CADILLAC

INDEX OF SERVICE OPERATIONS

Year	Model Designation	Wheel-base, Inches	Valve Location	Bore and Stroke	Piston Dis-place-ment, Cubic Inches	Com-pres-sion Ratio (Stand-ard)	Maximum Brake H.P. @ R.P.M.	Maximum Torque Lbs. Ft. @ R.P.M.	Oil Pressure @ M.P.H.
1940	La Salle V8.....40–50	123	In Block	3⅜ x 4½	322.0	6.25	130 @ 3400	234 @ 1800	25 @ 30
	La Salle V8.....50–52	123	In Block	3⅜ x 4½	322.0	6.25	130 @ 3400	234 @ 1800	25 @ 30
	V8.....40–60S	127	In Block	3½ x 4½	346.0	6.25	135 @ 3400	250 @ 1700	25 @ 30
	V8.....40–62	129	In Block	3½ x 4½	346.0	6.25	135 @ 3400	250 @ 1700	25 @ 30
	V8.....40–72	138	In Block	3½ x 4½	346.0	6.70	140 @ 3400	270 @ 1700	25 @ 30
	V8.....40–75	141	In Block	3½ x 4½	346.0	6.70	140 @ 3400	270 @ 1700	25 @ 30
	V16.....40–90	141	In Block	3¼ x 3¼	431.0	6.75	185 @ 3600	324 @ 1700	25 @ 30
1941	V8.....41–60S	126	In Block	3½ x 4½	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8.....41–61	126	In Block	3½ x 4½	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8.....41–62	126	In Block	3½ x 4½	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8.....41–63	126	In Block	3½ x 4½	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8.....41–67	139	In Block	3½ x 4½	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8.....41–75	136	In Block	3½ x 4½	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
1942	V8.....42–60S	133	In Block	3½ x 4½	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8.....42–61	126	In Block	3½ x 4½	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8.....42–62	129	In Block	3½ x 4½	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8.....42–63	126	In Block	3½ x 4½	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8.....42–67	139	In Block	3½ x 4½	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
	V8.....42–75	136	In Block	3½ x 4½	346.0	7.25	150 @ 3400	283 @ 1700	25 @ 30
1946	V8.....46–60S	133	In Block	3½ x 4½	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8.....46–61	126	In Block	3½ x 4½	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8.....46–62	129	In Block	3½ x 4½	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8.....46–75	136	In Block	3½ x 4½	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
1947	V8.....47–60S	133	In Block	3½ x 4½	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8.....47–61	126	In Block	3½ x 4½	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8.....47–62	129	In Block	3½ x 4½	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8.....47–75	136	In Block	3½ x 4½	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
1948	V8.....48–60S	133	In Block	3½ x 4½	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8.....48–61	126	In Block	3½ x 4½	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8.....48–62	126	In Block	3½ x 4½	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
	V8.....48–75	136	In Block	3½ x 4½	346.0	7.25	150 @ 3400	260 @ 1700	30 @ 30
1949	V8.....49–60S	133	In Head	3 13/16 x 3⅝	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8.....49–61	126	In Head	3 13/16 x 3⅝	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8.....49–62	126	In Head	3 13/16 x 3⅝	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8.....49–75	136	In Head	3 13/16 x 3⅝	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
1950	V8.....50–60S	130	In Head	3 13/16 x 3⅝	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8.....50–61	122	In Head	3 13/16 x 3⅝	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8.....50–62	126	In Head	3 13/16 x 3⅝	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8.....50–75	146¾	In Head	3 13/16 x 3⅝	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
1951	V8.....51–60S	130	In Head	3 13/16 x 3⅝	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8.....51–61	122	In Head	3 13/16 x 3⅝	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8.....51–62	126	In Head	3 13/16 x 3⅝	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
	V8.....51–75	147	In Head	3 13/16 x 3⅝	331.0	7.50	160 @ 3800	312 @ 1800	35 @ 30
1952	V8.....52–60S	130	In Head	3 13/16 x 3⅝	331.0	7.50	190 @ 4000	322 @ 2400	35 @ 30
	V8.....52–62	126	In Head	3 13/16 x 3⅝	331.0	7.50	190 @ 4000	322 @ 2400	35 @ 30
	V8.....52–75	146¾	In Head	3 13/16 x 3⅝	331.0	7.50	190 @ 4000	322 @ 2400	35 @ 30
1953	V8.....53–60S	130	In Head	3 13/16 x 3⅝	331.0	8.25	210 @ 4150	330 @ 2700	35 @ 30
	V8.....53–62	126	In Head	3 13/16 x 3⅝	331.0	8.25	210 @ 4150	330 @ 2700	35 @ 30
	V8.....53–75	146¾	In Head	3 13/16 x 3⅝	331.0	8.25	210 @ 4150	330 @ 2700	35 @ 30
1954	V8.....54–60	133	In Head	3 13/16 x 3⅝	331.0	8.25	230 @ 4400	330 @ 2700	35 @ 30
	V8.....54–62	129	In Head	3 13/16 x 3⅝	331.0	8.25	230 @ 4400	330 @ 2700	35 @ 30
	V8.....54–75	150	In Head	3 13/16 x 3⅝	331.0	8.25	230 @ 4400	330 @ 2700	35 @ 30

Year	Model	Spark Plugs		Breaker Gap, Inch	Cam Angle, Degrees (Note C)	Firing Order	Ignition Timing Mark and Location	Battery Terminal Grounded	Engine Idle Speed, R. P. M.		Cylinder Head Torque, Lbs. Ft.
		Type	Gap, Inch						Synchro-mesh Trans-mission	Auto-matic Trans-mission	
1940	V8	AC-104	.025	.016	21–30	D	A	Positive	375	...	70–75
	V16	AC-104	.030	.016	21–30	E	A	Positive	...	...	70–75
1941–42	All	AC-104	.025	.016	21–30	D	A	Positive	375	375	70–75
1946–48	All	AC-104	.030	.016	21–30	D	A	Negative	375	375	70–75
1949–51	All	AC-48X	.035	.016	21–30	F	B	Negative	375	375	65–70
1952	All	AC-48X	.035	.0125	31	F	B	Negative	450	400	65–70
1953	All	AC-46-5	.035	.0125	31	F	B	Negative	450	400	65–70
1954	All	AC-46-5	.035	.016	31	F	B	Negative	None	400	65–70

A—"IGA" or "IGN" mark on vibration damper. B—"A" mark on vibration damper with premium fuel; "C" mark for regular fuel.
C—For satisfactory operation, cam angle may be set within the range given provided the breaker gap is as shown.
D—Odd numbers left bank; even numbers right bank. Firing order: 1–8–7–3–6–5–4–2.
E—Odd numbers left bank; even numbers right bank. Firing order: 1–4–9–12–3–16–11–8–15–14–7–6–13–2–5–10. Wiring order: Right bank, 1–9–3–11–15–7–13–5; left bank, 2–10–4–12–16–8–14–6.
F—Odd numbers left bank; even numbers right bank. Firing order: 1–8–4–3–6–5–7–2.

