.

DRIVE GEAR. Inspect drive gear teeth for wear or broken edges. Inspect keyway.

Renew all parts that are worn or damaged. Some items are not furnished as separate units but in complete or partial assemblies. Assemblies which are available can be determined from parts catalogs.

Models 44-44K-44LP-55-55K-55LP

123. The governor is accessible for removal and/or overhaul after removing the timing gear cover. Check condition of governor shaft (10—Fig. MH228), bearings (7), and bumper spring (14). If excessive clearance is noted, renew worn parts. Bumper spring should be renewed if it shows signs of being set or is distorted. Pull pressure disc assembly (4) out of mounting plate (2) and check plunger for wear. Remove the four screws holding governor mounting plate (2) to camshaft gear (1) and remove plate. Check plate and weight units for wear and renew complete unit if necessary. Reinstall parts in reverse order of removal and renew oil seals where necessary. Check and adjust governor when installation is complete.

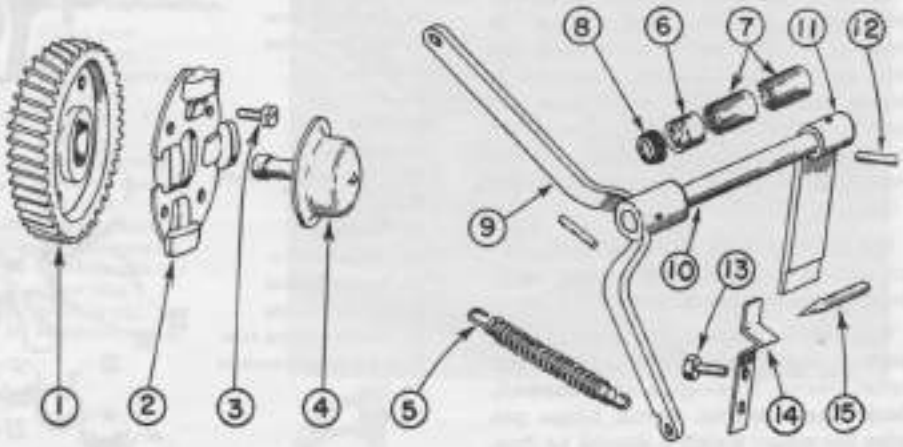


Fig. MH 228—Models 44, 44K, 44LP, 55, 55K and 55LP governor exploded view. The governor can be removed after removing the timing gear cover.

1. Camshaft gear
2. Mounting plate
3. Plate screw
4. Pressure disc
5. Control spring
6. Oil seal
7. Bearings
8. Oil seal
9. Governor lever
10. Governor shaft
11. Governor arm
12. Arm pin
13. Cap screw
14. Bumper spring
15. Spring adjusting screw

COOLING SYSTEM

R & R WATER PUMP

All models

125. To remove water pump, first drain cooling system and remove hood, grille, radiator and hoses. Remove fan and belt. Remove cap screws which hold water pump body to engine block and remove pump. The front section of the water pump used on tractor models 81-82-101SR-202-203 and 203G can be removed without disturbing the pump body. The water pump body is a part of the engine block casting on tractor models 44, 44D, 44K, 44LP, 55, 55D, 55K and 55LP, and it is necessary to remove only the front part of the pump for repair purposes.

OVERHAUL PUMP

Continental

The following paragraph gives a general procedure for overhauling water pumps as used on Continental engines. Differences in construction, which would vary the procedure slightly, are evident after an examination of the unit and reference to Figs. MH 229, 230, 231, 232 or 233.

126. Using a suitable puller, remove fan pulley. NOTE: Striking impeller shaft or hub with a hammer may damage the pump seal. Remove rear cover plate, impeller lockpin or screw, and pull impeller and seal assembly off shaft. Loosen bearing set screw and press shaft and bearing assembly out of pump body. Examine seal seat in pump body and renew if it is scored or worn. To assemble, reverse disas-

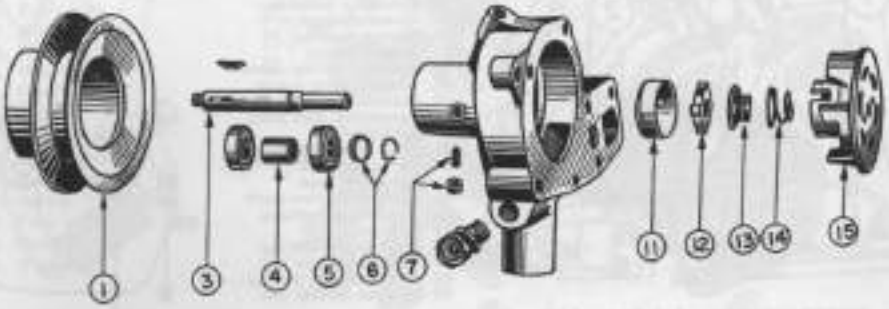


Fig. MH 229—Early type ball bearing pump used on Continental engines.

1. Pulley
3. Pump shaft
4. Bearing spacer
5. Ball bearing
6. Snap ring & retainer
7. Lock screw and nut
11. Seal cup
12. Seal disc
13. Neoprene seal
14. Seal spring
15. Impeller

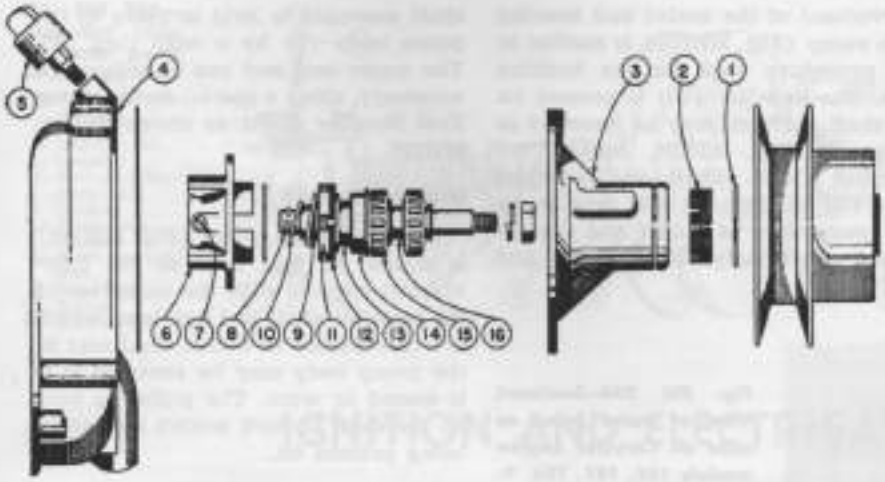


Fig. MH 230—Taper roller bearing type pump used on Continental engines.

1. Locking ring
2. Bearing adjuster
3. Front body
4. Rear body
5. Grease cup
6. Impeller
7. Set screw
8. Pump shaft
9. Neoprene seal
10. Seal spring
11. Seal cup
12. Seal disc
13. Thrust bushing
14. Thrust collar
15. Roller bearing
16. Bearing spacer

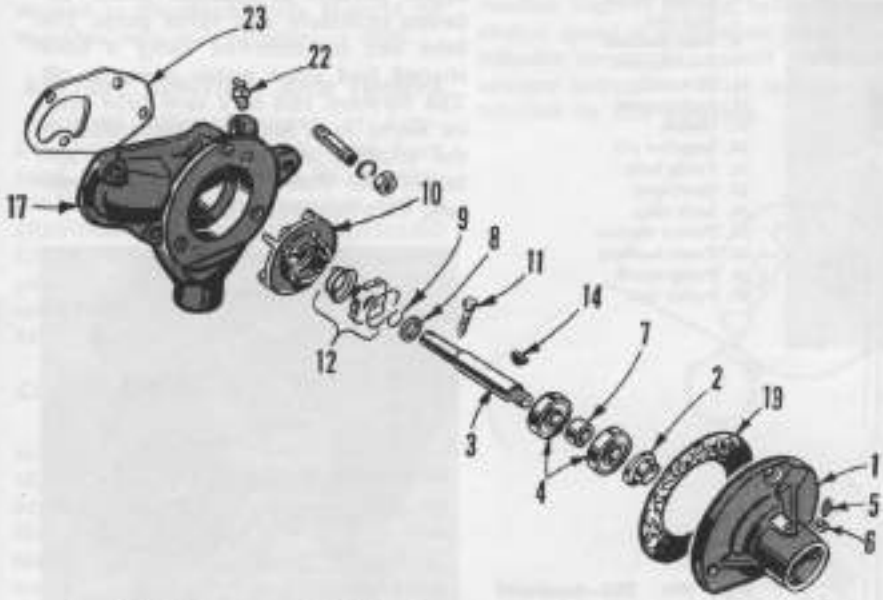
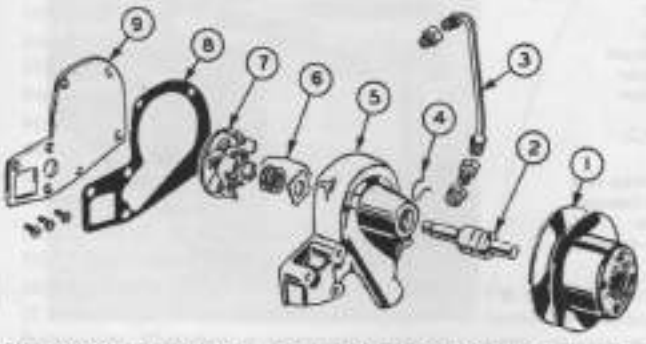


Fig. MH 231—Late type ball bearing pump used on Continental engines.

1. Shaft support
2. Seat for seal
3. Drive shaft
4. Ball bearing
5. Retainer screw
6. Nut
7. Spacer
8. Collar
9. Snap ring
10. Impeller
11. Set screw
12. Seal assembly
14. Woodruff key
17. Pump body
19. Gasket
22. Grease fitting
23. Gasket



1. Fan puller
2. Shaft and bearing assembly
3. By-pass tube assembly
4. Snap ring
5. Pump housing
6. Seal assembly
7. Impeller
8. Gasket
9. Plate to pump housing

Fig. MH232—Late style pump used on some Continental engines. Shaft and bearings are furnished as an assembly.

sembly procedure. Assemble ball bearings with the open faces inward to insure proper lubrication. Pack the space between the bearings with a fiber type grease. A water leak at the pump shaft is usually caused by a worn or defective seal. The seal assembly consists of a carbon or composition seal retainer washer, seal ring, seal retainer and thrust spring, and may be renewed, after impeller is off, without disturbing shaft or bearings. Use soap as a lubricant to prevent damage when installing the seal. Some pumps are equipped with tapered roller bearings which are adjustable by means of a threaded thrust collar located in the front portion of pump body.

Chrysler

127. To disassemble the bushing type pumps shown in Fig. MH 234, drive out fan pulley hub pin (10) and remove hub (20), using Chrysler Tool Number C-412. Remove rear cover and pull impeller (3) and shaft (19), as an assembly, out of pump body. Remove bushing lockpin (9) and using Tool Number C-373, press bushings (8 & 18), out toward the front. Assemble in reverse order, inserting pump shaft thrust washer (17) in pump body between front and rear bushing before front bushing is installed. Line burnish new bushings and reface seal seat, using a combination burnisher and

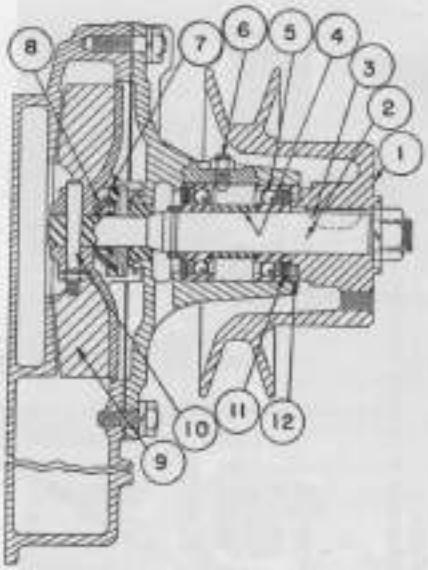


Fig. MH233—Sectional view of water pump as used on Continental engine models M290 and 330.

1. Pulley
2. Pump shaft
3. Shaft key
4. Bearing spacer
5. Ball bearing
6. Retainer screw
7. Neoprene seal
8. Seal spring
9. Impeller
10. Taper pin
11. Bearing seal
12. Grease retainer

seating Tool Number C-384. Install shaft, impeller and seal assembly using soap as a lubricant to prevent damage to the seal. Press pulley hub on front end of shaft and reinstall pin. Allow 0.003 inch end clearance between pulley hub and front bushing. Install rear cover using a new gasket and lubricate the pump using an approved water pump grease.

Overhaul of the sealed ball bearing type pump (Fig. MH235) is similar to the procedure used for the bushing type. The impeller (10) is pressed on the shaft (14) and may be removed as shown in Fig. MH236, using Tool Number C-498. Shaft and bearings (14—Fig. MH235) on this type pump are constructed as a unit and are renewed accordingly. The bearing and shaft assembly is held in place in the pump body (3) by a snap ring (6). The water seal seat can be refaced, if necessary, using a special facing cutter Tool Number C-551 as shown in Fig. MH237.

Massey-Harris

128. The water pump (Fig. MH238) is similar to that used on the Continental engines with the exception of the impeller shaft and bearings, which are constructed as a unit. Seal seat in the pump body may be renewed if it is scored or worn. The pulley is held on the shaft by lock screws instead of being pressed on.

WATER DISTRIBUTOR TUBE

Continental-Chrysler

129. Some engines are equipped with a water distributor tube located in the upper portion of cylinder block, between cylinders and valve ports. The tube can be removed using a hook shaped tool after water pump is off. The forward end of a new tube must be flared in a manner comparable to the original installation. Remove and inspect the tube at each engine overhaul or when water pump is off.

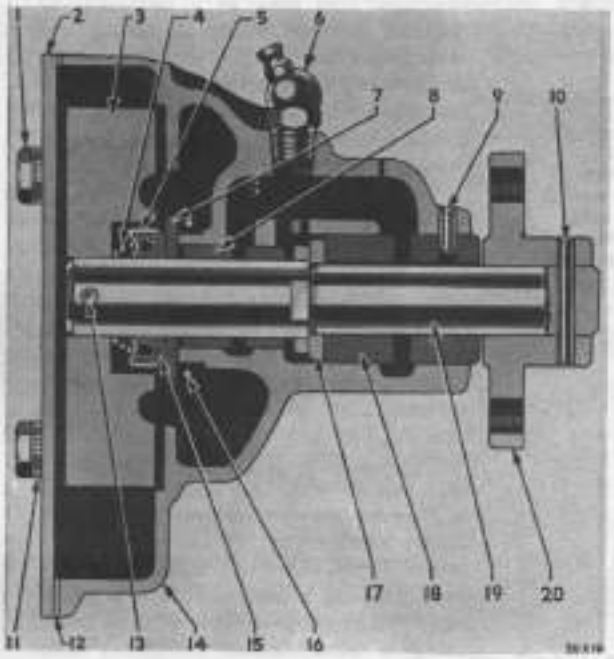


Fig. MH 234—Sectional view of water pump as used on Chrysler engine models T57, T81, T96, T-105 and T116.

1. Screw
2. Cover plate
3. Impeller
4. Seal spring
5. Seal retainer
6. Grease fitting
7. Seal disc
8. Rear bushing
9. Bushing pin
10. Hub pin
11. Lockwasher
12. Gasket
13. Impeller pin
14. Pump body
15. Shaft seal
16. Lock ring
17. Thrust washer
18. Front bushing
19. Pump shaft
20. Pulley hub

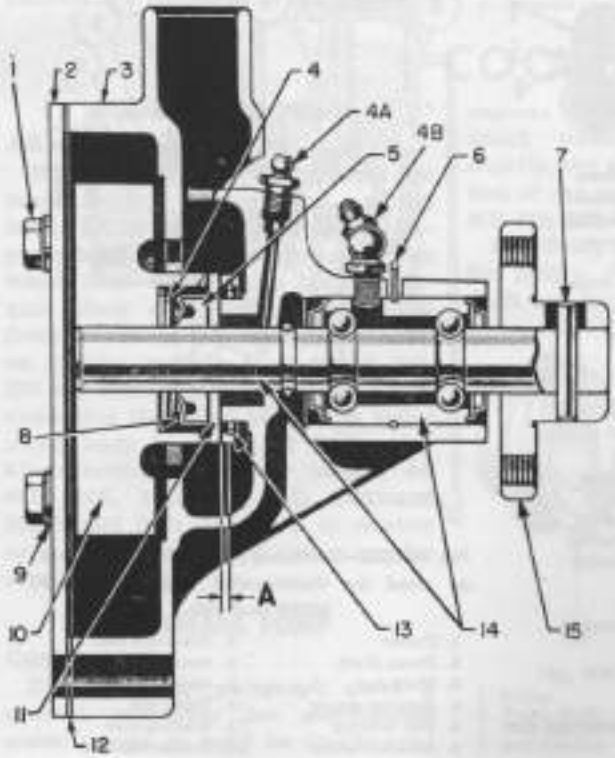


Fig. MH 235—Sectional view of water pump as used on Chrysler engine models T100 and T120.

1. Cover plate screw
2. Cover plate
3. Pump body
4. Seal spring
4A. Seal grease fitting
4B. Bearing grease fitting
5. Shaft seal
6. Snap ring
7. Pulley hub pin
8. Seal retainer
9. Lock washer
10. Impeller
11. Seal retainer
12. Gasket
13. Retainer snap ring
14. Shaft and bearing
15. Pulley hub
A. Minimum dimension 1/32"

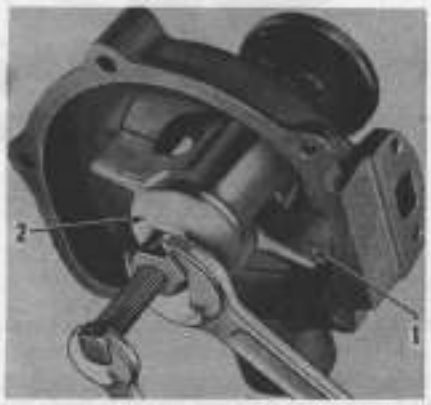


Fig. MH 236—Pulling impeller on ball bearing type pump used on Chrysler engines.
1. Impeller 2. Puller

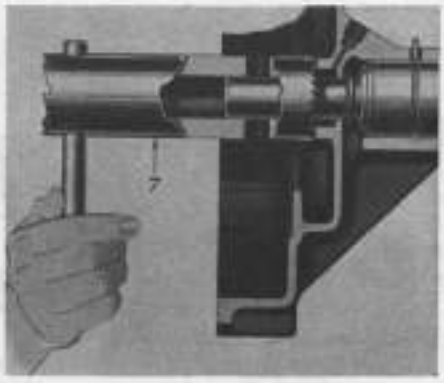


Fig. MH 237—Refacing seal seating surface on Chrysler engines water pump.

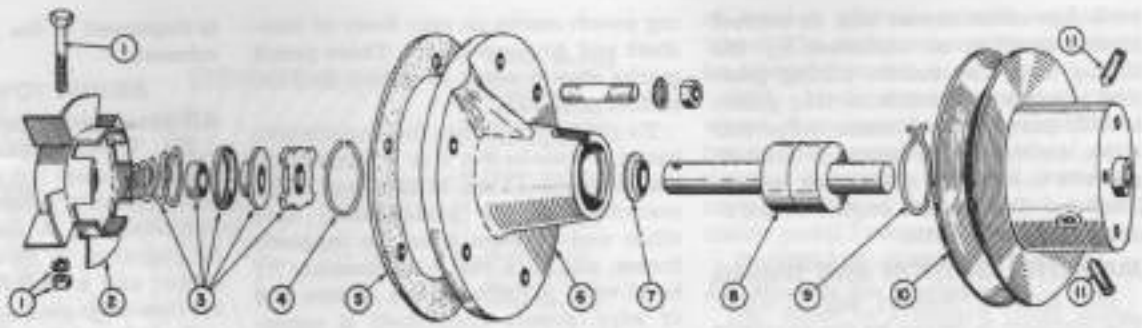


Fig. MH 238—Exploded view of water pump as used on Massey-Harris engines.

1. Impeller bolt
2. Impeller
3. Seal assembly
4. Snap ring
5. Gasket
6. Pump body
7. Slinger
8. Shaft bearing assy.
9. Snap ring
10. Pulley
11. Lock screws

IGNITION AND ELECTRICAL SYSTEM

GENERATOR, REGULATOR AND STARTING MOTOR

132. Refer to generator, regulator and starting motor name plate for model number, and to the appropriate section in Standard Units Manual for specifications and adjustment data.

BATTERY IGNITION AND TIMING

Several different models of Auto-Lite ignition distributors have been used. Refer to name plate on distributor housing for model number and to Distributor Section of STANDARD UNITS manual for specifications and general overhaul data. Typical flywheel markings are shown in Fig. MH 240.

Continental

133. **TIMING.** Set ignition breaker contact gap to 0.020. Crank engine until No. 1 cylinder is coming up on compression stroke and flywheel is in the proper position for setting the static ignition timing. On distillate models, the proper position is when timing pointer on front face of flywheel housing is in register with or not more than 3/8 inch past TDC mark on flywheel. On gasoline models, the pointer should be in register with or not more than 3/8 inch before TDC mark on flywheel.

Remove ignition cable from No. 1 spark plug and hold free end of cable near engine block. Loosen distributor clamp and, with ignition switch turned on, rotate distributor slowly until a spark occurs at end of spark plug cable; then lock distributor in this position.

133A. After setting the static ignition timing as outlined in paragraph 133, the running timing should be checked and slight adjustments made, if necessary, to assure satisfactory performance. Connect a vacuum gage to intake manifold, start engine and advance throttle lever to a point where engine is running at approximately 1000 rpm. Do not move throttle lever from this point. Advance the ignition timing until vacuum gage pointer reaches highest steady indication and engine speed is maximum. Retard distributor slowly to a point just before vacuum indication drops and lock distributor in this position.

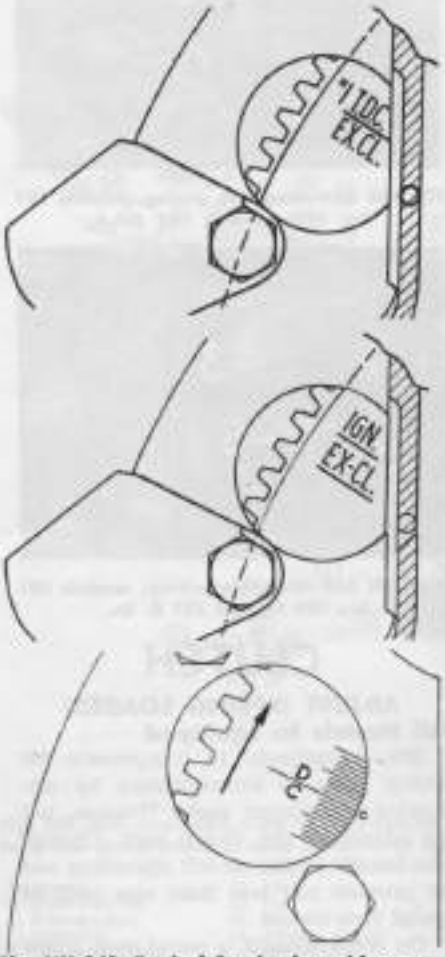


Fig. MH 240—Typical flywheel markings as found on Massey-Harris tractors equipped with Massey-Harris or Continental engines.

Massey-Harris

134. **TIMING.** Timing procedure for Massey-Harris engines is similar to timing procedure for Continental engines as outlined in paragraphs 133 and 133A, except that the static timing should be set with the DC mark on flywheel exactly in register with pointer on front of flywheel housing.

Chrysler

135. **TIMING.** Flywheel timing marks are not provided. A special timing tool, Chrysler Number C-435 (Fig. MH241), which permits measurement of piston travel, is used. Remove timing hole plug from cylinder head (above No. 6 cylinder) and install timing tool as shown. Rotate engine crankshaft until No. 6 piston is

Fig. MH 241—Special timing tool installed for checking ignition timing on Massey-Harris tractors equipped with Chrysler engines.

on compression stroke and in correct timing position as indicated by the timing tool. The correct timing position is when tool indicates that piston is 0.003 past top dead center. After this static timing index point is located, proceed to time the distributor as outlined for Continental engine in paragraphs 133 and 133A.

MAGNETO IGNITION AND TIMING

136. Breaker contact gap is 0.020. The magneto is driven by the governor gear and is located on the right side of engine, behind governor. The magneto mounting plate is provided with elongated holes to allow movement of magneto for timing purposes. If governor is removed, it will be necessary to check timing of governor gear before magneto is reinstalled. To check gear timing, rotate engine crankshaft until No. 4 piston on four-cylinder engines, or No. 6 piston on six-cylinder engines, is on top dead center of the compression stroke, then observe timing punch marks on rear faces of camshaft and governor gears. These punch marks should mesh as shown in Figs. MH242 and 243.

To prepare magneto for installation, insert a wire in No. 4 or 6 terminal of the magneto (Figs. MH244 and 245), according to the model used; hold other end of wire near the magneto frame; and turn the drive member by hand until a spark occurs at free end of wire. Rotate crankshaft if necessary to bring the gear marks into mesh as previously described and install the magneto, moving the coupling slightly if necessary to align the magneto drive member with the slot in governor gear hub. Magneto static timing is checked by turning crankshaft and observing whether the timing mark on flywheel face, as given in paragraph 133, aligns with timing pointer when impulse coupling releases.

Fig. MH 242—Magneto drive timing marks on models 101Jr., 102 Jr. and 102 G. Jr.

Fig. MH 243—Magneto drive timing marks on models 101 Sr., 102 Sr. and 102 G. Sr.

Fig. MH 244—Magneto wiring, models 101 Jr., 102 Jr. and 102 G. Jr.

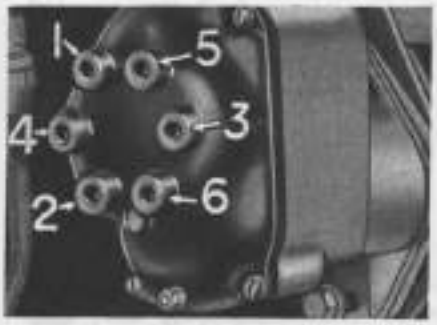


Fig. MH 245—Magneto wiring, models 101 Sr., 102 Sr. and 102 G. Sr.

CLUTCH

ADJUST (SPRING LOADED)
All Models So Equipped

200. Adjustment to compensate for lining wear is accomplished by adjusting the clutch pedal linkage, not by adjusting the clutch unit. Change the length of the clutch operating rod to provide not less than one inch of pedal free travel.

On some models, a pedal stop screw is provided. On such models, adjust the stop screw to provide ½ inch clearance between the end of the screw and the pedal stop when pedal is depressed to the point of full clutch release.

ADJUST (OVER-CENTER)
All Models So Equipped

201. When moving the clutch hand lever to engage the clutch, there should be a definite snap or feel of over-center action. A firm pressure should be required to force the cams over-center and a definite release of pressure as they go into place.

To adjust the clutch, remove the clutch housing cover, and with clutch disengaged, turn engine over until adjusting ring lock (1—Fig. MH301) is accessible and release the lock. To tighten the clutch, turn the adjusting ring clockwise one notch at a time, testing with the hand lever each time until the over-center action is felt. Engage the adjusting ring lock and tighten the lock nut. CAUTION: Do not make adjustment so tight that it requires undue effort to engage the clutch.

REMOVE AND REINSTALL
Models 101-101JR-102JR-102G.JR

202. Disconnect clutch pedal link rod. Disconnect flexible coupling between clutch and transmission and slide coupling hubs apart. Remove lower clutch cover pan and mark clutch cover plate and flywheel to facilitate reassembly in correct position. Unbolt clutch assembly from flywheel, unscrewing the bolts evenly to prevent distortion of cover plate. Unscrew the clutch shaft bearing carrier cap screws and pull the shaft and bearing assembly toward either side and to the rear until clutch assembly can be removed through bottom opening. Remove release bearing and, if necessary, pull shaft completely out of clutch housing.

Reinstall parts in reverse order of removal. Align the marks previously made on cover plate and flywheel, and tighten the attaching cap screws evenly to prevent cover distortion. After installation is complete, adjust clutch pedal linkage as previously described.

