WILLYS JEEP

INDEX OF SERVICE OPERATIONS

GENERAL SPECIFICATIONS

Year	Model Designation	Wheelbase, Inches	Valve Location	Bore and Stroke	Piston Displacement, Cubic Inches	Compression Ratio (Standard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Normal Oil Pressure Pounds
JEEPS									
1953–61	Jeep 4 ..... CJ-3B	80	①	3.1250 x 4.375	134	6.90	72 @ 4000	114 @ 2000	35
1955–61	Jeep 4 ..... CJ-5	81	①	3.1250 x 4.375	134	6.90	72 @ 4000	114 @ 2000	35
1955–61	Jeep 4 ..... CJ-6	101	①	3.1250 x 4.375	134	6.90	72 @ 4000	114 @ 2000	35
1956–61	Jeep Dispatcher DJ-3A	80	In Block	3.1250 x 4.375	134	6.48	60 @ 4000	105 @ 2000	35
STATION WAGONS									
1953	4 Cyl.	104½	①	3.1250 x 4.375	134	7.40	72 @ 4000	114 @ 2000	35
1953	6 Cyl.	104	In Block	3.1250 x 3.500	161	6.90	75 @ 4000	117 @ 1600	35
1953–61	4 Cyl.	104	①	3.1250 x 4.375	134	7.40	72 @ 4000	114 @ 2000	35
1953	6 Cyl.	104	In Block	3.1250 x 3.500	161	6.90	75 @ 4000	117 @ 1600	35
1954–61	6 Cyl. ..... 4 x 4-226	104	In Block	3.3125 x 4.375	226	7.30	115 @ 3650	190 @ 1800	35
1954–61	6 Cyl. 6-85	104	①	3.1250 x 3.500	161	6.90	75 @ 4000	117 @ 1600	35

①—Intake valves in head; exhaust valves in block.

TUNE UP SPECIFICATIONS

Year	Model	Ground Polarity and Voltage	Spark Plug		Distributor		Firing Order	Ignition Timing		Idle Speed RPM In Neutral	Compression Pressure @ Cranking Speed Minimum
			Type	Gap Inch	Point Gap Inch	Cam Angle Degrees		Mark	Location		
1953	L-Head 4	N-6	AN7②	.030	.020	④	1342	5°BTDC	Flywheel	600	90
	L-Head 6	N-6	J8③	.030	.020	39	153624	5°BTDC	Damper	550	105
1953–61	F-Head 6	N-6	①	.030	.020	39	153624	5°BTDC	Damper	550	115
1953–61	F-Head 4	N-6	J8③	.030	.020	42	1342	5°BTDC	Pulley	600	100
1954–61	6-226	N-6	J8③	.030	.020	39	153624	4°BTDC	Damper	450	120
1956–61	L-Head 4	N-6	J8③	.030	.020	42	1342	5°BTDC	Flywheel	600	100

①—Champion J7 on passenger cars, J8 on other models. ②—Auto-Lite. ③—Champion.
④—Cam angle varies according to distributor used.

PISTONS, PINS, RINGS, CRANKSHAFT & BEARINGS

Year	Model	Fitting Pistons		Ring End Gap ①		Wrist-pin Diameter	Rod Bearings		Main Bearings			
		Shim To Use	Pounds Pull On Scale	Comp.	Oil		Shaft Diameter	Bearing Clearance	Shaft Diameter	Bearing Clearance	Thrust on Bear. No.	Shaft End Play
1953–61	L-Head 4	.003	5–10	.008	.008	.8119	1.9375–1.9385	.0005–.0025	2.333–2.334	.0015–.003	1	.006 Max.
1953–61	F-Head 4	.003	5–10	.008	.008	.8119	1.9375–1.9385	.0005–.0025	2.333–2.334	.0015–.003	1	.006 Max.
1953	L-Head 6	.0025	7–12	.008	.008	.7497	1.875	.0001–.0025	2.250	.001–.003	1	.006 Max.
1953–61	F-Head 6	.003	5–10	.007	.007	.7497	1.875	.0001–.0025	2.250	.001–.003	1	.006 Max.
1954–61	6-226	.0015	5–10	.008	.008	.8592	2.062–2.063	.0005–.002	2.374–2.375	.0007–.002	1	.006 Max.

①—Fit rings in tapered bores for clearance listed in tightest portion of ring travel.

VALVE SPECIFICATIONS

Year	Model	Valve Lash		Valve Angles		Valve Spring Installed Height	Valve Spring Pressure Lbs. @ In.	Valve Lift		Stem Clearance		Stem Diameter	
		Int.	Exh.	Seat	Face			Int.	Exh.	Intake	Exhaust	Int.	Exh.
WILLYS JEEP													
1953	L-Head 4	.016C	.016C	45	45	2 7/64	110 @ 1 3/4	.384	.300	.0015-.0032	.0025-.0045	.3411	.3400
1953-61	F-Head 6	.018C	.016C	45	45	⑤	①	.260	.300	.0007-.0022	.0025-.0045	.3735	.3400
1953-61	F-Head 4	.018C	. ②	45	45	⑤	③	.260	.351	.0007-.0022	.0025-.0045	.3735	.3715
1954-61	6-226	.014C	.014C	④	④	1 21/32	98 @ 1 3/8	.352	.3315	.001-.003	.0032-.005	.3706	.3386
1956-61	L-Head 4	.016C	.016C	45	45	2 7/64	110 @ 1 3/4	.351	.351	.0007-.0022	.0025-.0045	.3735	.3715

①—Intake 153 @ 1 13/32", exhaust 105 @ 1 21/64".
②—Eaton face valve .012C, Thompson Roto Valve .016C.
③—Intake 140 @ 1 13/32", exhaust 110 @ 1 3/4".
④—Intake 30°, exhaust 45°.
⑤—Intake 1 21/32", exhaust 2 7/64".

GENERATOR AND REGULATOR SPECIFICATIONS

★To Polarize Generator: For internally grounded systems, disconnect field lead from regulator and momentarily flash this lead to regulator battery terminal. For externally grounded systems, reconnect the leads to the regulator, then momentarily connect a jumper wire from the "Arm" to the "Bat" terminals of the regulator.

Year	Generator						Regulator					
								Cutout Relay				
	Generator Number	Rotation and Ground Polarity ①	Rated Cap. Amps.	Gen. Field Ground Location★	Brush Spring Tension, Ounces	Field Current Amperes	Regulator Number	Voltage to Close Points	Armature Air Gap, Inch	Voltage Regulator Setting Volts	Current Regulator Setting Amperes	Current and Voltage Armature Air Gap, Inch
1953	GDZ-6001D	C-N	35	2000	35-53	1.3-1.5②	VRP-4007C-2	6.5	.032	7.3	35	.050
1953-60	GGW-4801D	C-N	45	2125	35-53	1.4-1.5②	VBE-6105A	6.5	.032	7.3	45	.050
1955-60	GGW-4801EN	C-N	45	2125	35-53	1.4-1.5②	VBE-6105A	6.5	.032	7.3	45	.050
1958-59	GJC-7002J	C-N	30	External	18-36	1.2-1.3③	VRX-6009B	13.1	.032	14.2	30	.050
1960-61	GJP-7202A	C-N	35	Internal	18-36	1.6-1.7③	VBO-4201E	13.1	.032	14.2	35	.050
1958-59	GJC-7002K	C-N	30	External	18-36	1.2-1.3③	VRX-6009B	13.1	.032	14.2	30	.050
1960-61	GJP-7202B	C-N	35	Internal	18-36	1.6-1.7③	VBO-4201E	13.1	.032	14.2	35	.050

①—C-Clockwise. N-Negative. ②—At 5 volts. ③—At 10 volts.

COOLING SYSTEM & CAPACITY DATA

Year & Model	Cooling System Data					Fuel Tank Gals.	Engine Oil			Transmissions			Rear Axle Pints
	Quarts No Heater	Quarts With Heater	Rad. Cap Relief Pressure	Thermostat Opening Temp. ①	Thermostat Opening Temp. ②		Refill Qts.③	Summer Grade	Winter Grade	Std. Pints	With Overdrive Pints	Automatic Qts.	
1953-55 4 Cyl.	11	12	7	180	160	15	4	30	10W	1 1/2④	2 1/4	None	2
1953 L-Head 6	11	12	7	180	160	15	5	30	10W	1 1/2	2 1/4	None	2
1953-61 F-Head 6	11	12	7	180	160	15	5	30	10W	1 1/2	2 1/4	11	2
1954 6-226	12	13	7	180	160	18	5	30	10W	2 1/2	3 1/2	11	3
1955-61 6-226-A	13	14	7	180	160	19	5	30	10W	2 1/2	3 1/2	11	3
1953-61 Jeep	11	12	7	180	160	10 1/2	4	30	10W	6 1/2⑤	None	None	2 3/4
1956-61 DJ-3A	11	12	7	180	160	12	4	30	10W	1 1/2	None	4 1/4	2

①—For permanent type anti-freeze. ②—For alcohol type anti-freeze. ③—Add one quart with filter change.
④—Models with transfer case 6 1/2. ⑤—Includes transfer case.

ENGINE TIGHTENING SPECIFICATIONS★

★Torque specifications are for clean and lightly lubricated threads only. Dry or dirty threads produce increased friction which prevents accurate measurement of tightness.

Year	Spark Plugs Ft. Lbs.	Cylinder Head Bolts Ft. Lbs.	Intake Manifold Ft. Lbs.	Exhaust Manifold Ft. Lbs.	Rocker Arm Shaft Bracket Ft. Lbs.	Rocker Arm Cover Ft. Lbs.	Connecting Rod Cap Bolts Ft. Lbs.	Main Bearing Cap Bolts Ft. Lbs.	Flywheel to Crankshaft Ft. Lbs.	Vibration Damper or Pulley Ft. Lbs.
1953–61 L-Head 4	25–30	60–70	31–35	31–35	....	.....	①	65–75	36–40	100–130
1953–61 F-Head 4	25–30	60–70	29–35	29–35	30–35	....	35–40	65–75	36–40	100–130
1953 L-Head 6	25–30	60–70	29–35	29–35	....	....	②	65–75	36–40	100–130
1953–61 F-Head 6	25–30	60–70	29–35	29–35	30–35	....	②	65–75	36–40	100–130
1954–61 6-226	25–30	30–35	30–35	30–35	....	....	40–45	85–95	35–40	100–130

①—For 7/16" bolts 50–55; for 3/8" bolts 35–40.
②—For 7/16" bolts 50–55; for 11/32" bolts 33–38.

DISTRIBUTOR SPECIFICATIONS

Year	Model	Part No. ①	Rotation ②	Cam Angle, Degrees	Breaker Point Opening, Inch	Condenser Capacity, Mfds.③	Breaker Arm Spring Tension, Ounces	Centrifugal Advance Data Degrees @ R.P.M. of Dist.		Vacuum Advance Data		
								Advance Starts	Full Advance	Inches of Vacuum to Start Plunger Movement	Inches of Vacuum for Full Plunger Travel	Maximum Vacuum Advance, Dist. Degrees
1953–59	Four	1AT-4204A	CC	42	.020	.21–.25	17–20	1 @ 300	11 @ 1700	5 1/8	14	6
1953	675	1AT-4007	CC	39	.020	.21–.25	17–20	1 @ 350	12 @ 1500	3 1/2	15	6
1953	685	1AT-4007A	CC	39	.020	.21–.25	17–20	1 @ 300	9 1/2 @ 1300	5 1/8	14	6
1953–54	Four	1AD-4008A	CC	42	.020	.23–.26	17–20	1 @ 300	11 @ 1700	None	None	None
1953–54	685	1AT-4205A	CC	39	.020	.21–.25	17–20	1 @ 300	9 1/2 @ 1300	5 1/8	14	6
1955–56	Four	1AD-4041	CC	42	.020	.23–.26	17–20	1 @ 300	11 @ 1700	None	None	None
1955–57	6-226	1AT-4206	CC	39	.020	.21–.25	17–20	1 @ 325	9 @ 1675	10	15	5
1956–59	DJ-3A	1AY-4012	CC	39	.020	.21–.25	17–20	1 @ 300	11 @ 1700	None	None	None
1957–59	6-226	1AT-4206B	CC	39	.020	.21–.25	17–20	1 @ 375	7 1/2 @ 1700	10	15	5
1960–61	Four	1AY-4401	CC	42	.020	.25–.28	17–20	1 @ 425	11 @ 1700	None	None	None

①—Stamped on plate riveted to side of distributor housing.
②—As viewed from the top. CC—Counter Clockwise.
③—Microfarads—as indicated on a condenser tester.

STARTING MOTOR SPECIFICATIONS

Year	Model	Part No.	Rotation ①	Brush Spring Tension, Ounces	No Load Test			Torque Test		
					Amperes	Volts	R.P.M.	Amperes	Volts	Torque, Lbs. Ft.
1953–54	675, 685	MCH-6203	C	42–53	65	5.0	4300	335	2.0	6
1953–57	Four	MCH-6207	C	42–53	65	5.0	4300	335	2.0	6
1955–60	6-226	MCH-6210	C	42–53	65	5.0	4300	335	2.0	6
1956–60	Four	MCH-6203	C	42–53	65	5.0	4300	335	2.0	6
1958–61	Four	MDM-6005	C	31–47	50	10.0	4400	210	4.0	5
1958–61	6-226	MDM-6006	C	31–47	50	10.0	4400	210	4.0	5

①—As viewed from the drive end. C—Clockwise.

REAR AXLE AND BRAKE CYLINDER SPECIFICATIONS

Year	Model	Ring Gear & Pinion Backlash, Inch	Drive Pinion Adjustment	Drive Pinion Bearing Preload, Inch Lbs.	Drive Pinion Bearing Adjustment	Axle Shaft End Play, Inch	Hydraulic Cylinder Bore Sizes, Inch		
							Wheel Cylinder		Master Cylinder
							Front	Rear	
1953–61	Jeep	①	Shims	③	Shims	.003–.007	1	3/4	1
1953–61	Station Wagons	.004–.009	Shims	12–18	Shims	.003–.007	②	②	1
1953–61	675, 685	.004–.008	Shims	③	Shims	.003–.007	1 1/8	1	1
1954–61	6–226	.004–.008	Shims	③	Shims	.003–.007	1 1/8	13/16	1
1956–61	DJ-3A		Shims	③	Shims		1 1/8	13/16	1

①—Backlash is .005–.007″ on CJ-2A up to serial No. 13453. After serial No. 13453 and on all later models the setting is .004–.008″.

②—Effective with Model 4x473 Serial No. 19523; Model 473 SW Serial No. 24122; Model SD Serial No. 14653; Model 673 SW Serial No. 17499 the front wheel cylinders were increased from 1″ to 1 1/8″ and the rear wheel cylinders from 7/8″ to 1″.

③—Drive pinion should turn with a slight drag only but with no end play.

WHEEL ALIGNMENT SPECIFICATIONS

Year	Model	Caster, Degrees		Camber, Degrees		Toe-In, Inches	Toe-out on Turns, Degrees		Kingpin Angle, Degrees②
		Limits	Desired	Limits	Desired		Outer Wheel	Inner Wheel①	
1953–61	Jeep	+ 3	+ 3	+ 1 1/2	+ 1 1/2	3/64 to 3/32	20	20	7 1/2
1953–61	Sta. Wagon	+ 1	+ 1	+ 1	+ 1	1/16 to 1/8	18 1/2	20	5
1953–55	675, 685	+ 1/2 to + 1 1/2	+ 1	+ 3/4 to + 1 1/4	+ 1	3/32 to 5/32	19	20	8
1954–55	6–226	+ 1/2 to + 1 1/2	+ 1	+ 3/4 to + 1 1/4	+ 1	3/32 to 5/32	19	20	7 1/2
1956–61	DJ-3A	+ 3	+ 3	+ 1	+ 1	3/64 to 3/32	20	22	7 1/2

①—Incorrect toe-out, when other adjustments are correct, generally indicates bent steering arms.