VALVE SPECIFICATIONS

Year	Model	Operating Clearance H-Hot C-Cold		Clearance For Timing Intake	Valve Seat Angle, Degrees	Valve Timing (Note A)		Minimum Valve Spring Pressure Pounds at Inches Length	Valve Stem Clearance		Valve Stem Diameter	
		Intake	Exhaust			Intake Opens Degrees BTDC	Exhaust Closes Degrees ATDC		Intake	Exhaust	Intake	Exhaust
1940	V8	Zero	Zero	Zero	45	B	10	66@1 59/64	.001 –.003	.002 –.004	.3420	.3410
	V16	Zero	Zero	Zero	45	6	12	50@1 25/32	.001 –.003	.002 –.004	.3420	.3410
1941–48	All	Zero	Zero	Zero	45	B	10	66@1 59/64	.001 –.003	.002 –.004	.3420	.3410
1949	All	Zero	Zero	Zero	44	15	40	60@1 11/16	.001 –.0025	.0015–.0035	.3420	.3410
1950–52	All	Zero	Zero	Zero	44	14	24	60@1 11/16	.001 –.0025	.0015–.0035	.3420	.3410
1953–54	All	Zero	Zero	Zero	44	22	27	60@1 11/16	.0005–.0025	.001 –.0025	.3420	.3417

A—BTDC means before top dead center; ATDC means after top dead center. B—Top dead center.

PISTON AND RING SPECIFICATIONS

Year	Model	Fitting Pistons With Scale			Rings				Pins	
		Removed From	Shim Thickness To Use	Pounds Pull on Scale	Ring Gap, Minimum (Note A)		Clearance in Groove		Type	Fit
					Compression	Oil	Compression	Oil		
1940	V8	Above	.002	11	.007	.007	B	.0015–.003	H	E
	V16	Above	.002	11	.007	.007	C	.0015–.003	D	E
1941–42	All	Above	.002	11	.007	.007	B	.0015–.003	F	G
1946–49	All	Above	.002	11	.007	.007	.0022–.0035	.0015–.003	F	G
1950–54	All	Above	.002	11	.010	.010	.0017–.0035	.0015–.003	H	H

A—Fit rings in tapered bores for minimum clearance in tightest portion of ring travel.
B—Top ring .0023-.0041", lower ring .0013-.0026".
C—Top ring .003-.0043", lower ring .0013-.0026".
D—Clamped in rod.
E—Thumb push fit with piston heated.
F—Floating type. Pin retained by snap rings in piston bosses.
G—Thumb push fit with parts at 70° (room temperature).
H—Press fit in rod and piston. See text for details.

Year	Model	Camshaft Bearings		Connecting Rod Bearings				Main Bearings			
		Camshaft End Play, Inch	Bearing Clearance, Inch	Journal Diameter, Inches	Bearing Clearance, Inch	Rod End Play, Inch	Rod Bolt Tension, Lbs. Ft.	Journal Diameter, Inch	Bearing Clearance, Inch	Crankshaft End Play, Inch Note A	Main Bolt Tension, Lbs. Ft.
1940	V8	B	.0015–.0033	2.4590–2.4595	.0015–.0025	.008–.014	50–60	2.4995–2.5000	.0015–.0025	.001–.005	130–140
	V16	B	.0013–.0025	1.9988–1.9993	.0015–.0025	.008–.014	50–60	1.9988–1.9993	.0015–.0025	.001–.005	100–110
1941	All	B	.0015–.0033	2.4590–2.4595	.0015–.0025	.008–.014	50–60	2.4995–2.5000	.0015–.0025	.001–.005	130–140
1942	All	B	.0015–.0033	2.4590–2.4595	.0015–.0025	.008–.014	50–60	2.4990–2.4995	.0015–.0025	.001–.005	130–140
1946–48	All	B	.0015–.0033	2.4590–2.4595	.0005–.002	.008–.014	60–65	2.4990–2.4995	.0008–.0025	.001–.005	130–140
1949–54	All	C	.001–.0022	2.2488–2.2493	.0005–.002	.008–.014	40–45	2.4990–2.4995	.0008–.0025	.001–.005	90–100

A—Thrust taken by 1940-48 V8; No. 5 on 1940 V16; rear bearing on 1949-54.
B—Controlled by a thrust plate at front bearing.
C—On early 1949 cars, end play is controlled by thrust plunger and spring; on late 1949 and all 1950–54 cars, controlled by the timing case cover.

LUBRICATION AND CAPACITY DATA

Year	Model	Cooling System Capacity, Quarts Without Heater	Fuel Tank Capacity, Gallons	ENGINE				TRANSMISSION			DIFFERENTIAL		
				Crankcase Refill Capacity, Quarts	Grade of Oil			Capacity, Pounds or Pints	Grade of Oil		Capacity, Pounds or Pints	Grade of Oil	
					Above +32°F.	Above +10°F.	Above −10°F.		Summer	Winter		Summer	Winter
1940	50, 52	25	22	7	20	20W	10W	2½	90	90	5	90	90
	60S, 62	24½	22	7	20	20W	10W	2½	90	90	5	90	90
	72	24½	24	7	20	20W	10W	2½	90	90	6½	90	90
	75	24½	26½	7	20	20W	10W	2½	90	90	6½	90	90
	90	30	26½	11	20	20W	10W	2½	90	90	6½	90	90
1941-42	All Except 75	25	20	7	20	20W	10W	2½ (B)	90 (B)	90 (B)	5	90	90
	75	25	24	7	20	20W	10W	2½ (B)	90 (B)	90 (B)	5	90	90
1946–48	60S, 61, 62	25	20	7	20	20W	10W	2½ (B)	90 (B)	90 (B)	5	90	90
	75	25	24	7	20	20W	10W	2½ (B)	90 (B)	90 (B)	5	90	90
1949–51	All	18	20	5	20	20W	10W	2½ (B)	90 (B)	90 (B)	5	90	90
1952	All	19	20	5	20	20W	10W	2½ (B)	90 (B)	90 (B)	5	90	90
1953	All	19¾	20	5	20	20W	10W	3¾ (B)	90 (B)	90 (B)	5	90	90
1954	All	19¾	20	5	20	20W	10W	22	A	A	5	90	90

A—Automatic transmission fluid.
B—For cars with Hydra-Matic Drive, approximately 12 qts. Use Hydra-Matic fluid only.

FIRST SERIAL NUMBERS

Note: Engine numbers identical with serial numbers

Location—1940-41 V8—On crankcase behind left cylinder block, and on left frame side rail near steering gear. 1942-48—On engine block behind water pump, and on right frame side bar. 1949-54—Upper right corner on front face of right hand block.

Year	Model	
1940	50	2320001
	52	4320001
	60S	6320001
	62	8320001
	72	7320001
	75	3320001
	90	5320001
1941	60S	6340001
	61	5340001
	62	8340001
	63	7340001
	67	9340001
	75	3340001
1942	60S	6380001
	61	5380001
	62	8380001
	63	7380001
	67	9380001
	75	3380001
1946	60S	6400001
	61	5400001
	62	8400001
	75	3400001
1947	60S	6420001
	61	5420001
	62	8420001
	75	3420001
1948	60S	486000001
	61	486100001
	62	486200001
	75	487500001
1949	60S	496000001
	61	496100001
	62	496200001
	75	497500001
1950	60S	506000001
	61	506100001
	62	506200001
	75	507500001
1951	60S	516000001
	61	516100001
	62	516200001
	75	517500001
1952	60S	526000001
	62	526200001
	75	527500001
1953	60S	536000001
	62	536200001
	75	537500001

Year	Model	Lining Dimensions Per Wheel, Inches			Brake Shoe Clearance Inch	Hydraulic Cylinder Bore Sizes, Inch		
						Wheel Cylinder		Master Cylinder
		Length	Width	Thickness		Front	Rear	
1940	La Salle	24½	2	3/16	.010	1 3/32	1	1
	60S, 62	24½	①	3/16	.010	1 3/32	1	1
	72	24½	②	3/16	.010	1 3/32	1	1
	75, 90	28 11/16	2¼	¼	.010	1¼	1	1⅛
1941	Except 75	24½	①	3/16	.010	1 3/32	1	1
	75	24½	②	3/16	.010	1 3/32	1	1
1942–48	Except 75	24½	①	3/16	.010	1⅛	1⅛	1
	75	24½	②	3/16	.010	1⅛	1⅛	1
1949	Except 75	24½	①	3/16	.010	1⅛	1	1
	75	24½	②	3/16	.010	1⅛	1	1
1950–51	Except 75	③	2½	3/16	.010	1⅛	1	1
	75	25¾	2½	3/16	.010	1⅛	1	1
1952	60S, 62	④	2½	¼	.010	1⅛	1	1
	75	26	2½	¼	.010	1⅛	1	1
1953	All	26	2½	¼	.010	1⅛	1	1
1954	All	23⅜	2½	¼	.010	1⅛	1	1

① Front wheel 2¼", rear wheel 2".
② Front wheel 2¼", rear wheel 2½".
③ Riveted lining 22½", bonded lining 19½".
④ Front wheel 26", rear wheel 23½".