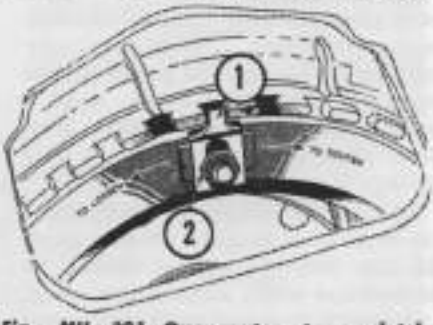
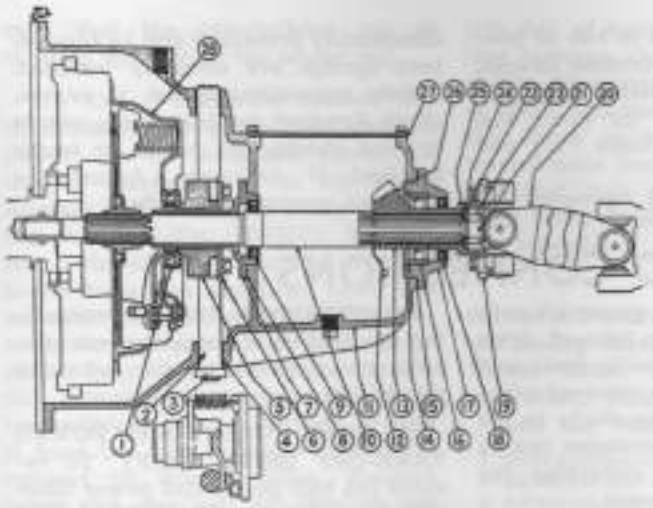


Fig. MH 301—Over-center type clutch, showing points of adjustment. To tighten clutch, release the adjusting ring lock (1) and turn the adjusting ring clockwise.



1. Release bearing
2. Release shaft
3. Shaft lever
4. Shaft bushing
5. Bearing sleeve
6. Bearing yoke
7. Bearing guide
8. Guide gasket
9. Guide oil seal
10. Clutch shaft
11. Drive housing
12. Oil paddle
13. Shaft spacer
14. Snap ring
15. Gasket
16. Shaft bearing
17. Bearing cap
18. Bearing oil seal
19. Joint knuckle
21. Cotter pin
23. Washer
24. Gasket
25. Gasket-cork
26. Pulley drive gear

Fig. MH 303—Sectional view showing the clutch installation on Massey-Harris models 20, 20K, 22, 22K, 81 and 82.

Series 44-44(6)-55-101SR-102SR-102G.SR-202-203

203. Move engine forward as outlined under R & R ENGINE, to permit removal of clutch shaft. Unbolt clutch housing at engine block, and pull the clutch housing and shaft assembly off toward the rear. If desired, shaft may be removed before clutch housing, by unbolting shaft bearing carrier and pulling shaft out. Mark the clutch cover plate and flywheel to facilitate reassembly in correct position. Remove clutch attaching screws, unscrewing them evenly to prevent clutch cover plate distortion and remove clutch assembly. Reinstall parts in reverse order of removal and adjust clutch pedal linkage.

Models 30-30K-101 Super-201

204. Clutch removal procedure is similar to that described in paragraph 203, except that clutch housing is not removed. The clutch assembly may be removed through bottom clutch housing pan opening after pan and clutch shaft are removed.

Models 20-20K-22-22K-81-82

205. Remove hood and side panels. Remove fuel line from tank and carburetor. Disconnect throttle rods from bell crank on clutch housing and clutch control rod at release lever. Remove fuel tank from tractor. Disconnect fuel tank front support bracket from clutch housing and slide support up on steering column to clear clutch housing. Disconnect front universal joint and move drive shaft aside to clear clutch housing for removal. Loosen engine front support cap screws three or four turns and block up rear end of engine to take weight off clutch housing. Remove cap screws holding clutch housing in place and move housing, complete with clutch shaft and belt pulley unit, toward rear of tractor, clearing clutch and flywheel. The clutch release bearing may be removed at this time.

205A. Mark clutch cover and flywheel, then remove cap screws holding clutch assembly to flywheel and remove assembly. Reinstall parts in reverse order of removal and adjust clutch pedal linkage.

OVERHAUL (SPRING LOADED)
All Models So Equipped

206. Refer to Standard Units Manual for clutch applications, general overhaul procedure and release lever setting data.

OVERHAUL (OVER-CENTER)
All Models So Equipped

207. The over-center type clutches can be disassembled as shown in Fig. MH305. Clean and check all parts for

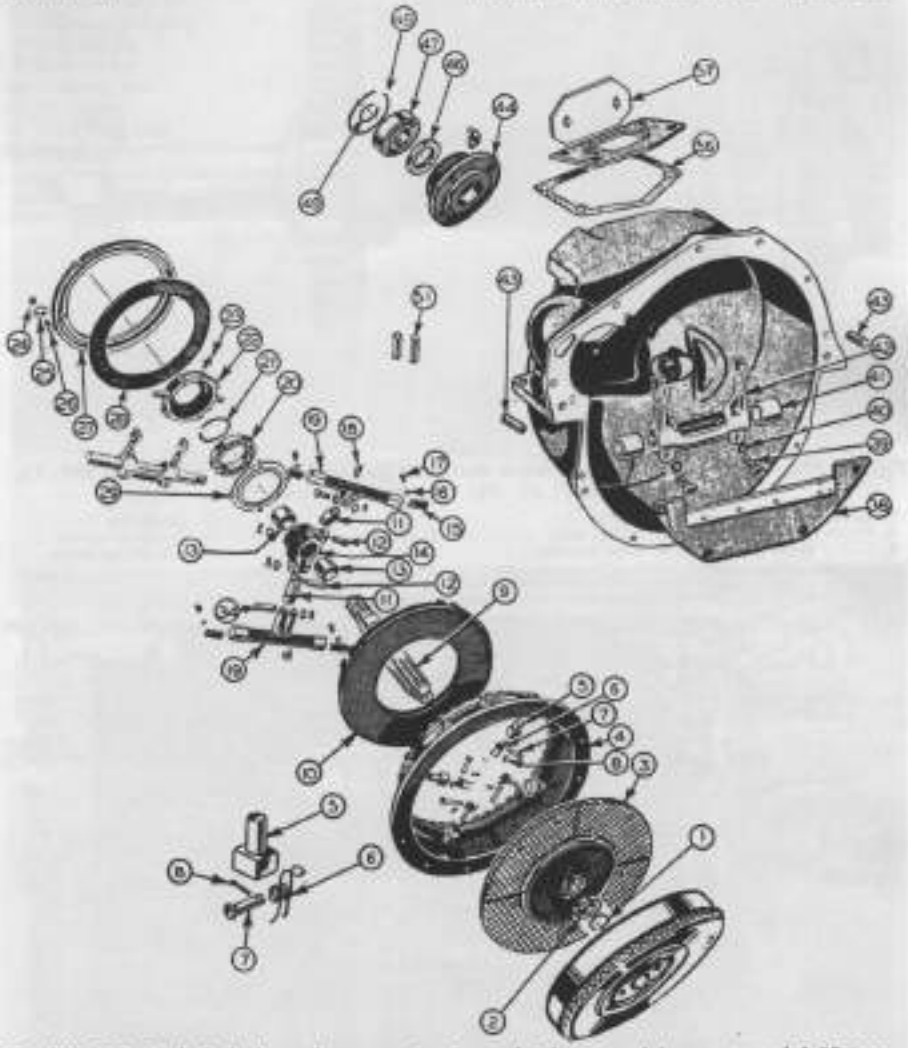


Fig. MH 305—Exploded view of over-center type clutch as used in some model 55 tractors. The clutch which is used in some 44 models is similar, the differences of which are evident after an examination of the unit.

1. Spacer
2. Pilot bearing
3. Driver plate assembly
4. Cover assembly
5. Dowel block
6. Spring
7. Pin
8. Cotter pin
9. Clutch shaft
10. Pressure plate
11. Link
12. Pin
13. Bushing
14. Release sleeve assembly
15. Cam block
16. Lock washer
17. Screw
19. Cam shaft
20. Bearing
21. Snap ring
22. Bearing carrier
24. Nut
25. Adjusting ring lock
26. Bolt
27. Adjusting ring
28. Adjusting ring plate
29. Bearing carrier cover plate
34. Pin
38. Dust cover
41. Bushing
42. Fork
43. Dowels
44. Bearing housing
46. Oil seal
47. Bearing
48. Snap ring
49. Snap ring
51. Dowel pins
56. Gasket
57. Inspection cover

wear; renew bushings (13) in the sleeve (14) if worn; check cam shaft (19), cam blocks (15) in pressure plate (10) for wear; check condition of return springs; check friction surface of pressure plate (10) and renew if warped, grooved or heat checked; check splines in hub of friction disc (3) and the friction facings; check threads on adjusting ring (27) and cover plate (4) for burrs and clean threads; check links (11) and pins for wear.

When reassembling, reverse the disassembly procedure and be sure return springs are correctly installed. Before reinstalling clutch to engine, check flywheel for high spots, ridges or heat checks and reface or renew flywheel if necessary. Adjust the clutch as previously specified.

TRANSMISSION AND CONNECTIONS

Series 101-102

The transmission, differential and master gears are contained in the same case; the differential being located on the opposite side of a dividing wall. Repair procedures for the differential and the master gears are treated separately in a later section.

The belt pulley unit, power lift unit, belt pulley and power take-off drive shaft and the shifter rails, forks and blocks may be directly removed without disturbing the main shafts in the transmission. The transmission can be disassembled without disturbing the differential or master gears.

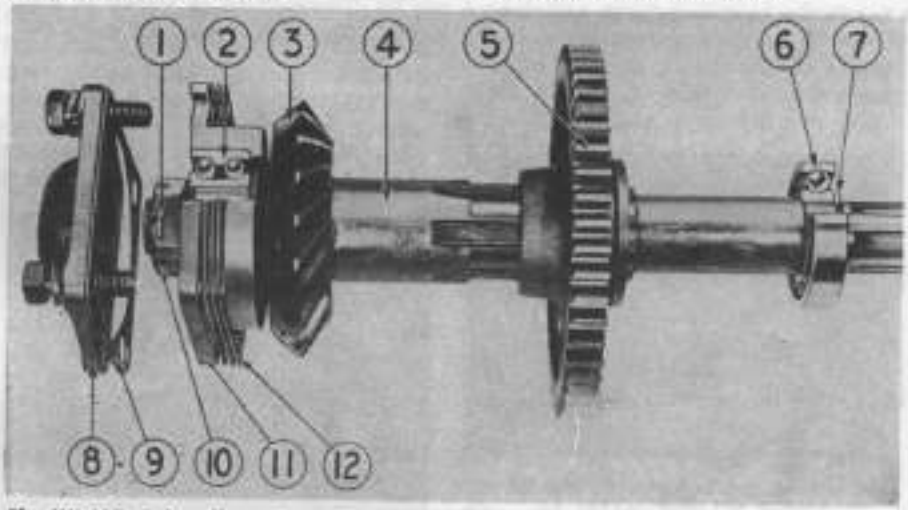


Fig. MH 310—Belt pulley and P.T.O. drive shaft and gears—All models except 20, 20K, 55, 55D, 55K, 55LP, 81, 82, 201, 202, 203 and 203G.

1. Cotter pin
2. Front bearing
3. Pulley drive gear
4. Shaft
5. P.T.O. gear
6. Rear bearing
7. Snap ring
8. Bearing cap
9. Gasket
10. Shaft nut
11. Bearing carrier
12. Adjusting shims

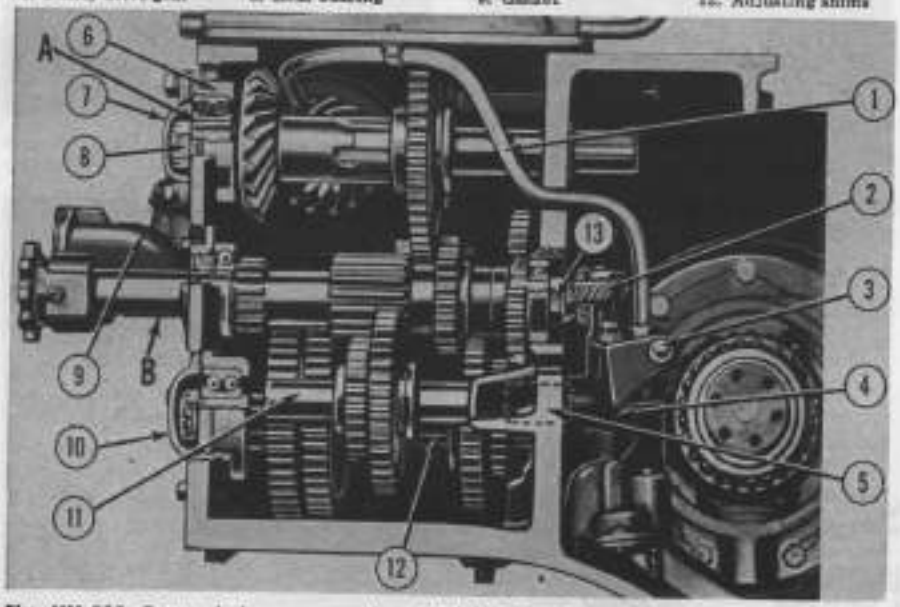


Fig. MH 311—Transmission cross-section—Models 101, 101Jr., 101SR., 101 Super, 102JR., 102SR., 102G. JR. and 102G. SR.

A. Belt pulley and power take-off drive shaft
B. Mainshaft
1. Oil line
2. Pump drive gears
3. Stud
4. Oil pump
5. Pump locating dowel
6. Bearing carrier
7. Bearing cap
8. Shaft nut
9. Shifter rail housing
11. Reverse idler shaft
12. Sliding gear shaft
13. Gear adapter nut

210. **OVERHAUL.** Data on overhauling the various transmission components are outlined in the following paragraphs.

211. BELT PULLEY AND POWER TAKE-OFF DRIVE SHAFT. To remove the belt pulley and power take-off drive shaft (A—Fig. MH311), first remove the belt pulley unit and the transmission cover. Remove front bearing cap (7) and nut (8) from shaft. Push shaft toward rear, using Owatonna Tool 938 or equivalent (Fig. MH312), until rear shaft bearing is out of its bore, then remove snap ring and rear bearing. Raise front end of shaft and remove shaft and gears through top opening.

Renew worn parts, reassemble as shown in Fig. MH310, and reinstall. Complete the installation by adjusting the mesh and backlash of bevel gears as described in the belt pulley section.

212. SHIFTER RAILS AND FORKS. To remove the shifter rails and forks, first remove the belt pulley and power take-off drive shaft as outlined in paragraph 211. Remove the shifter fork to shifter rail locking set screws through top cover opening. Disconnect rod from governor control lever (5—Fig. MH313) and remove the cap screws which hold shifter rail housing to front end of transmission case. Push or pull rail housing, rails and cover forward as a unit until rails are out of forks and blocks.

If unit is disassembled for renewal of parts, make certain that interlocking balls are on **both** sides of center rail when reassembling. Also make

Fig. MH 312—Pressing out belt pulley and P.T.O. drive gear shaft using OTC tool no. 938.

sure that the interlocking pin is through the hole in the center rail.

213. OIL PUMP. To remove the transmission oil pump, first remove power take-off shaft and power lift unit or transmission rear top cover. Remove inner nut from pump retaining stud (3—Fig. MH311). Remove left (viewed from rear of tractor) brake drum and install an extra nut on outer end of stud (3) which extends through pump body and master pinion bearing cap. Using this double nut arrangement, back stud out of transmission case far enough to free it from the hole in pump body. Disconnect oil line at pump. Remove pump and gear unit (2) through top opening in transmission case.

213A. After reinstalling pump, adjust the mesh of pump drive gears by turning the stud nuts on both sides of the pump bracket until there is noticeable backlash between the mating teeth; then, tighten nuts securely and recheck backlash. After reconnecting pipe to pump, check operation of same by rotating belt pulley by hand or by running engine. If oil flow from end of pipe is not directed on belt pulley gear, align pipe until this condition is obtained.

214. MAINSHAFT. To remove the transmission mainshaft (B—Fig. MH 311), first remove the belt pulley and power take-off drive shaft as in paragraph 211, shifter rails and forks as in paragraph 212 and oil pump as in paragraph 213. The next step in the removal procedure is to move the mainshaft forward and remove the front bearing, which requires the following preliminary work:

On models, 101, 101Jr., 102Jr. and 102G.Jr., remove the clutch shaft as in paragraph 202.

On models 101 Super, 101Sr., 102Sr. and 102G.Sr., move engine forward or remove same as in R & R ENGINE section; or, detach transmission from main frame and engine as follows: Remove hood and side panels. Disconnect and remove battery and platform. Disconnect choke wire and fuel feed line at carburetor. Disconnect oil pressure gage tubing at the instrument panel and engine block. Remove instrument panel and fuel tank. Disconnect steering shaft at lower end of universal joint. Disconnect governor linkage. Loosen steering shaft support on transmission case and remove cap screws at base of steering shaft. Remove seat and fuel tank rear support from front of transmission and lay support and instrument panel forward on left side of tractor. Disconnect coupling between clutch and transmission shafts. Disconnect clutch control rod at pedal, and remove clevis and locknut. Block up transmission case and tractor main frame. Remove the bolts and stud nuts which hold case and main frame together and separate the two assemblies.

On all models, proceed to remove the mainshaft as follows: Remove set screw and drive the coupling off front end of mainshaft. Remove adapter nut (13) and oil pump drive gear from rear end of shaft. Remove front bearing cap and oil seal as a unit. Slide shaft forward until bearings clear bearing bores in case, then extract

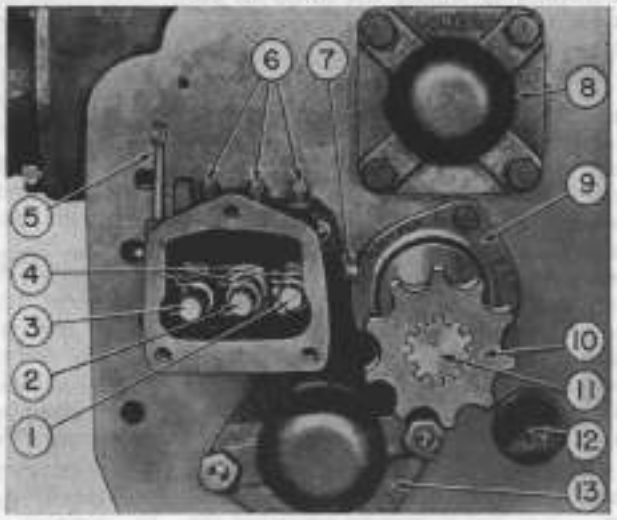


Fig. MH 313—Shifter rails and housing—Models 101, 101JR., 101SR., 101 Super, 102JR., 102SR., 102G.JR. and 102G.SR.

1. Reverse shifter rail
2. 1st and 2nd shift rail
3. 3rd and 4th shift rail
4. Snap rings
5. Governor control lever
6. Ball-spring plugs
7. Interlock ball plug
8. Bearing cap
9. Bearing cap
10. Coupling hub
11. Mainshaft
12. Idler shaft plug
13. Bearing cap

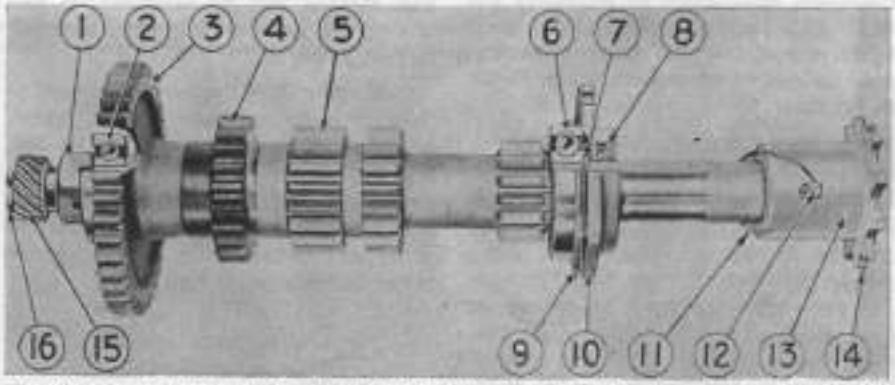


Fig. MH 315—Mainshaft and gears—Models 101, 101JR., 101SR., 101 Super, 102JR., 102SR., 102G.JR. and 102G.SR.

1. Adapter nut
2. Rear bearing
3. 4th speed gear
4. 3rd speed gear
5. Mainshaft
6. Front bearing
7. Snap ring
8. Oil seal
9. Gasket
10. Bearing cap
11. Lock wire
12. Lock screw
13. Coupling hub
14. Coupling teeth
15. Oil pump gear
16. Adapter screws

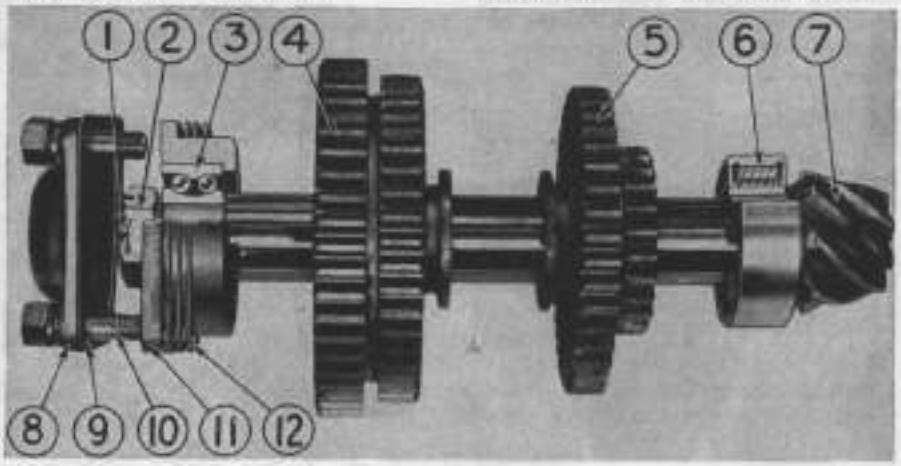


Fig. MH 316—Sliding gears and shaft—Models 101, 101 JR., 101 SR., 101 Super, 102 JR., 102SR., 102G.JR. and 102G.SR.

1. Cotter pin
2. Shaft nut
3. Front bearing
4. 1st and 2nd gear
5. 3rd and 4th gear
6. Rear bearing
7. Shaft and pinion
8. Bearing cap
9. Gasket
10. Cap stud
11. Bearing carrier
12. Adjusting shims

snap ring and pull front bearing off shaft, using Owatonna Tool 1003 or equivalent. Raise rear end of shaft and remove shaft and gears as a unit through top opening in housing.

Renew any worn parts and reassemble as shown in Fig. MH315. When reinstalling shaft in housing, it will be necessary to adjust the mesh of the transmission oil pump gears as outlined in paragraph 213A.

215. SLIDING (BEVEL PINION) GEAR SHAFT. The sliding gear shaft (12—Fig. MH311) can be removed after removing the mainshaft as outlined in paragraph 214. Remove front bearing cap (10) also the cotter pin and nut from the shaft. Slide shaft assembly forward and pull front bearing carrier, bearing, and shims off shaft. Raise rear end of shaft and remove same through top opening in transmission case. Remove rear bearing with Owatonna Tool 938 or equivalent.

Renew worn parts, reassemble as shown in Fig. MH316 and reinstall. Complete installation by adjusting the mesh and backlash of the gear shaft bevel pinion and the differential ring gear as described under "Main Drive Bevel Gears".

216. REVERSE IDLER GEAR. The reverse idler gear and shaft (11—Fig. MH311) can be removed after removing the mainshaft as in paragraph 214 and the sliding gear shaft as in paragraph 215. Remove the solid lockpin (1—Fig. MH317) from rear end of idler shaft (2). Drive idler shaft forward far enough to push out expansion plug in transmission case; then, continue to drive the shaft out of case and idler gear. Remove gear and renew the gear bushing if necessary. Reinstall shaft and gear, assembling as shown in Fig. MH317. Renew expansion plug in front of transmission case.

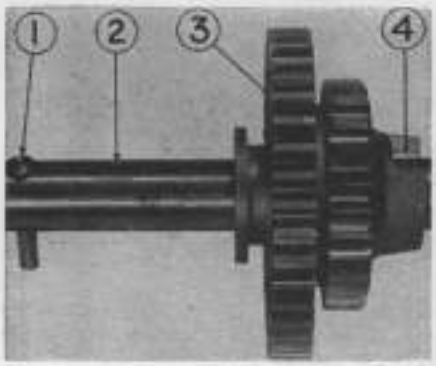


Fig. MH 317—Reverse idler gear and shaft —All series except 20, 22, 55, 81, 82, 201, 202 and 203.

1. Idler shaft pin
2. Idler shaft
3. Idler gear
4. Gear bushing

Series 30-44-44(6)

The transmission used on this group of tractors is similar in arrangement to that described for the preceding tractor group, except for minor changes which will be explained in subsequent paragraphs. The belt pulley, power lift unit, belt pulley and power take-off drive shaft and the shifter rails, forks and blocks can be removed from the transmission without disturbing any of the main shafts. Complete disassembly of the transmission requires removal of the differential and master gears.

220. **OVERHAUL.** Data on overhauling the various transmission components are outlined in the following paragraphs.

221. BELT PULLEY AND POWER TAKE-OFF DRIVE SHAFT. The belt pulley and power take-off drive shaft (8—Fig. MH320) is similar to the assembly shown in Fig. MH310 and can be removed by following the general procedure given in paragraph 211.

222. SHIFTER RAILS AND FORKS. The shifter rails and forks, shown in Fig. MH322, can be removed by following the general procedure outlined in paragraph 212.

223. OIL PUMP. Early production tractors were equipped with a transmission oil pump as shown in Fig. MH323. Later tractors are not equipped with the oil pump. The oil pump can be removed from models so equipped by following the procedure given in paragraph 213.

224. MAINSHAFT. The mainshaft (18—Fig. MH320) as used on early production models was mounted in ball bearings; whereas, the mainshaft as used in later models is mounted in taper roller bearings. The R & R and overhaul procedure for either shaft is substantially the same as outlined for models 101Super, 101Sr., 102Sr. and 102G.Sr. in paragraph 214. It is important to remember, when reinstalling, that on models with taper roller bearings, the nut on rear end of shaft must be tightened enough to provide a slight pre-load on the bearings.