②—Incorrect kingpin or knuckle support angle with correct camber indicates bent suspension arms or knuckle support.

Engine Section

ENGINE MARKINGS

Current production engines are marked with a letter following the serial number when the engine is not strictly standard.

The letter "A" means crankshaft journals are .010″ undersize.

The letter "B" means the bores are .010″ oversize.

The letter "C" means .010″ oversize bores and .010″ undersize crankshaft journals.

ENGINE, REPLACE

Jeeps

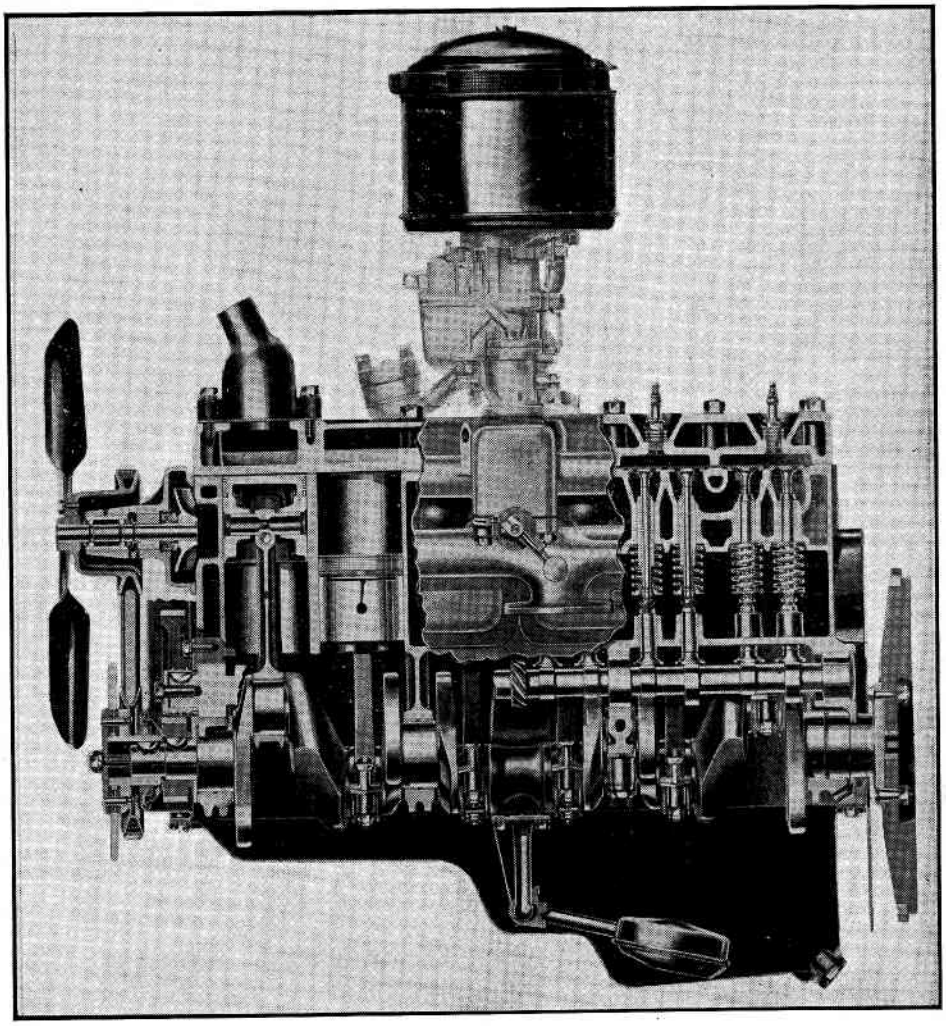
1. Disconnect one battery cable.
2. Drain cooling system.
3. Remove radiator stay bar on CJ-3B.
4. Remove radiator and heater hoses.
5. Remove fan and fan hub.
6. Remove radiator and shroud.
7. Disconnect fuel line at pump.
8. Disconnect windshield wiper hoses.
9. Remove air cleaner and two breather hoses.
10. Disconnect choke and throttle controls.
11. Remove starting motor.
12. Disconnect generator wires.
13. Disconnect primary wire at coil.
14. Disconnect heat indicator and oil pressure gauge tubes.
15. Disconnect exhaust pipe from manifold.
16. Remove front engine supports. This will allow engine to drop slightly and will permit access to the two top bolts on the bell housing.
17. Install a suitable lifting sling on engine. Attach sling to hoist and take up slack.
18. Pull engine forward or roll vehicle backward until clutch clears bell housing, and lift engine from vehicle.
19. To install, reverse procedure.

Four-Cylinder Station Wagons

1. Disconnect one battery cable.
2. Drain cooling system.
3. Remove hood and radiator brace rods.
4. Remove heater and radiator hoses.
5. Remove radiator.
6. Disconnect fuel line at pump.
7. Disconnect windshield wiper hose.
8. Remove carburetor air cleaner.
9. Disconnect throttle controls.
10. Remove starting motor.
11. Disconnect generator wires.
12. Disconnect primary wire at coil.
13. If equipped with overdrive, disconnect overdrive control wires. (To avoid possibility of error when connecting overdrive wires, mark or tag them.)
14. Disconnect heat indicator and oil gauge wires.
15. Disconnect exhaust pipe from manifold.
16. Remove engine support bolts.
17. Unfasten bell housing from engine.
18. Install a suitable lifting sling on engine. Raise engine high enough to relieve weight from front engine supports and pull engine forward, or roll vehicle backward, until clutch clears bell housing. Then remove engine from vehicle.
19. To install, reverse procedure.

F-Head 6-Cyl. Station Wagons

1. Remove hood and radiator stay bar.
2. Drain cooling system.
3. Disconnect one battery cable.
4. Remove air cleaner.
5. Disconnect wires from temperature sender, coil primary and secondary at distributor, starter solenoid, generator, oil sender.
6. Remove coil.



Six cylinder 148" and 161" L-Head Engine

7. Disconnect heater hoses at engine.
8. Disconnect throttle link and remove choke control from carburetor.
9. Disconnect accelerator pedal link from throttle bell crank and push back into vehicle.
10. Disconnect fuel line at pump.
11. Disconnect windshield wiper hose from vacuum booster tube.
12. Remove radiator and hoses.
13. Remove exhaust pipe from manifold.
14. Remove bolts from engine front supports.
15. Disconnect ground strap at left front engine support.
16. Remove bell housing-to-rear engine plate bolts and remove battery ground strap from bell housing if so attached.
17. The engine is now free of connections and can be lifted from vehicle.
18. To install, reverse procedure.

"6-226" Station Wagons

1. Drain cooling system.
2. Remove hood and radiator stay bars.
3. Remove radiator hoses and heater hoses.
4. Remove radiator and shroud.
5. Disconnect battery ground cable.
6. Disconnect wires from temperature sender, oil pressure sender, starter, generator, coil and secondary at distributor.
7. Remove air cleaner.
8. Disconnect accelerator pedal linkage from bell crank.
9. Disconnect vacuum line from wiper motor.
10. Disconnect fuel line from pump.
11. Disconnect engine ground strap from front engine support.
12. Disconnect clutch linkage.
13. Disconnect exhaust pipe at manifold.
14. Disconnect front engine supports.
15. The engine is now free of connections and can be lifted from vehicle.
16. To install, reverse foregoing procedure.

CYLINDER HEAD

Before the cylinder head is installed, make certain that all dirt and carbon is removed from both the head and block. File or hone all high spots.

Use a torque wrench when tightening down cylinder heads. Uneven or excessive tightening of nuts may distort cylinder bores, causing compression loss and excessive oil consumption.

Tighten cylinder heads in the sequence

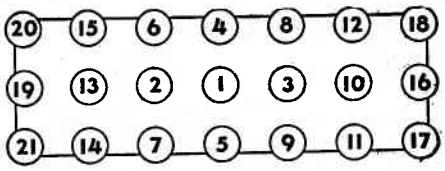


Fig. 2 Six cylinder head tightening. 1953-55 L-Head

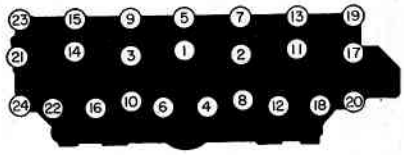


Fig. 3 Six-cylinder F-head engine head tightening

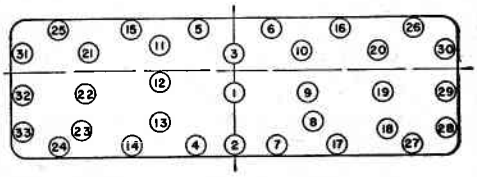


Fig. 4 Cylinder head tightening sequence. 226" engine

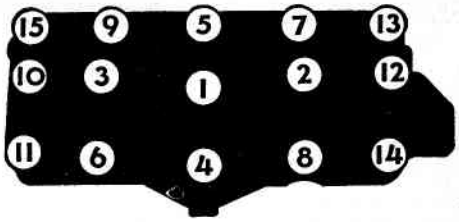


Fig. 5 Cylinder head tightening. Four-cylinder F-head engines

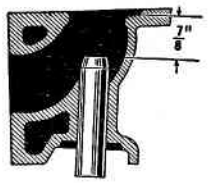


Fig. 6 Position of valve stem guides in six cylinder 148" and 161" L-Head engines

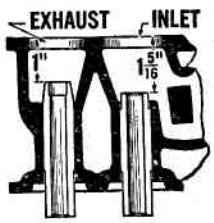
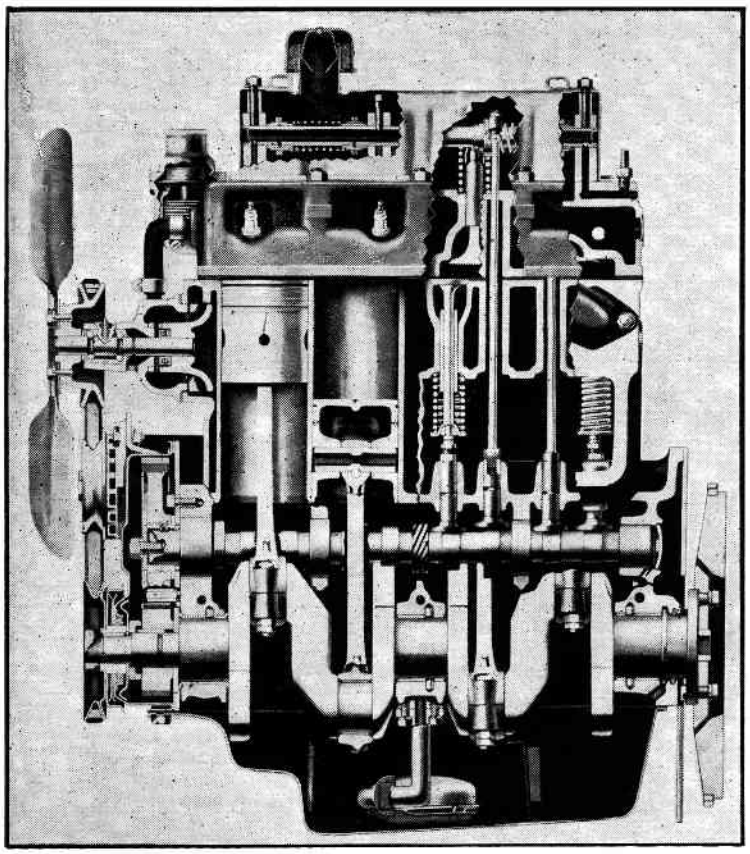
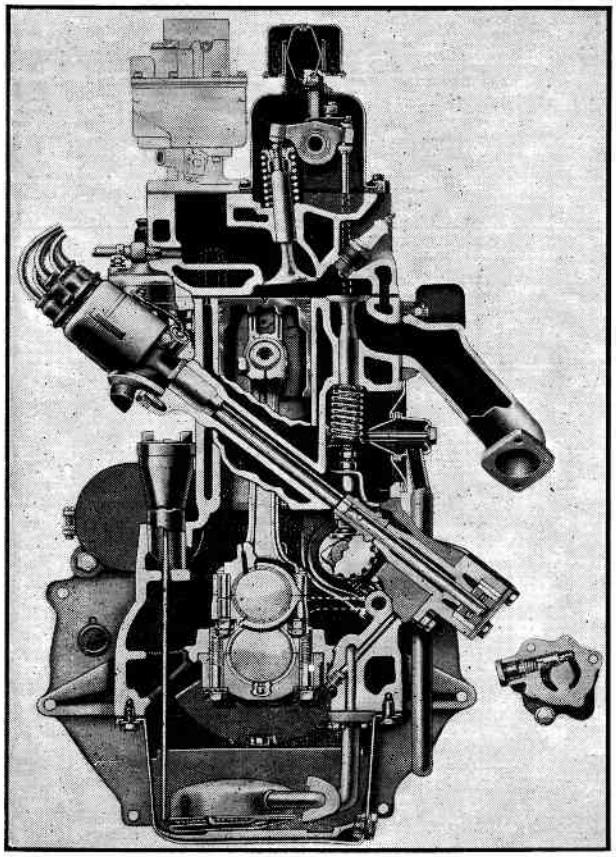


Fig. 7 Position of valve stem guides in four cylinder L-Head engine



F-Head four cylinder engine



F-Head four cylinder engine

shown in Figs. 2 to 5, tightening them a little at a time in the proper order a couple of times around before final tightening to the torque values given in the *Engine Tightening Chart*. After the engine has warmed up to operating temperature, recheck the torque and tighten as required.

On F-Head engines, be sure to check intake valve operating clearances after the final tightening.

Note—Tightening cylinder heads on F-head engines without removing rocker arms may be accomplished with a wrench having an $\frac{11}{16}$" box on one end and a ½" square box on the other end. This, together with a torque wrench will do the job.

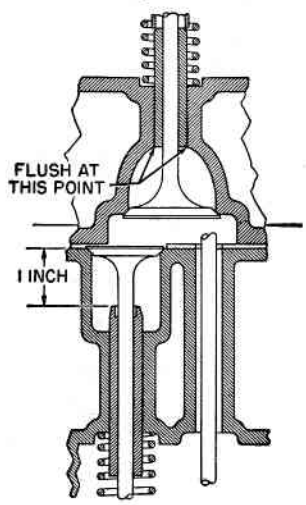


Fig. 8 Position of valve guides in F-head engines

Service Note

Accurate alignment of the cylinder head, gasket and block on L6-226 engines is required to prevent gasket failure. Two cylinder head bolt holes, at opposite corners of the head (positions 24 and 26 in Fig. 4) have a slightly smaller diameter than the other holes and can be used for guide pins.

The guide pins can be made by cutting the heads off two cylinder head bolts. Cut slots in the end from which the heads were removed to install and then remove the guide pins.

The torquing sequence for the head bolts is shown in Fig. 4.

ROCKER ARMS

F-Head Engines

To remove the rocker arm assembly, proceed as follows:

1. Remove carburetor air cleaner.
2. Disconnect spark plug wires.
3. Drain cooling system.
4. Remove rocker arm cover.
5. Remove rocker arm bracket screws and lift off rocker arm assembly.

Before disassembly, mark rocker arms, brackets and shaft so they can be reassembled in the original positions.

VALVES, ADJUST

L-Head Engines

The valves may be adjusted when the engine is at normal room temperature. Crank the engine over until the valve to be adjusted is fully closed. Hold the lifter body with a tappet wrench to prevent it from turning. Then turn the tappet adjusting screw until the proper clearance is obtained. Measure the clearance with a feeler gauge and, after adjusting one tappet, proceed in like manner with the others, being certain that the valve being adjusted is fully closed.