DELCO-REMY DISTRIBUTOR INDEX & SPECIFICATIONS

Car and Model	Distributor Number Note A	Cam Angle, Degrees	Breaker Point Opening, Inch	Condenser Capacity, Mfds. Note B	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
1940, V16	1110601	21–30	.016	.20–.25	19–23	1 @ 800	10 @ 2000	None	None	None
1940, V8	1110806	21–30	.016	.20–.25	19–23	½ @ 500	12 @ 2000	5–7	15–18	9
1941–48	1110807	21–30	.016	.20–.25	19–23	½ @ 500	12 @ 2000	5–7	15–18	9
1949	1110812	21–30	.016	.20–.25	19–23	¾ @ 300	18¾ @ 1800	6–8	14	9
1950	1110819	21–30	.016	.20–.25	19–23	¾ @ 300	16 @ 1800	4–6	12–16	10
1951	1110820	21–30	.016	.20–.25	19–23	¾ @ 300	16 @ 1800	4–6	13–15	10
1952	1110829	29.5–32.5	.0125	.20–.25	19–23	¾ @ 340	17 @ 1850	7–9	16½	11
1953	1110835	31	.0125	.20–.25	19–23	400–500	13¼ @ 2000	6½–9	16½	14
1954	1110844	31	.016	.20–.25	19–23	400–500	13¼ @ 2000	6½–9	16½	14

A—Distributor number stamped on plate riveted to side of housing.
B—Microfarads—as indicated on a condenser tester.

DELCO-REMY STARTING MOTOR INDEX AND SPECIFICATIONS

Car and Model	Unit Number Note A	Brush Spring Tension, Ounces	No Load Test			Torque Test		
			Amperes	Volts	R.P.M.	Amperes	Volts	Torque, Lbs. Ft.
1940, V8	1107912	24–28	60	5.0	6000	600	3.0	16
1941	1107923	24–28	60	5.0	6000	600	3.0	16
1942–48	1107931	24–28	60	5.0	6000	600	3.0	16
1949	1107945	24–28	60	5.0	6000	600	3.0	16
1950–52	1107969	24–28	60	5.0	6000	600	3.0	15
1953	1107602	24–28	75	10.3	6500	460	5.2	11.5
1954	1107622	24–28	75	10.3	6500	460	5.2	11.5

A—Stamped on plate riveted to housing.

Car & Model	Generator					Regulator						
	Generator Number	Generator Output		Brush Spring Tension, Ounces	Field Current at 6 or 12 Volts	Regulator Number	Cutout Relay			Voltage Regulator Setting (Adjust to) Volts	Current Regulator Setting (Adjust to) Amperes	Current and Voltage Armature Air Gap, Inch
		Amperes	R.P.M.				Voltage to Close Points (Adjust to)	Reverse Current to Open Points (Amperes)	Armature Air Gap Inch			
1940-41	1102661	35	3500	25	1.75-1.9	1118202	6.4	0-3	.020	7.4	35	.075
1941	1102686	36	3500	25	1.75-1.9	1118202	6.4	0-3	.020	7.4	36	.075
1942-48	1102693	36	3500	25	1.75-1.9	1118242	6.4	0-3	.020	7.4	36	.075
1942-47	1102694	36	3500	25	1.75-1.9	1118242	6.4	0-3	.020	7.4	36	.075
1949-51	1102700	45	3500	25	1.75-1.9	1118357	6.4	0-3	.020	7.4	42	.075
1951	1102700	50	3500	25	1.75-1.9	1118727	6.4	0-4	.020	7.4	47	.075
1952	1102781	50	3500	25	1.75-1.9	1118725	6.4	0-4	.020	7.4	47	.075
1953-54	1102002	30	2150	28	1.48-1.62	1118750	12.8	0-4	.020	14.5	30	.075

Generators rotate clockwise. Regulators are positive grounded prior to 1946; negative grounded thereafter.

WHEEL ALIGNMENT DATA

Year	Model	Preferred Caster, Degrees	Preferred Camber, Degrees	Toe In, Inches	Kingpin Inclination, Degrees
1940	75, 90	− 3/4	+ 1/4	1/16	5
	Others	− 2 1/4	+ 3/8	1/16	5
1941-47	All	− 2 1/8	Zero	1/16	6
1948-49	All	Zero	Zero	3/32	6
1950-54	All	Zero	Zero	3/32	5 5/6

ENGINE MARKINGS

1940-54 V8s — Engines are marked in production with a system of letters stamped on the top face of the cylinder block adjacent to each cylinder bore to indicate exact diameters of cylinder bores and pistons to aid in selective fitting of pistons on the assembly line. These letters have no value in service since replacement pistons cannot be supplied according to these code letters and usually some change has taken place in cylinder bore dimensions after the engine has been in service for some time.

ENGINE, REPLACE

1940-48 V8—The following procedure is specifically for 1942 models but may be applied to all other models. Any items that do not apply, however, should be disregarded.

1. Block up car at four wheels.
2. Drain cooling system.
3. Disconnect battery cables.
4. Remove propeller shaft.
5. Support rear of engine.
6. Loosen transmission and slide backward into frame X-member. Be sure to support transmission at front end.
7. Remove clutch release mechanism from bell housing.
8. Remove hood.
9. Remove radio ground cables, heater hoses and windshield washer reservoir.
10. Remove all water hose.
11. Disconnect exhaust pipe at right manifold.
12. Remove carburetor and control rod.
13. Disconnect fan, generator and water pump belts and remove generator and fan.
14. Pull wiring harness for generator toward side of car so it won't interfere with engine removal.
15. Remove distributor so it won't hit cowl on removal of engine.
16. Disconnect fuel line at fuel pump.
17. Install wooden or metal shield in back of radiator core to avoid damage to fins when removing engine.
18. Hook a rope under crankshaft pulleys, then up and around exhaust crossover manifold.
19. Place chain fall or hoist over engine and hook onto rope, raising hoist to take slack out of rope.
20. Disconnect both front engine support mountings.
21. Lift engine out of car.
22. Reinstall engine in reverse order of its removal.