225. SLIDING GEAR (BEVEL PINION) SHAFT. The sliding gear shaft (40—Fig. MH320) can be removed after removing the mainshaft as outlined in paragraph 224, and the differential as outlined in the differential section. Remove front bearing cap, also the cotter pin and nut from the shaft. Drive shaft back until front bearing half comes off. Remove bearing retainer and shims. Put a piece of brass shaft between low speed gear and dividing wall in transmission case and drive shaft out of rear half of front bearing, or use Owatonna Tool 515 or equivalent pusher. After bearing is off, pull shaft out of the sliding gears and remove shaft and gears from transmission case. Renew worn parts and reassemble as shown in Fig. MH321. The thrust washer (35) is installed between reverse sliding gear (36) and low speed gear (34). Check

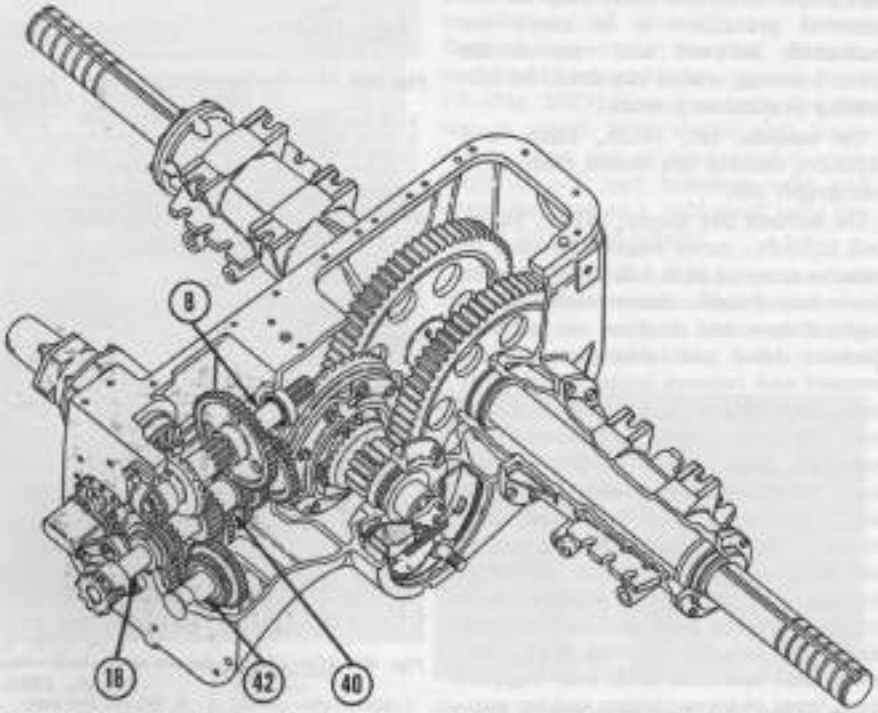
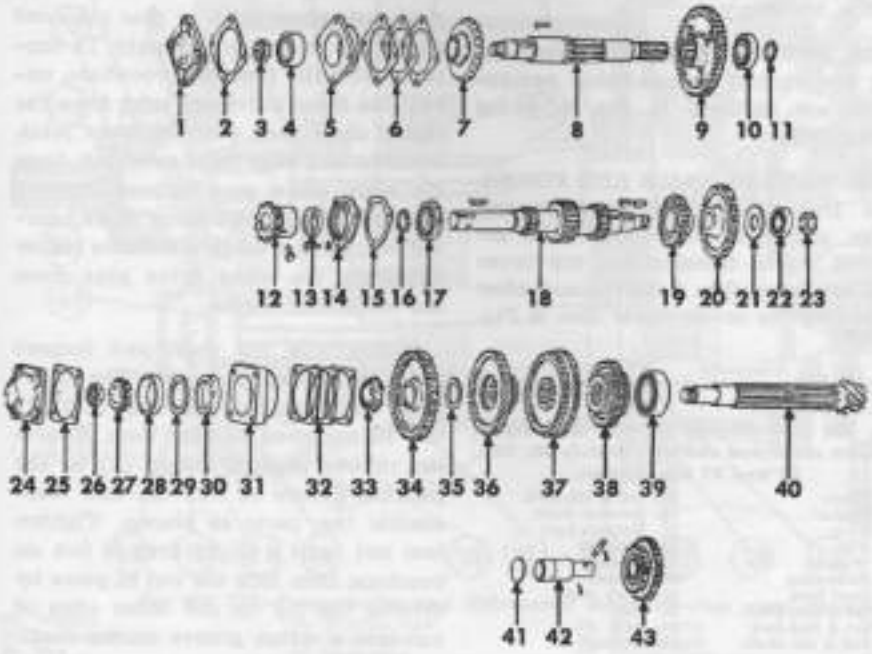


Fig. MH 320—Sectional view of typical transmission as used on models 30, 30K, 44, 44K, 44LP, 44D and 44(6). See Fig. MH 321 for legend.

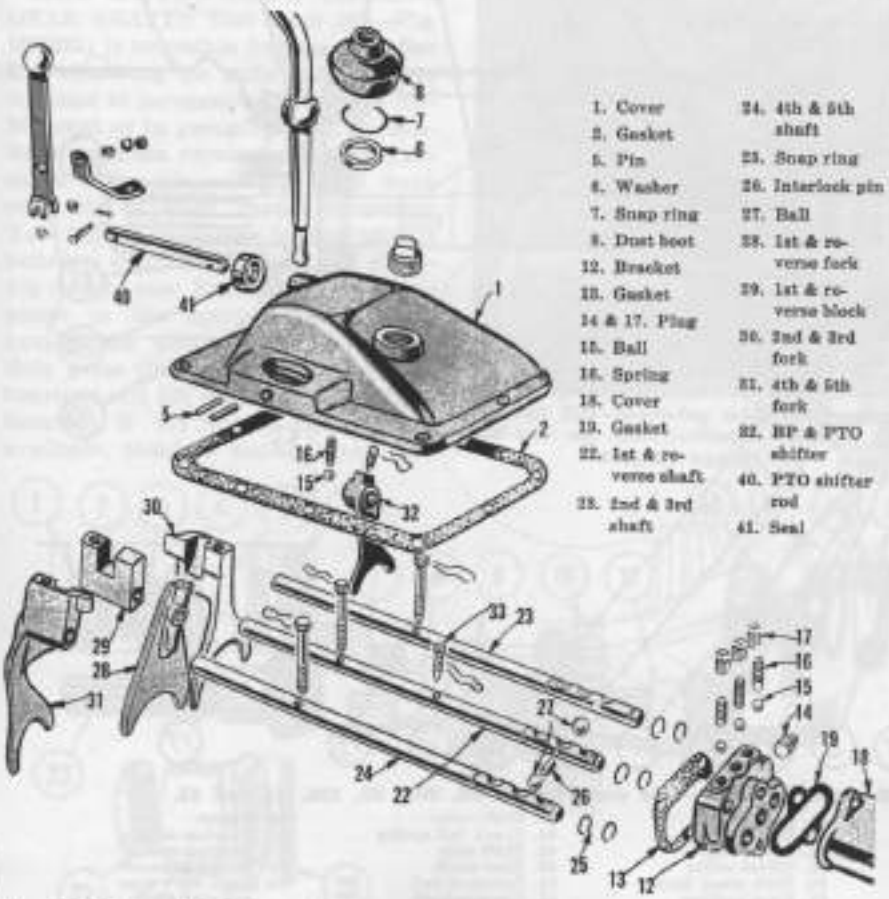
end clearance between low speed gear and thrust washer. The gear must run free on shaft and have from 0.004 to 0.008-inch end clearance. Tighten shaft nut until drag is felt, then back off nut ⅛ to ¼ turn and insert cotter pin. Complete installation by adjusting the mesh and backlash of the gear shaft bevel pinion and the differential ring gear as described under "Main Drive Bevel Gears".

226. REVERSE IDLER GEAR. The reverse idler gear and shaft (42—Fig. MH320 & MH321) are similar to the units shown in Fig. MH317 and can be removed by following the general procedure given in paragraph 216.



1. Bearing cap
2. Gasket
4. Bearing
5. Bearing carrier
6. Shims
7. Pulley drive gear
8. Pulley drive shaft
9. Shaft drive gear
10. Rear bearing
11. Snap ring
12. Coupling hub
13. Oil seal
14. Bearing cap
15. Gasket
16. Snap ring
17. Front bearing
18. Mainshaft
19. 4th drive gear
20. 5th drive gear
21. Spacer washer
22. Rear bearing
23. Adapter nut
24. Bearing cap
25. Gasket
26. Shaft nut
27. Bearing cone
28. Bearing cup
29. Spacer washer
30. Bearing cup
31. Bearing carrier
32. Shims
33. Bearing cone
34. 1st speed gear
35. Thrust washer
36. Reverse gear
37. 2nd and 3rd speed gear
38. 4th and 5th speed gear
39. Rear bearing
40. Sliding gear shaft
41. Expansion plug
42. Gear shaft
43. Reverse idler gear

Fig. MH 321—Exploded view of transmission shafts as used on early models of 30 and 44 series tractors. Later models are similar except that the mainshaft is mounted in taper roller bearings. Also, later models use a flange type coupling instead of item (12).



1. Cover
2. Gasket
5. Pin
6. Washer
7. Snap ring
8. Dust boot
12. Bracket
15. Gasket
14 & 17. Plug
15. Ball
16. Spring
18. Cover
19. Gasket
22. 1st & reverse shaft
23. 2nd & 3rd shaft
24. 4th & 5th shaft
25. Snap ring
26. Interlock pin
27. Ball
28. 1st & reverse fork
29. 1st & reverse block
30. 2nd & 3rd fork
31. 4th & 5th fork
32. BP & PTO shifter
40. PTO shifter rod
41. Seal

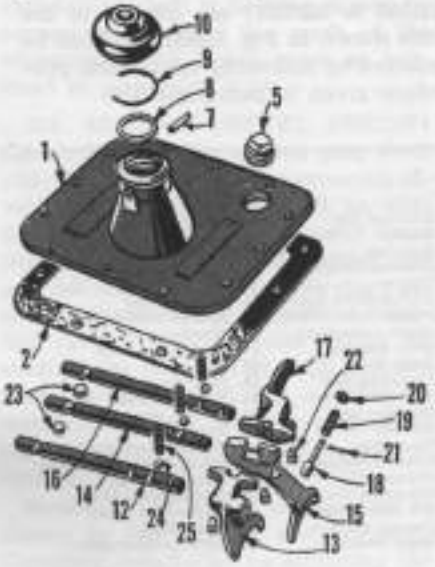
Fig. MH 322—Exploded view of shifter rails and forks as used on the 30 and 44 series tractors.

Fig. MH 323—Early model 30, 30K, 44, 44D, 44K, 44LP and 44(6) transmission oil pump exploded view.

3. Drive shaft
4. Drive gear
5. Pin
6. Thrust washer
7. Driven gear
8. Woodruff key
9. Idler gear
10. Idler gear shaft
11. Cover
12. Gasket
13. Ball
14. Spring
17. Cotter pin
23. Plug

Models 20-20K-22-22K-81-82

The transmission and differential are contained in the same housing, the differential being located on the opposite side of a dividing wall. Repair procedure for the differential is treated separately in a subsequent section.



The power lift unit and transmission cover, complete with gear shifter rails and forks, can be directly removed without disturbing mainshafts or clutch housing.

230. **OVERHAUL.** Data on overhauling the various transmission components are outlined in the following paragraphs.

231. SHIFTER RAILS AND FORKS. The transmission shifter rails and forks, shown in Fig. MH330, are attached to the transmission top cover and are accessible for overhaul after removing the cover. Refer also to Fig. MH331.

Fig. MH 330—Models 22 and 22K transmission cover and shifters. Models 20, 20K, 81 and 82 are similar.

1. Cover
2. Gasket
3. Plug
4. Pin
5. Washer
9. Snap ring
10. Dust boot
12. 1st & 2nd shaft
13. 1st & 2nd fork
14. 3rd & 4th shaft
15. 3rd & 4th fork
16. Reverse shaft
17. Reverse fork
18. Plunger
19. Spring
20. Washer
22. Lock screw
23. Ball
24. Ball
25. Spring

232. MAIN DRIVE (STUB SHAFT) GEAR. The main drive gear (60—Fig. MH332) is accessible for removal after removing the transmission cover, rear case cover plate or rear mounted power lift and shaft assembly. To continue with the removal procedure, unbolt the front universal joint from the clutch shaft then pull the front joint, knuckle and rear joint as a unit from the main drive gear splines. Remove the cap screws (A) from front bearing carrier and using a suitable puller withdraw the main drive gear from the transmission case.

Disassemble the shaft and inspect parts for damage and wear. The mainshaft pilot bearing (7—Fig. MH333) can be renewed at this time. Renew the rubber packing collar (2) in the packing groove of nut (1) and reassemble the parts as shown. Tighten jam nut until a slight drag is felt on bearings, then lock the nut in place by driving the lip on the inner edge of nut into a spline groove on the shaft.

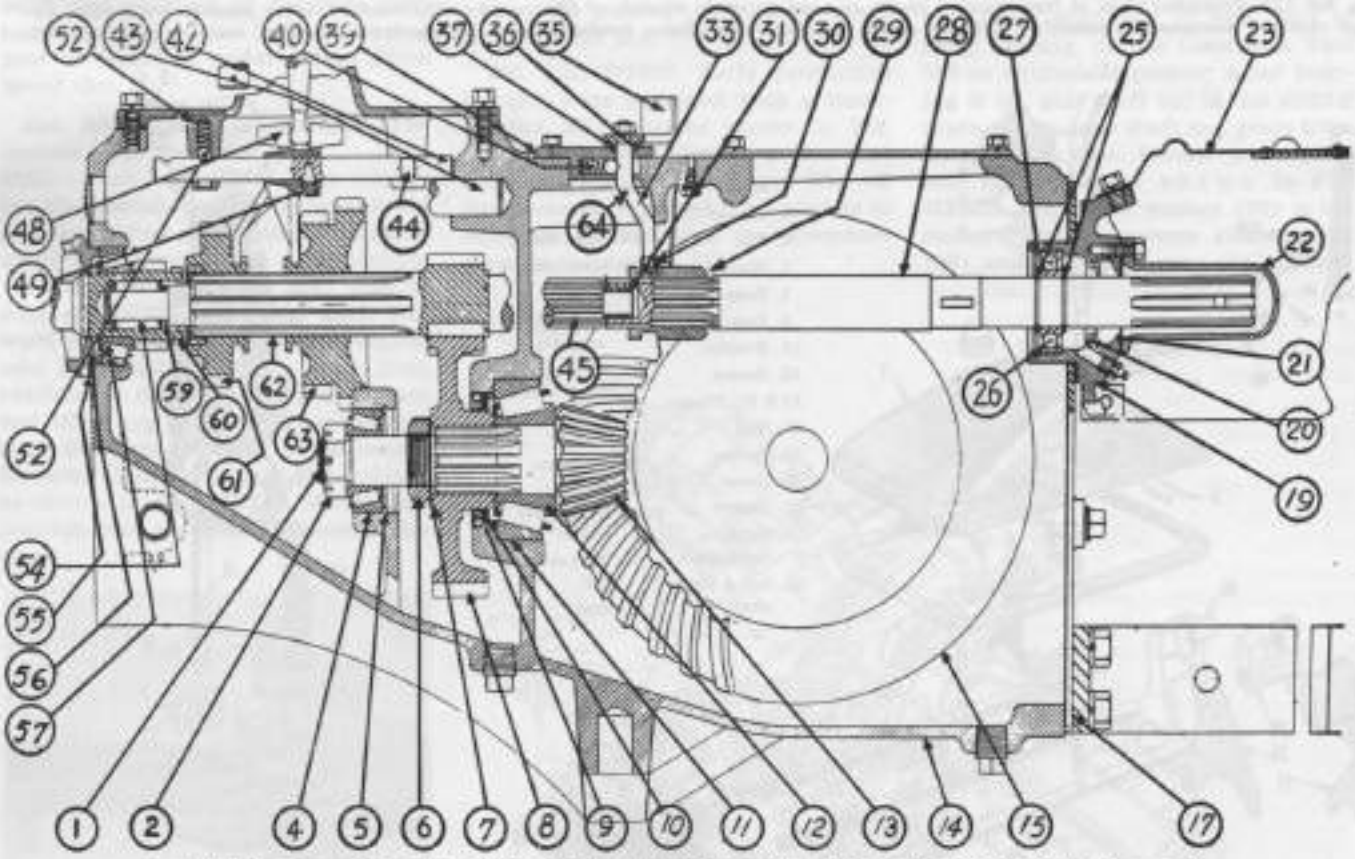


Fig. MH 331—Transmission and differential assembly—Side view—Models 20, 20K, 22, 22K, 81 and 82.

1. Cotter pin
2. Shaft nut
4. Bearing cup
5. Snap ring
6. Gear nut
7. Lockwasher
8. Reduction gear
9. Oil seal
10. Spacer
11. Bearing cup
12. Bearing cone
13. Pinion shaft
14. Main housing
15. Bevel ring gear
17. Rear cover
19. Bearing cage
20. Oil seal
21. Felt seal
22. Shaft cap
23. Shaft guard
25. Snap rings
27. Snap ring
28. P.T.O. shaft
29. Clutch collar
30. Shift crank block
31. Pilot bushing
33. Shift crank
35. Shift lever
36. Felt washer
37. Crank washer
39. Shift cover
40. Crank ball spring
42. Shift rails
43. Idler shaft
44. Interlock ball
45. Countershaft
48. Shifter fork
49. Lock screw
52. Detent spring
54. Front bearing
55. Gasket
56. Bearing cage
57. Bearing cone
59. Bearing spacer
60. Main drive gear and stub shaft
61. 3rd and 4th gear
62. Mainshaft (sliding gear shaft)
63. 1st and 2nd gear

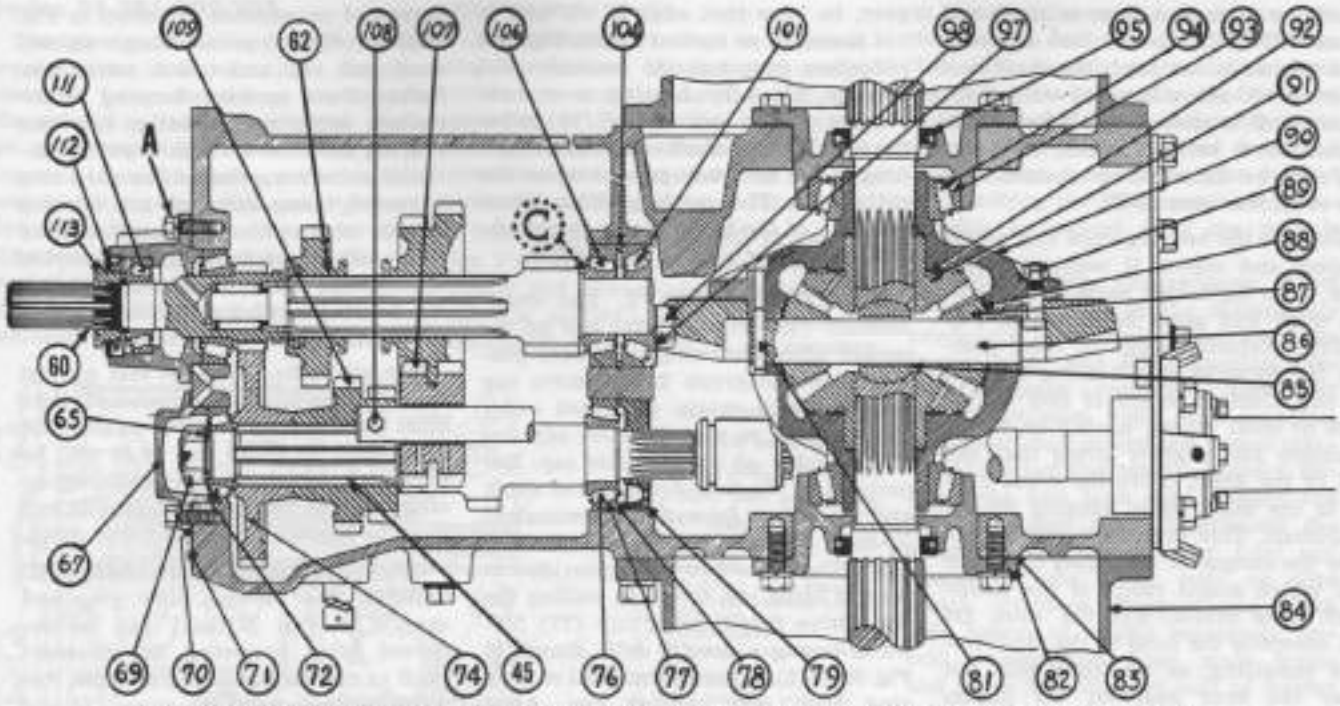


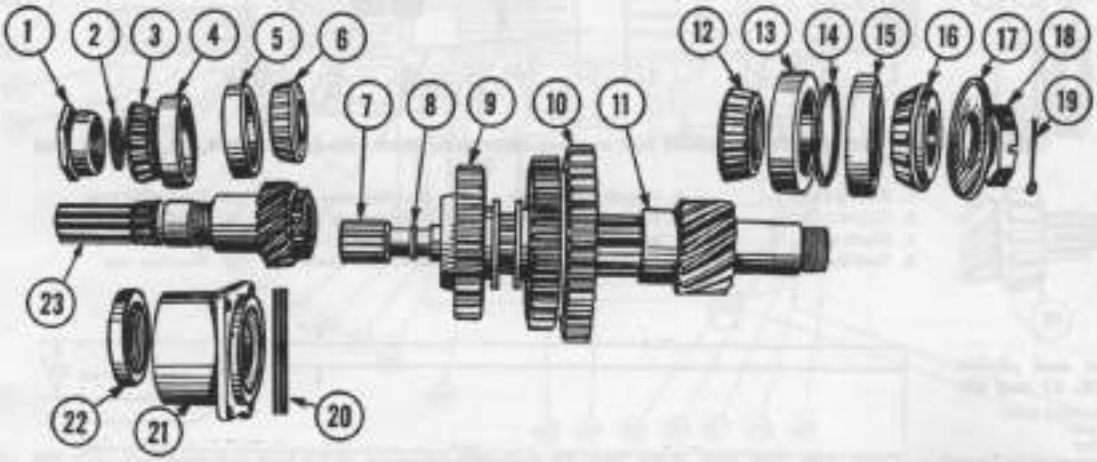
Fig. MH 332—Transmission and differential assembly—Top view—Models 20, 20K, 22, 22K, 81 and 82.

65. Washer
67. Bearing cup
69. Nut
70. Shims
71. Cork seal
72. Bearing cone
74. Countershaft gear
76. Bearing cone
77. Bearing cup
78. Snap ring
79. Oil baffle
81. Pinion pin
82. Bearing retainer
83. Shims
84. Axle sleeve
85. Thrust ball
86. Pinion shaft
87. Drive pinion
88. Thrust washer
90. Diff. case
91. Diff. side gear
92. Thrust washer
93. Bearing cup
94. Bearing cone
95. Oil seal
97. Diaphragm
98. Shaft nut
104. Snap ring
106. Bearing cone
107. Idler gear
108. Lock screw
109. 2nd and 3rd gear
111. Bearing cone
112. Oil seal
113. Nut

232A. MAINSHAFT (SLIDING GEAR SHAFT). This shaft (62—Fig. MH332) is accessible for removal after first removing the main drive gear as outlined in paragraph 232 and the differential as in paragraph 252. To continue with the removal procedure, remove cotter pin and nut (98) from rear end of shaft. Install Owatonna Tool MH671 as shown in Fig. MH335 between mainshaft pinion and dividing wall in case. Extend the adjustable screw in the special tool to abut against the sliding gears as shown, then press the mainshaft out of rear bearings and lift shaft and gears from housing. If the special tool is not available, obtain a washer measuring 2 inches inside diameter, 3 inches outside diameter and approximately ⅛-inch thick. Modify the washer to make it "C" shaped as shown in Fig. MH337. Slip the washer between rear of mainshaft pinion and the case, rotate washer on shaft so that the open side is horizontal and hold in place to keep it from dropping off the shaft. Push or drive the mainshaft out of rear bearings while bucking up against the

Fig. MH 335—Removing main shaft using OTC tool no. MH671—Models 20, 20K, 22, 22K, 81 and 82.

Fig. MH 337—Special washer for removing mainshaft—Models 20, 20K, 22, 22K, 81 and 82.



1. Jam nut
2. Packing collar
3. Front bearing cone
4. Front bearing cup
5. Rear bearing cup
6. Rear bearing cone
7. Mainshaft front bearing
8. Bearing spacer
9. 3rd and 4th sliding gear
10. 1st and 2nd sliding gear
11. Rear main shaft
12. Bearing cone
13. Bearing cup
14. Snap ring
15. Bearing cup
16. Bearing cone
17. Bearing diaphragm
18. Shaft nut
20. Gaskets
21. Bearing carrier
22. Oil seal
23. Front (stub) shaft

Fig. MH 333—Transmission mainshaft assembly—Models 20, 20K, 22, 22K, 81 and 82.

special washer and remove shaft and gears. NOTE: If special tool or modified washer is not used, the shaft rear bearing will move forward with shaft, when shaft is pushed out. If bearing is permitted to move forward, the bearing may be damaged by contact with the reduction gear teeth.

Remove the bearing cups and cones; inspect and renew if necessary. Renew worn mainshaft parts and assemble shaft and gears as shown in Fig. MH333. Reinstall shaft in case, placing the forward rear bearing cone in its cup. Using a length of thin walled pipe or steel tubing having an inside diameter just slightly larger than the OD of the shaft, drive the front cone on to the shaft while bucking up the mainshaft. This procedure will eliminate the danger of damaging the front cup which might result if the mainshaft were driven into the cone. Do not assemble the cone to the shaft before installing, as the cone will not clear the spur gear on the pinion shaft. Install the rear bearing cone, bearing diaphragm (17) and nut. Adjust bearings by tightening the shaft nut until there is no "up and down" play on front end of shaft, and a slight drag can be felt on bearings. After adjustment, lock shaft nut with a cotter pin.

233. BEVEL PINION. The main drive bevel pinion shaft (13—Fig. MH331) and the spur reduction gear (8) can be removed after removing the mainshaft as in paragraph 232 and 232A. Remove nut and cotter pin (1 and 2) from end of shaft. Remove nut (6) holding gear on shaft and bump the shaft out toward the rear. Move reduction gear forward out of oil seal (9) and remove from case. Renew worn parts and reinstall gear and shaft. When reinstalling reduction gear, be sure that edge of oil seal is not damaged or turned under. Tighten reduction gear nut (6) securely and lock in place by turning over new corners of the lockwasher (7) under the nut. Tighten shaft nut until a slight drag is felt on bearings, and insert the cotter pin. The mesh position (fore and aft) of the bevel pinion is not adjustable. Refer also to Fig. MH340.

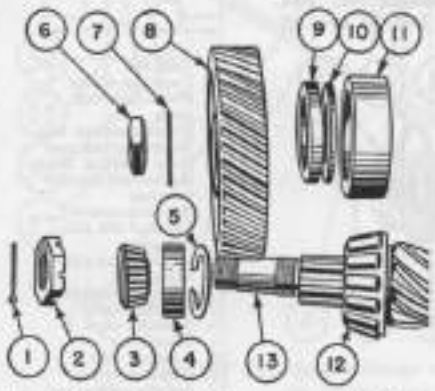


Fig. MH 340—Reduction gear and pinion shaft—Models 20, 20K, 22, 22K, 81 and 82.

2. Shaft nut
3. Bearing cone
4. Bearing cup
5. Snap ring
6. Gear nut
7. Lockwasher
8. Reduction gear
9. Oil seal
10. Spacer
11. Bearing cup
12. Bearing cone
13. Pinion shaft

234. COUNTERSHAFT. The countershaft (45—Fig. MH332) can be removed after removing the bevel pinion as in paragraph 233. Remove cap screws which retain the front bearing cap (67) to case. Remove cap and note number of shims under cap. Remove nut (69) from front end of shaft, and drive shaft forward approximately ¼-inch. Remove rear oil baffle cup (79). There are two holes provided in rear of baffle cup to aid in pulling the cup. Drive rear bearing cup (77) forward (using a special drift shown in Fig. MH342) to permit removal of snap ring from rear bearing cup. After snap ring is removed, bump shaft to the rear until rear bearing cup is clear of case, then pull shaft rearward and out of gears and case. Renew worn parts and reassemble as shown in Fig. MH341. When reinstalling, tighten shaft nut (4) and insert cotter pin. Before front bearing housing is installed, drive rear bearing cup into bearing bore far enough to permit installation of snap ring. After snap ring is seated, bump the shaft and bearing toward rear until cup is against snap ring. Adjust the bearings by varying the number of shims under front bearing housing until a slight drag is felt when shaft is turned.

The oil baffle cup must seat against bearing snap ring when installed. Care must be taken not to drive against the inner part of baffle cup or it will be distorted, which would result in an oil leak. The two holes in rear of cup must be located straight up and down.

235. REVERSE IDLER GEAR AND SHAFT. The reverse idler gear and shaft (12—Fig. MH341) can be removed after removing the countershaft as outlined in paragraph 234. Remove lock wire and set screw (14 and 15—Fig. MH341) from idler shaft. Slide shaft forward and out of gear and case. Renew worn parts and reinstall in reverse order.