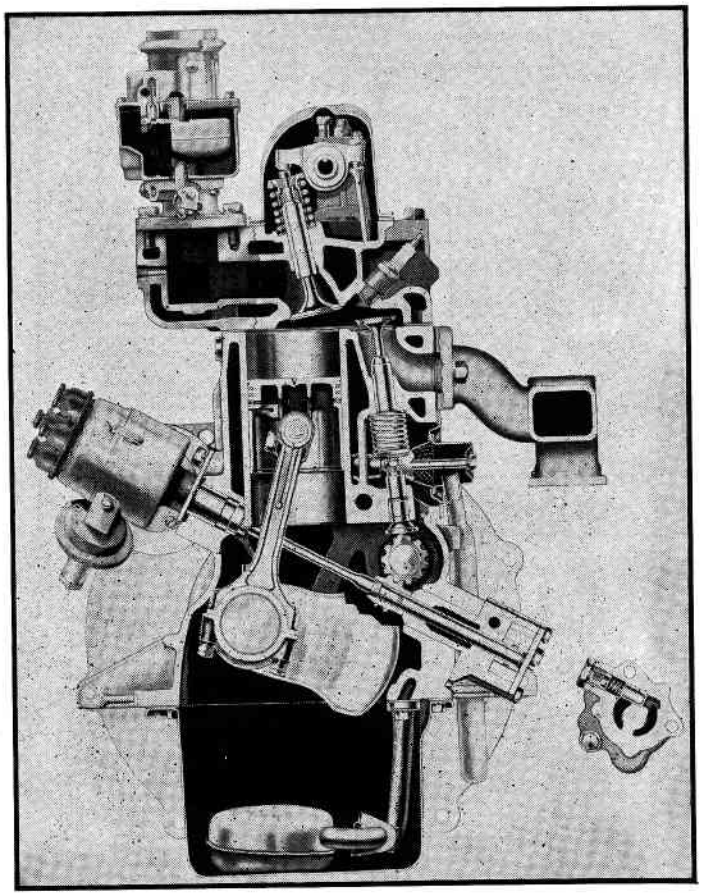
In addition to the conventional method of adjusting tappets by locating the distributor rotor and then adjusting the tappets by following the firing order of the engine, the following method may also be used:

Four-Cylinder Engines

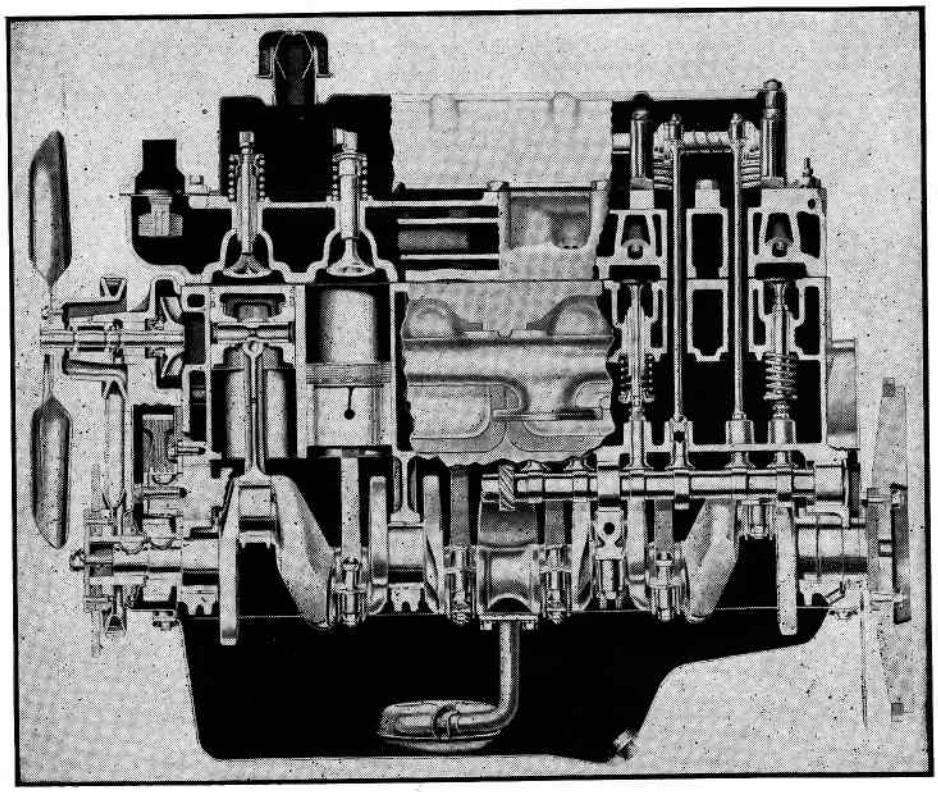
Valves Fully Raised	Adjust Tappets
1 and 3	6 and 8
2 and 5	4 and 7
6 and 8	1 and 3
4 and 7	2 and 5

Six-Cylinder 148" & 161" Engines

Valves Fully Raised	Adjust Tappets
1 and 3	10 and 12
7 and 9	4 and 6
2 and 5	8 and 11
10 and 12	1 and 3
4 and 6	7 and 9
8 and 11	2 and 5



Six-cylinder F-Head engine



Six-cylinder F-Head engine

Six-Cylinder 226" Engine

Valves Fully Raised	Adjust Tappets
1 and 3	10 and 12
8 and 9	4 and 5
2 and 6	7 and 11
10 and 12	1 and 3
4 and 5	8 and 9
7 and 11	2 and 6

F-Head Engines

The exhaust valves (in block) may be adjusted in the same manner as outlined for L-head engines. However, the intake valves may best be adjusted with the engine running after it has warmed up to operating temperature.

If the cylinder head has been tightened, be sure to recheck intake valve clearances and adjust as required.

VALVES, REMOVE

L-Head Engines

After removing the cylinder head, take off the valve chamber covers and use cloth to block off the holes in the valve chamber to prevent the valve locks from falling into the crankcase.

With a suitable valve spring compressor, raise the springs on those valves which are closed and remove the valve locks. Then turn the crankshaft until those valves which are open are closed and remove the remaining valve locks.

Remove all valves and place them in a board with numbered holes so they can be identified as to the valve port from which they were removed.

F-Head Engines

Follow the same procedure in removing the exhaust valves from these engines as outlined for L-head engines.

In removing the intake valves from the head a suitable fixture is available which holds the valves closed and compresses the spring at the same time.

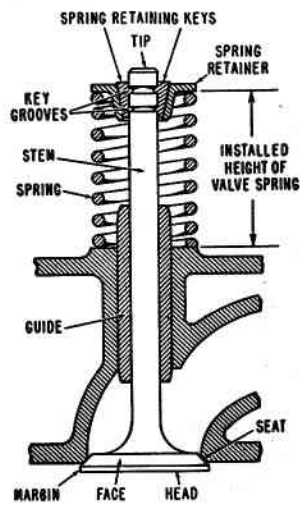


Fig. 5A Checking valve spring installed height

VALVE SPRING INSTALLED HEIGHT

When valves and seats are reground the position of the valve in the head is changed so as to lessen the valve spring tension. Without proper valve spring tension the valve does not seat long enough or it may not seat completely. Since the valve is cooled by transferring heat from the valve head to the seat and thence to the coolant, improper valve spring tension will cause worn, pitted and distorted valves which result in loss of compression and power as well as poor gasoline mileage.

When valves, springs, retainers and locks are installed, measure the assembled height of valve springs from the surface of the cylinder head spring pad to the underside of the spring retainer as shown in Fig. 5A. If the assembled height is greater than the dimension given in the *Valve Specifications Chart,* install a spacer or shim of proper thickness between cylinder head spring pad and spring to bring the assembled height to specifications.

Do not install spacers unless necessary. Excessive use of spacers will result in overstressing valve springs and overloading camshaft lobes which could lead to spring breakage and worn camshaft lobes.

VALVE SPRING TESTING

After taking out the valves, remove the springs and wash them with gasoline or other suitable solvent. Examine the springs for damage or corrosion due to acid etching, which will develop into surface cracks and cause spring failure.

Check valve spring pressure on a spring testing fixture if one is available. If a fixture is not available, at least check the free length of each spring by standing it alongside a new spring. Any spring that does not conform to the pressure specifications given in the *Valve Data* chart within 10 per cent should be replaced. Likewise, any spring that stands shorter than the new spring used for comparison should be discarded.

VALVE GUIDES

After the valves and springs have been removed, clean the valve guides with a wire brush, and clean the valves with a wire wheel brush, making sure that all carbon is removed from the top and bottom of the heads, as well as the gum which might have accumulated on the stems.

Check the clearance between the valve stems and guides carefully. The standard clearances are given in the *Valve Data* chart.

Excessive clearance between the valve stem and guide will cause improper seating and burned valves. When there is too much clearance between intake valve stems and guides, there is a tendency to draw oil vapor through the guide on the suction stroke, causing excessive oil consumption, fouled spark plugs and poor low speed performance.

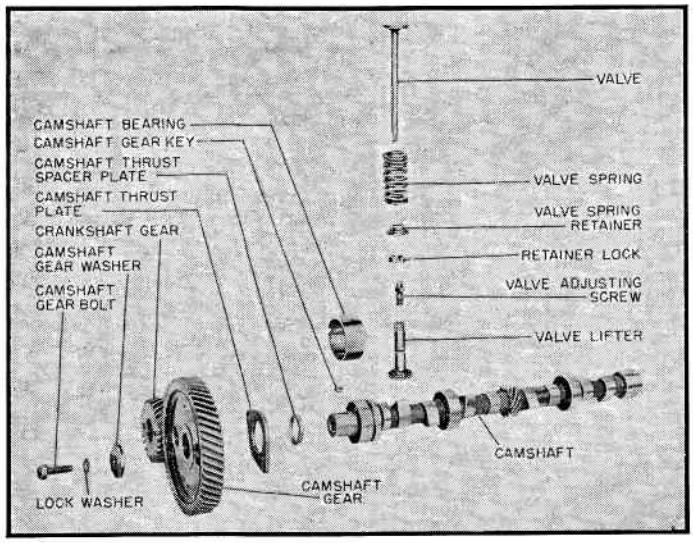


Fig. 9 Layout of valve system. Four cylinder L-head engine. This is typical of the F-head engine except that the intake valve mechanism is contained in the cylinder head

To check valve stem-to-guide clearance, take a new valve and place it in each valve guide and feel the clearance by moving the valve stem back and forth. If this check shows excessive clearance, it will be necessary to replace the valve guide. If the clearance is not excessive when checking with a new valve but is excessive when checked with the old valve, the old valve stem is worn and a new valve must be installed.

If it is necessary to replace the valve guides, the old guides can be driven out with a special driver which is available for the purpose. However, in lieu of the driver, the guides can be pulled out by using a suitable piece of pipe together with a long bolt and suitable washers.

When replacing the guides, maximum engine performance can only be secured when the guides are installed correctly (see Figs. 6, 7 and 8).

VALVES, GRIND

In refacing valves, take off the minimum of metal required to clean up the valve faces. If the outer edge of the valve becomes too thin or sharp due to excessive grinding, the valve must be replaced.

Inspect the valve seats in the block and head for cracks, burns, pitting, ridges or improper angle. During any general engine overhaul it is advisable to reface the valve seats regardless of their condition. If new valve guides are required, they must be installed before refacing the seats if the equipment used has a valve guide pilot.

The valve seat width after refacing should measure not more than $\frac{5}{64}$ in. The width may be checked by placing a scale across the face of the seat.

A simple check can be made to prove the fit of the valve in the valve seat by spreading a thin film of Prussian Blue on the valve face and then inserting the valve into the valve seat. With hand pressure, rotate the valve ¼ turn and then remove it and observe the transfer of Prussian Blue to the valve seat. An uneven transfer of Prussian Blue will indicate an inaccurate valve and valve seat refacing operation.

VALVE LIFTERS

These lifters are of the mushroom type operating in guide holes cast in the block. This means that the camshaft will have to be removed from the engine if valve lifters require replacement.

Whenever the camshaft is removed, inspect the faces of the lifters where they contact the cams and replace any that are scored, rough or cracked. Check the clearance of the lifters in the guides, replacing those that have worn excessively. Oversize available is .004 in. and the guides must be reamed to accommodate them.

CAMSHAFT & GEAR COVER, REPLACE

All Engines (Except 6-226)

1. Drain cooling system.
2. Remove radiator and grille or guard.
3. Remove cylinder head, valves and springs.
4. On L-head engines, remove manifolds.
5. Remove fuel and oil pumps.
6. Remove oil pan.
7. Remove crankshaft pulley (and vibration damper on 6-cyl.).
8. Remove fan assembly.
9. On CJ-2A and CJ-3A, remove nuts from front engine support.
10. Remove engine front cover.
11. Remove camshaft gear and thrust plate.
12. Tie valve lifters up to their highest point of travel with string wrapped around the adjusting screws and

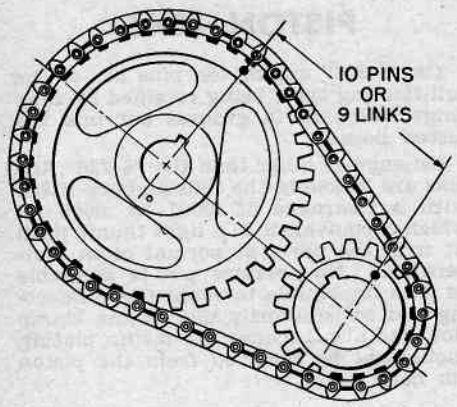


Fig. 10 Valve timing. Six-cyl. 226" engine

attach to manifold studs. Spring clip type clothespins or small "C" clamps may also be used.

13. On CJ-2A and CJ-3A, raise front of engine until camshaft will clear front crossmember.
14. Remove camshaft from engine.
15. To install, reverse foregoing procedure and set valve timing as shown in Fig. 10.

"6-226" Engines

1. Drain cooling system.
2. Remove radiator.
3. Remove vibration damper.
4. Remove timing chain cover.
5. Remove timing gears and chain.
6. Remove fuel pump.
7. Remove cylinder head.
8. Remove oil pan and oil pump.
9. Remove valves and springs.
10. Hold valve lifters up with spring type clothespins or string to prevent them from interfering with camshaft as it is being withdrawn.
11. Unfasten camshaft thrust plate from cylinder block and withdraw the camshaft.
12. To install, reverse removal procedure and set valve timing as shown in Fig. 11.

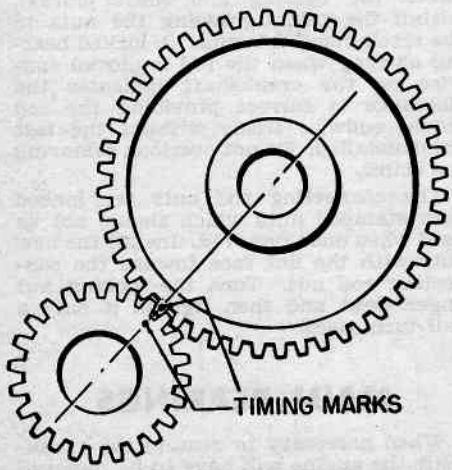


Fig. 11 Valve timing for timing gear driven engines

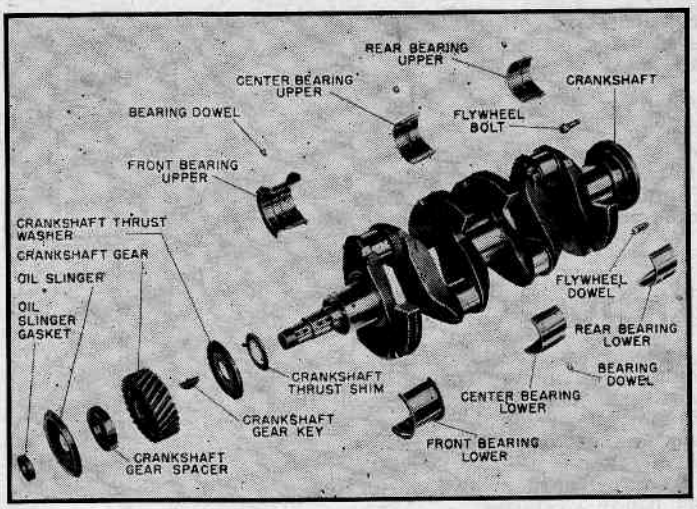


Fig. 12 Layout of crankshaft and related parts. Four cylinder engine

VALVE TIMING DATA

Year	Model	Intake Opens①	Intake Closes②	Exhaust Opens③	Exhaust Closes④
1953-61	6-226 Eng.	10	60	55	10
	Others	9	50	47	12

①—Degrees before top dead center.
②—Degrees after bottom dead center.
③—Degrees before bottom dead center.
④—Degrees after top dead center.