1949-54 — To remove the engine with transmission attached from the car, proceed as follows:

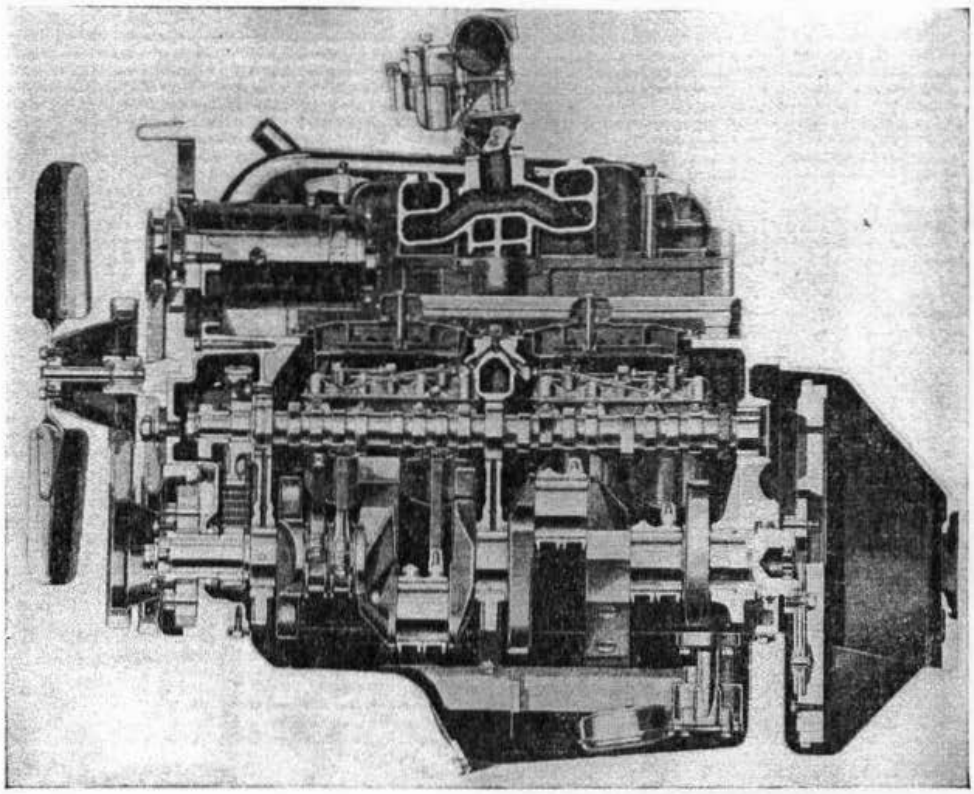
1. Drain cooling system, crankcase and transmission.
2. Remove hood top panel.
3. Disconnect battery cables.
4. Disconnect hood release cable (1950-51).
5. Disconnect voltage regulator wires (1950-54).
6. Remove upper and lower radiator hose.
7. Remove radiator core.
8. Remove generator and fan belt.
9. Disconnect carburetor linkage and remove carburetor.
10. Disconnect flexible fuel line at fuel pump.
11. Disconnect heater hoses at heater.
12. Disconnect ground straps, ignition coil wires, and oil pressure gauge line and temperature gauge wired.
13. Remove fan blade and pulley.

13A. Disconnect power steering pump-to-valve body hoses and install caps on fittings to prevent oil leakage (on cars so equipped).

14. Raise front of car and install stand jacks.
15. Disconnect propeller shaft at rear axle and remove assembly from car by sliding front yoke out of transmission extension housing.

15A. On 1952-54, remove Hydramatic linkage slush deflector.

16. Disconnect speedometer cable and shift linkage at transmission.
17. Remove starter from engine.
18. Disconnect front engine supports at frame.
19. Disconnect exhaust pipes from manifolds.
20. Remove idler arm support screws from frame and lower idler arm and steering connecting link (1950-54).
21. Loosen hand brake cable at relay (1950-54).
22. On cars with syncromesh transmission, disconnect clutch pedal-to-release yoke rod.
23. Remove back-up light switch bracket from transmission (if syncromesh).
24. Remove stand jacks from under car and lower car to floor.
25. Install a rope or chain around intake manifold, attach to overhead hoist and take up slack.
26. Disconnect and remove rear engine support bracket from frame and extension housing.



Sectional view of V8 engine, 1940-48

27. Lift engine and transmission out of car.

28. Reverse the order of the removal procedure to install the engine. Adjust throttle control linkage, time the engine and check operation of car.

CYLINDER HEAD

1940-48 V8—Thorough tightening of cylinder head capscrews is necessary to insure a leak-proof connection. Tighten screws in the order shown in Fig. 1 once when engine is cold and again after engine is thoroughly warm. Correct torque tightness is given in the *Tune-Up Chart.*

Caution — The two capscrews used at the water outlet connection on each cylinder head have oversized heads and are ½" longer than the other screws. *Use these screws only at water outlet connections.* If installed at any other point, they may break through the water jacket and irreparibly damage the entire engine block.

1949-54—Before checking the cylinder head capscrew torque on these engines, be sure to loosen the intake manifold. This is necessary to prevent the upper row of cylinder head screws from being under-torqued because of the bridging effect of the intake manifold. To relieve any pressure, it is merely necessary to loosen either side of the intake manifold before checking the head screw tightness, which should be 65-70 lbs. ft.

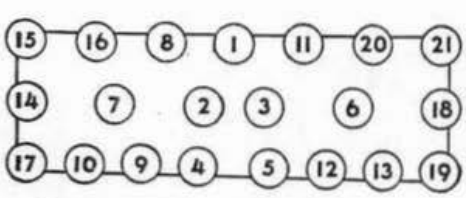


Fig. 1 1936-48 V8 cylinder head tightening sequence

Removal

1. Drain radiator.
2. Remove two bolts from water pump flange at cylinder head.
3. Remove ground strap screw at rear of cylinder head.
4. Remove carburetor air cleaner.
5. Disconnect fuel line from fuel pump to carburetor.
6. Remove vacuum advance line from front of carburetor to vacuum advance at distributor.
7. Remove windshield wiper vacuum pipe from clamp at rear of intake manifold.
8. Disconnect vacuum line at intake manifold and at vacuum pump.
9. Disconnect ignition coil high tension wire and primary wire at distributor.
10. Disconnect throttle control linkage at carburetor.
11. Remove intake manifold with carburetor and heat control pipe as a unit.
12. Remove rocker arm covers and distributor cap as an assembly.
13. If right cylinder head is to be removed, remove generator.
14. Remove exhaust manifold bolts which attach manifold to head, or if preferred, the manifold may be disconnected from exhaust pipe and cross-under pipe (1949-51).
15. Remove rocker arm assembly.
16. Remove push rods from openings in cylinder head.
17. Remove remaining cylinder head bolts and lift off head.

Note—If both heads are to be removed, the exhaust manifolds should be supported to prevent undue strain at manifold-to-exhaust pipe connection.

Installation Notes

1. Cylinder head gasket is marked "TOP" and should be so installed.
2. Eight short cylinder head screws belong in outside row, five medium length screws in center row, and the four long head screws go through rocker arm shaft and head.
3. Be sure bottom of push rods are correctly seated in hydraulic lifter cups.
4. Tighten all cylinder head screws in sequence shown in Fig. 2 and to 65-70 pounds feet torque.
5. Tighten manifold screws to 25-30 pounds feet torque.
6. When installing intake manifold, be sure choke heater pipe enters hole in heater stove in exhaust manifold before intake manifold is all the way down into position.

ROCKER ARMS

1949-54—The rocker arms may be lifted off after removing the screws holding each assembly to the cylinder heads. Note when removing the push rods that the end with the undercut groove is *up* toward the rocker arms.

To disassemble the rocker arms, remove the cotter pin from the end of the rocker arm shaft and remove two flat washers and spring washer. Keep tention on the rocker arm springs to keep the springs from pushing the parts off the end of the shaft. This can be done by leaving the cylinder head screws in the rocker arm brackets. Slide rocker arms, brackets and springs off the shaft. Keep parts in relative position as they are removed.

Note that the center rocker arm spring is shorter than the two outer springs. This spring must be installed in the center position. Also the two outer shaft brackets have mounting holes for the rocker arm cover screws. All rocker arms are identical and can be installed in any position.