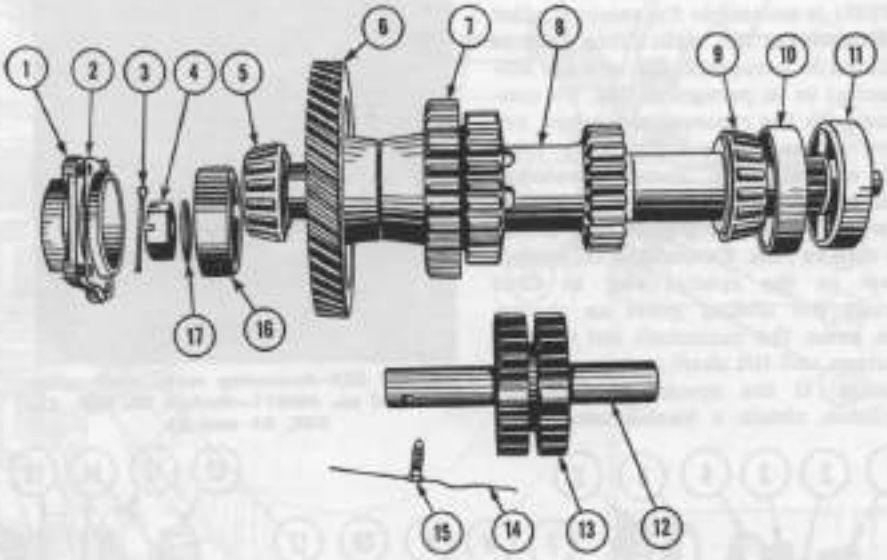


Fig. MH 341—Countershaft and reverse idler gear shaft—Models 20, 20K, 22, 22K, 81 and 82.

1. Bearing cap
2. Shims
4. Shaft nut
5. Bearing cone
6. Countershaft gear
7. 2nd and 3rd speed gear
8. Countershaft
9. Bearing cone
10. Bearing cup
11. Oil baffle
12. Rev. idler shaft
13. Rev. idler gear
14. Lock wire
15. Lock screw
16. Bearing cup

Fig. MH 342—Special drift used to drive bearing cup, paragraph 234.

Series 55-201-202-203

The transmission and differential are contained in the same case, the differential being located on the opposite side of a dividing wall. The master gear assembly is contained in a separate housing which is bolted to the rear of the transmission and differential case. Repair procedures for the differential and the master gears are treated separately in their respective sections. The belt pulley unit can be removed without disturbing the transmission main shafts.

240. **OVERHAUL.** Data on overhauling the various transmission components are outlined in the following paragraphs. Before the transmission can be completely disassembled, however, the power take-off case must be removed as in paragraph 240A.

240A. R & R PTO CASE. To remove the PTO case, which contains the belt pulley and power take-off drive shaft (2—Fig. MH351) and the transmission mainshaft drive shaft, it is necessary to either move engine forward or remove same as in R & R ENGINE section OR, detach transmission from frame which is usually the quickest method. Refer to the following paragraph 240B for method of detaching transmission from frame. The method of detaching the PTO case from transmission is evident after the split is made.

240B. *Detach Transmission From Frame.* First step in the disassembly procedure is to drain lubricant from transmission and PTO housing. Remove voltage regulator, disconnect the transmission input shaft coupling, disconnect belt pulley and power take-off shifter rod and remove battery. Remove the fuel tank rear support and block up fuel tank. Disconnect the steering drag link at rear joint and disconnect any other rods or clips which interfere. Support and block both halves of tractor separately, unbolt transmission from main frame and move transmission half of tractor rearward.

241. MAIN DRIVE GEAR. The main drive gear (14—Fig. MH350), or (49—Fig. MH351), can be removed from the PTO case after removing the case as in paragraph 240A. First step in the disassembly procedure is to remove the upper shaft (19-Fig. MH350) as follows: Remove the front bearing cap (3) and rear cap (21). Remove

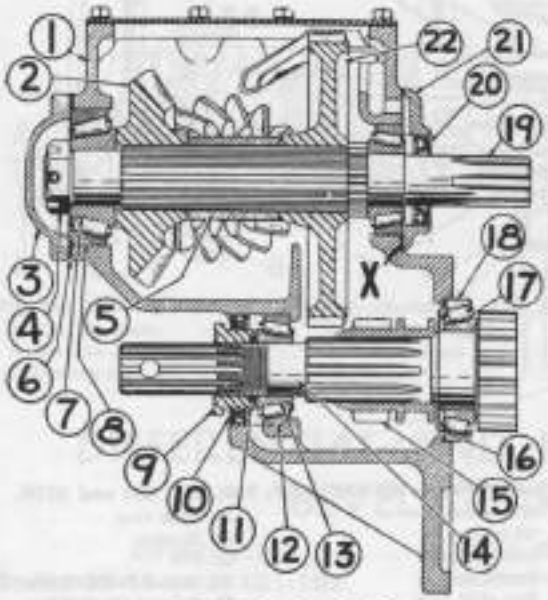
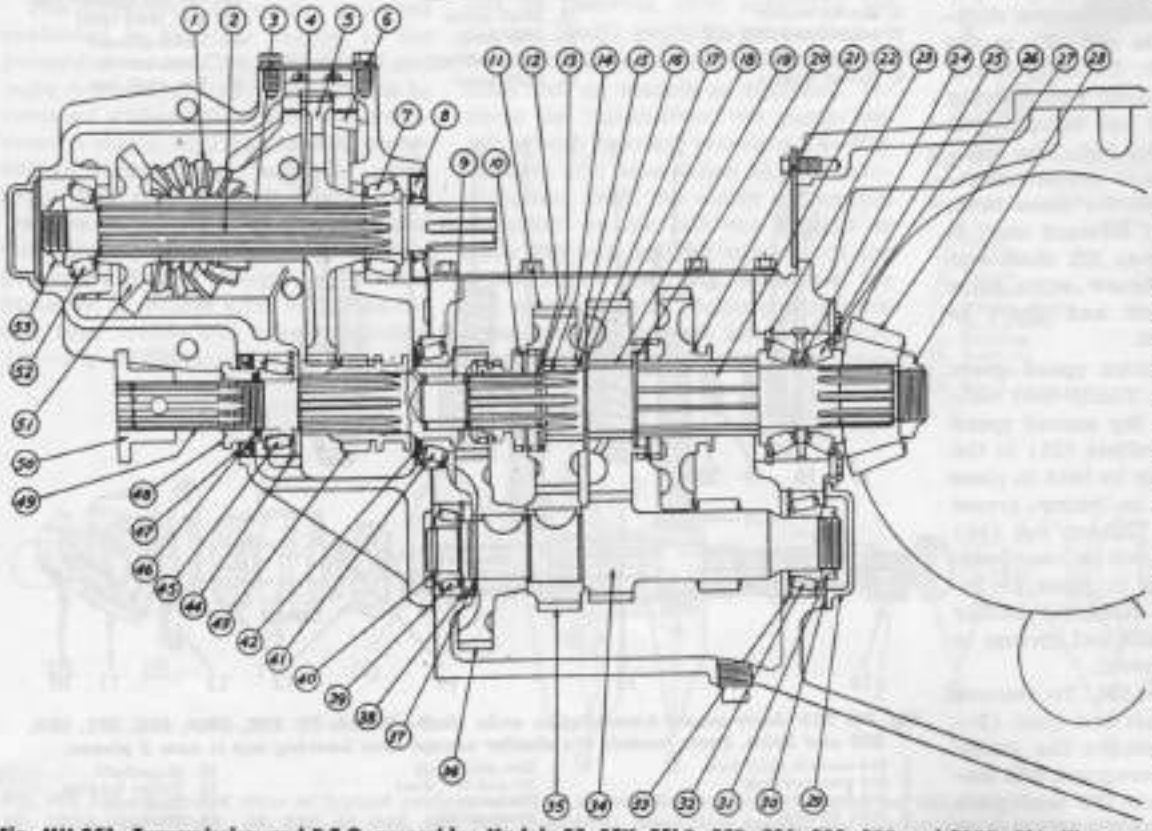


Fig. MH 350 — Sectional view of PTO case as used on the 55, 55K, 55LP, 55D, 201, 202, 203 and 203G tractors.

X. Shims
1. Power take-off case
2. Belt pulley drive gear
3. PTO front bearing cover
4. PTO shaft nut
5. Spacer sleeve
6. PTO front bearing cover shim
7. PTO bearing cone
8. PTO bearing cup
9. Collar nut
10. Oil seal
11. Bearing oil seal
12. Bearing cup
13. Bearing cone
14. Main drive shaft
15. BP and PTO drive gear
16. Bearing shield
17. Bearing cone
18. Bearing cup
19. PTO shaft
20. Oil seal
21. PTO rear bearing cover
22. PTO shaft gear



1. Pulley shaft gear
2. PTO drive shaft
3. Gear spacer
4. Gear shim
5. Pulley drive gear
6. Oil trough
8. Oil seal
9. Roller bearing
10. 3rd and 4th shift hub
11. 3rd sliding gear
12. Snap ring
13. Roller retainer
14. Bushing lockpin
15. Roller bearing
16. Bushing
17. Retainer
18. 2nd sliding gear
19. Roller bearing
20. Washer
21. 1st and rev. gear
22. Mainshaft
24. Spacer
26. Retainer
27. Bevel pinion
29. Bearing cap
30. Gasket
34. Countershaft
35. 3rd gear
36. Countershaft gear
37. Snap ring
38. Snap ring
40. Snap ring
42. Bearing shields
43. Shifter collar
44. Snap ring
46. Gasket
47. Oil seal
48. Shaft nut
49. Front (stub) shaft
50. Coupling hub
51. Pulley drive gear

Fig. MH 351—Transmission and P.T.O. assembly—Models 55, 55K, 55LP, 55D, 201, 202, 203 and 203G. This illustration is not necessarily correct regarding minor details, and is used only to show the relative position of the component parts.

nut from forward end of shaft and bump shaft rearward and out of gears and case. Remove coupling and nut (9) from forward end of drive gear and bump same rearward and out of case. The need and procedure for further disassembly is evident after an examination of the unit.

When reassembling the unit, install the same number of shims (6) as were removed and tighten nuts (4 and 9) to obtain a slight amount of bearing drag.

242. MAIN (BEVEL PINION) SHAFT. The mainshaft or bevel pinion shaft (22—Fig. MH351) can be removed after performing the following preliminary work: Remove the power take-off case as in paragraph 240A and the differential and master gears as outlined in their respective sections.

Unstake and unscrew nut (28). Remove bevel pinion (27) and rear bearing retainer plate (26).

On the right side of the transmission case, locate three small pipe plugs in a vertical line under the plate which supports the steering gear housing. Unscrew the two upper plugs and remove the coil spring and ball under each. These balls are used as detents to hold shifter rods in correct position. Remove shifter fork from upper shifter rod (7—Fig. MH352) by removing shifter fork lock set screw and sliding the rod rearward. Note: The transmission gears must be in neutral position when this is done. Remove shifter fork from middle rod (2) in the same manner. NOTE: Do not pull rod completely out of front rod bearing bore or detent balls and lockpin will drop out and may be lost. The lockpin must be in place to prevent shifting into two gears at the same time. Bump the mainshaft forward until it is out of bearing, then lift shaft and gears out of case. Renew worn parts and reassemble shaft and gears as shown in Fig. MH353.

The second and third speed gears ride on loose rollers. Thirty-four rollers (5) are used in the second speed gear and thirty-six rollers (21) in the third. The rollers may be held in place with rubber bands or heavy grease when reassembling. Tighten nut (10) until a slight drag is felt on rear bearing and lock the nut in place by indenting the flange. Reinstall shifter rods, forks, detent balls and springs in reverse order of removal.

243. REVERSE IDLER. To remove the reverse idler shaft and gear (2—Fig. MH354) first remove the mainshaft as outlined in paragraph 242. Remove idler shaft lock (3) and push idler shaft out of case toward rear of tractor.

244. COUNTERSHAFT. To remove the countershaft (34—Fig. MH351) first remove the mainshaft as outlined in paragraph 242 and the reverse idler as in paragraph 243. Remove rear bearing retainer plate (29) and unstake and remove the nut (31) from shaft.

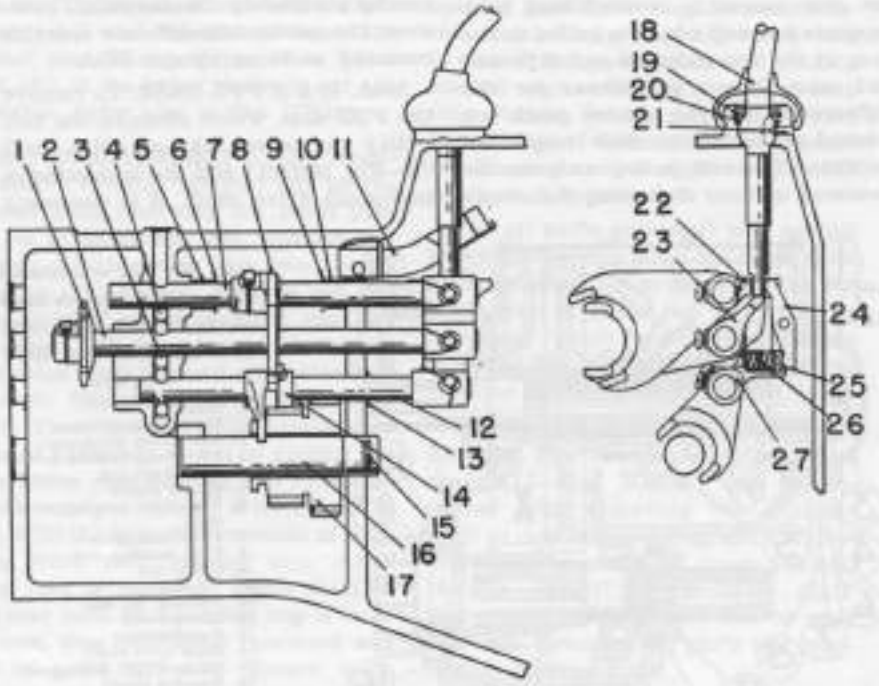


Fig. MH 352—Gear shifter rails and forks—Models 55, 55K, 55LP, 55D, 201, 202 and 203G.

1. 3rd and 4th shift fork
2. 3rd and 4th shift rail
3. Interlock pin
4. Interlock ball
5. Spacer tube
6. Spacer washer
7. 1st and 2nd shift rail
8. 1st and 2nd shift fork
9. Spacer washer
10. Spacer tube
11. Oil tube
12. Idler shift rail
13. Spacer washer
14. Rev. shift fork
15. Shaft collar
16. Idler shaft
17. Gear bushing
18. Shift lever
19. Snap ring
20. Washer
21. Pin
22. 1st and 2nd shift lug
23. 3rd and 4th shift lug
24. Rev. latch lever
25. Latch plunger
26. Latch spring
27. Rev. shift lug

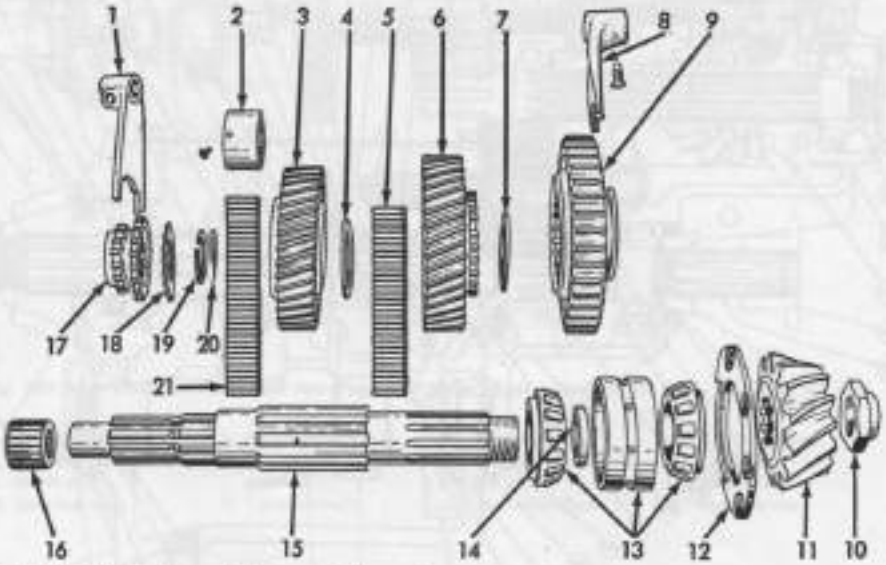


Fig. MH 353—Early model transmission main shaft—Models 55, 55K, 55LP, 55D, 201, 202, 203 and 203G. Later models are similar except rear bearing cup is now 2 pieces.

1. 3rd and 4th shift fork
2. 3rd gear bushing
3. 3rd speed gear
4. Gear washer
5. 2nd gear rollers
6. 2nd speed gear
7. Washer
8. Rev. shift fork
9. 1st and rev. gear
10. Pinion nut
11. Bevel pinion
12. Bearing plate
13. Bearing
14. Spacer
15. Mainshaft
16. Roller bearing
17. Shift hub
18. Washer
19. Snap ring
20. Shim
21. 3rd gear rollers

Remove snap ring (40) from front end of shaft and bump assembly toward the rear, far enough to permit the rear bearing cone to be pulled off the shaft. Pull the bearing cone and remove shaft assembly through top opening in case. Renew worn parts and reassemble as shown in Fig. MH-354. Reinstall, and adjust bearings by tightening the spanner nut (31—Fig. MH351) until a slight drag is felt. Lock nut by indenting (staking) the flange.

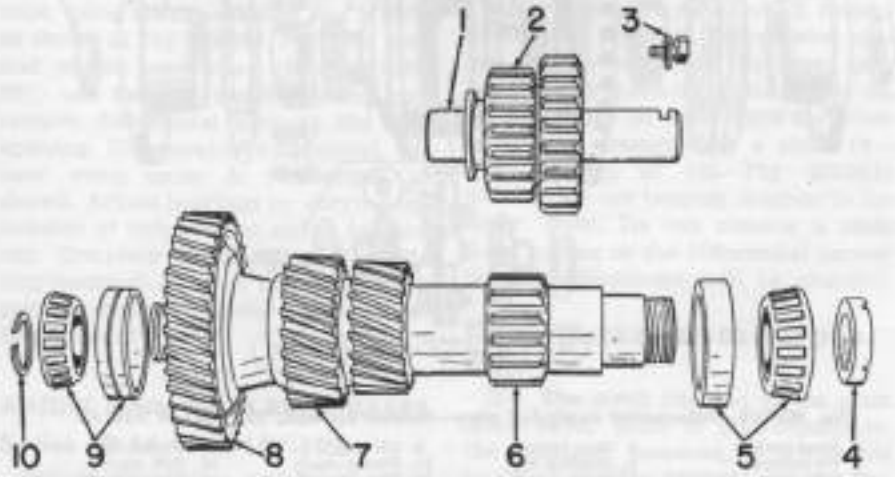


Fig. MH 354—Idler and countershaft—Models 55, 55K, 55LP, 55D, 201, 202, 203 and 203D.

1. Rev. idle shaft
2. Rev. idle gear
4. Bearing nut
5. Bearing
6. Countershaft
7. 3rd gear
8. Drive gear
9. Bearing
10. Snap ring

DIFFERENTIAL AND MAIN DRIVE BEVEL GEARS

DIFFERENTIAL

Series 30-44-44(6)-101-102

The differential and master gears are contained in the rear section of the transmission case. The differential and main drive bevel ring gear unit can be removed without disturbing the transmission shafts. NOTE: The R & R procedure given in the following paragraph 250, applies to all of the above tractors except the 44 models equipped with live power take-off. The removal procedure for the excepted 44 models, however, is evident after removing the disc type brakes and bearing carriers (29—Fig. MH361).

250. **R & R AND OVERHAUL.** The differential and bevel ring gear unit can be removed after removing the master (bull) gears by proceeding as follows: Remove both brake assemblies and on models so equipped, remove the transmission oil pump. Remove both bearing retainers (4—Fig. MH360) and save shims (5) for reinstallation. Drift the entire differential assembly to the left far enough to push the left bearing cup out of the transmission case and withdraw the left master (bull) pinion and bearing cone assembly through bearing bore in case. Drift the right master (bull) pin-

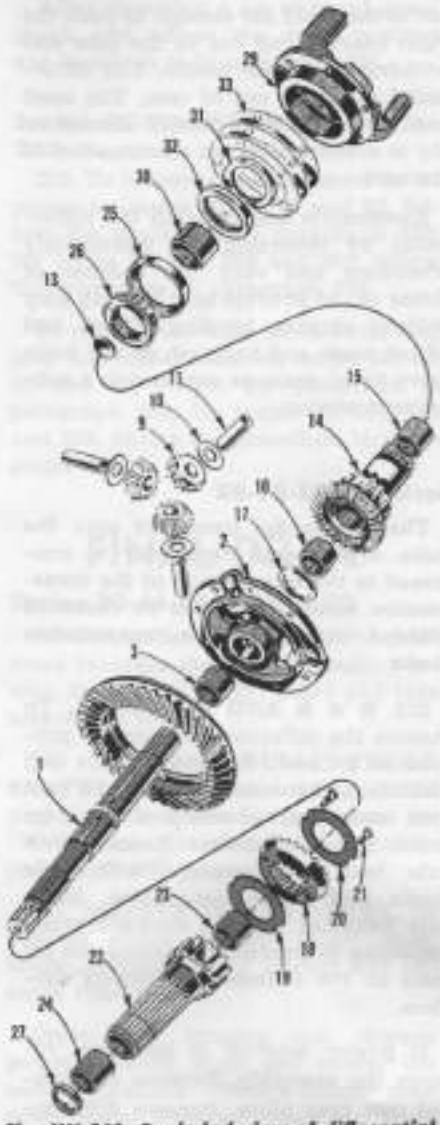


Fig. MH 361—Exploded view of differential as used on 44 series tractors when equipped with continuous (live) power take-off.

2. Cage
3. Bushing
5. Pinion
10. Thrust washer
11. Pinion shaft
14. Bull pinion
15. Bushing
16. Bushing
17. Thrust washer
18. Right drive gear
19. Thrust washer
20. Thrust washer
22. Pinion sleeve
23 & 24. Bushing
25 & 26. Bearing
27. Oil seal
29. Bearing carrier
30. Sleeve
31 & 32. Oil seals
33. Shims

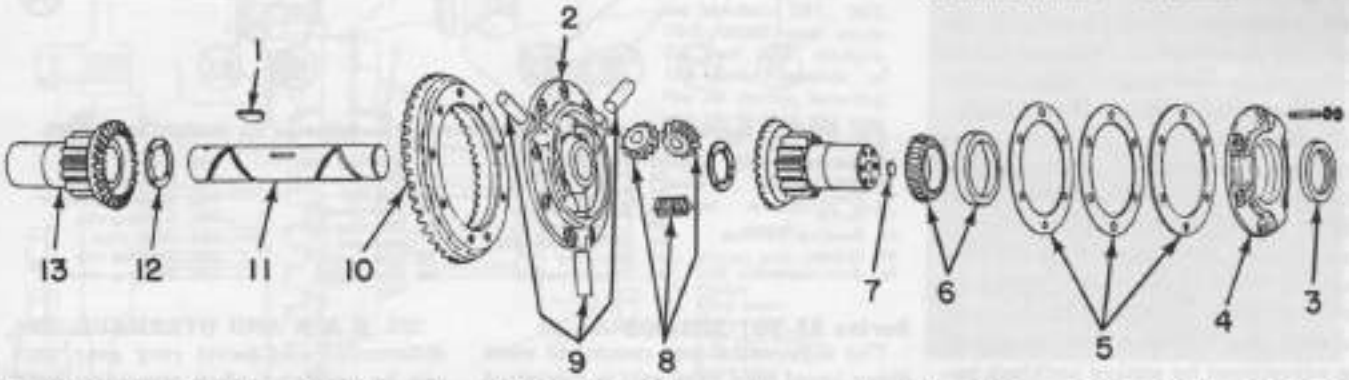


Fig. MH 360—Exploded view of typical early production differential assembly as used on 101, 101 Super, 101JR., 102JR., 101SR., 102 SR., 102G.JR., 102G.SR., 30, 30K, 44, 44D, 44K, 44LP and 44(6). Some later models are equipped with bronze thrust washers for pinions.

1. Shaft key
2. Diff. spider
3. Oil seal
4. Retainer
5. Shims
6. Bearing
7. Plug
8. Pinions
9. Pinion pins
11. Through shaft
12. Thrust washer
13. Gear and pinion

ion to the right far enough to push the right bearing cup out of the case and withdraw the right pinion. Lift differential assembly out of case. The need and procedure for further disassembly is evident after an examination of the unit.

Reassemble and reinstall the differential by reversing the disassembly procedure and vary the number of shims (5) to provide zero bearing play without causing binding. Check and adjust mesh and backlash of the main drive bevel gears as outlined in a subsequent section.

Series 20-22-81-82

The differential combined with the main drive bevel ring gear is contained in the rear section of the transmission housing and can be removed without disturbing the transmission shafts.

252. **R & R AND OVERHAUL.** To remove the differential assembly, proceed as follows: Remove fenders and platforms, disconnect both brake pull rods, raise rear wheels and block up under transmission case. Remove both axle housings complete with axle shafts and brake assemblies. Move axle housings straight outward when removing to prevent damaging the oil seals in the differential bearing carriers.

If power take-off is installed, remove the assembly. Remove differential case rear plate. Remove differential bearing housings (82—Fig. MH-363). On models so equipped, loosen the differential thrust shoe adjusting screw (102) and remove differential assembly. CAUTION: Do not distort oil scraper which is on the side of the differential assembly. Disassemble the differential by driving lockpin (16—Fig. MH 362) out of shaft (10), and sliding shaft out. Turn thrust ball (13) sidewise and remove. Remove spider gears and thrust washers. Renew worn parts and reassemble as shown. Reinstall differential, and adjust bearings by varying the number of shims under bearing housings until a slight drag is felt on bearings. The full width of oil scraper must clear the side of the ring gear by 0.020 inch. Set differential thrust shoe, if so equipped, to clear the ring gear by 0.010 inch. Complete the adjustment by setting backlash between bevel pinion and ring gear as described under "Main Drive Bevel Gears".

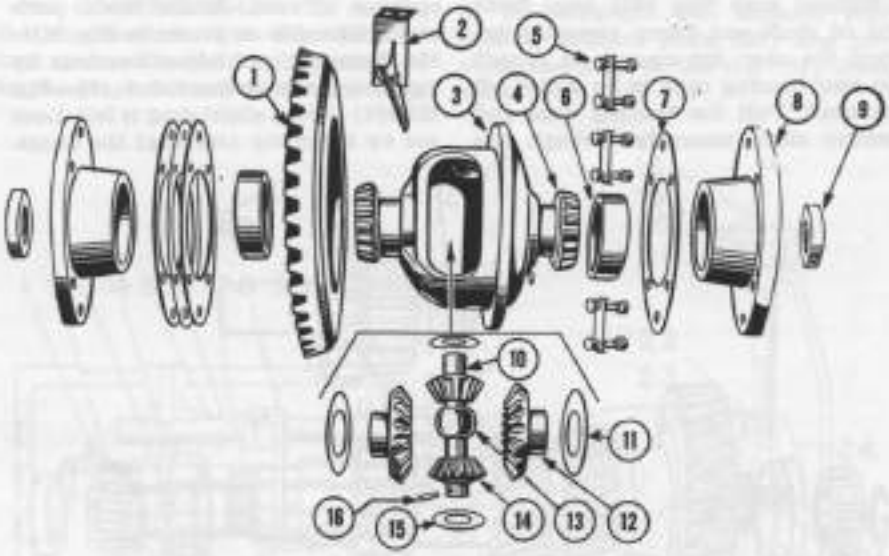


Fig. MH362—Differential exploded view—Models 20, 20K, 22, 22K, 81 and 82.