TIMING CHAIN

"6-226" Engines

For correct valve timing on this engine, install the chain so there are 10 pins between the sprocket timing marks, Fig. 10.

TIMING GEARS

All Except "6-226"

The camshaft is driven by a steel gear on the crankshaft and a fibre gear on the camshaft. Lubrication is positive through a jet pressed into the crankcase directly back of the contact point of the gears. When the gears are removed, check both the jet and oil passage to make sure they are clear.

When it becomes necessary to replace the timing gears, due attention must be given to the end play of both shafts and running clearance of the gears.

End play of the crankshaft is controlled by the running clearance between the crankshaft gear and gear thrust plate, Fig. 11. The end play is adjusted by shims placed between the thrust plate and the end of the front main bearing. Shims .002 in. thick are available for this adjustment. When the thrust plate or washer is removed, be sure it is reinstalled with the beveled inner edge toward the crankcase.

End play of the camshaft is determined by the running clearance between the camshaft gear and thrust plate. The standard clearance is .003 to .0055 in. which is determined by the thickness of the camshaft gear thrust plate spacer, Fig. 9. Should a check indicate not enough clearance, place a thin shim between the thrust plate spacer and the shoulder on the camshaft. Clearance may be reduced by dressing off the spacer slightly. Whenever the spacer is installed, make sure that the beveled inner edge is toward the rear.

End play of both the camshaft and crankshaft can best be measured with a dial indicator.

Standard running clearance between the gears is .000 to .002 in., which should be checked with a dial indicator.

To set the valve timing, install the crankshaft gear followed by the camshaft gear with the camshaft positioned to allow installation with the timing gear marks meshed, Fig. 11.

PISTONS & RODS, REMOVE

After removing the cylinder head and oil pan, examine the cylinder bores above the ring travel area. If the bores are worn so that a shoulder or ridge exists at this point, remove the ridge with a ridge reamer to avoid damaging rings or cracking ring lands of pistons during removal.

Remove the connecting rod caps and push pistons and rods out of cylinders, using care to prevent rod bolts from contacting and nicking crankshaft journals.

Make sure the rods and pistons are properly numbered so they can be reinstalled in original locations. It is advisable to install caps on rods to avoid mixing parts.

PISTONS & RODS, ASSEMBLE

All Except "6-226" Engine

As shown in Fig. 13, pistons should be assembled to the connecting rods so that the oil spray hole in the rod *faces* away

from the camshaft side of the engine with the vertical slot in the piston facing the camshaft side.

"6-226" Engine

When correctly assembled, the oil spray hole in the rod *faces* the camshaft side of the engine with the vertical slot in the piston facing away from the camshaft side.

PISTONS

Standard size service pistons are high limit or maximum diameter; therefore, they can usually be used with a slight amount of honing to correct slight scoring or excessive clearances in engines having relatively low mileages. Service pistons are also furnished in .005, .010, .015, .020 and .030 in. oversizes.

Before a honing or boring operation is started, measure all new pistons with a micrometer at points exactly 90 degrees away from the piston pin. Then select the smallest piston for the first fitting. The slight variation usually found between pistons in a set may provide for correction in case the first piston is fitted too free.

It is very important that refinished cylinder bores are trued up to have not more than .0005 in. out-of-round or taper. Each bore must be final honed to remove all stone or cutter marks and provide a smooth surface. During final honing, each piston must be fitted individually to the bore in which it will be installed and should be marked to insure correct installation.

After final honing and before the piston is checked for fit, each bore must be thoroughly washed to remove all traces of abrasive and then dried thoroughly. The dry bore should then be brushed clean with a power-driven fibre brush.

Both the piston and cylinder block must be at the same temperature (room temperature of 70 degrees) when the piston is checked for fit in the cylinder bore. Therefore the cylinder should be allowed to cool after boring or honing and before the piston fit is checked. This is important because a difference of 10 degrees between the temperature of parts is sufficient to produce a variation of .0005 in.

To check the fit of pistons, use a feeler ribbon gauge ¾ in. wide and the thickness listed in the *Piston & Ring Data* chart. Insert the piston upside down in the cylinder bore with rings removed. Locate the feeler 90 degrees from the piston pin hole, between the thrust face of the piston and cylinder wall. Hook the feeler to a spring scale. If the force required to pull the feeler out of the cylinder with the scale is as specified in the chart, the piston fit is correct. If too tight, the cylinder must be honed out until the proper clearance is obtained.

PISTON RINGS

When new piston rings are to be installed without reboring cylinders, the glazed cylinder walls should be slightly dulled, but without increasing the bore diameter. This is done with a "Glaze-buster" or with a hone equipped with the finest grade of stones.

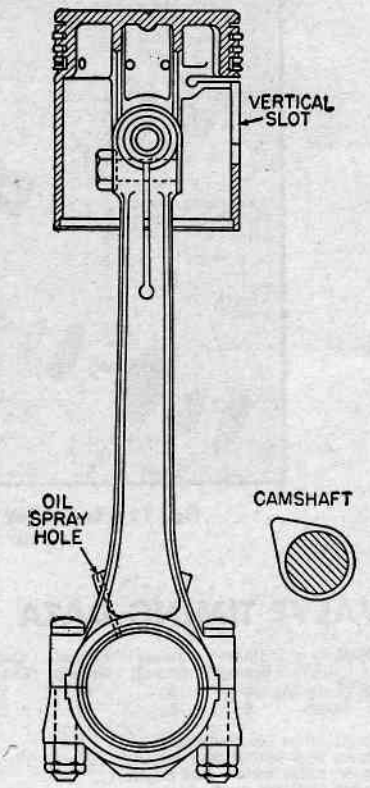


Fig. 13 Assemble pistons and rods as shown. All except "6-226" engine. On. "6-226" the oil spray hole faces the camshaft side with the vertical piston slot away from the camshaft side

New piston rings must be checked for clearance in piston grooves and for gap in cylinder bores. Cylinder bores and piston grooves must be clean, dry and free of carbon and burrs.

Check the clearance of each ring in its piston groove by installing the ring and then inserting feeler gauges *under* the ring. Any wear that occurs in the piston groove forms a step or ridge at the inner portion of the lower land. If gauges are inserted above the ring, the ring may rest on the step instead of on the worn portion of the lower land, and a false measurement of clearance will result.

If the piston grooves have worn to the extent that relatively high steps or ridges exist on the lower lands, the piston should be replaced because the steps will interfere with the operation of the new rings and the ring clearances will be excessive. Piston rings are not furnished in oversize widths to compensate for ring groove wear.

See the *Piston & Ring Data* chart for ring groove clearances and end gap clearances.

To check the end gap of rings, place the ring in the cylinder in which it will be used. Square it in the bore by tapping with either end of the piston, then measure the gap with feeler gauges. If necessary to increase the gap, file the ends with a smooth file.

PISTON PINS

On "6-226" engine the pins are of the full-floating type, being retained by snap rings which fit in grooves cut into the piston bosses.

On engines other than the "6-226", the pins are locked in the rods and are fitted with a clearance of .0001 to .0005 in. which is equivalent to a light thumb push fit with the parts at normal room temperature. No oversize pin is available as it is impossible to ream the connecting rod satisfactorily due to the clamp slot, and also because the piston plating should not be removed from the piston pin bore.

ROD BEARINGS

Insert type bearings consist of two half shells, the upper shell having an oil spray hole which communicates with the oil hole in the rod.

When the shells are placed in the rod and cap the ends extend slightly beyond the parting faces so that when the rod bolts are tightened the shells will be clamped tightly in place to insure positive seating and to prevent turning. *The ends of the shells must never be filed flush with the parting faces of the rod and cap.*

If this type bearing becomes noisy or is worn so that clearance on the crankpin is excessive, a new bearing of proper size must be selected and installed since no provision is made for adjustment. Under no circumstances should the rod or cap be filed to adjust bearing clearance.

Service bearings are furnished in standard sizes and several undersizes, including undersizes for reground crankshafts.

The clearances of connecting rod (and main) bearings may be checked with Plastigage which is available at any auto parts jobber and full instructions for its use are furnished with the envelope in which it is contained.

Lacking Plastigage, however, clearance may be checked with a .002 in. test shim, ¾ in. square. Place the shim between the bearing and shaft journal. Install the cap, tightening the nuts to the recommended torque. A locked bearing or drag when the rod is moved endwise on the crankshaft indicates the clearance is correct providing the rod moves endwise freely without the test shim installed. Do not overlook removing the shim.

The connecting rod nuts are locked with stamped nuts which should not be used when once removed. Install the new nuts with the flat face toward the connecting rod nut. Turn the locking nut finger tight and then tighten it only a half-turn more.

MAIN BEARINGS

When necessary to remove the crankshaft the engine will have to be removed from the chassis. And since the main bearings on all four-cylinder engines are

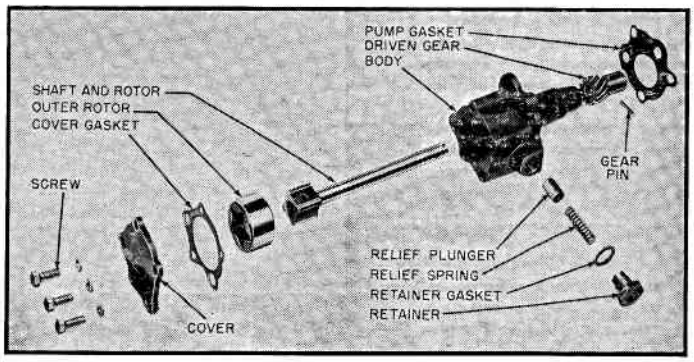


Fig. 14 Rotor type oil pump. All except "6-226" engine

held in place by dowels, the engine will have to be removed when their replacement becomes necessary.

Main bearings on six-cylinder engines may be removed and installed without removing the engine.

The bearings are made to size and do not require line reaming or adjustment.

When it is necessary to install new bearing shells it is advisable to measure the shaft journals with a micrometer for being out-of-round. If an out-of-round condition exists in excess of the standard running clearance of the bearings (either main or rod) a satisfactory bearing replacement cannot be made and it will be necessary to replace or regrind the crankshaft. Undersize bearings of .010 and .020 in. are available.

Before installing the shaft and bearings, use a rifle brush to clean the oil passages thoroughly in both the shaft and crankcase. If possible, blow out the holes with compressed air. Be sure the journals are not nicked or scored and that all parts are thoroughly clean.

After installing the bearings, check the running clearance to be sure it is standard (see *Engine Bearing Data* chart). Use Plastigage or a .002 in. test shim about one inch square. Place the shim between the shaft and bearing and tighten the bearing cap nuts to the recommended torque. The shaft should be locked if the clearance is at the low limit or show a drag if at the high limit when turned, proving that the clearance is correct. Do not overlook removing the test shim.

CRANKSHAFT OIL SEAL

The rear main bearing is sealed against external leakage by a lip type neoprene seal with a metal core. The seal has the advantage of being able to be slipped into place without removing the crankshaft.

For easy installation, give the seal a coat of grease. Be careful not to coat the ends of the seal as they have sealing compound applied to them.

OIL PAN

The floating oil intake is attached to the crankcase with two cap screws. Whenever the oil pan is removed, the float, screen and tube should be cleaned thoroughly in a suitable cleaning fluid to remove any accumulation of dirt. If the screen has been crushed, it is better to replace it rather than attempt to make a repair.

OIL PUMP

All Except "6-226" Engines

The oil pump is located externally on the left side of the engine. When necessary to remove the pump, first take off the distributor cap and note the position of the rotor so that the pump may be reinstalled without disturbing the ignition timing.

To install the pump without disturbing the timing, the pump gear must be correctly meshed with the camshaft driving gear to allow engagement of the driving key on the distributor shaft in the pump shaft driving slot without moving the distributor rotor. Assembly can be made only in one position because the slot and driving key are machined off center.

To disassemble the pump, Fig. 14, remove the cover and gasket. Hold a hand over the cover opening and, with the pump upside down, turn the shaft until the outer rotor slips out. Drive out the pin securing the drive gear to the shaft. Press the shaft out of the gear and slide the shaft and inner rotor out of the body.

Failure of the pump to operate at full efficiency may usually be traced to excessive end play in the rotor or excessive clearance between the rotors. The clearance between the outer rotor and pump body should also be checked.

End play of the rotors is controlled by the thickness of the cover gasket which is made of special material which can only be slightly compressed. Never use other than a standard factory gasket.

"6-226" Engines

The oil pump is of the positive gear type, located at the bottom of the vertical shaft which also drives the distributor.

To disassemble the oil pump, take off the screen float. Drive out the pin which secures the drive gear to the shaft and take off the gear. Remove pump cover and gasket. Position the pump with the drive shaft end up and allow the gears to drop from the pump body. Do not remove the idler gear shaft unless worn or damaged.

Assemble the pump with new parts, using a new gasket. When replacing the upper drive gear, position it on the shaft and use a feeler gauge to measure clearance between gear and end of pump body, allowing a clearance of .002 to .004". When proper clearance has been obtained, drill a $\frac{3}{16}$" pin hole through the drive shaft, install the pin and peen it securely.

RADIATOR, REMOVE

Raise the hood, disconnect the upper and lower hose, unfasten the core from its mounting and lift it off.

WATER PUMP, REPLACE

Remove the fan belt and blades, unfasten the pump from the cylinder block and lift it off. On some models, it may be necessary to loosen the radiator core and pull it forward in order to remove the water pump assembly.

WATER PUMP REPAIRS

To disassemble the pump, take out the bearing retaining wire and press the shaft through the impeller and pump body. Remove the seal washer and seal. Place the pump shaft and fan pulley on the press in such a position that the bearing will clear the opening and press the shaft from the pulley.

To reassemble the pump, install the long end of the shaft in the pump body from the front end until the outer end of the bearing is flush with the front end of the pump body.

Dip the seal and seal washer in brake fluid and install in the impeller. Place the impeller on the bed of the press and press the long end of the shaft into the impeller until the end of the shaft is flush with the impeller.

Support the assembly on the impeller end of the shaft and press the fan pulley on the shaft so that the end of the shaft is flush with the face of the fan pulley. Move the shaft in the body so that the grooves in the bearing and pump body line up, then lock in position with the bearing retaining wire.

DISTRIBUTOR, REPLACE

All Except "6-226" Engines

The distributor is mounted on the right side of the engine and is operated by a coupling on the oil pump shaft which is driven by a spiral gear on the camshaft.

1. Remove wires from the distributor cap, noting the order in which they are assembled to assure correct reassembly.
2. Remove primary lead from terminal post at side of distributor.
3. Disconnect vacuum tube.
4. Remove distributor cap.
5. Note position of rotor in relation to the distributor housing. Mark housing to facilitate installing and timing.
6. Remove screw holding distributor to

crankcase and lift unit from engine.

7. Reinstall in the reverse order of removal and set the timing as outlined below.

"6-226" Engines

To remove the distributor, disconnect the vacuum tube and low tension wire and remove distributor cap. Remove bolt and washer that holds advance arm to adapter and lift out distributor. Install the distributor in the reverse order of removal and set the ignition timing as outlined below.