When assembling the rocker arms, note the notched end of the shaft on both the right and left shaft, Fig. 3. These must point toward the center of the engine to allow for proper lubrication. Also the rocker arm brackets with the tapped holes at the top for the

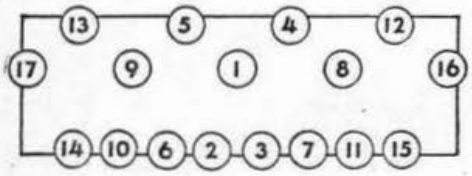


Fig. 2 1949-54 cylinder head tightening sequence

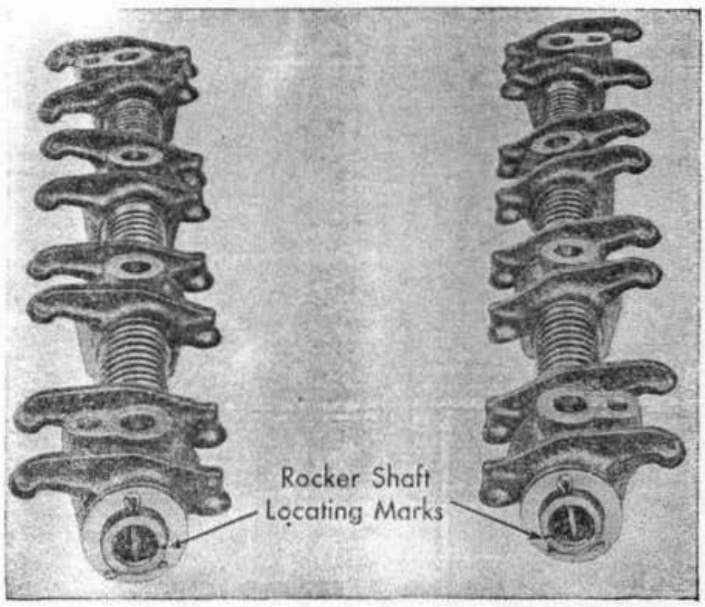
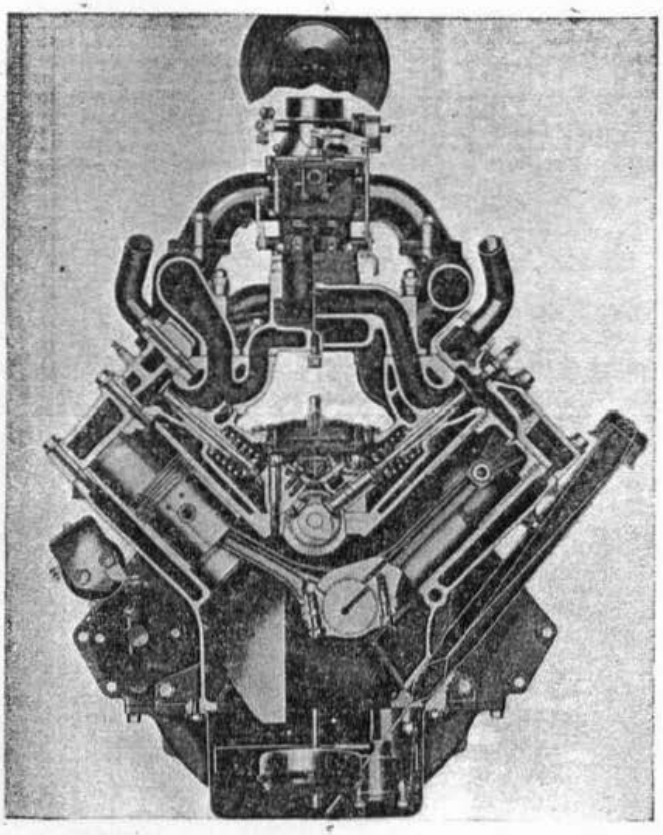


Fig. 3 Assembly of 1949-54 rocker arms



Cross sectional view of V8 engine, 1940-48

rocker arm cover bolts must be positioned at each end of the rocker arm and the tapped hole must be toward the valve end of the rocker arms.

Position the rocker arms, brackets and springs on the shaft. The short spring is in the middle position while the two long springs are on the outside. Slip the screws in the rocker brackets and shaft to hold them in position when the shaft is assembled. Compress the springs and install two flat washers and spring washer on the end of the shaft. Install and spread the cotter pin.

When installing push rods make sure that the groove in each rod is up toward the cylinder head. This is important because the radius is not the same on each end. Care should be taken to see that all the push rods fit into the rocker arm sockets properly, and that push rods are properly seated on the valve lifter cups. Push rods can be bent when the head bolts are tightened if they are not in the sockets.

VALVES & SPRINGS

1940-48 V8—To remove the valves and springs, it is necessary to take out the valve lifters first. Then, with the cylinder heads removed, compress the valve springs, take out the locking keys and lift out the valves and springs.

Note—As these engines have hydraulic valve lifters, cleanliness is a prime consideration whenever the engine is disassembled for valve grinding or other work. In view of this, the following precautionary measures should be taken.

1. Before removing the valve cover plates, clean the engine Vee thoroughly, using a compressed air cleaning gun if available; if not handy, use a good cleaning solution and a brush, blowing off with compressed air.

2. Cover the intake and exhaust manifold port holes with plywood or heavy cardboard when manifolds are taken off.

3. After removing the valve lifter brackets, the openings in the crankcase should be covered with pieces of inner tube rubber cut to fit; rubber is superior to rags for preventing valve locks, etc., from falling into the oil pan as it leaves no lint in the engine and does not fray.

4. Cylinder bores should be covered with masking tape laid in shingle fashion across the entire block, and vented with a cotter pin inserted at the lower edge of each cylinder.

Caution—Before re-installing valve lifter assemblies, valve stems should be checked for proper length, using special valve stem length gauge J-1055 to measure the distance from the end of the valve stem to the heel of the cam, Fig. 4. If the valve stems are found to be too long when checked in the closed position, they should be ground off until the tool will slide into place with the valve seated. If Tool J-1055 is not available, it will be necessary to install valves, valve springs and lifters and check clearances between stems and lifters, which should be from .030" to .070".