1. Ring gear
2. Oil scraper
3. Diff. case
4. Bearing cone
5. Gear screws
6. Bearing cup
7. Shim
8. Housing
9. Oil seal
10. Pinion shaft
11. Thrust washer
12. Side gear
13. Thrust ball
14. Diff. pinion
15. Thrust washer
16. Shaft pin

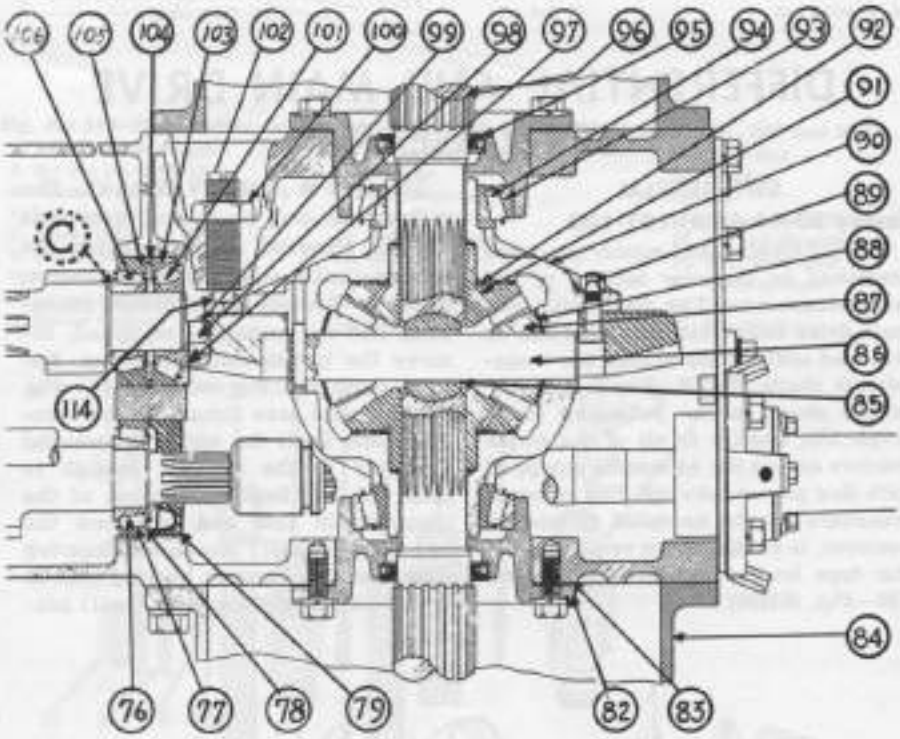


Fig. MH363—Sectional view showing differential installation on models 81 and 82.

76. Bearing cone
77. Bearing cup
78. Snap ring
79. Baffle
82. Bearing housing
83. Shims
84. Axle sleeve
85. Thrust ball
86. Pinion shaft
87. Pinion
88. Thrust washer
89. Lock screw
90. Differential case
91. Side gear
92. Thrust washer
93. Bearing cup
94. Bearing cone
95. Oil seal
96. Axle shaft
97. Bearing diaphragm
98. Nut
99. Cotter pin
100. Nut
101. Bearing cone
102. Adjusting screw
103. Bearing cup
104. Snap ring
105. Bearing cup
106. Bearing cone

Series 55-201-202-203

The differential and combined main drive bevel ring gear unit is contained in the rear section of the transmission case and can be removed without disturbing the transmission shafts.

253. **R & R AND OVERHAUL.** The differential and bevel ring gear unit can be removed after removing both brake assemblies as in paragraph 291 or 294, and the master (bull) gears and housing assembly as outlined in para-

graph 268, by proceeding as follows:

253A. Remove bearing caps or carriers (9—Fig. MH365) from both sides of differential case, noting the number of shims under each. Remove snap rings (8) from ends of through shaft (6) and on early models, pull bearing cups, using Owatonna Tool No. MH670 as shown in Fig. MH366. Pull side gear and pinion assemblies (2—Fig. MH-365) out through bearing bores, and remove differential through the case opening. Disassemble differential, renew worn parts & reassemble as shown. Adjust bearings by varying the number of shims under either bearing cap. Complete the adjustment by setting backlash of bevel pinion and ring gear as described under "Main Drive Bevel Gears".

ADJUST MAIN DRIVE BEVEL GEARS

Series 30-44-44(6)-101-102

255. Mesh position and backlash of main drive bevel gears is adjustable with shims. The mesh position (fore and aft position of the bevel pinion) is controlled by shims (12—Fig. MH-316) or (32—Fig. MH321). Bevel gear backlash is controlled by shims (5—Fig. MH360) or (33—Fig. MH361). The first step in the adjustment procedure is to set the fore and aft position of the main drive bevel pinion.

Note: It is important to have some bevel gear backlash **before** and **after** setting the fore and aft position of the bevel pinion, or a fallacious mesh position setting will be obtained.

On series 101 and 102, vary the number of shims (12—Fig. MH316) until heel (large end) of the bevel pinion is flush with heel of the main drive bevel ring gear. On series 30, 44, and 44(6), vary the number of shims (32—Fig. MH321) until toe (small end) of the bevel pinion is flush with toe of the main drive bevel ring gear.

The differential carrier bearings must always be adjusted to zero end play before adjusting the backlash.

After setting the fore and aft (mesh) position of the main drive bevel pinion, proceed to adjust the bevel gear backlash to 0.008-0.010 for series 30, 44, and 44(6) or 0.006-0.010 for other models by transferring a shim (5—Fig. MH360) or (33—Fig. MH361) from under one bearing retainer to the other. Note: Do not remove a shim from tractor or the differential carrier bearing adjustment will be changed.

Series 20-22-55-81-82-201-202-203

256. The mesh position of the main drive bevel gears is non-adjustable; the backlash, however, is adjustable by shims (7—Fig. MH362) or (11—Fig. MH365). After the differential carrier bearings have been adjusted to zero end play proceed to adjust the bevel gear backlash to 0.007-0.012 by transferring a shim from under one bearing retainer (or carrier on some late models) to the other. Note: Do not remove a shim from tractor or the differential carrier bearing adjustment will be changed.

R & R OR RENEW BEVEL GEARS

Series 30-44-44(6)-101-102

257. To remove the main drive bevel pinion on series 101 and 102 follow the procedure in paragraph 215; for series 30, 44, and 44(6), follow the procedure in paragraph 225.

To remove the main drive bevel ring gear, follow the procedure in paragraph 250.

After renewing a set of bevel gears, check and adjust the mesh position and backlash as in paragraph 255.

Series 20-22-55-81-82-201-202-203

258. To remove the main drive bevel pinion on series 20, 22, 81 and 82, follow the procedure in paragraph 233; for series 55, 201, 202 and 203, follow the procedure in paragraph 242.

To remove the main drive bevel ring gear and differential on series 20, 22, 81 and 82, follow the procedure in paragraph 252; for series 55, 201, 202 and 203, follow the procedure in paragraph 253.

FINAL DRIVE

Series 30-44-44(6)-101-102

As treated in this section, the final drive includes the master (bull) pinions, the master (bull) gears and rear wheel axle shafts.

260. **MASTER (BULL) PINION SHAFTS.** To remove the master (bull) pinion shafts, follow the procedure for "R&R And Overhaul" differential, paragraph 250.

261. **MASTER (BULL) GEARS.** To remove either master (bull) gear, block up rear end of tractor and remove rear wheel.

Drain rear housing and remove power take-off shaft and power lift unit if installed. Remove master gear cover plate. Remove cotter pin from master gear hub. Unbolt axle sleeve (6—Fig. MH370) and pull the sleeve and axle shaft assembly out of the master gear and the housing. Remove master gear (1) through top of housing. Renew worn parts and reinstall in reverse order.

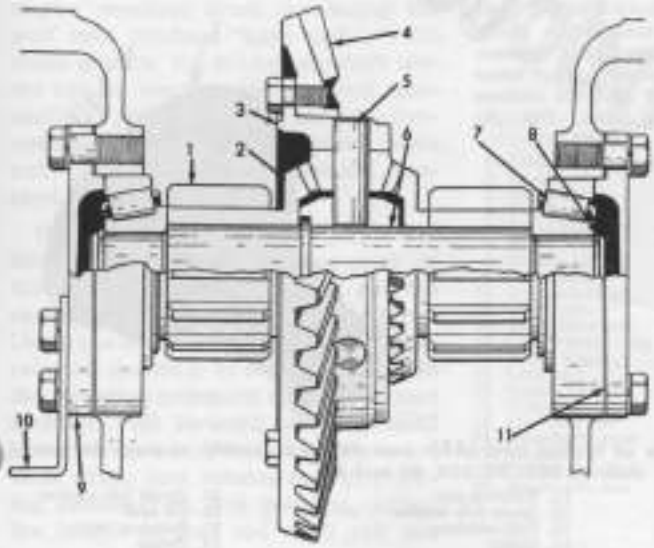


Fig. MH365—Differential assembly as used on models 201, 202, 203, 203G and early 55 and 55K models. On later models of the 55 series, bearing cap (9) is also the carrier for the bearing cups. Also, on later models, pinion gear thrust washers are used.

1. Master gear pinion
2. Diff. side gear
3. Spider
4. Ring gear
5. Pinion pin
6. Through shaft
7. Diff. bearing
8. Snap ring
9. Bearing cap
10. Pedal stop
11. Shims

Fig. MH366—Removing differential bearing cups using OTC tool MH670 on models 201, 202, 203, 203G and early 55 & 55K models.

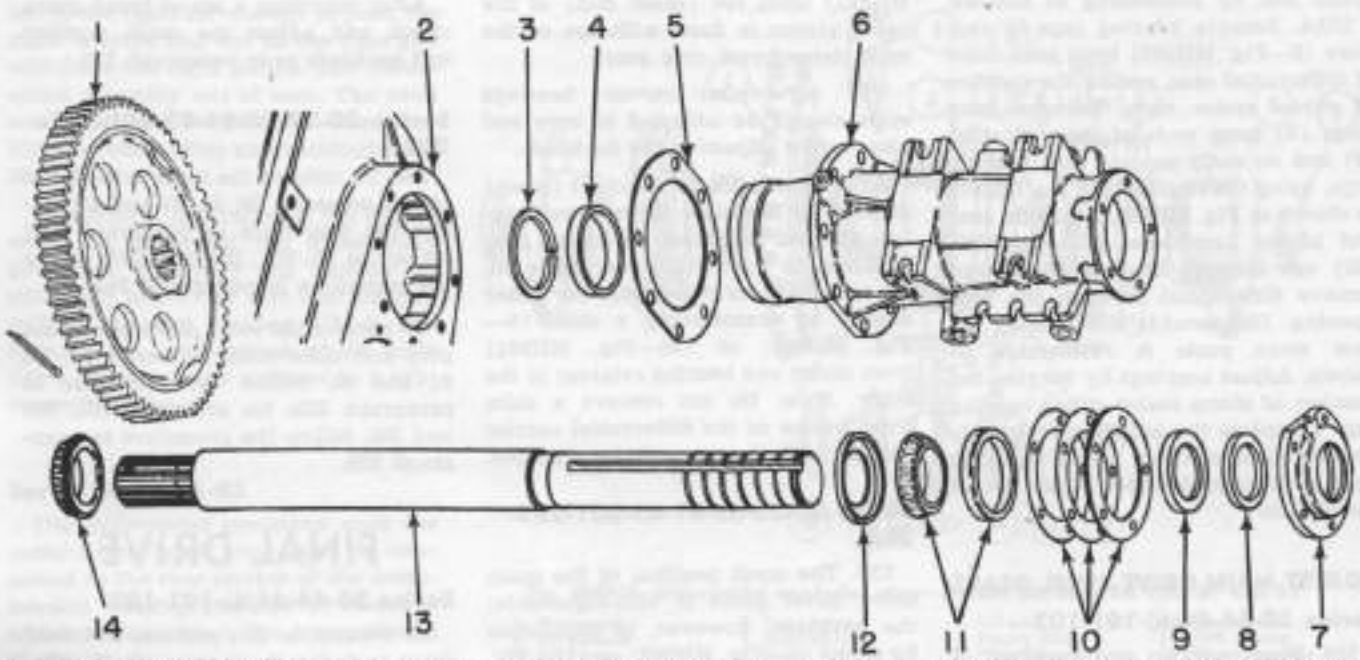


Fig. MH370—Master gear and rear axle—All models except 20, 20K, 22, 22K, 55, 55D, 55K, 55LP, 81, 82, 201, 202, 203 and 203D.

1. Master gear
2. Housing
3. Snap ring
4. Bearing cup
6. Axle housing
7. Bearing cup
8. Felt seal
9. Oil seal
10. Shims
11. Bearing
12. Washer
14. Bearing cone

When installing, first slide axle and sleeve assembly into the housing opening about halfway to the sleeve flange or until the inner end of the axle shaft just clears the master gear hub. Put master gear in place, aligning cotter pin holes in gear hub and axle shaft. Start the gear hub on the axle shaft spline and push the sleeve and axle assembly in all the way. Bolt the sleeve flange to the housing securely, and insert and lock the cotter pin.

262. **REAR WHEEL AXLE SHAFT AND BEARINGS.** The procedure for renewing the axle shaft and/or bearings is evident after the respective bull gear is removed as outlined in paragraph 261.

After the axle shaft and sleeve assembly is reinstalled on tractor, adjust the bearings to provide zero shaft end play without causing binding, by varying the number of shims (10—Fig. MH370).

Series 20-22-81-82

As treated in this section, the final drive includes the rear wheel axle shafts and housings.

265. **REAR WHEEL AXLE SHAFT AND BEARINGS.** To remove either rear wheel axle shaft, first block up rear end of tractor and remove wheel, fender and platform. Disconnect brake pull rod. Remove bolts holding axle sleeve to transmission housing and pull assembly straight out from housing. CAUTION: If axle is tipped, the inner oil seal may be damaged. Remove outer bearing cap (17—Fig. MH 371) and slide axle and bearings out of sleeve. Renew worn parts and reassemble using care not to damage oil seal when installing axle shaft.

After the unit is installed on the tractor, vary the number of shims (18) to provide .002-.005 total shaft end play to assure that bore of thrust ball (13—Fig. MH362), is approximately centered on pinion shaft (10).

Series 55-201-202-203

As treated in this section, the final drive includes the master (bull) pinions, the master (bull) gears and the rear wheel axle shafts.

267. **MASTER (BULL) PINIONS.** To remove the master (bull) pinions, first remove the master (bull) gear housing from transmission as per para-

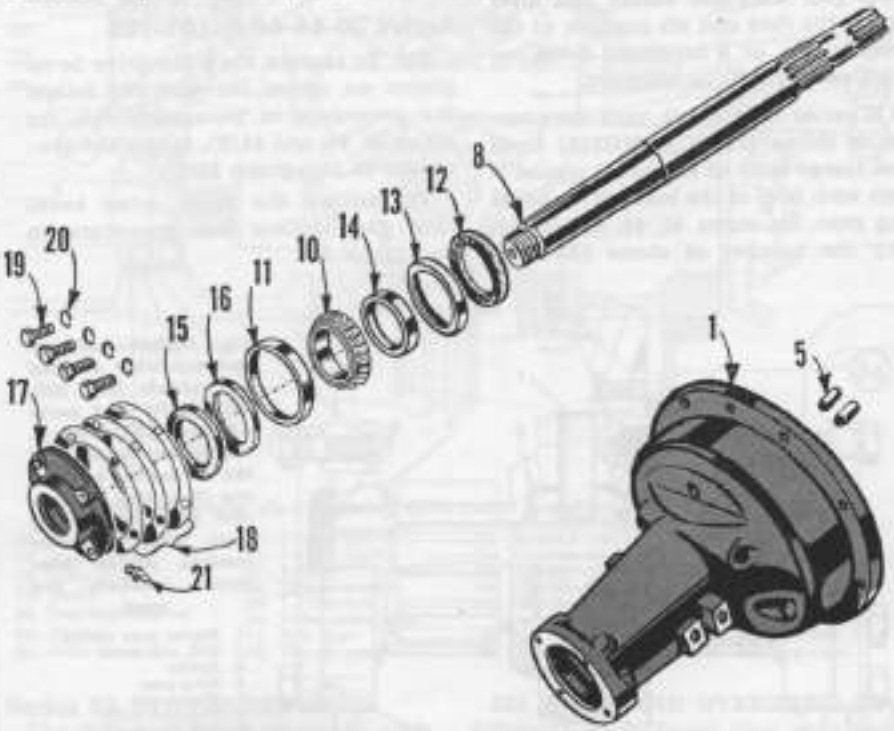


Fig. MH371—Exploded view of typical axle shaft and sleeve assembly as used on models 20, 20K, 22, 22K, 81 and 82.

1. Axle sleeve
5. Dowels
6. Axle shaft
10. Bearing cone
11. Bearing cup
12. Inner felt washer
13. Felt retainer
14. Collar
15. Outer felt washer
16. Oil seal
17. Bearing cup
18. Shims

graph 268 and remove brake housing units; then, proceed as in removing the differential as outlined in paragraph 253A.

268. **MASTER (BULL) GEARS, SHAFTS & BEARINGS.** To remove either bull gear or rear wheel axle shaft, first drain the master gear housing and remove the power take-off shaft. Block up rear end of tractor ahead of master gear housing (13—Fig. MH372). Unbolt master gear housing and roll complete assembly away from transmission.

268A. Block up the removed assembly and remove rear wheels. Remove cap screws which hold axle sleeves (10) to gear housing. Unbolt gear housing upper half (9) and remove. Remove shaft inner bearing cap (6). Raise the gear, shaft and sleeve assembly away from lower gear housing. The shaft outer bearing cap and sleeve may be pulled off the gear and shaft assembly as a unit. Press the bull gear from the axle shaft.

Reassemble in reverse order and vary the number of shims (4) to provide zero shaft end play without causing binding.

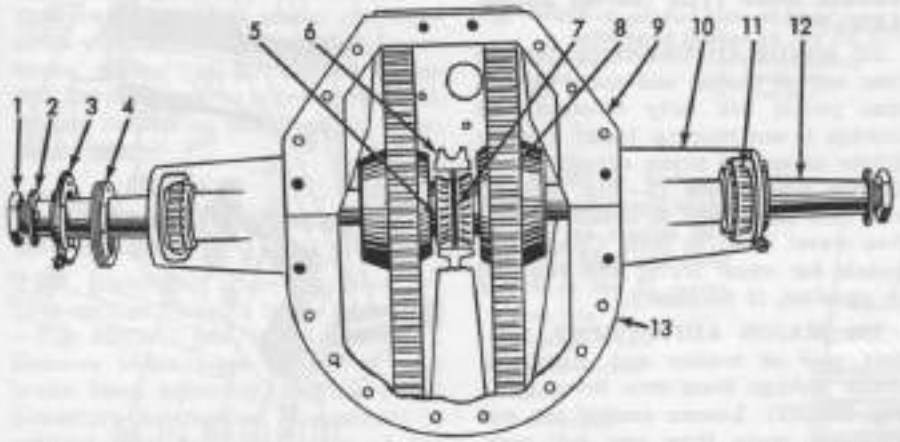


Fig. MH372—Master gears and rear axles—Models 55, 55D, 55K, 55LP, 201, 202, 203 and 203G.

2. Lip washer
3. Bearing cap
4. Shims
5. Bearing
6. Bearing cap
7. Spacers
8. Master gear
9. Upper housing
10. Axle housing
11. Bearing
12. Axle shaft
13. Lower housing

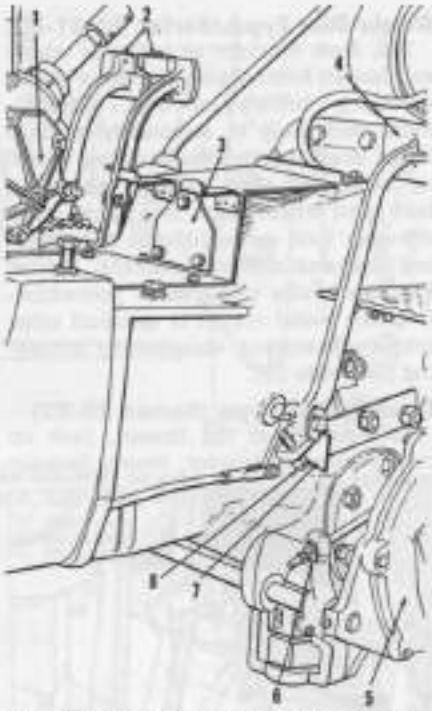


Fig. MH381—Brake and clutch pedals—Models 55, 55K, 55D, 55LP, 201, 202, 203 and 203G equipped with band type brakes.

1. Steering gear
2. Brake pedals
3. P.T.O. shaft plate
4. Clutch pedal
5. Brake housing
6. Adj. nut
7. Pedal stop
8. Stop screw

BRAKES

ADJUSTMENT

Internal Band Type

280. The Owners Book method of adjusting the brakes is by shortening the pull rods. This method will eliminate excessive free travel of the brake pedals but in some cases, the lever angles resulting from shortening the pull rods produce "hard pedals". On these models, the brake camshaft levers can be reset on the serrated camshafts to restore the original effectiveness, providing the lining is not worn out. To make this adjustment, proceed as follows:

Disconnect the brake pull rod. Scribe or pencil a correlation mark on the outer end of the camshaft and the camshaft lever, then remove the lever. Using the correlation marks as a guide, reinstall the lever to a new position on the serration rearward from its former position. Pull forward on lever until lining drags on drum; then rearward until drum just rotates freely. Holding camshaft in this position, adjust the length of pull rod until rod can be connected freely without moving the pedal or the camshaft. Apply the brake heavily and note angle of camshaft lever, the rod end of which should be slightly (5-10 degrees) rearward of perpendicular. Perpendicular line is taken from an imaginary line through center line of camshaft and center line pedal crossshaft. If rod end of lever is forward of perpendicular, it should be repositioned on the camshaft one serration farther to the rear and the pull rod readjusted. Do the same to the other brake.

Note: If one brake is tighter than the other, lengthen the pull rod slightly on the tight brake. Refer to Figs. MH380 and 381.

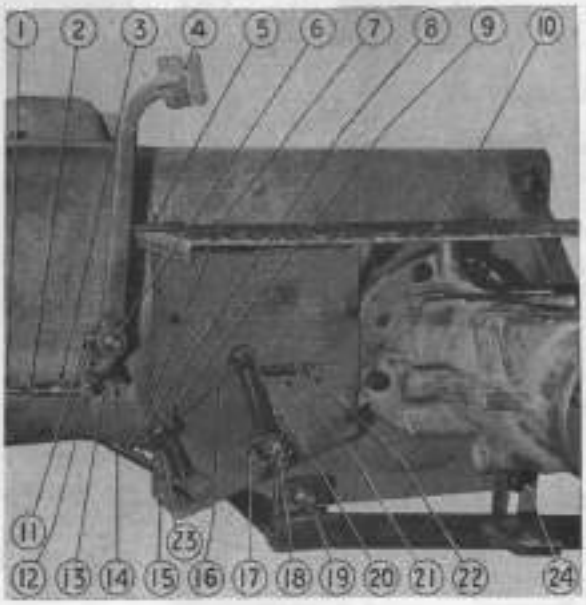


Fig. MH380—Brake and clutch adjustments — All models equipped with band type brakes except models 55, 55D, 55K, 55-LP, 201, 202, 203 and 203G.

1. Clutch release rod
2. Locknut
3. Rod end
5. Pedal stop
6. Pivot shaft
7. Pivot shaft
8. Grease fitting
9. Shaft arm
11. Grease fitting
12. Clevis pin
13. Stop screw nut
14. Clutch pedal stop
15. Brake plate
16. Link rod
17. Grease fitting
18. Camshaft
19. Drawbar bolt
20. Camshaft lever
21. Spring
22. Spring bracket
23. Brake adj. nut

Single Disc Type (Series 20-81-82)

282. Jack up right or left rear wheel and loosen locknuts on the three brake adjusting bolts (1A—Fig. MH382). Turn each bolt in separately until a slight drag is felt when turning wheel by hand, and then back off adjusting bolt until wheel turns free. Then back off each bolt an additional one-quarter turn and tighten locknuts. Adjust opposite brake using same procedure. If brake pedal travel is unequal after brake adjustment, equalize by adjusting pull rods (3).

Double Disc Type (Series 20-22)

283. To adjust the brakes, jack up rear portion of tractor, loosen locknut and vary the length of rod (1—Fig. MH383) by turning adjusting nut (6) until pedals have a free travel of 1½ inches from platform. Check both pedals for equal travel and readjust to equalize, if necessary.

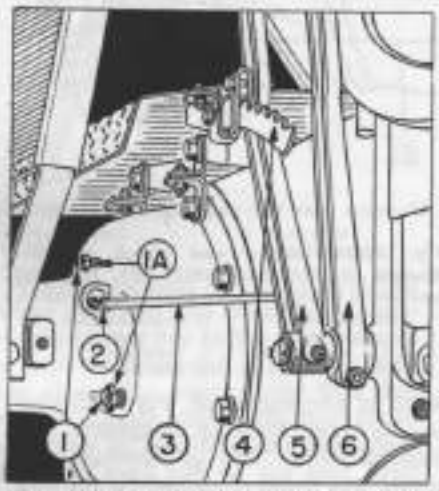


Fig. MH382—Single disc brake controls—Models 20, 20K, 81 and 82.

1. Adjusting bolt lock screw
1A. Adjusting bolt
2. Clevis
3. Pull rod
4. Pedal ratchet
5. R.H. brake pedal
6. L.H. brake pedal

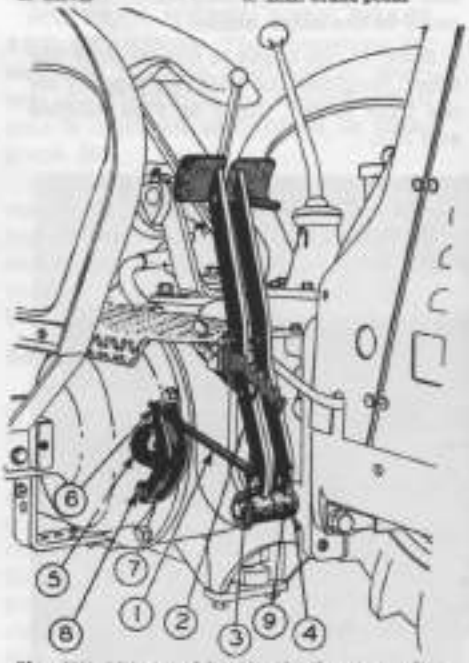


Fig. MH 383—Double disc brake controls—Models 20, 20K, 22 and 22K.

1. Brake pull rod
2. Pedal ratchet
3. Right brake pedal
4. Left brake pedal
5. Dust cover
6. Adjusting nut
7. Locknuts
8. Cotter key, washer and stud
9. Groove pin

Double Disc Type (44 Series Equipped with Live PTO)

284. To adjust the brakes, jack up rear portion of tractor, loosen lock nut and turn adjusting nut (6—Fig. MH384) until pedals have a free travel of 1¼-1¾ inches. Check both pedals for equal travel and readjust to equalize, if necessary.

Bendix Shoe Type (Series 30-44-44(6)-55)

285. **MINOR ADJUSTMENT.** Jack up rear end of tractor and make certain that pedals are fully released and linkage is not binding. Insert a screw driver or special brake adjusting tool in star wheel hole (5—Fig. MH385) and turn star wheel to obtain a pedal free travel of ½-¾ inch. Check both pedals for equal travel and readjust to equalize, if necessary.

286. **MAJOR ADJUSTMENT.** Support rear of tractor and disconnect brake linkage from cam lever (12—Fig. MH385). Loosen anchor pin nut (11) not more than one full turn. Loosen the six cap screws which retain the brake plate (1—Fig. MH386) to transmission housing (or brake mounting flange assembly on 55 series) until brake plate is free to move. On some models, it will be necessary to block up front end of platform to allow sufficient room for the brake plate to move. Insert a screw driver or special brake adjusting tool in star wheel hole (5—Fig. MH385) and turn star wheel until it is impossible to turn wheels by hand. Tighten the anchor pin locknut and the six brake plate retaining cap screws securely. Reposition platform (if platform was moved). Pull brake pedals back against platform, and while holding brake cam lever (12) fully forward by hand pressure only, adjust brake linkage until pin (9) will freely slide into position.

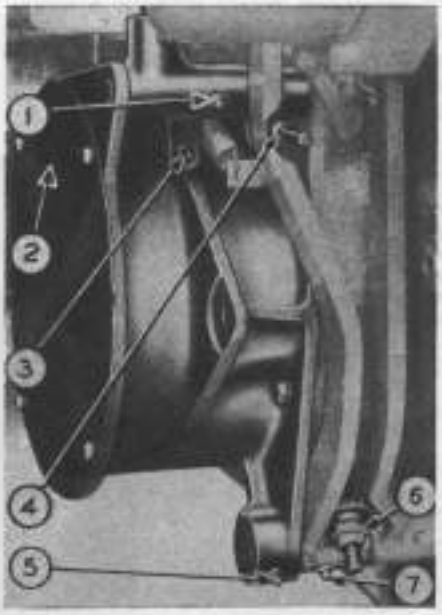


Fig. MH384—Clutch and double disc brake controls—(44 series equipped with live PTO).