IGNITION TIMING

Crank engine to bring No. 1 piston up on its compression stroke and stop when the timing mark is in the center of the hole in the flywheel housing or when the pointer on the timing gear cover lines up with the specified timing mark on the crankshaft pulley or vibration damper (see *Tune Up Chart*). Loosen the distributor body clamp and rotate the distributor until the points close. Then turn it in the opposite direction until the points just begin to open and tighten the clamp bolt. Check the timing with a timing light.

When using a timing light, *it is advisable to disconnect the distributor vacuum line before checking timing,* otherwise the timing may be affected due to the fact that the centrifugal advance may operate if the engine is idling too fast, thus obtaining incorrect timing.

Connect the timing light according to the manufacturer's instructions. Start the engine and operate at idle speed. Direct the light on the timing mark. It should flash just as the timing mark lines up with the pointer, indicating correct timing. If the pointer and timing mark does not line up, rotate the distributor as required to bring them in alignment.

Carburetor Section

Performance Complaints

Flooding, stumble on acceleration or other performance complaints are in many instances caused by the presence of dirt, water or other foreign matter in the carburetor. To aid in diagnosing the cause of the complaint, the carburetor should be carefully removed from the engine without draining the fuel from the bowl. The contents of the fuel bowl may then be examined for contamination as the carburetor is disassembled.

Check the fuel in the bowl for contamination by dirt, water, gum or other foreign matter. A magnet moved through the fuel in the bowl will pick up and identify any iron oxide dust that may have caused intake needle and seat leakage.

Inspect gasketed surfaces between body and air horn. Small nicks or burrs should be smoothed down to eliminate air or fuel leakage. On carburetors having a vacuum piston, be especially particular when inspecting the top surface of the inner wall of the bowl around the vacuum piston passage. A poor seal at this location may contribute to a "cutting-out" on turns complaint.

Fill the carburetor bowl with clean fuel before installing on manifold. This will help prevent dirt trapped in the fuel system from being dislodged by the free flow of fuel as the carburetor is primed. The operation of the float and intake needle and seat may be checked under pressure if a fuel pump is used at the bench to fill the carburetor bowl. Operate the throttle several times and visually check the discharge from pump jets.

Poor Mileage and Engine Loading Complaints

Cases of poor mileage and engine loading may be due in many instances to sluggish choke valve opening during cold driveaway, caused by insufficient vacuum in choke housing, a plugged or restricted heat pipe or inlet in choke cover. To check for this condition, have engine warm and running at slow idle. Remove choke heat pipe and hold a finger over the heat inlet hole (hole is on choke housing on some carburetors). If there is little or no vacuum pull on the finger, check the choke housing for gasket leaks or plugged vacuum passages. If these are OK, check choke vacuum housing and manifold.

Dirty or Rusty Choke Housing

In cases where it is found that the interior of the choke housing is dirty, gummed or rusty while the carburetor itself is comparatively clean, look for a punctured or eroded manifold heat tube (if one is used).

Manifold Heat Control Valve

An engine equipped with a manifold heat control valve can operate with the valve stuck either in the open or closed position. Because of this, an inoperative valve is frequently overlooked at vehicle lubrication or tune-up.

A valve stuck in the "heat-off" position can result in slow warm-up, combustion chamber deposits, carburetor icing, flat spots during acceleration, low gas mileage and spark plug fouling.

A valve stuck in the "heat-on" position can result in power loss, engine knocking, sticking or burned valves and spark plug burning.

To prevent the possibility of a stuck valve, check and lubricate the valve each time the vehicle is lubricated or tuned-up. Check the operation of the valve manually. To lubricate the valve, place a few drops of penetrating oil on the valve shaft where it passes through the manifold. Move the valve up and down a few times to work in the oil. *Never use engine oil for this purpose as it will leave a residue which hampers valve operation.*

Rough Idle & Low Speed Stalling

These engines are equipped with positive sealed type crankcase ventilation which reduces to a minimum condensation and the formation of sludge. The correct operation of the system depends upon the free flow of air from the carburetor air cleaner through the oil filler tube and engine to the control valve mounted in the intake manifold.

Be sure there is no air leakage at the tube connection, and that the oil filler tube cap gasket is in good condition. Always keep the cap locked securely.

Be sure that the ventilator valve, mounted in the intake manifold, operates at all times. Should the valve become clogged with carbon the ventilating system will not operate and a pressure will build up in the engine crankcase which may cause oil loss at the rear main bearing or by the piston rings.

Should the valve fail to seat it will be impossible to make the engine idle satisfactorily. When the valve operates correctly, a slight vacuum is present in the crankcase which is of material assistance in oil control.

Clean the ventilator valve each time the valves are ground or the engine tuned.

CARTER CARBURETOR ADJUSTMENTS

Year	Carburetor Model	Float Level	Float Drop	Idle Screw Turns Open	Pump Travel Setting	Fast Idle Setting	Choke Unloader Setting	Choke Setting
1956–61	YF-2467S	9/32 ①	1 1/4 ②	1 — 2 1/2	③	④	None	None
1956–61	YF-2392S	9/32 ①	None	1/2 — 2	None	④	None	None
1954–61	WCD-2204S	3/16 ⑤	None	1 — 2	11/32 ⑥	.016 ⑦	1/8 ⑧	Index
1954–55	WGD-2052S	⑨	None	1/2 — 1 1/2	1/2 ⑩	.020 ⑪	9/64 ⑫	2 Rich
1954–55	WGD-2052SA	⑨	None	1/2 — 1 1/2	1/2 ⑩	.020 ⑪	9/64 ⑫	Index
1953–61	YF-938S-A-B-C	5/16 ①	None	3/4 — 1 3/4	None	④	None	None
1953–61	YF-951S-A	5/16 ①	None	3/4 — 1 3/4	None	④	None	None

CARTER NOTES

METERING ROD

YF—This adjustment must be checked after adjusting pump and each time the carburetor is reassembled. With throttle valve closed, press down on upper end of diaphragm shaft until diaphragm bottoms in vacuum chamber. Metering rod should contact bottom of metering rod well and metering rod arm should contact lifter link at outer end nearest springs and at supporting lug. Adjust by bending lip of metering rod arm to which metering rod is attached.

WGD and WCD—This adjustment must be made after pump adjustment. With throttle valves closed, press down on vacumeter link until metering rods bottom. With rods held down, revolve metering rod arm until lip contacts vacumeter link. Hold in place and tighten set screw.

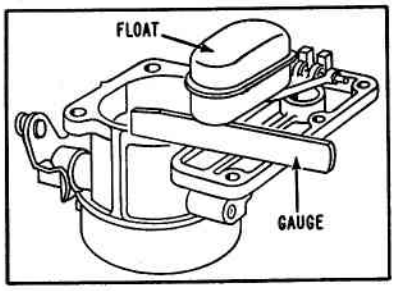


Fig. ①—YF float level.

②—With bowl cover held upright, distance between free end of float and bowl cover should be as listed. Adjust by bending stop tabs on float arm.

③—With throttle valve closed, press down on upper end of diaphragm shaft until it reaches bottom. Metering rod arm should now contact pump lifter link at outer end and nearest springs. Adjust by bending pump connector link at lower angle.

④—With choke held wide open, lip of fast idle cam should contact boss on body casting. Adjust by bending at offset portion of choke connector link.

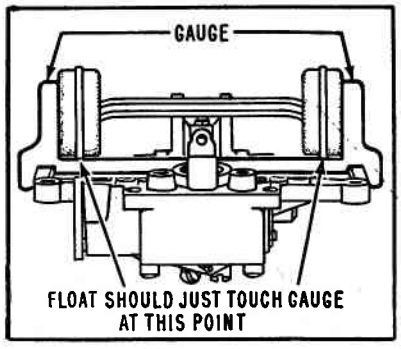


Fig. ⑤—WCD float level.

⑥—With throttle valves closed, distance from top of plunger shaft to top of dust cover boss should be as listed. Adjust by bending throttle connector rod.

⑦—With choke valve closed, tighten fast idle screw on high step of fast idle cam until the clearance listed exists between throttle valve and carburetor bore.

⑧—With throttle wide open, there should be the clearance listed between upper edge of choke valve and inner wall of air horn. Adjust by bending unloader lip on throttle shaft lever.

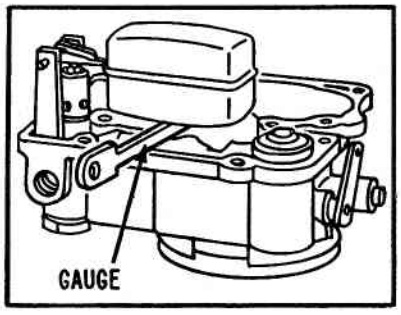


Fig. ⑨—WGD float level. With solid needle 9/32", with spring loaded needle 7/32".

⑩—With throttle valves closed, distance from dust cover boss to top of plunger shaft should be as listed. Adjust by bending throttle connector rod.

⑪—Hold choke valve closed, then close throttle. There should now be the clearance listed between throttle valve and carburetor bore. Adjust by bending choke connector rod.

⑫—With throttle valves wide open, close choke valve as far as possible without forcing. There should now be the clearance listed between upper edge of choke valve and inner wall of air horn. Adjust by bending arm on choke trip lever.

Clutch, Transmission and Transfer Case

CLUTCH PEDAL, ADJUST

Jeeps

To adjust the clutch pedal free travel, which should be 1½", lengthen or shorten the clutch control cable as required.

Station Wagons (Except "6-226")

To adjust clutch pedal free travel, which should be 1", turn the threaded connection between the clutch control lever and the clutch control tube lever as required to obtain the desired result.

"6-226"

To adjust the clutch free pedal travel on these models, loosen the two lock nuts on the pedal adjusting rod. Turn the nuts forward to increase or backward to decrease the free travel. After pedal free travel of 1" is obtained, tighten both lock nuts against the adjusting trunnion, being careful not to change the adjustment.

CLUTCH, REPLACE

Both the Auburn and Rockford clutches, Figs. 1 and 2, are used. They are of the single plate, dry disc type, the difference between them being that the Auburn clutch has three springs while the Rockford clutch has six.

When it becomes necessary to replace the clutch assembly or just the driven disc, follow the procedure outlined for removing the transmission or transmission and transfer case from the vehicle.

Note that labor will be saved on all models except "6-226" if the engine is removed from the chassis without the bell housing. Then remove the clutch from the flywheel.

On "6-226" models, which are equipped with a split bell housing, it is advisable to disconnect both the front and rear propeller shafts, pull the transmission and transfer case to the rear sufficiently to clear the shaft from the clutch. Remove the bottom pan from the bell housing and remove the clutch from the flywheel with the engine still in the vehicle.

If only a new driven disc is to be installed, mark both the pressure plate and flywheel so that the assembly may be installed in the same position to maintain clutch balance. When removing the clutch from the flywheel, loosen the attaching screws a turn or two at a time in progression to prevent distortion of the clutch bracket (cover).

Installation is made in the reverse order, being sure to turn the screws a little at a time in progression until all are tight. When installation is complete, adjust the clutch pedal free travel as outlined above.

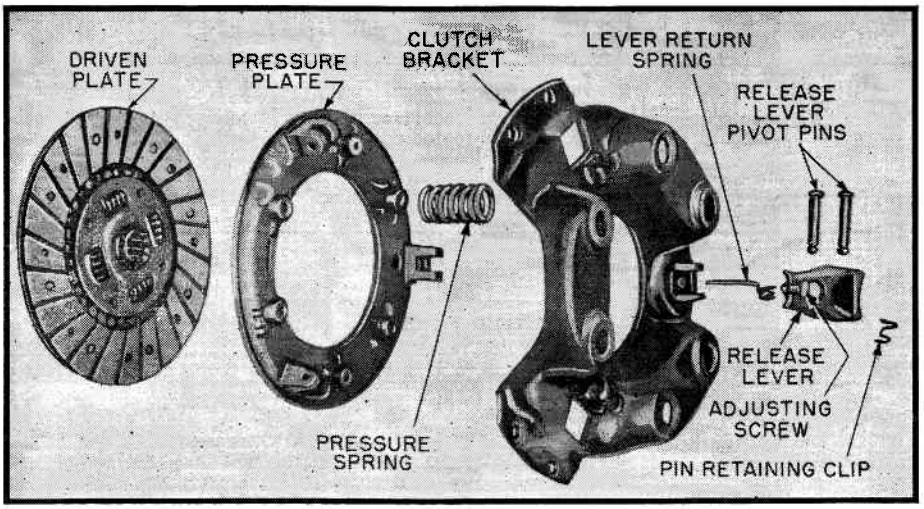


Fig. 1 Layout of Rockford clutch parts

TRANSMISSION, REPLACE

Jeeps & 4-Wheel Drive Station Wagons

1. Remove front and rear propeller shafts.
2. If vehicle is equipped with a power take-off, disconnect transfer case end of power take-off drive shaft.
3. Disconnect speedometer cable at transfer case.
4. Disconnect brake cable.
5. Support transmission and engine with jacks.
6. Remove nuts holding rear mounting to frame crossmember.
7. Remove transfer case snubbing rubber bolt nut at crossmember.
8. Remove shift lever or remote control rods.
9. Disconnect clutch release cable at bell crank at yoke end.
10. Remove floor board inspection plate.
11. Remove transfer case shift lever pivot pin screw.
12. Remove transfer case shift lever pivot pin and remove levers. If vehicle is equipped with power take-off, remove shift lever plate screws and lift out lever.
13. Remove frame center crossmember.
14. Remove bolts holding transmission to bell housing.
15. Force transmission to right to disengage clutch control lever tube ball joint.
16. Lower jacks under engine and transmission and slide transmission and transfer case toward rear of vehicle until clutch shaft clears bell housing.

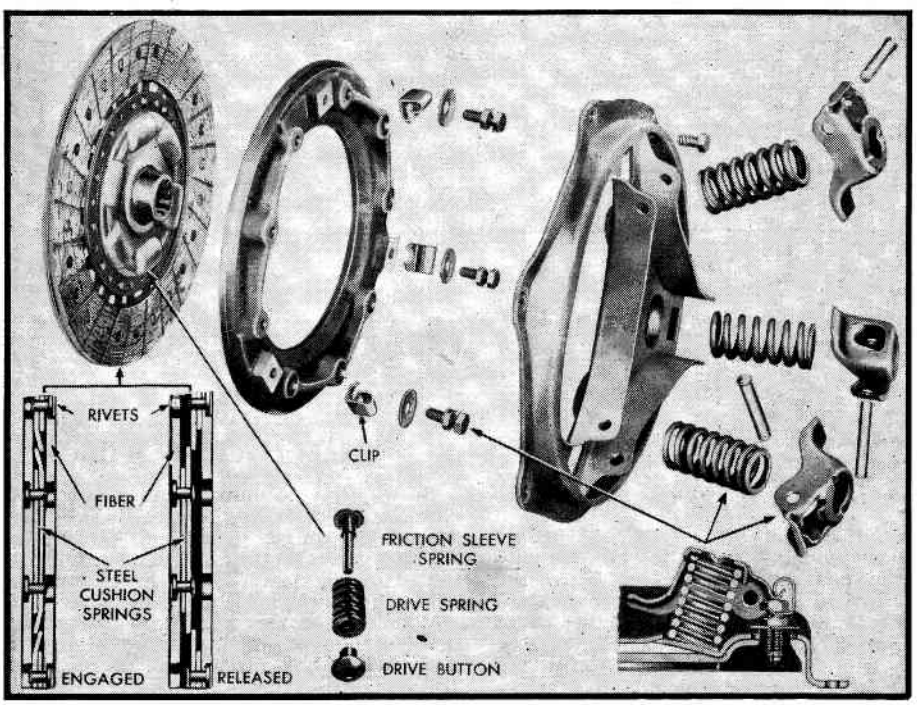


Fig. 2 Layout of Auburn clutch parts

Separate Transmission From Transfer Case

1. Drain lubricant from both units.
2. Remove five screws from cover on rear face of transfer case (if equipped with power take-off, remove power take-off shift housing).
3. Remove transfer case main drive gear from rear end of transmission mainshaft.
4. Remove shift tower from transmission.
5. In the absence of a transmission mainshaft retaining plate, loop a piece of wire around the mainshaft just back of the second speed gear, twist the wire and attach one end to right hand front cover screw and the other end to left hand cover screw.
6. Draw wire tightly to prevent mainshaft from pulling out of transmission case when transfer case is removed.
7. Separate the two housings, using care to see that the transmission mainshaft bearing, which bears in both housings, remains in the transmission case.
8. Reverse the removal procedure to attach the transmission to the transfer case and install the assembly in the vehicle.