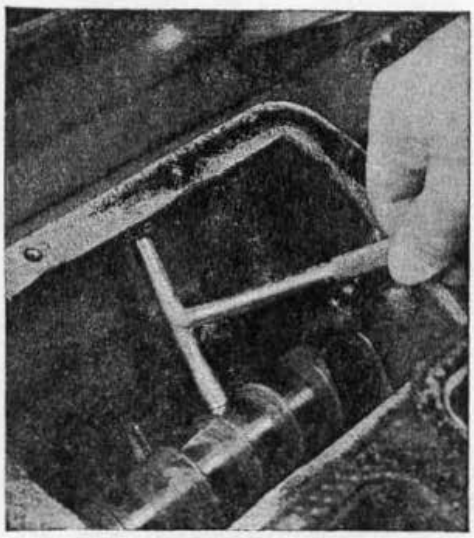


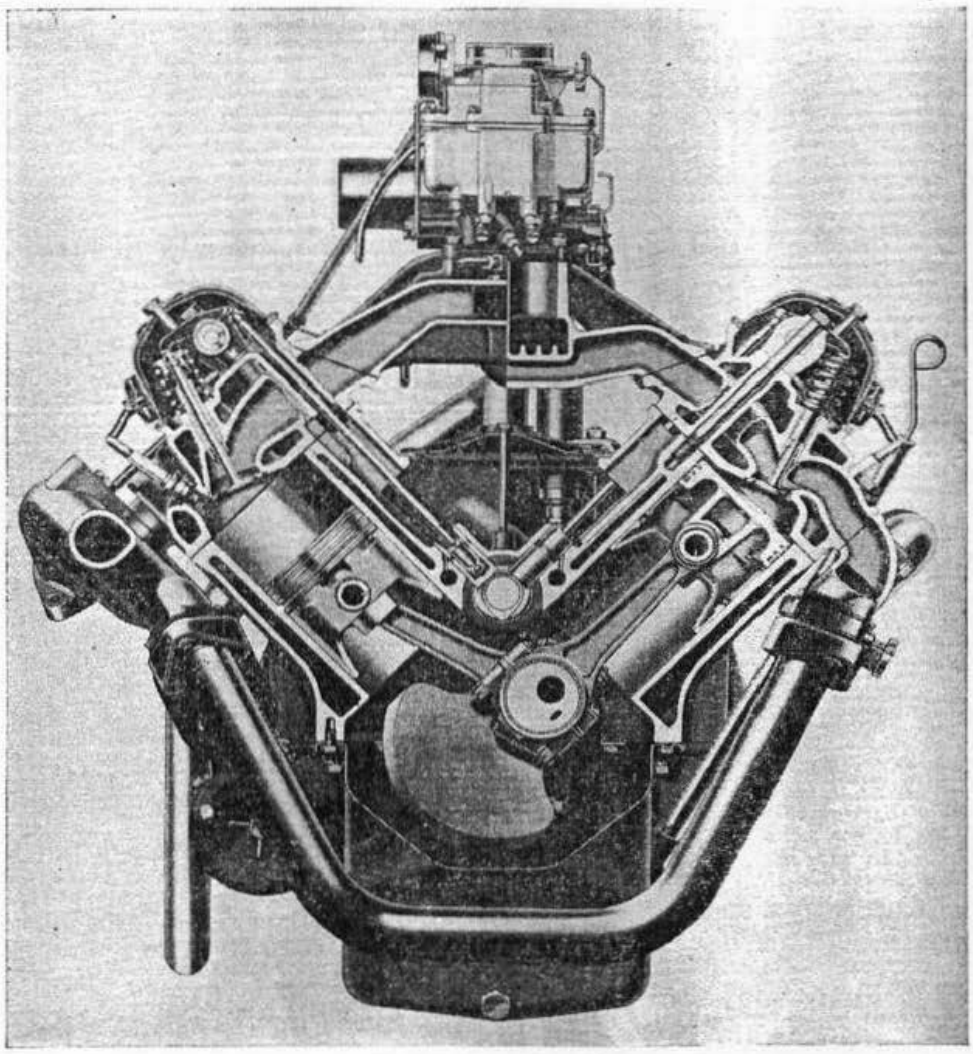
Fig. 4 Checking valve stem length. 1940-48 V8 engines

1949-54—Fig. 5 illustrates the tool used to remove and replace valves and springs. The small rubber oil seal that goes around the valve is used to keep excess oil from the valve stem. If a smoking condition develops, check the seals to see if they are in good condition.

When installing the rubber oil seals, be sure to seat them properly in the valve seat ring. To check to see that the seal has not broken while installing the retainers, place a suction cup, similar to that used when grinding valves, over the valve retainer and valve stem. If the oil seal is properly installed, the vacuum cup should stick to the end of the retainer. If there is no suction present, it is an indication that the seal is broken and the parts must again be disassembled.

Note the hardened undercut stem on the exhaust valves. The purpose of the undercut is to give greater clearance and to prevent valve sticking.

Note that the intake and exhaust valve spring retainers are different. The flare at the bottom of the intake spring retainer helps to deflect the oil away from the intake valve stems.



Cross sectional view of 1949-54 engine

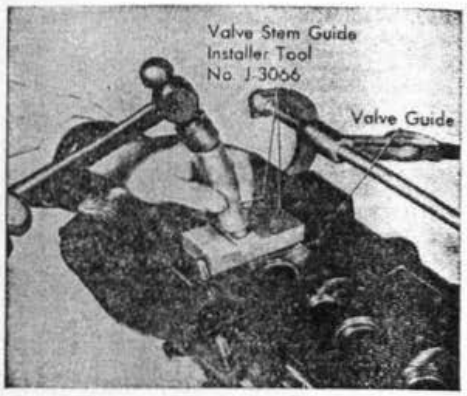


Fig. 6 Showing special tool used to control position of valve guides when driven into 1949-54 engines