1. Grease fitting
2. Cover
3. Clutch lever position adjustment
4. Clutch adjustment
5. Grease fitting
6. Brake adjustment
7. Grease fitting

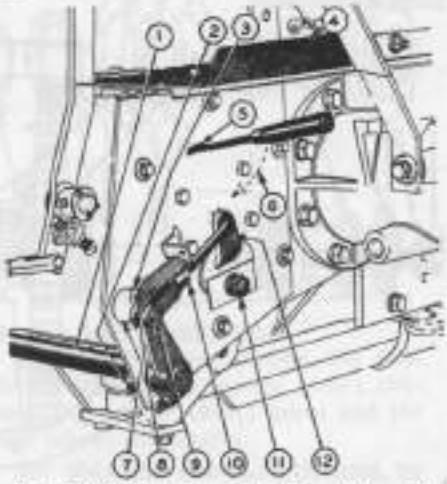


Fig. MH385—Typical Bendix shoe type brake controls as used on models 30, 30K, 44, 44D, 44K, 44LP, 44(6), 55, 55D, 55K, and 55LP.

1. Pedal cross shaft
2. Cross shaft arm
3. Foot board
4. Star wheel adjusting hole
5. Move screwdriver down to tighten
6. Bearing hole (used on 55)
7. Pedal return spring
8. Linkage pin
9. Brake linkage
10. Anchor pin nut
11. Cam lever

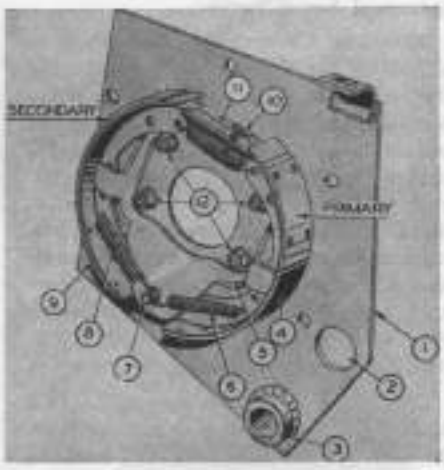


Fig. MH386—Inside view of Bendix shoe type brakes as used on models 30, 30K, 44, 44D, 44K, 44LP, 44(6), 55, 55D, 55K and 55LP.

1. Left brake plate
2. Bearing for cross shaft
3. Primary shoe
4. Spider for brake shoes
5. Primary spring (light)
6. Anchor pin for brake shoes
7. Secondary spring (heavy)
8. Secondary brake shoe
9. Star wheel-brake adjustment
10. Adjustment screw nut
11. Bolts for spider to brake plate

Loosen star wheels until pedals have a free travel of ½ to ¾ inch. Check both pedals for equal travel and readjust at star wheel to equalize, if necessary.

R&R DRUM, PLATES, BAND, SHOES OR DISCS

Internal Band Type (All Models Except Series 55-201-202-203)

290. To remove brake assemblies for brake band relining or drum renewal, proceed as follows: Disconnect both brake link rods (5—Fig. MH390). Remove brake shaft lever (7) and brake shaft (10) complete with brake pedals. Remove both brake plates (9) complete with brake band units. Remove brake drums (12) if desired. Reinstall parts in reverse order of removal. Adjust brakes as described in paragraph 280.

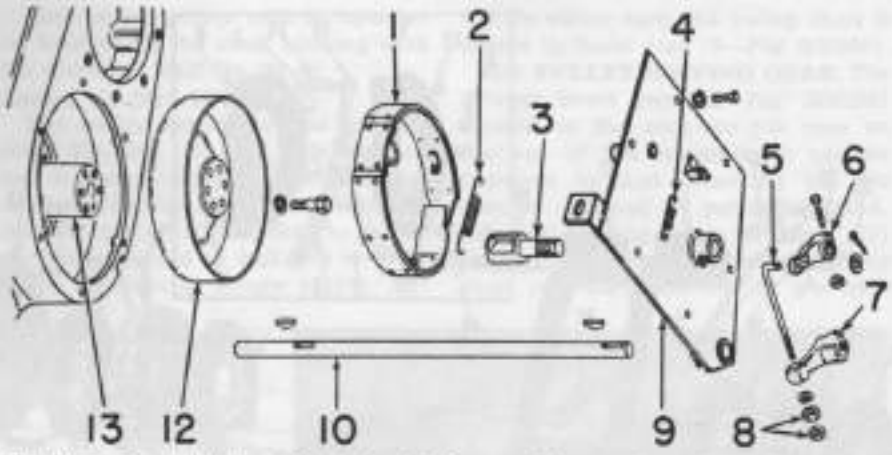


Fig. MH390—Exploded view of band type brake assembly as used on all models equipped with band brakes except 55, 55D, 55K, 55LP, 201, 202, 203 and 203G.

1. Brake band
2. Spring
3. Cam
4. Return spring
5. Brake rod
6. Cam arm
7. Shaft arm
8. Adj. nuts
9. Housing plate
10. Pedal shaft
12. Brake drum
13. Pinion hub

Internal Band Type (Series 55-201-202-203)

291. Disconnect brake cam lever return springs. Remove brake cover (14—Fig. MH391) and brake drum (4). Remove brake band spring (6) and brake band assembly. The need and procedure for further disassembly is evident after an examination of the unit. Reinstall parts in reverse order of removal. Adjust brakes as described in paragraph 280, after installation is complete.

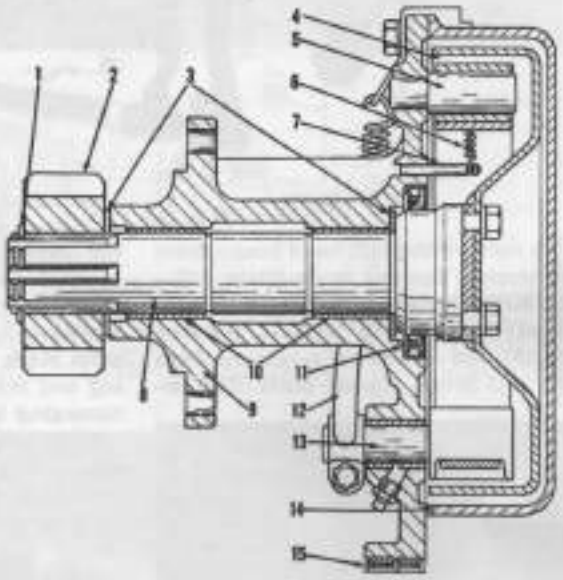


Fig. MH391 — Sectional view of band type brake as used on models 201, 202, 203, 203G and older models of the 55 series.

1. Snap ring
2. Brake shaft gear
3. Thrust washers
4. Drum
5. Band anchor
6. Spring
7. Spring anchor
8. Mounting flange
10. Shaft bushings
11. Oil seal
12. Brake lever
13. Shaft and cam
14. Brake cover
15. Bushing

Disc Type (Series 20-22-81-82)

292. The procedure for removing and overhauling either the single or double disc type brakes is evident after removing the axle sleeves as follows: Block up rear end of tractor and remove fenders, platforms and rear wheels. Disconnect the brake linkage and remove the cap screws securing the axle housings to the transmission case. Move the axle housing assemblies straight outward when removing, to prevent damaging the oil seals in the transmission case. The axle sleeves and brake assemblies are shown in Figs. MH393 and 394.

Reassemble the parts by reversing the disassembly procedure and adjust the single disc brakes as in paragraph 282; double disc brakes, as in paragraph 283.

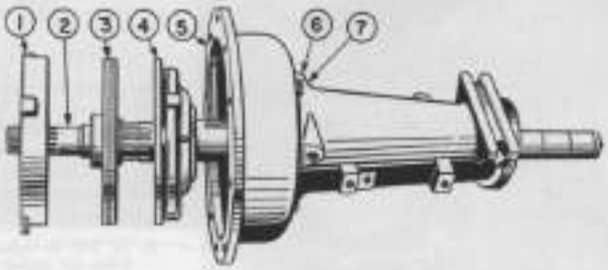


Fig. MH393—Single disc brake assembly as used on models 81, 82 and early 20 and 20K models.

1. Secondary disc
2. Axle shaft
3. Middle ring
4. Primary disc
5. Axle housing
6 & 7. Adj. screw and lock

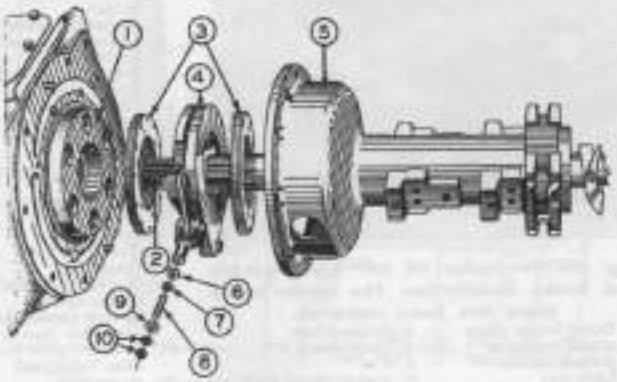


Fig. MH 394—Double disc brake assembly as used on models 22, 22K and late 20 and 20K models.

1. Secondary disc
2. Rear axle shaft
3. Middle disc
4. Actuating disc
5. Rear axle sleeve
6. Washer
7. Locknut
8. Stud
9. Washer
10. Locknuts

Double Disc Type (44 Series Equipped with Live PTO)

293. The procedure for overhauling the disc type brakes is evident after the units have been removed from the tractor.

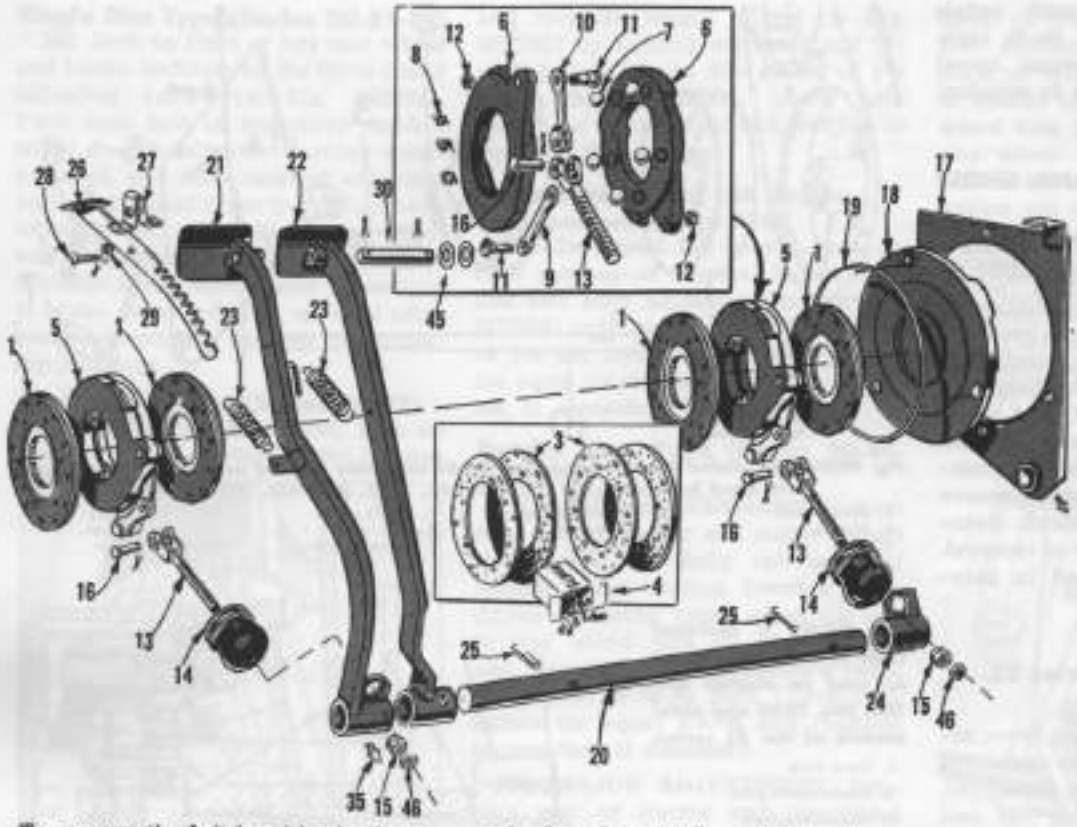


Fig. MH395 — Exploded view of series 44 double disc type brakes. The left brake is accessible after removing plate (17). The right brake can be removed after removing the power take-off clutch.

1. Lined disc
3. Linings
4. Rivets
5. Actuating disc assembly
6. Actuating disc
7. Ball ⅞ inch
8. Spring
9. Link
10. Yoke link
11. Stud
12. Brake rod
14. Dust cover
15. Nut
17. Cover plate
18. Brake plate
19. Dust ring
20. Brake cross shaft
21. Right pedal
22. Left pedal
23. Pedal return spring
24. Lever
25. Pin
26. Pedal ratchet
27. Bracket
28. Pivot pin
29. Spring
30. Lock pin

To remove the left hand brake from the tractor, remove cover plate (17—Fig. MH395), back plate (18) and outer (lined) disc (7—Fig. MH396). Remove pin (6) and withdraw actuating discs unit and inner (lined) plate. The inner brake plate (differential bearing carrier) can be removed at this time, if lining contacting face of plate is scored or if oil seals are leaking. Use shim stock or tin sleeve when removing and reinstalling the plate to avoid damaging the seals.

The removal procedure for the right brake is similar to the left, after removing the power take-off clutch units as outlined in a subsequent section.

After brakes are installed, adjust same as outlined in paragraph 284.

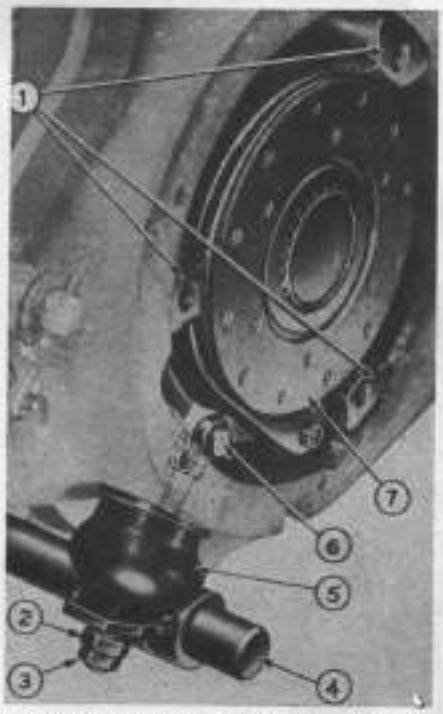


Fig. MH396—Series 44 left hand double disc brake installation. The outer brake plate has been removed.

1. Outer brake plate attaching holes
2. Adjusting nut
3. Lock nut
4. Cross shaft
5. Dust cover
6. Pin
7. Outer (lined disc)

Bendix Shoe Type (Series 30-44-44(6)-55)

294. To remove the component parts of the brake unit, remove the pedal return spring and disconnect the operating linkage. Remove arm (19—Fig. MH400). (When working on right side of tractor, remove the right brake pedal and return spring.) Remove the cap screws retaining the brake plate (9) and remove the plate. The need and procedure for further disassembly is evident after an examination of the unit. If difficulty is encountered when

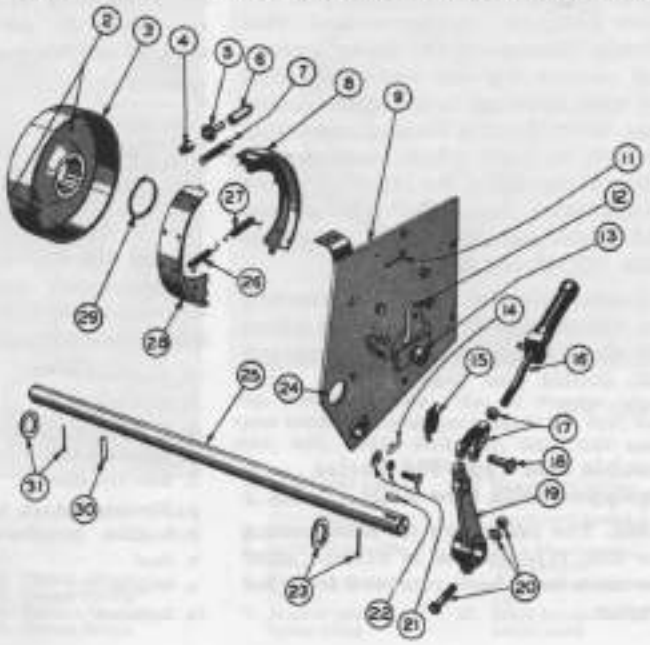


Fig. MH400 — Exploded view of typical Bendix type brakes as used on late models of the 30, 30K, 44, 44D, 44K, 44LP, 44(6), 55, 55D, 55K, and 55LP.

2. ½" NC threaded holes for puller bolts
3. Brake drum
4. Socket
5. Adjusting screw
6. Adjusting screw nut
7. Spring
8. Rear shoe secondary
9. Brake plate
11. Slotted hole
12. Cam lever
13. Anchor pin nut
14. Seal clip
15. Pedal return spring
16. Brake rod
17. Clevis and lock nut
18. Pin
19. Arm
22. Woodruff key
25. Cross shaft
26. Spring (primary) (weak spring)
27. Spring (secondary) rear shoe (heavy)
29. Primary shoe-front shoe (edge red)
29. Snap ring

removing brake drum (3), two long ½ inch N.C. cap screws can be screwed into holes (2), to act as a puller.

Reassemble parts by reversing the disassembly procedure; make certain, however, that the primary shoe (edge painted red) is installed at front. The primary (front) spring (26) is the weaker spring. Adjust brakes as outlined in paragraph 286.

BELT PULLEY

All Except Series 20-22-55-201-202-203

The belt pulley shaft and gear (11—Fig. MH420) is driven by a bevel gear on the belt pulley and power take-off drive shaft. The driving bevel gear (3—Fig. MH310) can be removed by following the general procedure given in paragraph 211.

300. **OVERHAUL DRIVEN UNIT.** Remove the unit from tractor. Remove nut (1—Fig. MH420), withdraw the pulley from the shaft and press shaft out of housing. Renew any worn parts, prelubricate the bearings and reassemble the unit. After bearing carrier (6) retaining cap screws are tight, check pulley shaft for end play. If end play is more than 0.010, renew bearing (7).

When installing the unit on the tractor, vary the number of shims (8—Fig. MH420) and (12—Fig. MH310) until heels (large end) of bevel gears are in register and backlash is not less than 0.005 or more than 0.010 when checked at the bevel gears.

Series 20-22-81-82

The pulley shaft and gear (8—Fig. MH421) are driven by a bevel gear on the clutch shaft. The driving bevel gear (26—Fig. MH303) can be removed from the clutch housing after removing the housing. The procedure for removing the clutch housing is given in paragraph 205.

301. **OVERHAUL DRIVEN UNIT.** Remove unit from tractor. Remove cotter pin and nut (9—Fig. MH421), and press shaft out of housing. The need and procedure for further disassembly is evident after an examination of the unit. When reassembling the unit, tighten nut (9) until shaft has zero end play, yet turns freely.

When reinstalling the pulley unit on the tractor, vary the number of shims between pulley housing and clutch housing to provide a bevel gear backlash of 0.006, measured at gears. The bevel gear backlash is correct if the pulley face has 3/64 inch free travel.

Note: After pulley unit is installed on tractor, fill the shaft housing with 3½ quarts of SAE No. 90 oil.

Series 55-201-202-203

The pulley driven unit as used on early 201, 202, 203 and 203G models was mounted in taper roller bearings as shown in Fig. MH422. On later 201, 202, 203, and all 55 tractors, the pulley shaft is mounted in ball and straight roller bearings as shown in Fig. MH 423. In either case, the pulley shaft is driven by bevel gear (2—Fig. MH350).

302. **PULLEY DRIVING GEAR.** The driving bevel gear (2—Fig. MH350) located in the separate pto case on the top of the transmission can be removed by first removing the pto case as outlined in paragraph 240A. Remove bearing caps (3) and (21) from opposite ends of shaft and bump shaft rearward and out of pto case

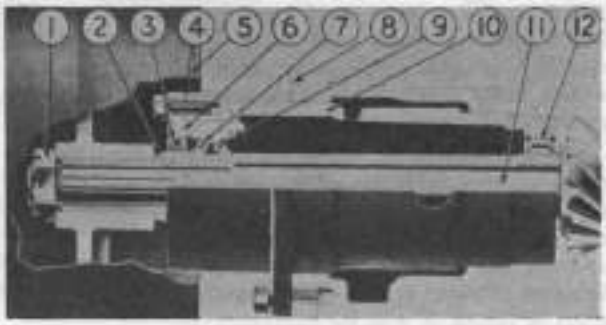


Fig. MH420 — Sectional view of typical belt pulley unit as used on all models except 20, 20K, 22, 22K, 55, 55D, 55K, 55LP, 81, 82, 201, 202, 203 and 203G.

2. Spacer sleeve
3. Oil seal
4. Gasket
6. Bearing carrier
7. Bearing
8. Shims
9. Snap ring
10. Shaft sleeve
11. Shaft and gear
12. Bearing

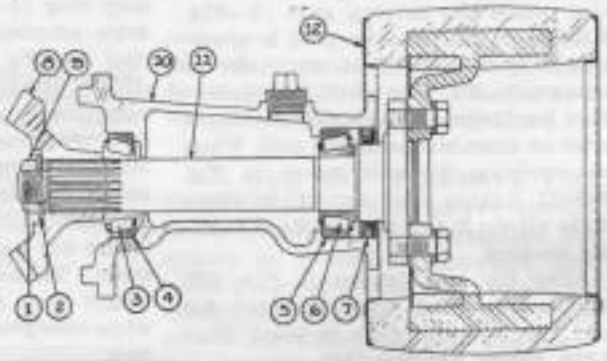


Fig. MH421—Section view of typical belt pulley driven unit as used on models 20, 20K, 22, 22K, 81 and 82.

1. Cotter pin
2. Washer
3. Bearing cone
4. Bearing cup
5. Bearing cup
6. Bearing cone
7. Oil seal
8. Drive gear
9. Shaft nut
10. Shaft sleeve
11. Pulley shaft
12. Belt pulley

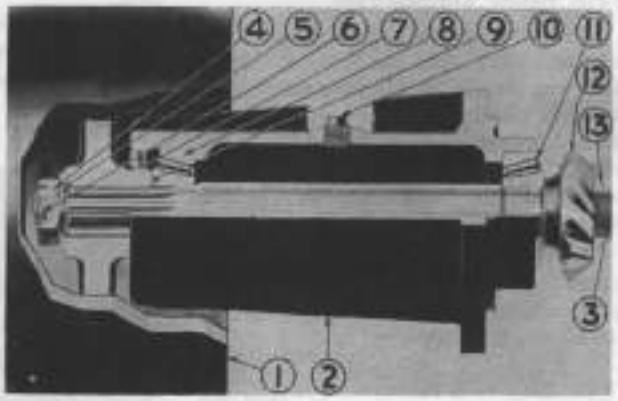


Fig. MH422—Pulley unit as used on early 201, 202, 203 and 203G models.

1. Belt pulley
2. Shaft sleeve
3. Puller shaft
4. Nut
5. Washer
7. Oil seal
8. Bearing
9. Gasket
10. Filler plug
11. Bearing
12. Drive gear
13. Gear nut

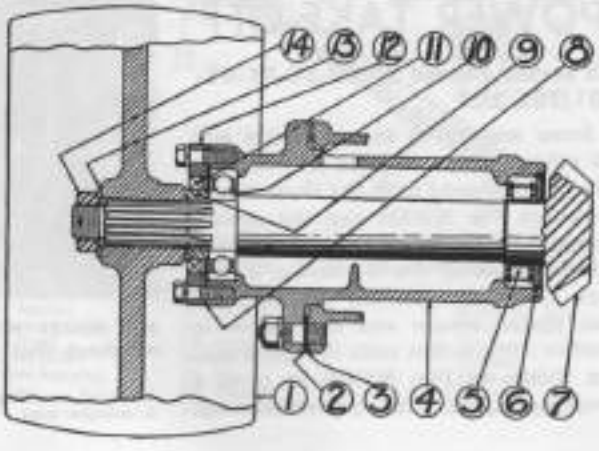


Fig. MH423—Pulley unit as used on late 201, 202, 203, 203G and all 55, 55D, 55K and 55LP models.

1. Belt pulley
2. Shim (thin)
3. Shim (thick)
4. Shaft sleeve
5. Bearing
6. Snap ring
7. Shaft and gear
8. Gasket
9. Spacer
10. Bearing
11. Oil seal
12. Bearing cap
13. Lockwasher
14. Shaft nut

after removing nut (4) from front end. If the driving bevel gear (2) is faulty it will be necessary to also renew the driven gear on the belt pulley shaft as gears are available only in matched pairs. After installing shaft adjust bearings to zero end play by varying shims (6) and (X) located under the bearing caps. If a new gear has been installed adjust the bearings first, then adjust the mesh position to bring heel (thick end) ends of driving and driven gear teeth flush, by removing a shim or shims from under one cap and installing the same shim or shims under the cap at opposite end of shaft.

302A. **OVERHAUL DRIVEN UNIT.** Refer to Figs. MH422 and MH423. After removing the pulley unit from tractor, remove nut from pulley end of shaft and bump or pull shaft out of housing. If bevel gear on end of pulley shaft is faulty it will be necessary to also renew the driving gear (2—Fig. MH350) in pto case as gear is available only as a matched set. Refer to paragraph 302. The need and procedure for further disassembly is evident after an examination of the unit. When reassembling the unit shown in Fig. MH422, tighten shaft nut (4) to eliminate all shaft end play without causing binding.

After the unit (shown in Fig. MH 423) is assembled, check the shaft for end play. If end play is more than 0.010, renew bearing (10).

When reinstalling pulley unit on tractor, vary the number of shims between the pulley housing flange and case to obtain backlash of not less than 0.005 or more than 0.008. Refer also to paragraph 302 for method of obtaining the mesh position of the bevel gears.

Note: It is advisable to pour one quart of transmission oil in pulley housing to pre-lubricate the bearings after an overhaul.

POWER TAKE-OFF

All series except 20-22-55-81-82-201-202-203

Some models of the 44 series and all other models covered in this section are equipped with the shaft layout shown in Fig. MH430 and the system is known as a non-continuous type. On other models of the 44 series, a disc type clutch is mounted on the right bull pinion sleeve and the clutch is used in conjunction with the shaft layout shown in Fig. MH430 to form a continuous type (live) power take-off.

The forward end of shaft (1—Fig. MH430) is connected to the belt pulley and power take-off shaft (4—Fig. MH 310). The procedure for removing this shaft is given in paragraph 211.

310. **CLUTCH (CONTINUOUS TYPE) ADJUST.** To adjust the disc type power take-off clutch, turn nut (4—Fig. MH384) until top of control lever has a free travel of 3½ to 4 inches.

Note: If clutch operating lever is more than two inches either way of being in a vertical position, the clutch linkage will bind when clutch is disengaged. To correct this condition, turn bolt (3) until lever is in vertical position.

311. **CLUTCH (CONTINUOUS TYPE) OVERHAUL.** To remove the clutch assembly and the power release mechanism, first remove the right hand fender and platform and remove cover from clutch housing. Extract snap ring (3—Fig. MH424) and withdraw adapter gear (2). Remove snap ring (3—Fig. MH425) and withdraw clutch assembly from housing. Remove snap ring (24—Fig. MH426) and disconnect rod (3—Fig. MH425A). Remove cap screws (1) and withdraw the power release mechanism.

Disassemble the removed units and renew any parts which are excessively worn. Renew any pressure spring which does not test 198-242 pounds when compressed to a height of one inch.

When reassembling the clutch, make certain that the clutch plate splines are perfectly aligned and tighten the assembly cap screws to a torque of 50-55 ft.-lbs.

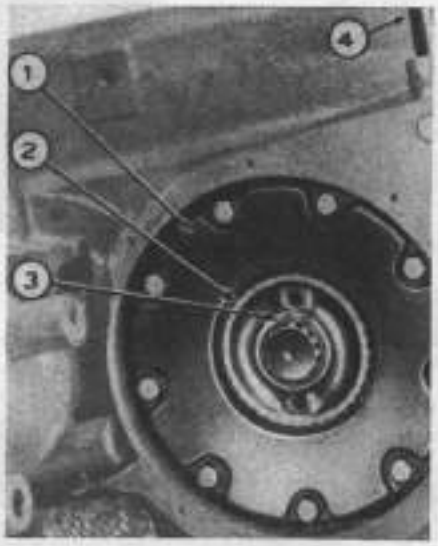


Fig. MH424—Series 44 live power take-off clutch view with the housing cover removed.