Two-Wheel Drive Station Wagons

The following outline covers removal of transmission and overdrive. If not so

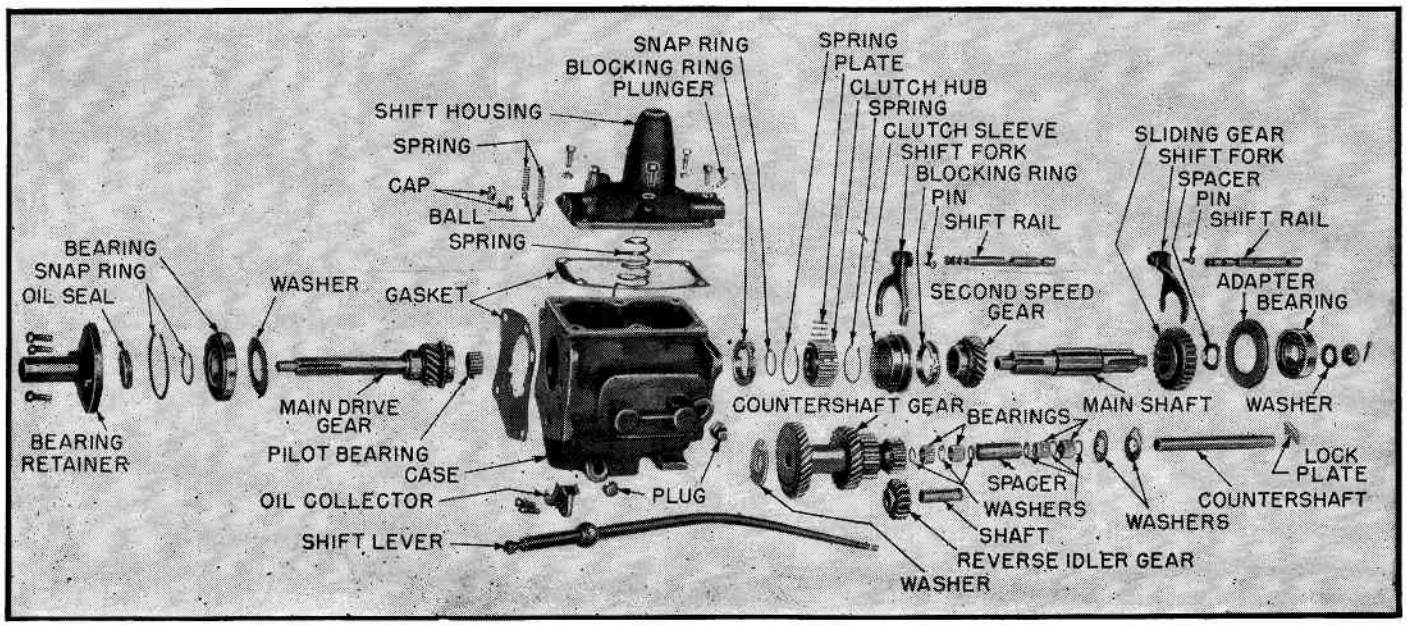


Fig. 3 Exploded view of transmission. Jeeps and four-wheel drive Station Wagons

equipped, disregard operations pertaining to overdrive.

1. Disconnect remote control rods at transmission.
2. Disconnect two wires from overdrive solenoid. *Tag wires and terminals to assure correct assembly.*
3. Disconnect two wires at overdrive rail switch. *Tag wires and terminals to assure correct assembly.*
4. Disconnect front universal joint, and speedometer cable at transmission. Have available an ordinary cork of correct size to close cable opening to prevent leakage of lubricant.
5. Disconnect overdrive control cable and conduit.
6. Remove rubber mounted saddle support at rear end of overdrive. Use care not to lose spacers. Remove overdrive governor.
7. Place jack under flywheel bell housing and raise it to support weight of housing.
8. Remove frame cross member with rubber insulators attached.
9. Place jack under engine to support engine when transmisson is removed.
10. Thread out four screws attaching transmission to bell housing as far

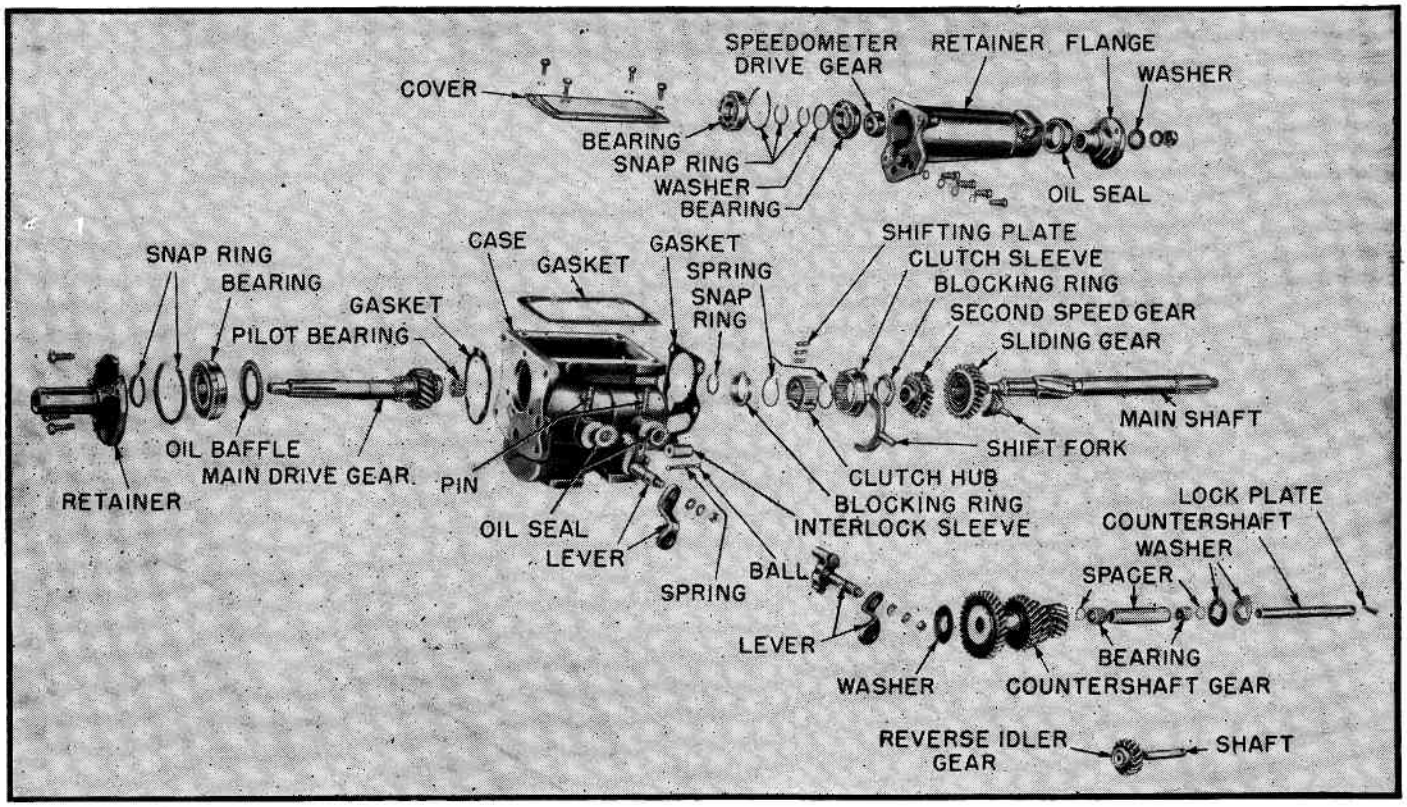


Fig. 4 Exploded view of transmission. Two-wheel drive models

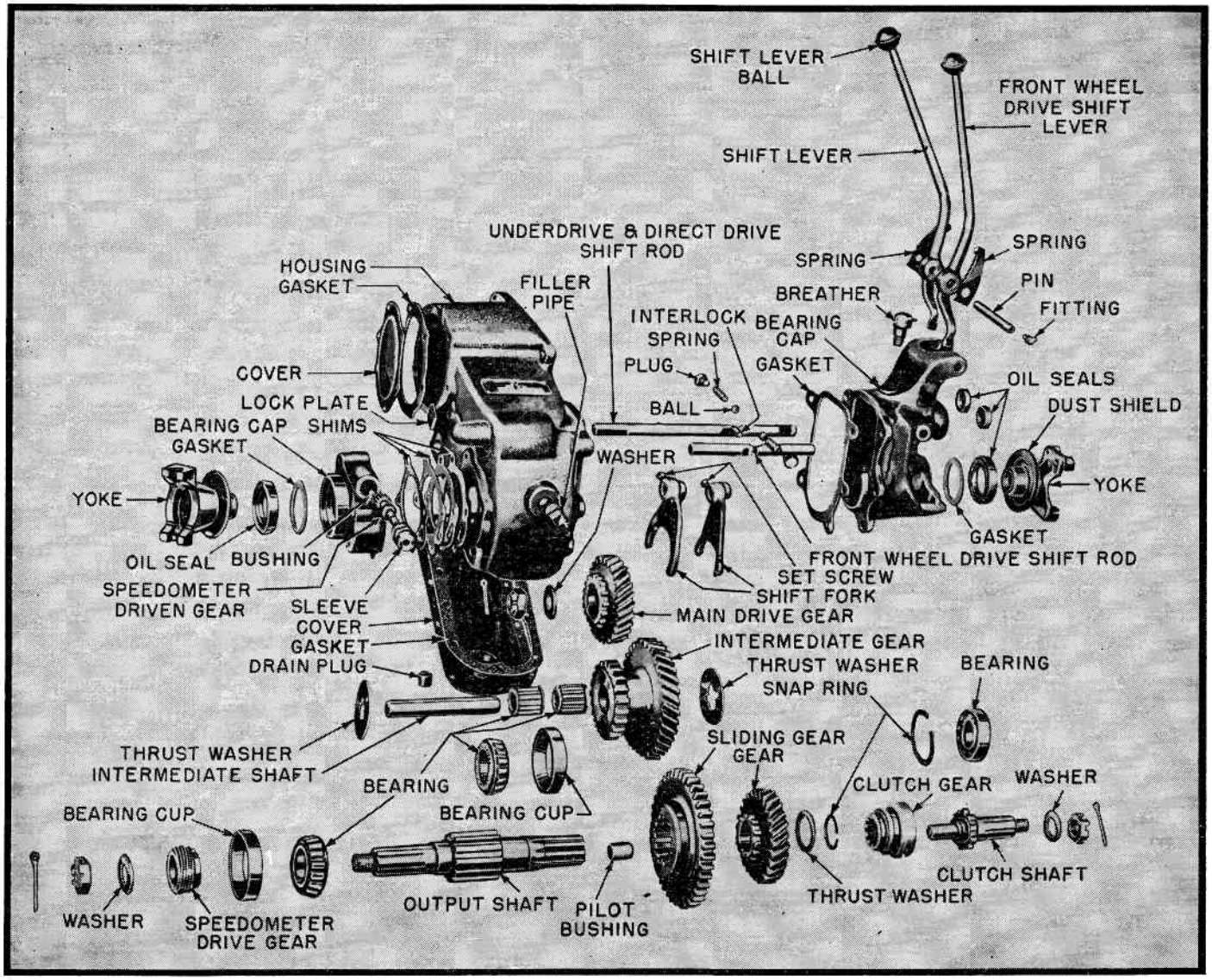


Fig. 5 Exploded view of transfer case. Jeeps and four-wheel drive Station Wagons

as possible and yet support weight of transmission. Pull transmission back to bolt heads which will provide approximately ¾" opening between the two housings and at the same time relieve pressure on clutch release fork in bell housing.

11. Use a long screwdriver through opening in side of bell housing to pry clutch release fork from engagement with clutch release bearing carrier.
12. Complete removal of four transmission attaching screws and pull transmission back until clutch shaft clears bell housing and remove the assembly with release bearing carrier attached.

TRANSMISSION REPAIRS

Four Wheel Drive, Fig. 3

1. Drain lubricant from case and clean case with a suitable solvent.
2. If transfer case is attached, remove its rear cover.
3. If equipped with a power take-off, remove the shift unit which replaces the cover.
4. Remove transfer case main drive gear.
5. Remove transmission cover.
6. Loop a piece of wire around mainshaft directly back of mainshaft second speed gear. Twist wire and attach one end to right hand front cover screw and other end to left front screw. Draw wire tightly to prevent mainshaft from pulling out of transmission case when transfer case is removed. Should mainshaft come out, synchronizer parts will drop into bottom of case.
7. Support transfer case and with a rawhide mallet or brass drift and hammer, tap lightly on end of transmission mainshaft to separate the two units. The transmission mainshaft bearing should slide out of transfer case and remain in transmission.
8. Remove drive gear bearing retainer.
9. Remove lock plate and drive countershaft out through rear.
10. Remove mainshaft rear bearing adapter.
11. Remove mainshaft and gear assembly through transfer case opening.
12. Remove countershaft gearset and thrust washers, noting position of washers.
13. Drive reverse idler shaft out rearward and lift out gear.

Assembly Notes

Reverse the order of the above procedure to assemble the transmission, being sure to observe the following precautions:

The countershaft gearset should have from .012" to .018" end play when assembled in the case. This clearance is obtained by selective thickness of the rear steel thrust washer, which is avail-

able in two thicknesses. Assemble the larger bronze washer at the front of the case with the lip entered in the slot in the case. The bronze faced steel washer goes next to the gear at the rear end, and the steel washer next to the case. Use a loading sleeve to assemble the countershaft roller bearings.

Two Wheel Drive, Fig. 4

1. Remove cover, front flange and snap rings from pinion bearing.
2. Use puller to remove pinion bearing, using a suitable synchronizer ring protector to take up the thrust and prevent possible damage to the synchronizer.
3. Pull off the companion flange, remove the rear bearing retainer and oil seal, and slide the speedometer drive gear off the shaft.
4. Mark the synchronizer blocker rings, gear and sleeve so that these parts may be reassembled in their original position.
5. Raise the drive pinion over the countershaft gear, pull the mainshaft and bearing rearward and remove the drive gear from the case.
6. Cock the mainshaft to the side as far as possible, disengage and remove the shift forks.
7. Release the mainshaft front snap ring. Grasp the mainshaft parts and slide the shaft through these parts and out through the rear.
8. Remove the lock plate and drive the countershaft out rearward.
9. Lift out the cluster gear and washers, noting the position of these parts.
10. Drive out the shaft and lift out the reverse idler gear.
11. Remove the shift shaft locating pins and take out the shift levers and shafts and oil seals.
12. Assembly may be made in the reverse order, being sure to use new gaskets and oil seals.