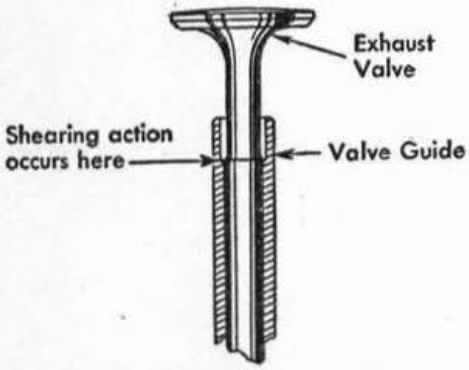


Fig. 7 Showing undercut of exhaust valve on 1949-53 engines

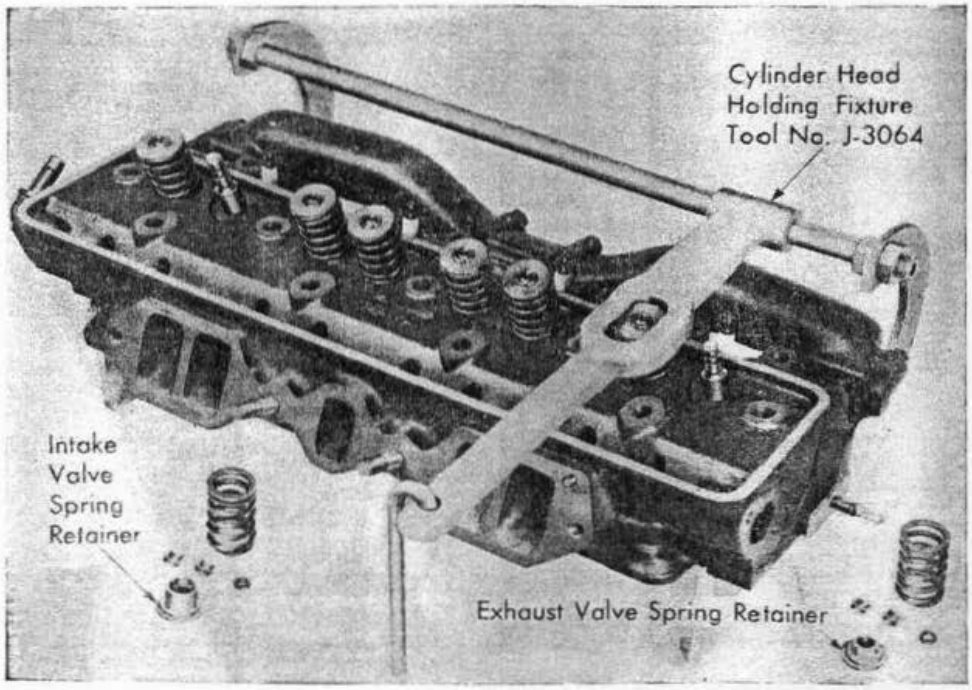


Fig. 5 Showing tool used for removing and installing 1949-54 valves

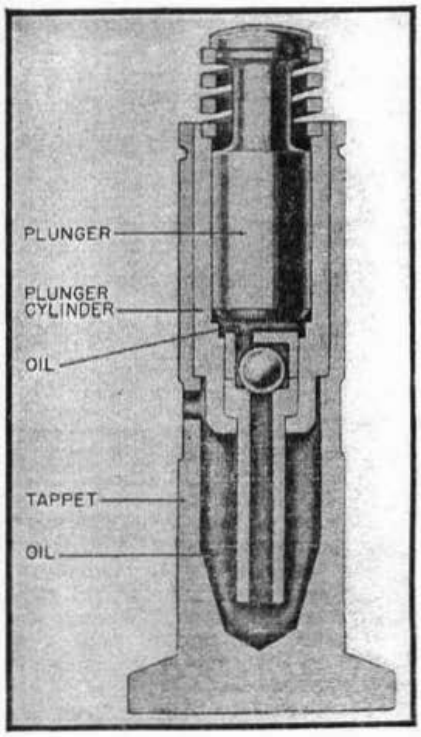
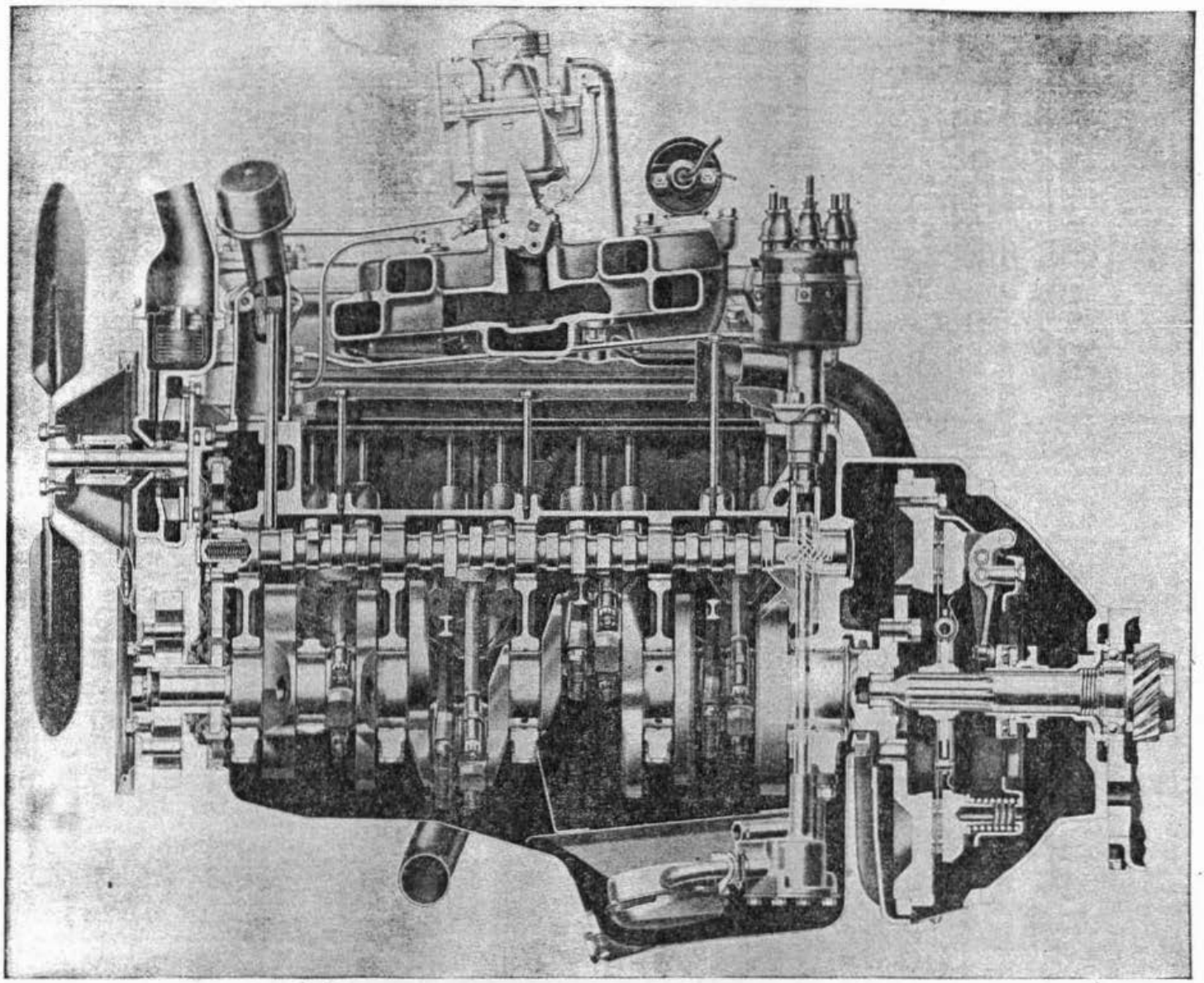


Fig. 8 Hydraulic valve lifter. 1940-48



Side sectional view of 1949-54 engine

VALVE GUIDES

1940-48—See the *Valve Table* for valve stem clearance specifications. If valve stem clearance exceeds .005", new guides must be installed. Worn valve guides are not only noisy, but may also cause excessive oil consumption, as well as improper seating of valves.

1949-54—Remove valve guides by driving them out toward the upper part of the cylinder head. When installing guides it is important that the tool shown in Fig. 6 be used. If the valve guides are not installed to an exact dimension, the undercut of the exhaust valve, Fig. 7, would not have a shearing action to keep carbon out of the guide and sticking valves would occur at very low mileage.

HYDRAULIC VALVE LIFTERS

1940-54—Figs. 8 and 9 illustrate the type lifters used. Because of the close fit between cylinders and plungers in the type shown in Fig. 8, the plungers and cylinders should never become mismatched. On the type shown in Fig. 9, the plunger is matched with the lifter body and should always be installed in the same body.

Failure of a hydraulic valve lifter is generally caused by an inadequate oil supply or dirt. An air leak at the intake side of the oil pump or too much oil in the engine will cause air bubbles in the oil supply to the lifters, causing them to collapse. This is a probable cause of trouble if several lifters fail to function, but air in the oil is an unlikely cause of failure of a single unit.

Servicing Fig. 8 Type

Remove the lock ring from the top of the lifter body and slide the complete unit out of the bottom of the lifter bracket. Take out the cylinder and plunger. Remove the plunger from the cylinder by twisting plunger counterclockwise to release the spring on the plunger.

Wash all parts in clean kerosene. *Never use gasoline or other fast drying agents.* Wash cylinder thoroughly until ball check rattles in cylinder.

To assemble, insert plunger in body. Plunger spring should be locked into cylinder body by turning clockwise with a twist of the plunger. Insert the lifter body in the lifter bracket and install the lock ring holding lifter in bracket. Fill the lifter body with clean engine oil and insert plunger and cylinder assembly.

Before installing valve lifters in the engine, note the following items to make sure lifters are assembled properly. And be sure they are installed in the original position.

1. Ball check should rattle when cylinder unit is shaken.
2. Plunger should bounce back when pressed quickly into cylinder and released.

3. Plunger spring should be locked into cylinder body with a twist of the plunger.
4. Cylinder should slide smoothly into lifter body when free of oil.

When installing lifters, fill the bodies with oil and set them in the lifter brackets. Install the lifter brackets in their original position in the engine. Apply engine oil to the top of lifter assemblies after they have been installed. The bracket oil feed pipes should be connected to the *supply end only* and engine cranked until all air is expelled from the lines. The oil feed pipes can then be attached to the lifter bracket connection fittings.

Servicing Fig. 9 Type

1. Remove right and left rocker arm covers along with coil, high tension wiring, and bracket from cylinder heads and hang on cowl.
2. Remove intake manifold.
3. Remove three valve compartment cover screws.
4. Loosen engine ventilator pipe clamp screw at flywheel housing, move pipe out of the way, and remove valve compartment cover.
5. Remove right and left rocker arm assemblies. When only one or two valve lifters are to be removed, it is not necessary to remove the complete rocker arm assembly. Merely compress the valve spring, slide the rocker arm over and remove the push rod.
6. Remove push rods.
7. Using the tool shown in Fig. 10, remove lifters from engine, being sure to keep them in order so that they can be reinstalled in the same bore from which they were removed. Rotate valve lifter back and forth while lifting them out to remove any carbon or varnish from base of lifter.