1. Clutch assembly
2. Adapter gear
3. Snap ring
4. Control lever

After units are installed on tractor, adjust the clutch as in paragraph 310.

312. **R&R AND OVERHAUL PTO SHAFT.** Remove cap screws holding power take-off shaft rear bearing cage (6—Fig. MH430) to the master gear housing and pull the shaft and bearing assembly out of the housing. Renew any worn parts and reinstall in reverse order of removal. Slight

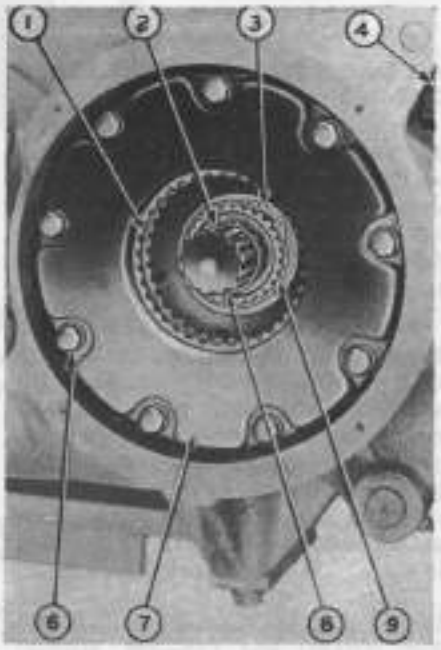


Fig. MH425—Series 44 live power take-off clutch view with the housing cover and adapter gear removed.

1. Drive plate
2. Snap ring groove
3. Snap ring
4. Lever adjustment
5. Assembly bolts
7. Clutch assembly
8. Differential shaft
9. Pinion sleeve

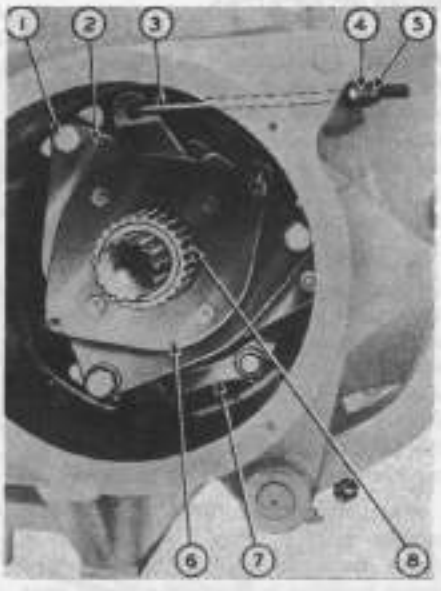


Fig. MH425A—Series 44 power release view after clutch assembly is removed.

1. Cap screws
2. Power release
3. Control rod
4. Adjusting nut
5. Lock nut
6. Movable plate
7. Brake linkage
8. Snap ring groove

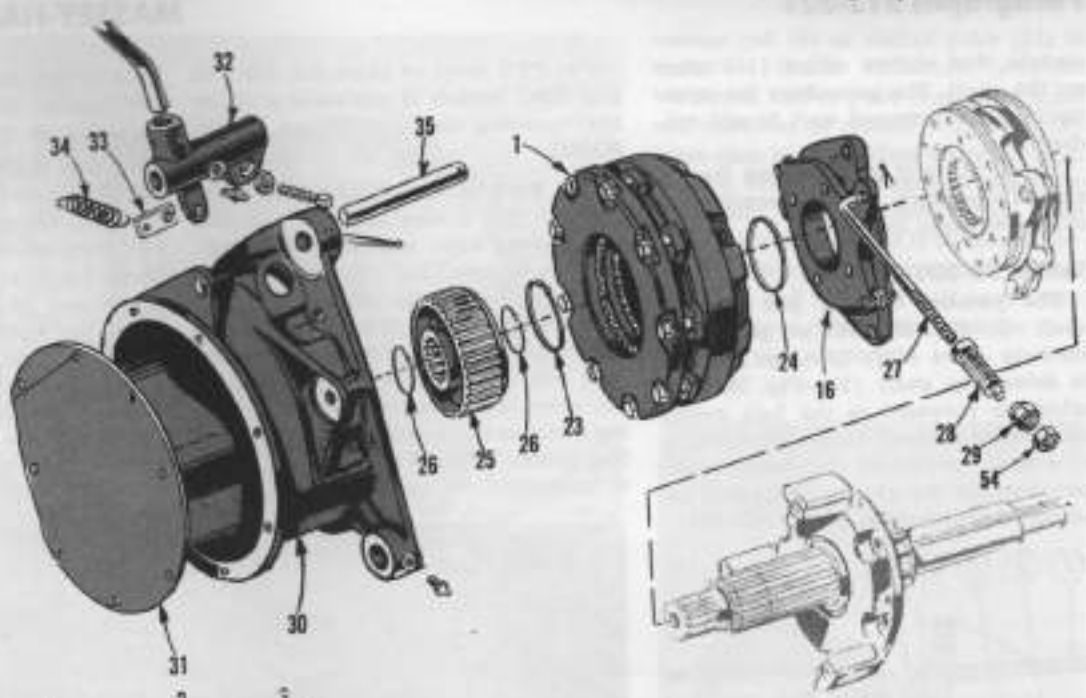


Fig. MH426 — Exploded view of series 44 live power take-off clutch. A disassembled view of item (1) is shown in Fig. MH428.

1. Clutch assembly
16. Power release
23. Snap ring
24. Snap ring
25. Adapter gear
26. Snap ring
27. Clutch release rod
28. Dust boot
29. Nut
30. Housing
31. Cover
32. Pivot
33. Clip
34. Spring
35. Shaft

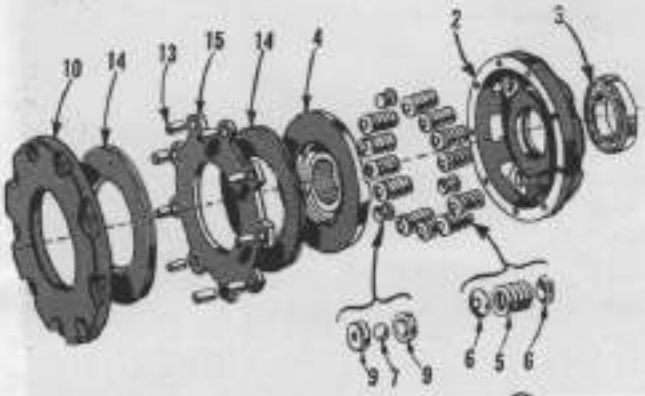


Fig. MH428 — Exploded view of 44 series live power take-off clutch (1—Fig. MH426).

2. Housing
3. Thrust bearing
4. Power plate
5. Pressure spring
6. Spring seat
7. Ball
9. Ball insert
10. Clutch cover
13. Spacer
14. Disc
15. Intermediate disc

procedure for removing the countershaft is covered in paragraph 234. Bevel gear (23) drives the mechanical lift system on models so equipped.

313. **R&R AND OVERHAUL PTO SHAFT.** To remove the power take-off shaft, first remove the mechanical lift system on models so equipped. Remove shifter assembly and cap screws holding bearing carrier (5—Fig. MH 431) to rear plate. Pull shaft and bearing assembly out toward rear, making difficulty may be encountered when reinstalling shaft if a power lift unit is installed.

Series 20-22-81-82

The forward end of shaft (1—Fig. MH431) is provided with a bushing (2) and is supported by the rear end of the transmission countershaft. The

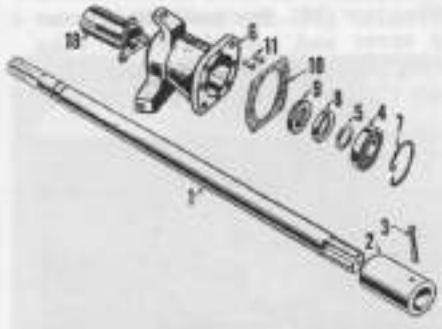


Fig. MH430—Exploded view of PTO shaft and associated parts as used on all models except 20, 20K, 22, 22K, 55, 55D, 55K, 55LP, 81, 82, 201, 202, 203 and 203G.

1. PTO shaft
2. Coupling
3. Cotter pin
4. Bearing
5. Snap ring
6. Bearing cage
7. Snap ring
8. Oil seal
9. Felt washer
10. Gasket
11. Dowel pins
18. Cap

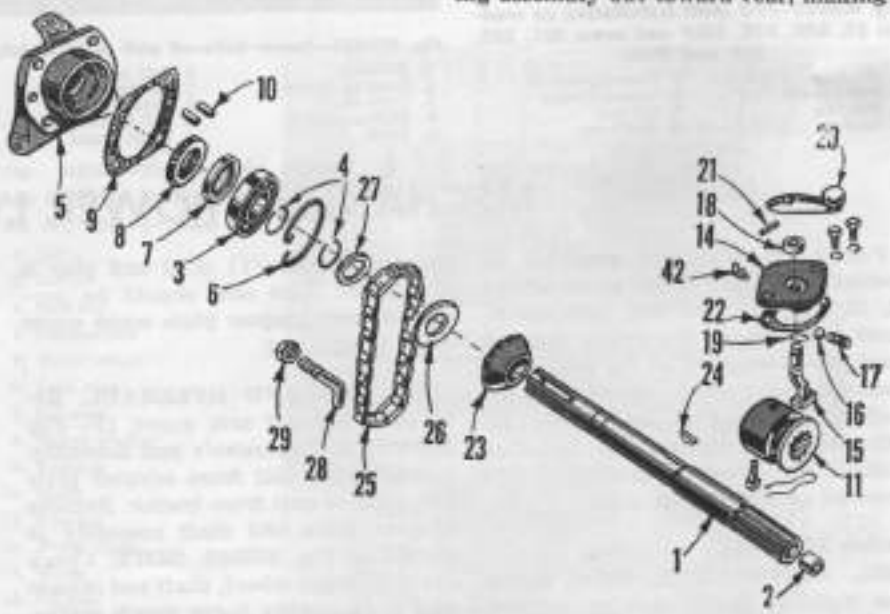


Fig. MH431—Exploded view of power take-off unit as used on models 20, 20K, 22, 22K, 81 and 82. Bevel gear (23) is used only on models 20, 20K, 81 and 82 which are equipped with mechanical lift.

1. Take-off shaft
2. Bushing
3. Bearing
4. Snap ring
5. Bearing cage
6. Snap ring
7. Oil seal
8. Felt washer
9. Gasket
10. Dowel pin
11. Shifter collar
14. Shifter housing
15. Shifter
16. Ball
17. Spring
18. Felt washer
19. Snap ring
21. Pin
22. Gasket
23. Bevel gear
24. Woodruff key
25. Oiler chain
26. Washer
27. Washer
28. Pilot stud
29. Nut
42. Grease fitting

certain that shifter collar (11) stays on the shaft. The procedure for overhauling the removed unit is self-evident.

Install the unit by reversing the removal procedure, making certain that shifter engages collar (11).

Series 55-201-202-203

The forward end of pto external shaft (2—Fig. MH432) or pto intermediate drive shaft (3—Fig. MH433) is driven by shaft (19—Fig. MH350) which is mounted in the belt pulley and power take-off drive housing (1). Overhaul procedure for shaft (19) contained in the pto drive housing assembly is covered in paragraph 302.

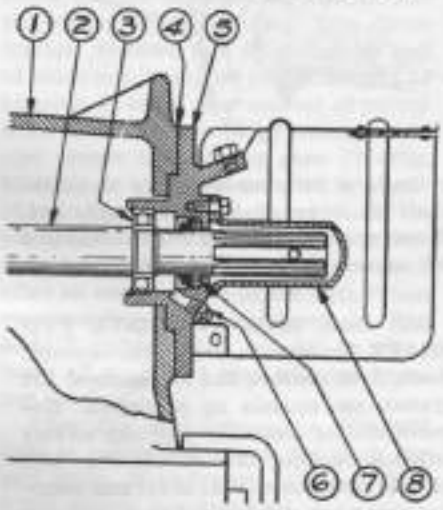


Fig. MH432—PTO shaft installation on models 55, 55D, 55K, 55LP and some 201, 202, 203 and 203G.

1. Housing
2. Drive shaft
3. Bearing
4. Gasket
5. Bearing carrier
6. Grease fitting
7. Oil seal
8. Shaft cap

The PTO shaft on some 201, 202, 203 and 203G models is equipped with an over-running clutch as shown in Fig. MH433.

314. R&R AND OVERHAUL PTO SHAFT. The power take-off unit can be removed after removing the bearing carrier retaining cap screws.

The procedure for overhauling the unit shown in Fig. MH432 is evident. On models shown in Fig. MH433, the rear end of intermediate drive shaft (3) rides in a bracket mounted bushing which may be renewed when worn. The power take-off external shaft (9) is supported by two roller bearings (16) which are adjusted by varying the number of shims (17) under bearing cap (18). The power take-off clutch (14) and (15) is provided with an adjustable stop screw (6), which may be adjusted as follows: Remove cover (5) from power take-off housing (8). Push hand lever (7) forward until lower end of lever enters hole provided for locking lever in disengaged position. At this position there should be approximately ⅛-inch clearance between the ends of the two clutch jaws (14) and (15) as shown. Adjust set screw (6) to obtain the proper jaw clearance. Reinstall cover (5).

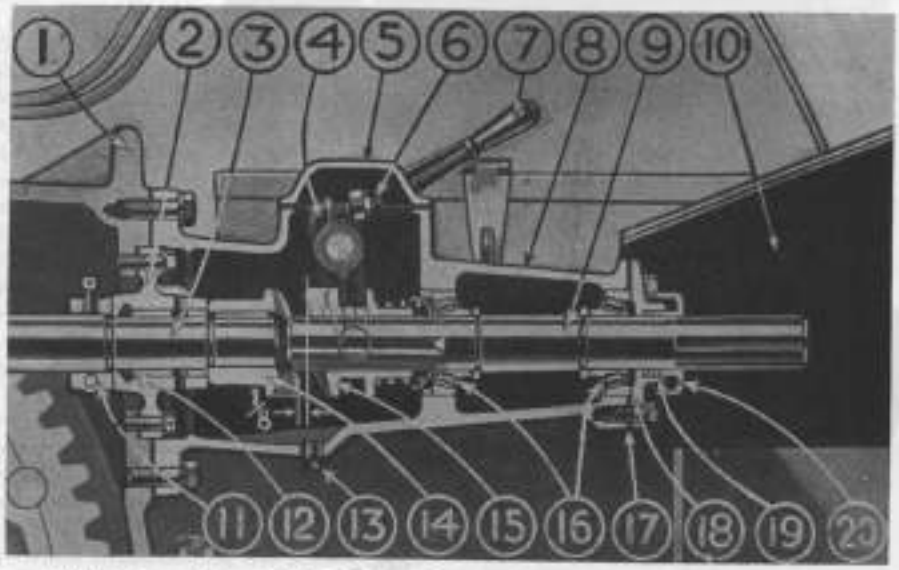


Fig. MH433—Power take-off unit (with clutch) as used on models 201, 202, 203 and 203G.

1. Housing
2. Bearing flange
3. Drive shaft
4. Shifter yoke
5. Cover
6. Adj. screw
7. Shifter lever
8. Housing
9. P.T.O. shaft
10. Shaft guard
11. Shaft collar
12. Felt seal
13. Drain plug
14. Shaft jaw
15. Sliding jaw
16. Bearings
17. Shims
18. Bearing cap
19. Packing
20. Packing gland

MECHANICAL POWER LIFT

Power lift units are available as special equipment for all series except 22, 55, 201, 202 and 203. Lift equipment is driven by the power take-off shaft and is mounted on the final drive housing in the place normally occupied by the housing top cover. Lift units may be removed or installed without disturbing transmission, differential or master gear units.

Series 20-81-82

320. ADJUSTMENT. Bevel drive gear backlash is adjusted by varying the number of shim gaskets between the adapter plate (C—Fig. MH450) and the housing. Gear backlash of 0.003 inch or barely perceptible backlash at clutch jaw (E) at tightest spot is satisfactory. End play in worm shaft (3—Fig. MH451) is corrected by varying the number of shims under bearing carrier (1) until end play is eliminated. Lift unit should be separated from adapter plate when worm shaft is adjusted.

321. R&R AND OVERHAUL. Remove power lift arm guard (F—Fig. MH452) and operator's seat assembly. Separate lift unit from adapter plate and remove unit from tractor. Remove adapter plate and shaft assembly as shown in Fig. MH450. NOTE: Check lift arm, worm wheel, shaft and release cam for assembly index punch marks. Alignment of these marks is necessary to assure reassembly of parts in correct relative position. Remove lift arm (15—Fig. MH453) from shaft (10). Disconnect external release linkage and remove foot pedal with release arms. Remove bearing carrier (1—Fig. MH451), raise worm and shaft assembly out of case and remove clutch sliding jaw (28). Remove bottom housing cover and unhook shifter yoke spring (27). Remove worm wheel (15), shaft (16) and cover as an assembly.

Fig. MH450—Power lift adapter and drive clutch—models 20, 20K, 81 and 82—Showing adapter plate "C", shims "D" and clutch jaw "E".

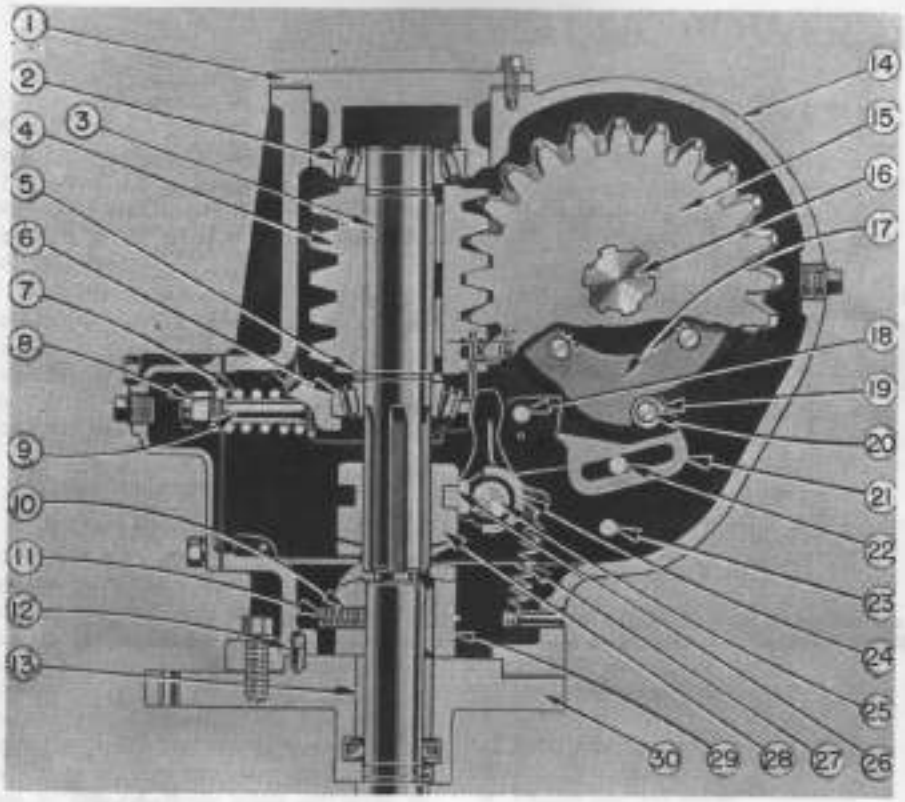


Fig. MH451—Power lift side sectional view—models 20, 20K, 81 and 82.

1. Bearing carrier
2. Worm bearing
3. Worm shaft
4. Worm
5. Spacer washer
6. Worm bearing
7. Rod spring
8. Rod nut
9. Release rod
10. Set screw
11. Lock wire
12. Housing dowel
13. Shaft bushing
14. Housing
15. Worm wheel
16. Wheel shaft
17. Release cam
18. Link pin
19. Link roller
20. Roller pin
21. Release link
22. Trip lever
23. Stop pin
24. Shift yoke
25. Foot lever shaft
26. Shift collar
27. Yoke spring
28. Sliding jaw
29. Fixed jaw
30. Adapter plate

Disconnect release rod (9) and link (21) and remove both from case. Remove operating shaft (25), shifter yoke (24) and trip lever (22).

Disassemble adapter plate and shaft assembly. Check condition of drive oiler chain and lift drive gear on power take-off shaft. See Fig. MH454. Renew worn or defective parts, install new bushings, bearings, thrust washers and oil seals as required. If a new release link (21—Fig. MH451) release rod (9) or shifter yoke (24) is installed, check clearance between bottom of shifter yoke horizontal arms and shoulder of release rod, when release cam is in position shown in Fig. MH451. Where clearance is less than 1/16 inch, file horizontal yoke arms until correct clearance is obtained. Reassemble parts in reverse order of disassembly and reinstall unit on tractor. Adjust bevel drive gear mesh as outlined in paragraph 320.

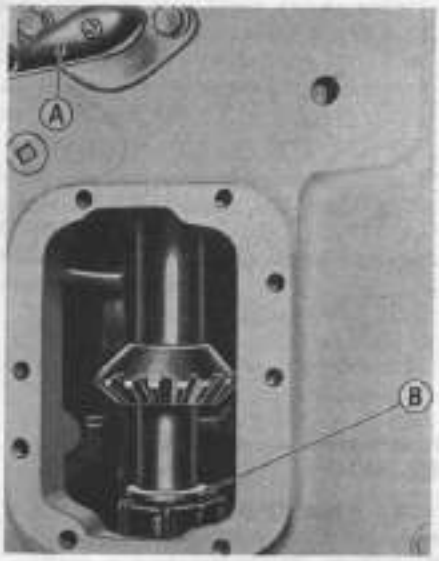


Fig. MH454—Power take-off shaft and lift bevel drive gear—20, 20K, 81 and 82.

Fig. MH452—Power lift unit—models 20, 20K, 81 and 82.

F. Lift arm shield M. Crank arm
N. Crank arm link

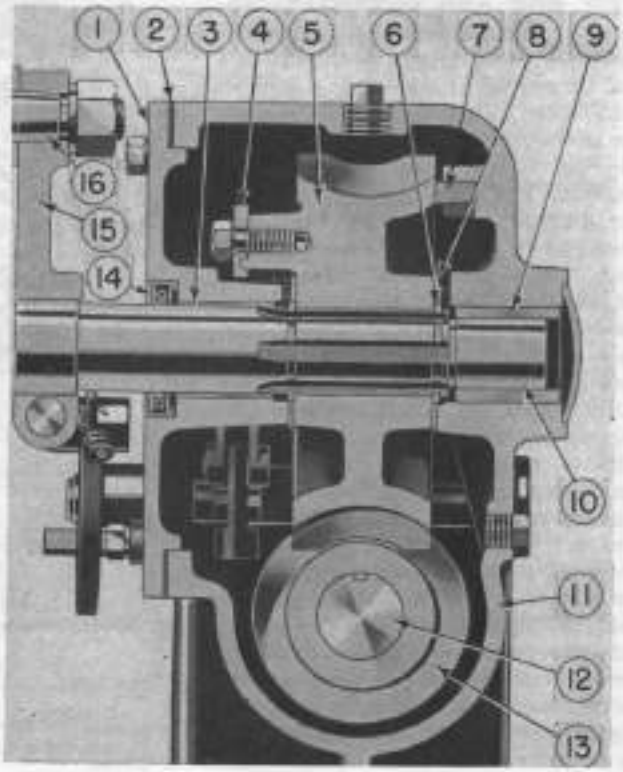
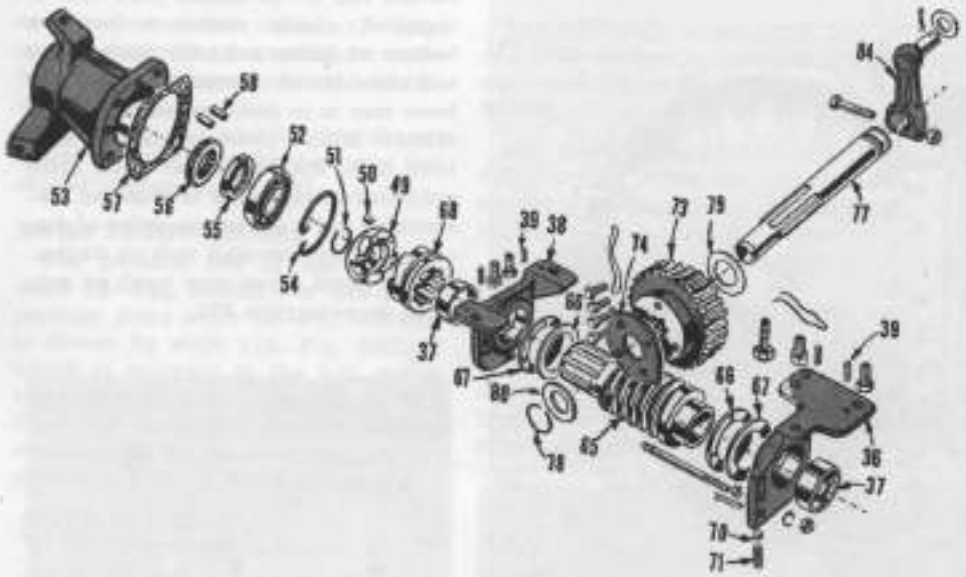


Fig. MH453—Power lift top sectional view—models 20, 20K, 81 and 82.

1. Cover
2. Gasket
3. Bushing
4. Release cam
5. Worm wheel
6. Lock ring
7. Oil wick
8. Thrust washer
9. Bushing
10. Shaft
11. Housing
12. Worm shaft
13. Worm
14. Oil seal
15. Crank arm
16. Arm stud



37. Bushing
38. Hanger
39. Dowel pin
49. Lift jaw
50. Key
51. Snap ring
52. Bearing
53. Bearing cage
54. Snap ring
55. Oil seal
56. Felt washer
57. Gasket
58. Dowel pin
65. Worm
66 & 67. Thrust washer
68. Sliding jaw
70. Ball
71. Spring
73. Worm wheel
74. Release cam
77. Shaft
78. Snap ring
79 & 80. Thrust washers
84. Crank

Fig. MH455—Power lift assembly—All models except 20, 20K, 22, 22K, 55, 55D, 55K, 55LP, 81, 82, 201, 202, 203 and 203G. Worm (65) is mounted on the PTO shaft.

Other series except 22-55-201-202-203

322. **ADJUSTMENT.** Power lift worm (65—Fig. MH455) and worm wheel shaft (77) are carried in bushings, with end play controlled by thrust washers. Adjustment is possible only by renewing parts.

323. **R&R AND OVERHAUL.** Remove power take-off shaft assembly, power lift arm guard and operator's seat assembly. Remove cap screws holding lift unit to tractor and remove the unit. Unbolt worm hangers (38 & 36—Fig. MH455) and remove worm assembly. Pry out expansion plug (2—Fig. MH456) and remove snap ring from end of lift shaft. Check lift arm, shaft, worm wheel and release cam for assembly index punch marks or mark if necessary before disassembly. Pull shaft (77—Fig. MH455) out of case and worm wheel (73). Remove worm wheel and thrust washers. Unbolt release plunger rod cap (7—Fig. MH456), extract spring lock (9) and remove spring (11), retainer (10) and plunger rod guide (12). Drive taper pins out of release levers (19 & 22) and pull shaft (21) out of case. Remove lever (18), link (20) and plunger rod (15) from case. Renew worn or defective parts, install new bushings, thrust washers and oil seals as required. Reassemble parts as shown in Fig. MH455 and 456 and reinstall unit on tractor.