TRANSFER CASE

Four Wheel Drive, Fig. 5

In removing the transfer case, follow the procedure outlined under transmission removal. Then dismantle the case as follows:

1. Remove propeller shaft flange, brake assembly and linkage.
2. Remove lower cover.
3. Remove lock plate.
4. Drive intermediate shaft to rear of case, being careful not to lose thrust washers.
5. Remove intermediate gear, thrust washers and roller bearings through bottom of case.
6. Shift front wheel drive to engaged position (shaft forward) and remove poppet plugs, springs and balls on both sides of output bearing cap.
7. Remove output bearing cap together with the universal joint end yoke, clutch shaft, bearing, clutch gear, fork and shift rod. Use care not to lose the interlock.
8. Remove output shaft snap ring and thrust washer.
9. Use a rawhide mallet to drive against the front end of the mainshaft to start the rear bearing from the case. As the shaft is removed, the gears will remain in the case and can be taken out through the bottom, also the snap ring and thrust washer.
10. Remove set screw in sliding gear shift fork and take out the shift rod.
11. Disassemble the front and rear bearing caps as required.

Assembly Notes

Reverse the order of the above procedure to assemble the transfer case. But when rear bearing cap assembly is installed, check the end movement of the mainshaft which determines the adjustment of the tapered roller bearings. For correct bearing adjustment, the shaft should have from .004″ to .008″ end play. Adjustment is made by selective shim installation between the cap and case. Shims .003″, .010″ and .031″ thicknesses are available for this adjustment. Do not install the rear cap oil seal until the bearings are properly adjusted.

GEARSHIFT, ADJUST

Remote Control Models

To make an adjustment, shift the hand control lever to its neutral position. Align the pin holes in the levers at the bottom of the main shifting rod to hold them in their neutral positions. Disconnect the control rods from the levers at the transmission and place the transmission levers in neutral. Finally, adjust the length of the control rods so that they will just slip into their respective levers on the transmission without moving the levers from their neutral positions.

Service Note

Difficult shifting on two-wheel drive utility vehicles and station wagons may be due to improper installation of the second and high shift rod on the shift lever.

The shift lever, mounted on the lower end of the remote control shift shaft, is provided with two holes. The shift rod should be placed in the outer hole of the lever on six cylinder models and in the inner hole on four cylinder models.

Rear Axle, "Live" Front Axle and Brakes

Refer To Hydraulic Brakes Chapter For Brake Adjustments

REAR AXLE

This rear axle is of the semi-floating, hotchkiss drive type. The drive pinion is the over-hung type, mounted on preloaded taper roller bearings. Sealing of the pinion shaft is accomplished at the front end by a spring-loaded leather seal bearing on the companion flange, which is splined and secured to the pinion shaft by a nut, Fig. 1.

Axle Shaft, Remove

To remove an axle shaft, jack up the wheel and pull off the hub and brake drum. Block the brake pedal in such a manner that it cannot be depressed. Disconnect the hydraulic brake line from the wheel cylinder. Remove the mounting screws and take off the outer oil seal, shims and brake support. The shaft and bearing may then be pulled out of the housing. The inner oil seal may be removed at this time.

Axle Shaft, Install

Replace the shaft and bearings in the reverse order. If the old parts are replaced and the shims have not been disturbed, the end play should be correct when the parts are assembled. However, if a new axle shaft, bearing, differential carrier or housing has been installed, it will be necessary to check the end play.

Axle Shaft End Play, Adjust

Axle shaft end play can be checked when all parts have been replaced except the wheel and hub. To make the check, rap each axle shaft after the nuts are tight to be sure the bearing cups are seated. Then mount a dial indicator on the axle housing with its contact button touching the end of the shaft. Work the shaft in and out by hand and note the reading on the indicator. If an adjustment is necessary, remove the oil seal and brake support and add or remove shims as required to bring the end play to .001″ to .005″.

When making this adjustment, an equal thickness of shims should be removed or added on each side of the axle housing to maintain the central position of the axle shafts.

Rear Axle Assembly, Replace

Inasmuch as the axle tubes are pressed into the differential carrier to form a one-piece housing, the rear axle assembly must be removed from the chassis when it becomes necessary to overhaul the unit.

1. Raise vehicle from floor and support

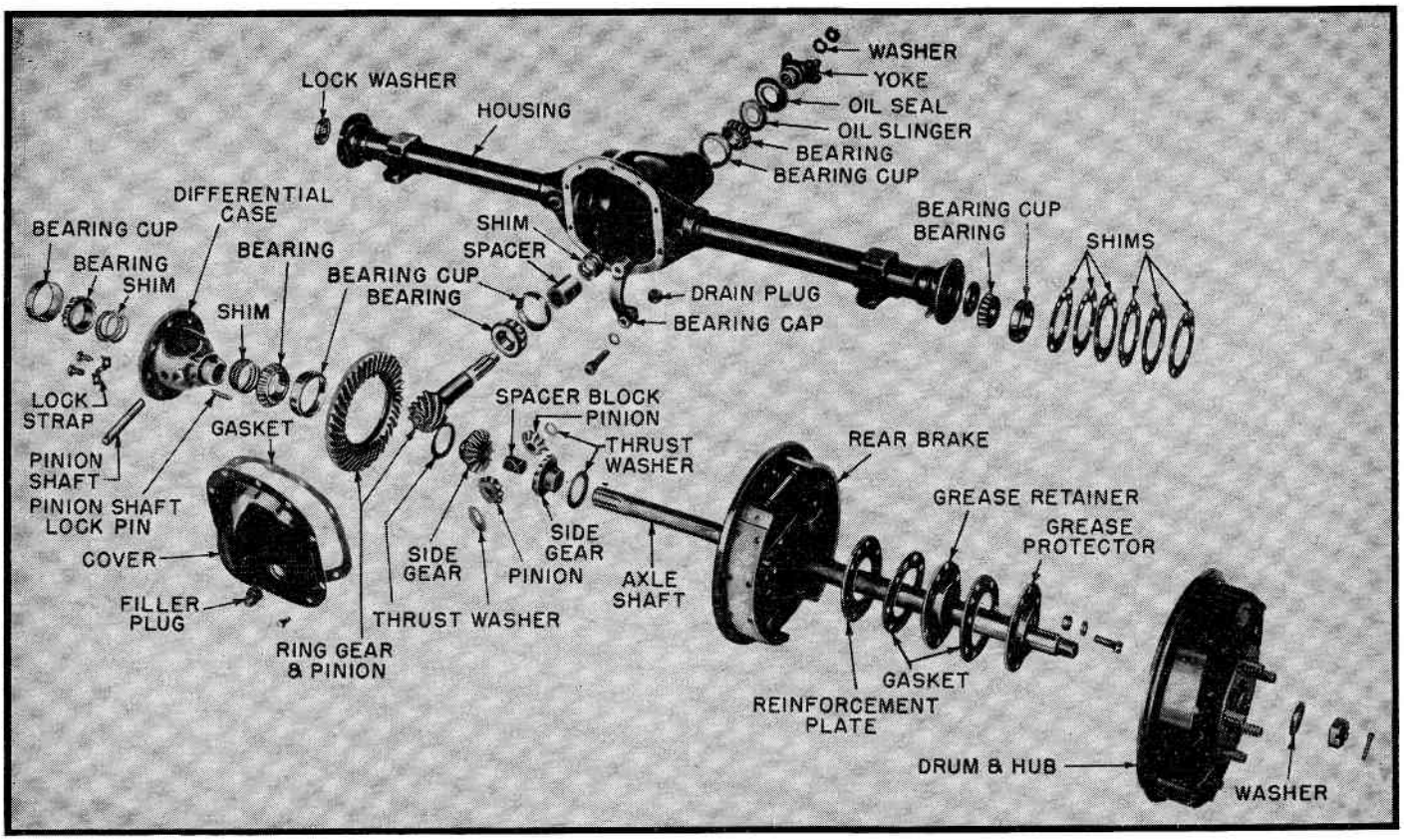


Fig. 1 Exploded view of rear axle assembly. All Models

with stand jacks under frame side rails.
2. Remove rear wheels.
3. Split rear universal joint.
4. Disconnect parking brake cable (if equipped) from operating lever and from brake backing plates.
5. Disconnect hydraulic brake line connection at rear axle housing.
6. Loosen and move shock absorbers out of the way.
7. While supporting axle housing with hydraulic jack, remove spring clips and lower axle assembly to the floor.
8. Reverse the foregoing procedure to install the rear axle assembly, being sure to bleed the brake system when the installation is completed.

Differential Carrier, Disassemble

1. Remove axle shafts as outlined previously. Axle shafts may be pulled out only far enough to clear differential side gears.
2. Drain lubricant and remove rear cover.
3. Make sure differential side bearing caps and axle housing are marked, then remove the side bearing caps.
4. Pry differential from housing.
5. Remove side bearing cups.
6. Pull off side bearings and adjusting shims, tagging the shims for identification on reassembly.
7. Unfasten ring gear from case.
8. Drive out differential pinion shaft pin and pull out the shaft, pinions and side gears.
9. Hold companion flange from turning and remove flange nut.
10. Pull flange from pinion shaft.
11. Remove pinion from carrier by tapping on front end with soft hammer.
12. Remove pinion shaft bearing oil seal and bearings from carrier, keeping separate the shim pack at each bearing.

Pinion & Bearings, Replace

If the original ring gear and pinion are being used in the original carrier, use the original shim packs at each bearing, Fig. 2. If a new pinion or differential carrier is installed, note the markings on the end of the pinion gear and on the differential carrier to obtain the correct thickness of shimming to be used with these parts from your supplier. The shims behind the rear bearing establishes the correct pinion depth.

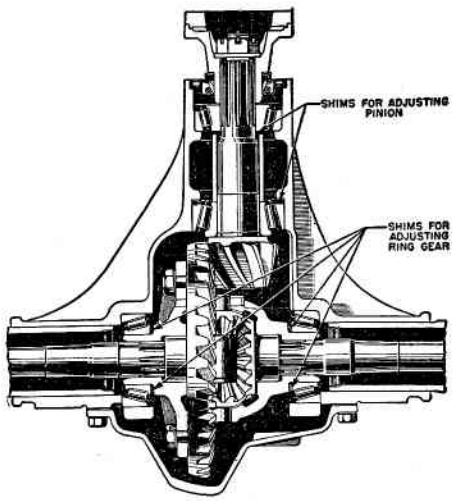


Fig. 2 Rear axle adjustments. All models

1. Press the rear pinion bearing cup in the housing with the proper thickness of shims. Press the rear pinion bearing on the shaft.
2. Install the front bearing cup and shims, and front bearing.
3. Install the companion flange and, while holding the flange from turning, tighten the nut to a torque load of 200-220 lb. ft.
4. Check the pinion bearing pre-load with a spring scale and heavy cord wrapped around the companion flange. Pull on the spring scale. The torque required to rotate the pinion is 10-30 inch lbs. If not within these limits, add or remove shims from behind the front bearing to obtain the proper pre-load.
5. Remove the companion flange and install a new oil seal (well soaked). Reinstall the companion flange and tighten the nut.

Ring Gear, Replace

1. Install guide pins in every other hole in the ring gear. These pins can be made from 1½" long capscrews with heads cut off and ends slotted.
2. Make sure back face of ring gear and face of case are free of dirt and

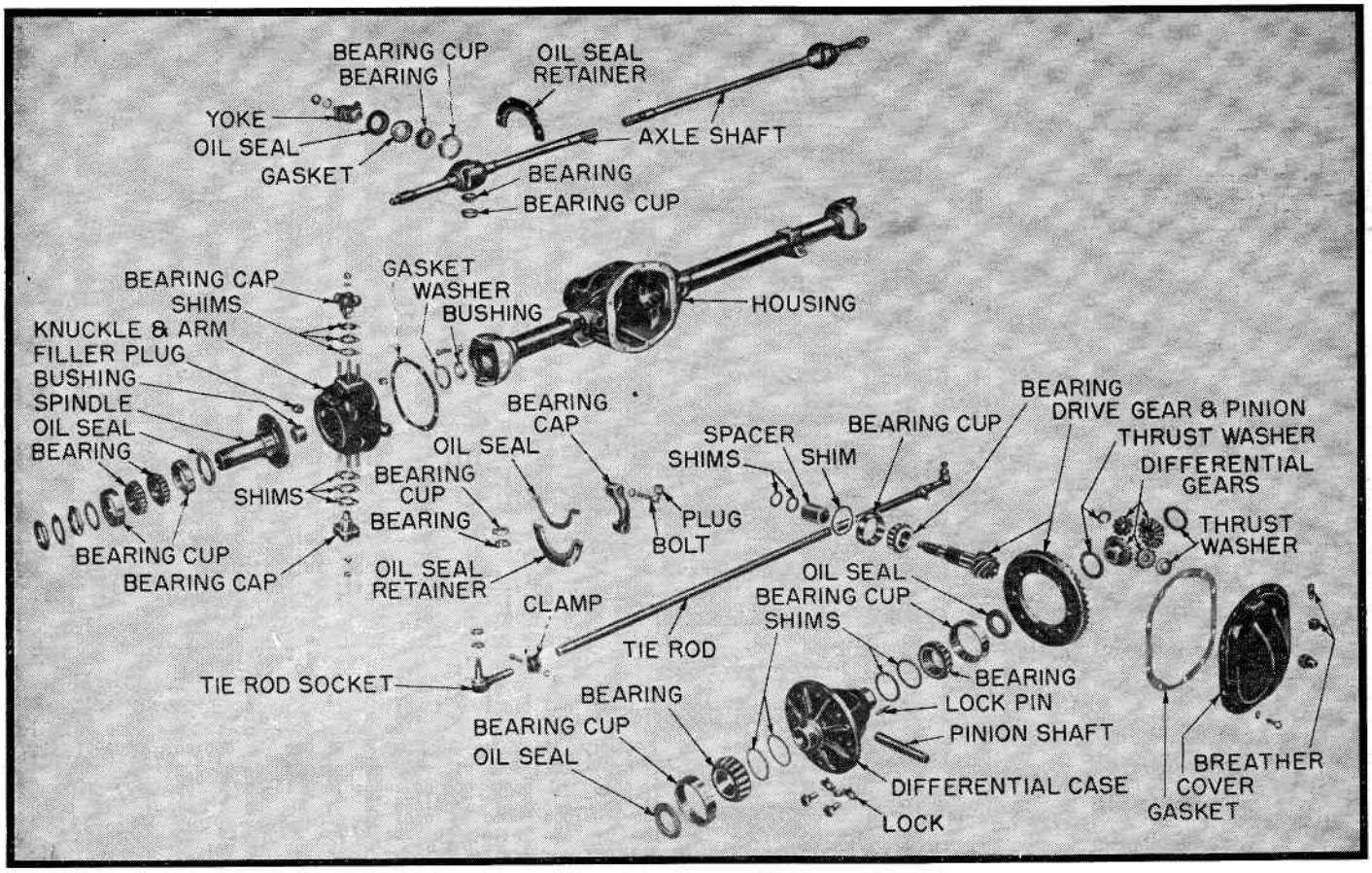


Fig. 3 "Live" front axle. Jeeps and four-wheel drive Station Wagons

burrs and slip gear over pilot diameter of case.

3. Install every other ring gear bolt. Draw them up evenly and snugly so ring gear face is flush with case.
4. Remove guide pins and install remaining bolts.

Differential Carrier, Assemble

The differential bearings are adjusted by shims, Fig. 2. These shims also establish the ring gear position with the pinion. Therefore, backlash must be checked whenever a bearing adjustment is made.

The correct bearing adjustment is one which will provide a .008" pinch fit when the differential unit is assembled into the carrier. To make the adjustment, install the bearing cones without shims and place the assembly in the housing with the bearing cups. Force the unit to one side and check the clearance between the bearing cup and differential case with a feeler gauge. When the clearance is determined, select shims of this amount plus .008" extra to establish the proper pre-load.

Remove the differential bearings again and divide the shims into two packs of equal thickness and install on each side and replace the bearings. Reinstall the unit in the carrier. This operation is made easier by cocking the bearing cups slightly when the differential is placed in the housing and then tapping them lightly with a mallet. However, when installing the differential in the housing, be sure the ring gear teeth mesh with the pinion teeth before tapping the bearings in place.