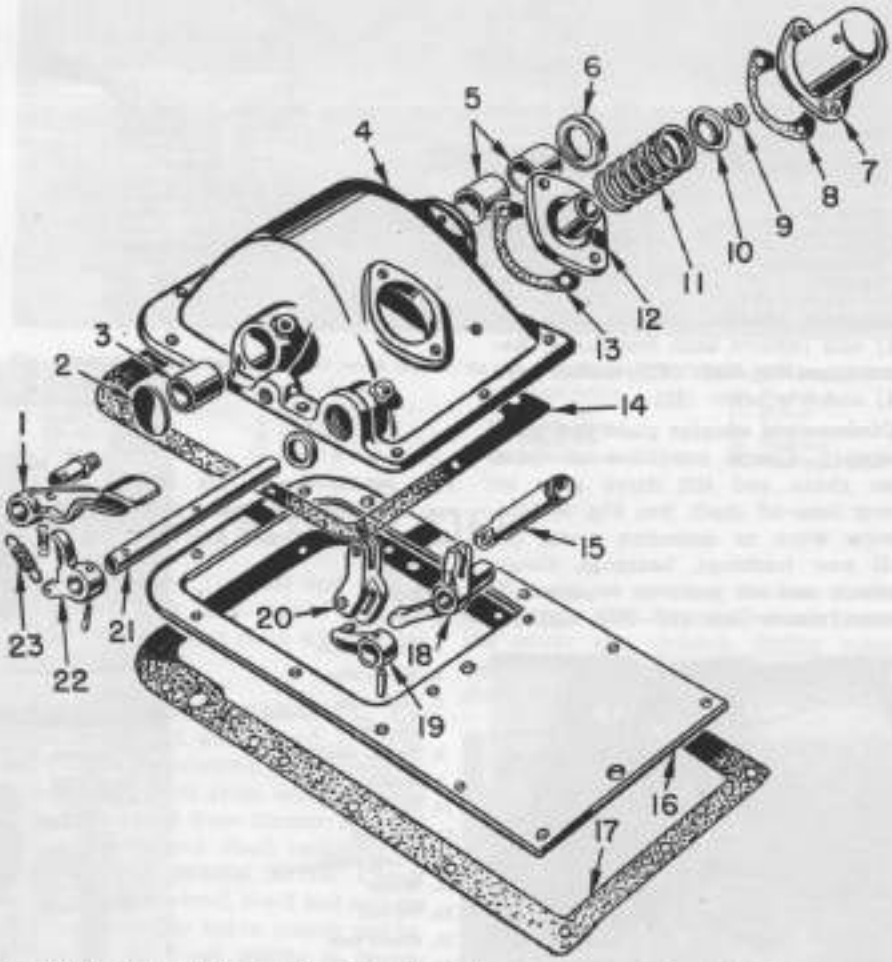


Fig. MH456—Power lift housing assembly—All models except 20, 20K, 22, 22K, 55, 55D, 55K, 55LP, 81, 82, 201, 202, 203 and 203G.

1. Foot pedal
2. Plug
3. Shaft bushing
4. Housing
5. Shaft bushings
6. Oil seal
7. Rod cap
9. Spring lock
10. Spring retainer
11. Rod spring
12. Rod guide
13. Gasket
14. Gasket
15. Plunger rod
16. Cover
17. Gasket
18. Shift lever & yoke
19. Inner trip lever
20. Release link
21. Trip lever shaft
22. Outer trip lever
23. Retracting spring

HYDRAULIC POWER LIFT

The Massey-Harris hydraulic system is of the continuous power type wherein the gear type pump is driven from the engine timing gear train. The two-way hydraulic system provides power for both raising and lowering of implements.

Note: The maintenance of absolute cleanliness of all parts is of utmost importance in the operation and servicing of the hydraulic system. Of equal importance is the avoidance of nicks or burrs on any of the working parts.

LUBRICATION AND BLEEDING

350. It is recommended that the working fluid (S.A.E. No. 10 premium grade motor oil) be changed at least once-a-year. Drain the system while oil is warm. Refill the oil reservoir, start engine and run the engine until hydraulic oil is at normal operating temperature. Operate the lift system several times and check for leaks at all connections. Stop engine and add oil to the reservoir until oil level is to the full mark.

For operation down to plus 10°F, no dilution of the oil is necessary. For operation down to 0°F, drain one quart of oil from the reservoir and substitute one quart of kerosene. For operation down to minus 10°F, drain two quarts of oil and substitute two quarts of kerosene.

TROUBLE SHOOTING

351. The following data should be helpful in shooting trouble on the hydraulic lift system.

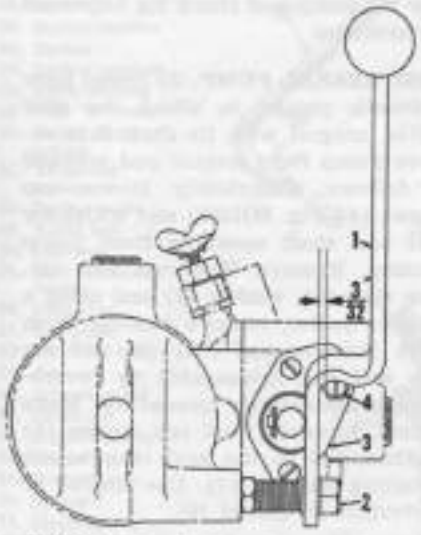


Fig. MH460—"Depth-O-Matic" control handle adjustments.

1. Control handle
2. Pivot bolt
3. Stop plate
4. Slow speed stop

TROUBLE: Control handle does not return to neutral position; check for:

a. Foreign matter in control valve
b. Burrs on control valve parts
c. Bent control valve spool

TROUBLE: Lift will not raise implement; check for:

a. No oil in reservoir
b. Faulty pump
c. Faulty piston seal
d. Faulty relief valve

TROUBLE: Lift will not stay in position; check for:

a. Faulty control valve
b. Faulty piston seals

TROUBLE: Short piston seal life; check for:

a. Faulty piston
b. Faulty rod bearing

TROUBLE: Lift will not raise load fast enough; check for:

a. No oil in reservoir
b. Faulty pump
c. Faulty piston seal
d. Faulty relief valve
e. Faulty control valve

The procedure for correcting many of the aforementioned troubles is evident; however, the accompanying illustrations and the subsequent paragraphs should provide helpful disassembling, cleaning and/or overhauling information for the component units of the lift system.

SYSTEM ADJUSTMENTS

The subsequent paragraphs outline the adjustments which can be performed in the field. The need for a particular adjustment is usually evident after observing the action of the system.

353. **CONTROL HANDLE.** (See Fig. MH460). Adjust pivot bolt (2) so that control handle is in a vertical position. Loosen retaining screws in stop plate (3) and move the plate to obtain 3/32 inch clearance between control handle and slow speed stop (4).

354. **FOLLOWER ARM.** (See Fig. MH461). Straighten follower arm (3), if necessary, so that the arm remains parallel with the cylinder throughout its full range of travel.

355. **STOP LEVER.** (See Fig. MH 462). Adjust stop lever (1) to obtain 1/16 inch clearance between the stop lever and the follower arm (2). The stop lever can be moved by loosening the retaining nut.

356. **STOP PLATE.** (See Fig. MH 462). Loosen retaining screws in stop plate (3) and move the plate until there is a clearance of ⅛ inch between it and slow stop screw (4) also shown in MH461.

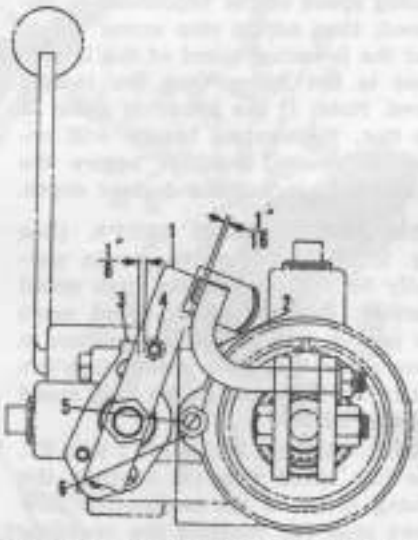


Fig. MH462—"Depth-O-Matic" cylinder and control valve adjustments.

1. Stop lever
2. Follower arm
3. Stop plate
4. Slow speed stop
5. Shut-off valve
6. Lock nut

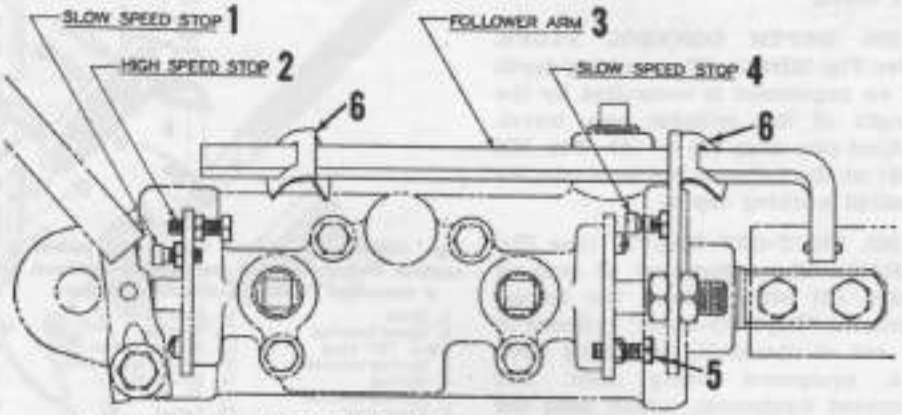


Fig. MH461—"Depth-O-Matic" cylinder, showing points of adjustment.

5. High speed stop
6. Stop clips

357. **HIGH SPEED STOP.** (See Fig. MH461). The high speed stops (2 & 5) are located at each end of the valve body. These stops control the length of movement of the control lever and control valve. Normal factory adjustment of the high speed stops provide full stroke of the ram in 3 to 4 seconds. The screws can be adjusted to give faster or slower action if desired.

357A. USING A HIGH LIFT SHAFT. To operate the ram at a faster speed, adjust stop screw (5) until the desired raising speed of the implement is obtained; then, adjust stop screw (2) so that with the heaviest implement attached, the lowering speed of the implement is not faster than the raising speed. Note: If the lowering speed is too fast, the control handle will return to neutral position before the implement reaches the desired depth.

357B. USING A LOW LIFT SHAFT. To operate the ram at a faster speed, adjust stop screw (2) until the desired raising speed of the implement is obtained; then adjust stop screw (5) so that the lowering speed of the implement is not faster than the raising speed. Note: If the lowering speed is too fast, the control handle will return to neutral position before the implement reaches the desired depth.

358. **SLOW SPEED STOPS.** (See Fig. MH461). The valve should normally be operated in the high speed position; however, slow speed stops are provided to facilitate operation in some cases. The slow speed stops are controlled the same as the high speed stops as follows:

358A. USING A HIGH LIFT SHAFT. The low speed stop (4) controls the raising speed of the implement. Low speed stop (1) controls the lowering speed.

358B. USING A LOW LIFT SHAFT. The low speed stop (1) controls the raising speed and stop (4), the lowering speed.

359. **DEPTH CONTROL STOPS.** (See Fig. MH461). The working depth of an implement is controlled by the length of the cylinder ram travel. Adjust stop clips (6) or (53—Fig. MH 464) on the follower rod to obtain the desired working depth.

360. **SHUT-OFF VALVE.** (See Fig. MH462). The adjustment of shut-off valve (5) either places the tractor mounted "Depth-O-Matic" cylinder in or out of operation, depending upon the equipment being used. For mounted equipment, which used the mounted cylinder, the screw should be turned **out.** For pull-behind and other equipment using remote cylinders, the screw should be turned **in** as far as it will go when cylinder is fully retracted, thereby eliminating the action of the mounted work cylinder. Valve (5) can be turned either way after loosening lock nut (6). Make certain that the lock nut is securely tightened after the adjustment is complete.

361. **RELIEF VALVE.** To check and adjust the relief valve opening pressure, install a 2000 psi gage in the rear side port of the control valve, start engine and run until the hydraulic working fluid is at normal operating temperature. Hold control lever back until relief valve opens which can usually be detected by an audible buzzing sound; at which time, the gage should show a pressure of 1200-1300 psi. If gage pressure is not as specified, remove the relief valve spring (13—Fig. MH463) or (30—Fig. MH464) and check the spring against the following specifications.

Spring free length .....2¼ inches
Test load .....70.2-85.8 lbs.
Test length .....1½ inches

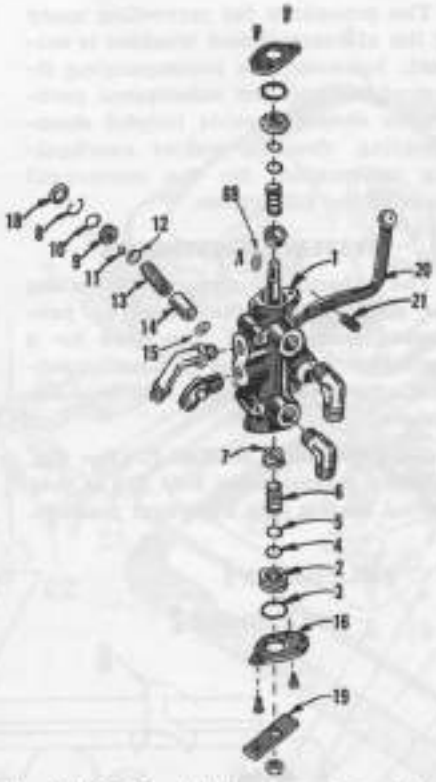


Fig. MH463—Exploded view of typical control valve as used on models without a mounted "Depth-O-Matic" cylinder.

1. Body
2. Spool bearing
3 & 4. "O" ring
5. Spring retainer
6. Spring
7. Spring retainer
8. Snap ring
9. Valve seat
10. "O" ring
11. Relief valve ball
12. Ball guide
13. Spring
14. Spring sleeve
15. Adjusting washer
16. End plate
18. Washer
19. Lever
20. Control handle
21. Spring
69. Washer

If spring is in satisfactory condition, vary the number of adjusting washers (15—Fig. MH463) or (31—Fig. MH 464) to obtain the desired pressure. Each washer represents approximately 25 psi pressure. If the insertion of washers does not bring the pressure to specified value it indicates leakage at valve or a faulty pump.

PUMP

The gear type hydraulic pump, shown in Fig. MH465, is gear driven from the engine timing gear train. On some early model pumps (not shown), the drive gear was separable from the pump shaft; on later models, the gear is integral with the shaft. In either case, however, a seal replacement package is available and can be installed as outlined in paragraph 363. The Massey-Harris Company does not recommend further overhaul of the pump in the field. If parts other than the seals have failed, renew the complete pump unit. A failed pump unit can be returned to an official service station for overhaul.

362. **TESTING.** There are many variables affecting the pump delivery pressure; therefore, a satisfactory gage check cannot be made. The pump, however, should be renewed if the delivery pressure is not of sufficient capacity to raise the relief valve. Refer to paragraph 361 for checking and adjusting the relief valve opening pressure.

Note: If other parts of the system are known to be in good condition and the system will not lift the load fast enough, it is common practice to renew the pump and check for improved performance.

363. **RESEAL PUMP.** To reseal later hydraulic pumps, in which the gear (1) is integral with its shaft first remove pump from tractor and proceed as follows: Completely loosen cap screws (4—Fig. MH465) and withdraw gear and shaft assembly from pump housing. Remove Woodruff key (2), snap ring (9), washer (8) and using a suitable puller, remove bearing from shaft. Remove seal ring (5) and renew seal (3). Reassemble by reversing the dissassembly procedure. Make certain, however, that cap screws (4) are installed in the seal ring before installing bearing (7). Use shellac or equivalent on gasket (6).

Note: The procedure for resealing earlier model pumps where gear is separable from shaft is evident after an examination of the unit.

CONTROL VALVE & "DEPTH-O-MATIC" CYLINDER

On models where the hydraulic work cylinder is mounted on the tractor, the control valves unit is mounted on and forms an integral part of the work cylinder as shown in Fig. MH464. On other models, the control valves Fig. MH463, are independently mounted on a valve manifold.

364. **OVERHAUL CONTROL VALVE.** Normal overhaul of the valve unit (See Figs. MH463 and 464) consists of disassembling the unit, cleaning, renewing worn parts and installing a packing kit. It is important, however, to check the valve bore for possible burrs, and the spool for straightness. If burrs cannot be removed from valve bore by polishing, and if spool cannot be thoroughly straightened, renew the valve body and spool. Check and adjust the relief valve opening pressure as outlined in paragraph 361.

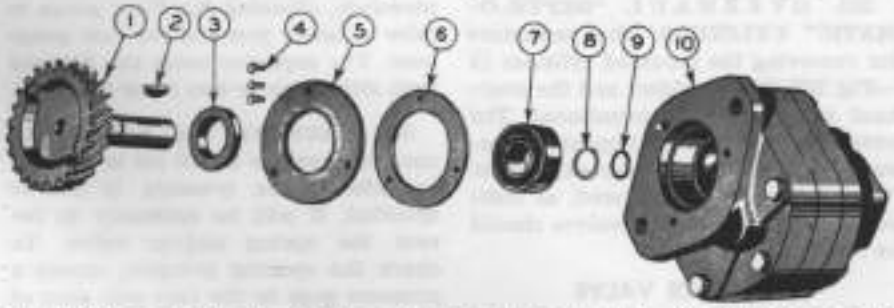


Fig. MH465—Exploded view of late model Massey-Harris hydraulic pump where gear (1) and shaft are integral. On early models, the gear was separable from the shaft.

1. Drive gear and shaft
2. Woodruff key
3. Seal
4. Cap screws
5. Seal ring
6. Gasket
7. Bearing
8. Washer
9. Snap ring
10. Housing

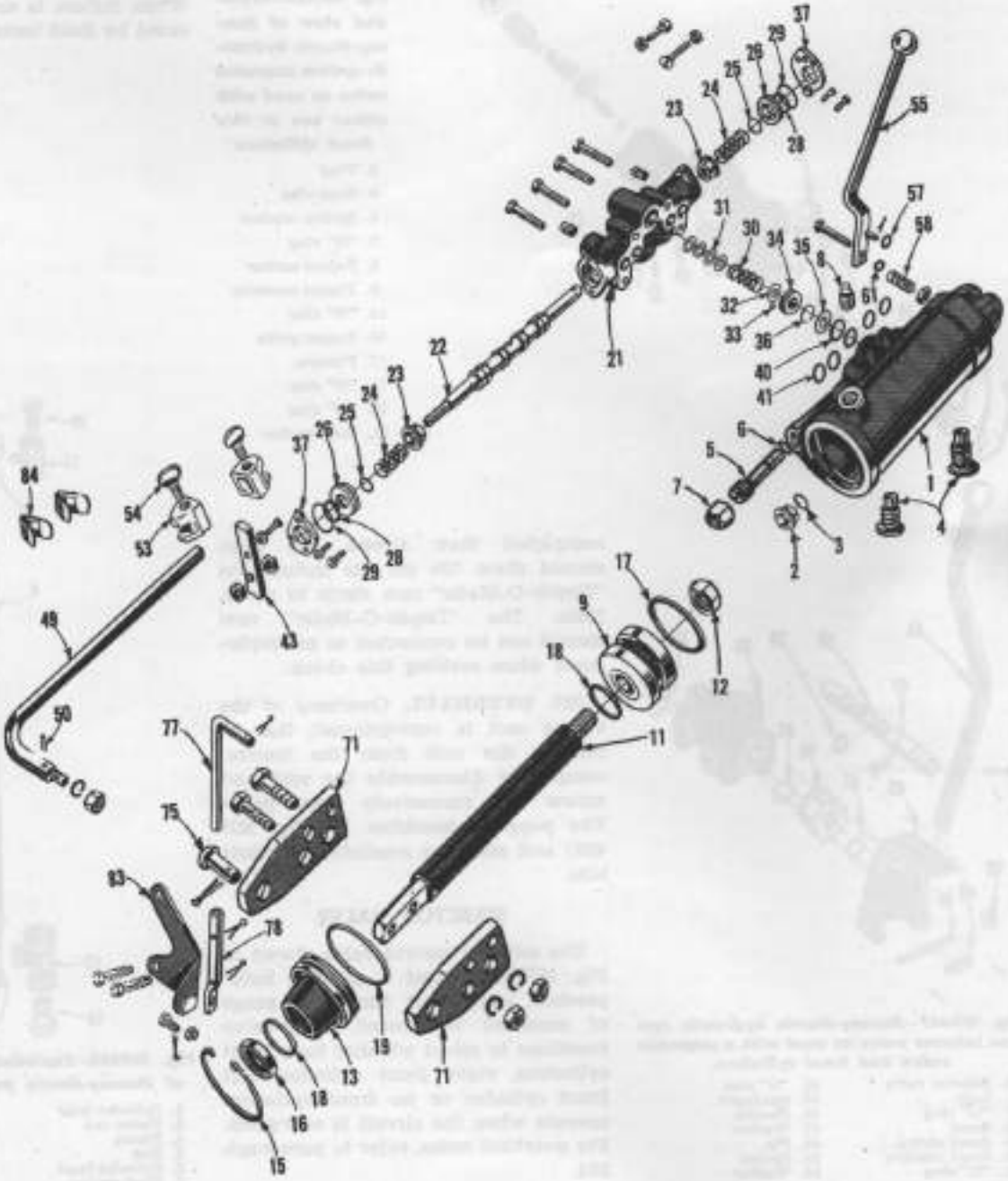


Fig. MH464—Exploded view of control valve and mounted "Depth-O-Matic" cylinder. Notice that the control valve attaches to side of cylinder.

1. Cylinder
2. Core hole plug
3. Gasket
4. Overload relief valve
5. Shut-off valve
6. "O" ring
7. Lock nut
8. Pipe plug
9. Piston
11. Piston rod
12. Nut
13. Bearing
15. Snap ring
16. Oil seal
17. Piston seal
18. Rod seal
19. Gasket
21. Valve body
22. Spool
23. Spring retainer
24. Spring
25. Spring retainer
26. Spool bearing
28 & 29. "O" ring
30. Relief valve spring
31. Adjusting washer
32. Spring guide
33. Relief ball
34. Ball seat
35. Seat retaining washer
36. Snap ring
37. End plate
40 & 41. "O" ring
48. Arm
49. Adjusting rod
50. Groov pin
53. Adjusting stop
54. Thumb screw
55. Control lever
58. Spring
71. Clevis plate
75. Clevis pin
77. Support rod
78. Guide
84. Early model adjusting stop

After overhauling a valve unit, operate the lift system several times and check for fluid leaks at all connections.

365. **OVERHAUL "DEPTH-O-MATIC" CYLINDER.** The procedure for removing the mounted cylinder (1—Fig. MH464) is evident and the overhaul procedure is conventional. The overload relief valve (4) opening pressure of 2000 psi is non-adjustable. When failure is encountered, as indicated by fluid leaks, the valves should be renewed.

SEQUENCE VALVE

On some models, a sequence valve Fig. MH466 is mounted between the control valve and the hydraulic cylinder. This valve provides delayed action to the rear gangs of mounted implements, allowing the front gangs to raise or lower first and the rear gangs later. The sequence valve can be used with either one or two front cylinders.

366. **TESTING.** The relief valve opening pressure of 700 psi is non-adjustable. If the pressure is not as specified, it will be necessary to renew the spring and/or valve. To check the opening pressure, mount a pressure gage in the rear side port of the control valve and operate the system. After the front cylinders have completed their stroke, the gage should show 700 psi the instant the "Depth-O-Matic" ram starts to move. Note: The "Depth-O-Matic" ram should not be connected to an implement when making this check.

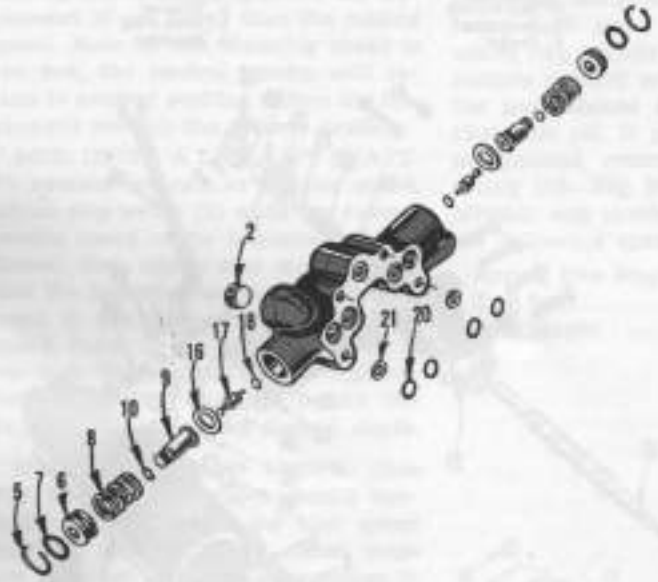


Fig. MH466—Exploded view of Massey-Harris hydraulic system sequence valve as used with either one or two front cylinders.

2. Plug
5. Snap ring
6. Spring retainer
7. "O" ring
8. Poppet spring
9. Poppet assembly
10. "O" ring
16. Poppet guide
17. Plunger
18. "O" ring
20. "O" ring
21. Body washer

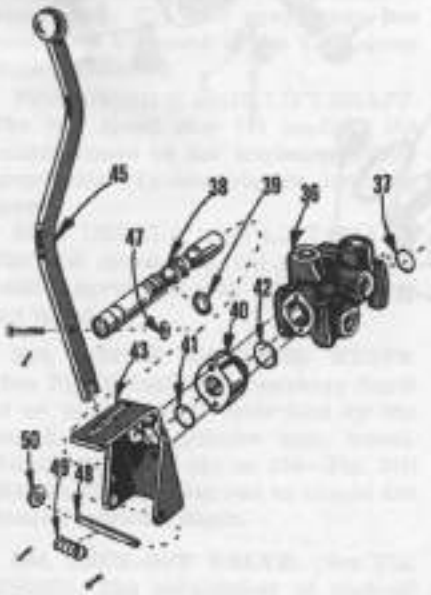


Fig. MH467—Massey-Harris hydraulic system selector valve as used with a sequence valve and front cylinders.

36. Selector valve body
37. "O" ring
38. Spool
39. Spool spring
40. Spool retainer
41. "O" ring
42. "O" ring
43. Quadrant
45. Handle
47. Washer
48. Pin
49. Spring
50. Washer

367. **OVERHAUL.** Overhaul of the valves unit is conventional; that is, remove the unit from the tractor, completely disassemble the unit and renew any excessively worn parts. The poppet assemblies (9—Fig. MH 466) and seals are available in repair kits.

SELECTOR VALVE

The selector control valve shown in Fig. MH467 is used to provide independent control of the front gangs of mounted equipment. The valve functions to select whether both front cylinders, right front cylinder, left front cylinder or no front cylinders operate when the circuit is energized. For overhaul notes, refer to paragraph 364.

WORK CYLINDERS (NOT "DEPTH-O-MATIC")

CAUTION: When using pull behind cylinders, the mounted "Depth-O-Matic" ram should be made inoperative by adjusting the shut-off valve as outlined in paragraph 360.

368. **OVERHAUL NOTES.** The procedure for disassembling the work cylinders is evident after an examination of the unit.

Check all parts for burrs, scratches and/or nicks and make certain that the piston rod is perfectly straight. Maximum allowable clearance between piston rod and bearing is 0.015. The overload relief valve opening pressure of 2000 psi is non-adjustable. When failure is encountered, as indicated by fluid leaks, renew the valves.

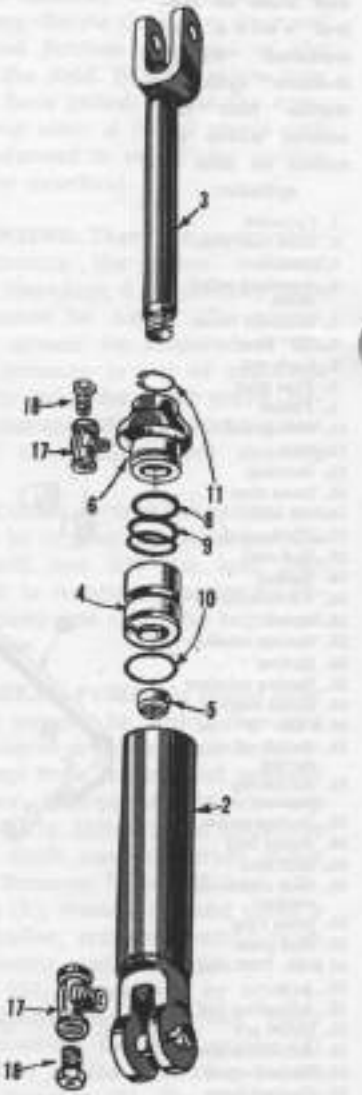


Fig. MH468—Exploded view of one type of Massey-Harris pull behind cylinder.

2. Cylinder body
3. Piston rod
4. Piston
5. Nut
6. Cylinder head
8. Head gasket
9. Packing
10. Piston packing
11. Snap ring
17. Tee
18. Overload relief valve

MASSEY-HARRIS

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