After the bearing cups are firmly in place, install the bearing caps. The bearing caps and gasket surface of the housing are marked with a horizontal numeral and on the other side by a vertical numeral. The position of the numerals should correspond when reinstalling the bearing caps.

Ring Gear & Pinion Backlash, Adjust

Mount a backlash gauge indicator on the carrier and start checking for the correct backlash between the ring gear and pinion. If the backlash is not within the limits of .004" to .009", it will be necessary to change the arrangement of the shims back of the bearings. Make corrections in backlash, as described for this type axle in the *Rear Axle Chapter*, bearing in mind that shims removed from one side must be installed on the opposite side so that the total shim thickness of the right and left side will remain unchanged, and the bearing adjustment undisturbed.

Gear Tooth Contact Pattern

Allowable variations in the carrier or drive pinion may cause the pinion to be too far in or out even when shimmed properly. Thus, the tooth contact must be tested and corrected as necessary or the gears may be noisy.

Paint the ring gear teeth with a light coating of red lead, white lead or prussian blue. Revolve the gears and observe the contact, referring to the illustrations shown in the *Rear Axle Chapter* for this operation.

Installation in Vehicle

To install the axle under the vehicle, have the end of the vehicle securely supported with a chain hoist or a support under the frame just ahead of the rear springs. Place the axle assembly in position and raise it so the spring clips and front spring bolts may be installed. Connect the brake line hose at the frame, install lock clip and attach brake line. Connect the propeller shaft at the rear universal joint. The wheels may then be installed and the vehicle lowered to the floor. Bleed the brakes to remove any air from the lines.

"LIVE" FRONT AXLE

Four-Wheel Drive Models, Fig. 3

The front axle on these models is a live driving unit with hypoid driving gears and spherical steering knuckles mounted on pivot pins which ride on tapered roller bearings for ease of steering. The drive is of the full-floating type through axle shafts built integrally with constant velocity universal joints which revolve in the steering knuckles.

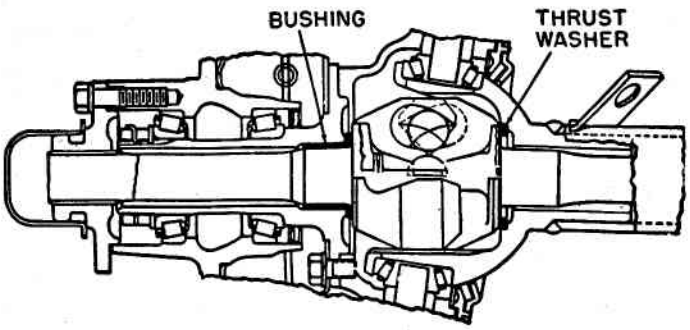


Fig. 4 Bendix type axle shaft and universal joint. For "live" front axles

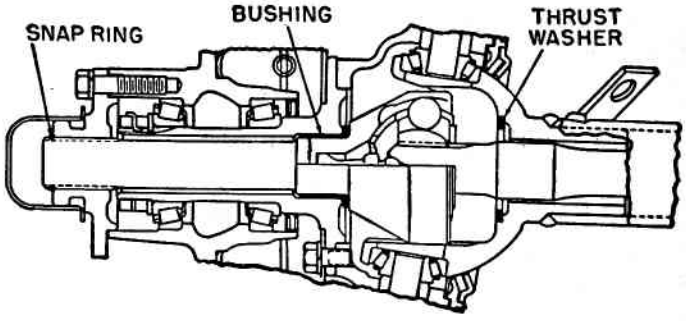


Fig. 5 Rzeppa type axle shaft and universal joint. For "live" front axles

Front Axle Service

The differential is mounted in a housing similar to that used in the rear axle except that the pinion shaft faces toward the rear instead of to the front and to the right of the center of the axle. This design allows the placing of the front propeller shaft along the right side of the engine oil pan to avoid reducing road clearance under the engine.

The axle is of the full floating type and the axle shafts can be removed without dismantling the steering knuckle housing.

Overhaul of this axle unit is the same as the rear axle.

Service Note (Axle Shafts)

A change in design of the front axle on four-wheel drive vehicles was placed in production effective with the following serial numbers:

No. 37549 on CJ-3A

No. 44070 on 4WD

No. 14284 on 4x463

In the new design the front axle shaft outer splined end floats in the wheel driving flange and is not retained by a nut and lockwasher as originally used. With this construction it is no longer necessary to install shims between the driving flange and wheel hub to provide the correct end float of the axle shaft universal joint.

The new construction, when using the Bendix type axle shaft, is shown in Fig. 4. Note that the end float of the Bendix type joint is predetermined in manufacture by the position and flange thickness of the bushing and thrust washer. These parts are so positioned and of the correct thickness to provide .088″ maximum end float of the universal joint to operate at the centerline of the spindle pivot pins. With the correct joint end float controlled by the bushing flange and thrust washer, it is no longer necessary to install shims between the driving flange and wheel hub, a gasket only being used.

The new type Bendix axle shaft and universal joint may be readily installed in an old type axle by installing the new type flanged bushing. When this is done, discard the shims previously installed between the flange and hub, installing a gasket only. The flanged bushing requires no reaming and is so designed that when it is pressed into the spindle it will be compressed to provide correct running clearance. Coat the inner surface of the bushing with chassis grease before installing the spindle.

The axle construction is similar for installation of the Rzeppa joint, Fig. 5. The thrust washer is not necessary although it is installed in all axles to allow installation of the Bendix type shaft if so desired. As the thrust washer is not effective, a snap ring is installed at the outer end of the shaft to control end float.

Steering Knuckle Pivot Pins

When reinstalling a steering knuckle, sufficient shims must be installed under the bearing caps so the proper tension will be obtained on the bearings. The shims are available in thicknesses of .003″, .005″, .010″ and .030″.

Install one each of the shims over the studs on the steering knuckle at the top and bottom. Install the bearing caps, lock washers and nuts and tighten securely. Check the tension of the bearings by hooking a spring scale in the hole in the arm for the tie rod socket. The load should be 6-9 lbs. without the oil seal in position and is secured by adding or removing shims as required. Make sure there are the same thickness of shims between the upper cap and the knuckle as between the lower cap and knuckle.

Service Note (Lower Shims)

On models CJ-3A, 473-4WD and 4x473, .058″ was added to the bottom face of the king pin boss on the steering knuckles. This eliminated the shims for the lower kingpin bearing and the adjustment of the bearing is now made by shims at the top only.

BRAKE MASTER CYLINDER, REPLACE

To remove the master cylinder, disconnect the fluid lines and stop light wires from the cylinder. Unfasten the cylinder from its mounting. Remove the eye bolt from the shaft and drop the cylinder from its mounting.

Front End and Steering Section

CAMBER & CASTER

Two-Wheel Drive Station Wagons

Camber is adjusted by adding or removing shims as required from behind the upper control arm frame bracket, Fig. 1.

Caster is controlled by the relationship between the position of the front spring and its location in the frame cross member channel. If caster is out, examine the suspension for worn or damaged parts.

TOE-IN, ADJUST

Two-Wheel Drive Station Wagons

Load the front end of the vehicle by weights or persons so that the front spring main leaf is flat. Flatness of the front spring main leaf may be checked by holding a straight edge or string below the main leaf, and parallel with it.

Roll the vehicle backward and forward so that all parts will attain a normal position. With suitable trams or gauge, measure the distance between the wheels at the rear and then at the front. These measured distances should be equal (for zero toe-in).

If the distances are not equal, readjust the tie rods as required to make the distance equal.

When the load is removed from the front of the vehicle, it will be found that the wheels will attain a slight toe-in, ranging from $\frac{1}{8}$ to $\frac{5}{16}$ in., depending upon the arch of the front spring. This is normal and will give satisfactory results in respect to tire wear and proper handling of the vehicle.

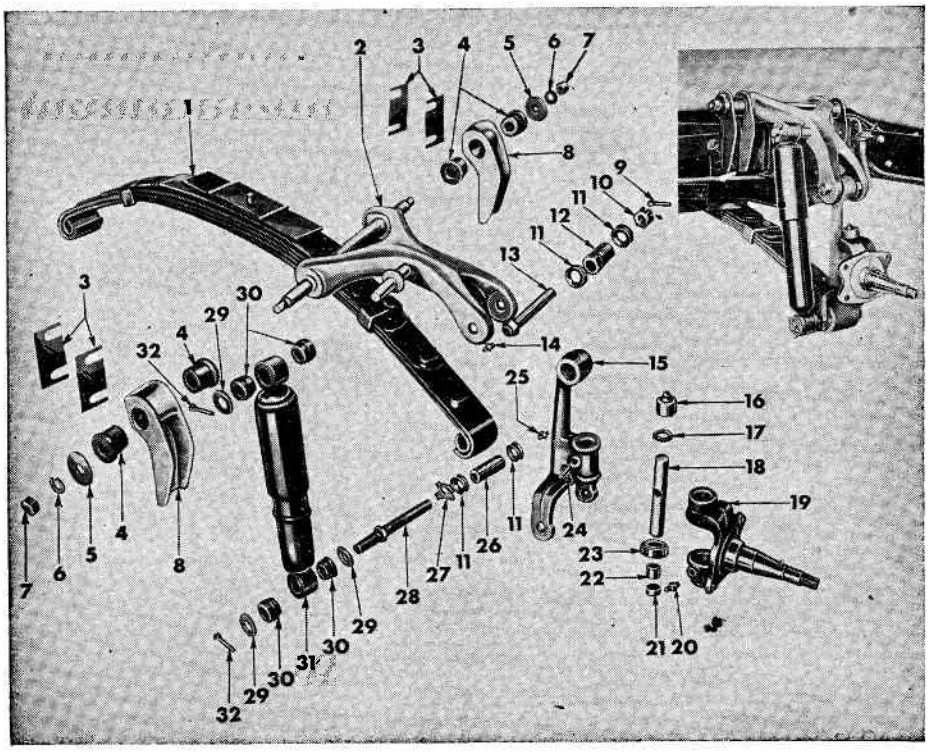


Fig. 1 Front Suspension. Two-Wheel Drive Station Wagons

1 — Front spring
2 — Control arm
3 — Camber shims
4 — Rubber bushing
5 — Control arm washer
6 — Lock washer
7 — Nut
8 — Frame bracket
9 — Cotter pin
10 — Nut
11 — Dust seal
12 — Arm pin bushing
13 — Control arm pin
14 — Grease fitting
15 — Knuckle support
16 — Knuckle bearing
17 — Bearing washer
18 — Kingpin
19 — Knuckle
20 — Grease fitting
21 — Expansion plug
22 — Knuckle bushing
23 — Thrust bearing
24 — Kingpin lock pin
25 — Grease fitting
26 — Spring bushing
27 — Bolt lock
28 — Pivot bolt
29 — Pin washer
30 — Rubber bushing
31 — Shock absorber
32 — Cotter pin

FRONT END REPAIRS

Two-Wheel Drive Station Wagons Kingpins & Bushings

The following text applies to earlier models insofar as this operation is concerned.

1. Remove wheel hub and dust caps.
2. Take off wheel and hub, bearings and oil seal.
3. Disconnect hydraulic brake tube and remove brake backing plate with brake assembly attached.
4. Drive out kingpin lock pin.
5. Use a sharp drift to remove the kingpin lower expansion plug.
6. Use a brass drift to drive the kingpin up until the upper needle bearing is removed.
7. Use a brass drift to drive the kingpin out through the bottom.
8. Remove the bushing from the lower part of the spindle.

Assembly is the reverse of the above. When reaming the bushing to size, use a pilot type reamer to be sure that the bushing is square with the upper needle bearing. Examine the ball thrust bearing and replace it if worn or damaged. Do not overlook bleeding the brakes.

Steering Knuckle Supports

Should it be necessary to disassemble the front suspension, be sure that the steering knuckle supports are reinstalled on the proper side. The left support will interchange with the right but the wheel camber will be incorrect, resulting in unstable steering. The supports have the part number on the forging for identification—641026 left side, 641027 right side. Later production parts may be identified by the letter L for left and R for right.

When mounting the upper control arm pin bushing in the steering knuckle support, tighten it to 175 lbs. ft. torque. Centralize the control arm over the knuckle support before starting to thread the pivot pin through the support. This is necessary to provide the proper caster effect and equal clearance at each side of the support for the rubber dust seals. Also for the same reasons centralize the spring eye in the lower end of the knuckle support before starting the spring pivot bolt.

HORN BUTTON OR RING

Remove the horn button or steering wheel hub cover by turning it about ⅛ turn to the left and disengaging.

STEERING WHEEL

After removing the horn button and ring, use a suitable puller to pull off the steering wheel.

STEERING GEAR, REPLACE

Jeeps & Station Wagons

It is necessary to pass the steering gear down through the floor pan. The procedure is as follows:

1. Remove left front fender on CJ-2A.
2. Disconnect remote control rods from levers on steering column if equipped with steering post shift.
3. Remove horn button and steering wheel.
4. Remove steering post bracket at instrument panel.
5. Remove steering post hand lever.
6. Remove exhaust pipe from manifold.
7. Remove steering column cover plate on toe board.
8. Remove two screws attaching remote control housing to steering column.
9. Remove horn wire contact brush (CJ-2A) or disconnect horn wire.
10. Remove remote control gearshift assembly down through floor pan.
11. Remove pitman arm from steering gear.
12. Unfasten steering gear from frame and bring it down through the floor pan and over the outside of the frame side rail.

STEERING GEAR REPAIRS

This steering gear, Fig. 2, is the cam and twin lever type in which the cam is

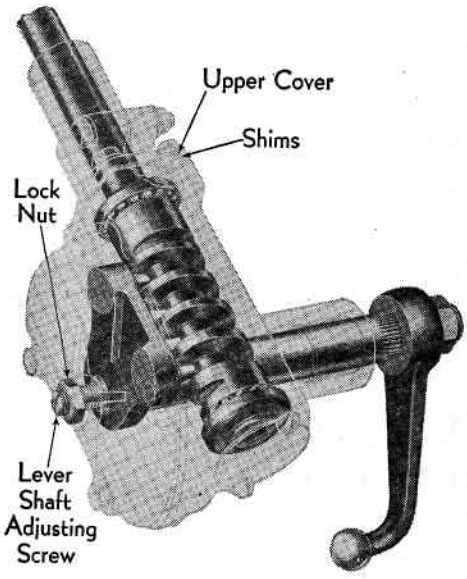


Fig. 2 Steering gear adjustments

mounted on ball bearings and the lever shaft turns on steel backed bronze bushings.

As the cam is turned by the wheel tube, the follower studs are pulled along the cam groove, causing the lever arm to rotate the lever shaft. The groove in the cam is cut shallower in the straight-ahead driving position to provide closer adjustment between the studs and the cam where most of the steering action occurs.

Cam End Play, Adjust

1. Free the steering gear of all load by disconnecting the drag link and loosening the steering column braces.
2. Loosen the lock nut adjusting screw in the side cover to free the studs in the cam groove.
3. Remove the upper cover stud nuts and raise the housing upper cover to permit removal of the adjusting shims, which are .002", .003" and .010" thickness.
4. Clip and remove one thin shim, tighten down the cover and check the adjustment. There should be a slight drag but the steering wheel should turn freely with the thumb and forefinger lightly gripping the rim. If necessary, remove or replace shims until the adjustment is correct.

Lever Shaft Backlash, Adjust

1. Centralize the steering gear by turning the wheel all the way to the right. Then, starting from this point, count the number of turns required to reach end of travel to the left. Turn the wheel back half this number of turns to the mid-position.
2. Tighten the side cover adjusting screw until a very slight drag is felt through the mid-position when turning the steering wheel slowly from one side to the other. The gear should not bind in any position but a slight drag should be felt in the mid-position only.
3. After proper adjustment is secured, tighten the lock nut and give the gear a final check for binding.