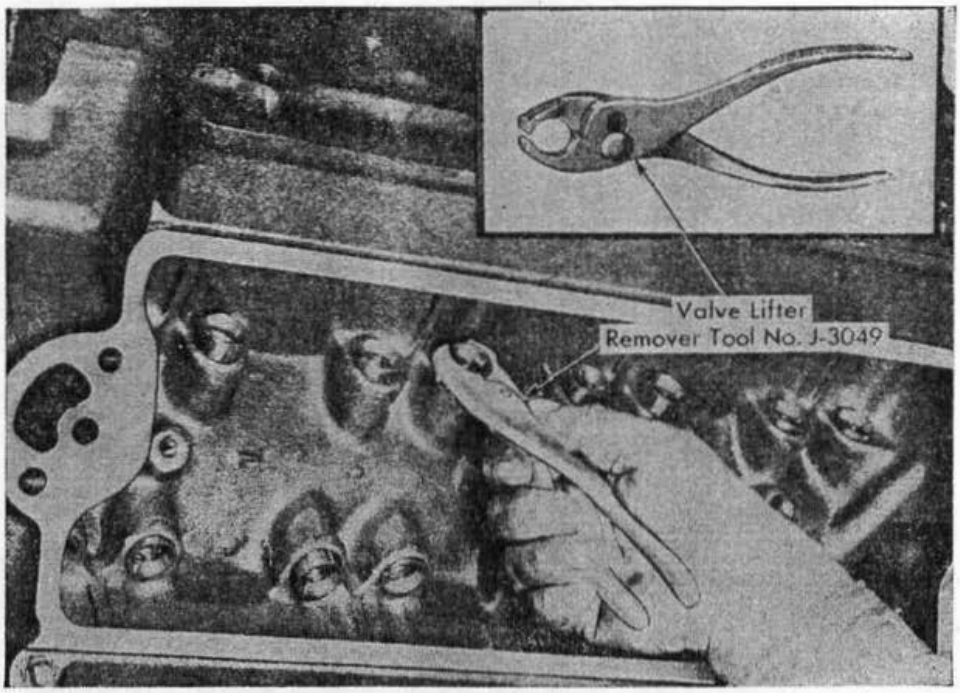


Fig. 10 Showing special pliers used to remove stuck valve lifters from 1949-54 engines

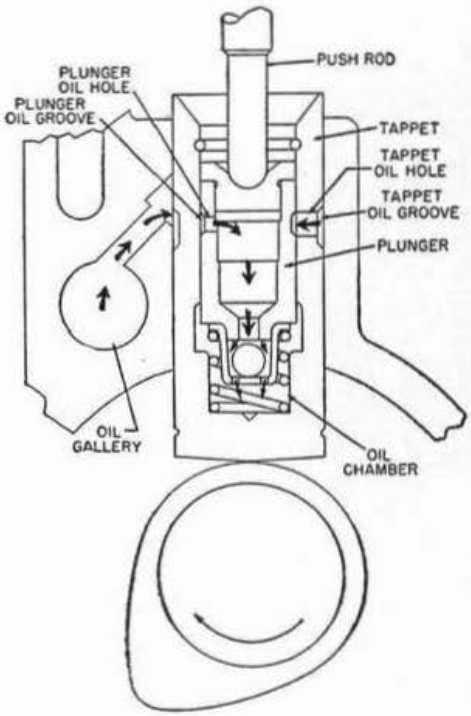


Fig. 9 Hydraulic valve lifter. 1949-54

To disassemble, press down on the center of the push rod cup. Using a pointed tool, remove lock wire from the groove while holding the plunger upside down. Invert lifter and slide out push rod cup, plunger, ball retainer and spring.

To assemble, place the ball on its seat in the lower end of the plunger while holding the plunger upside down. Position the ball retainer and spring over ball and end of plunger. Lower the body over the plunger. Turn the assembly right side up and fill the plunger with clean engine oil. Jiggle the ball with a small piece of wire until oil drains out of plunger into the body and trapped air is released from the body. Refill the plunger with oil, place the push rod cup on the plunger and position the lock wire over the cup, locking it in its groove.

TIMING CHAIN & COVER

1940-48 V8s—The chain and sprockets should be installed as a unit. A pilot tool (J-836) should be used on the end of the camshaft when the installation is made. Line up the sprocket marks as shown in Fig. 11 for correct valve timing. Do not force the sprocket onto the camshaft as damage to the distributor and oil pump drive gear may result, Fig. 12.

1949-54—To remove the timing chain and sprockets, proceed as follows:

1. Turn engine over until distributor rotor is under the number six contact in the distributor cap.
2. Remove water pump and oil pan.
3. Remove crankshaft pulley.
4. Take off chain cover.
5. Remove two capscrews attaching sprocket to camshaft. Then remove chain together with camshaft sprocket.
6. Pull crankshaft sprocket.

To install the sprockets and chain, reverse the foregoing procedure, being sure to have the sprocket marks lined up as shown in Fig. 13 when the chain is installed.

CAMSHAFT & BEARINGS

1940-48 V8—To take out camshaft, remove radiator core, fuel pump, timing chain cover, both exhaust manifolds, intake manifold and carburetor as a unit, valve covers, valve lifters and brackets, timing chain and retaining plate. Then on 1942-48 models, pull camshaft forward into radiator grille until shaft is clear of front end of engine and lift out. On earlier models, first remove radiator grille.

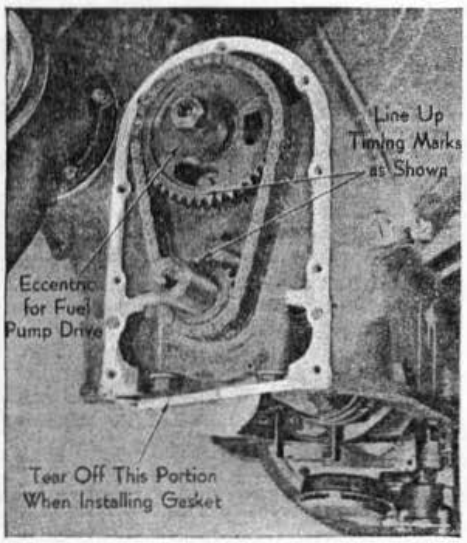


Fig. 11 Valve timing, 1940-48 V8

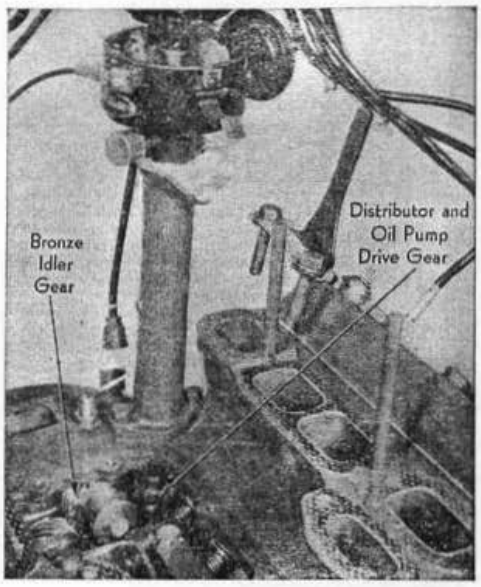


Fig. 12 Distributor and oil pump drive, 1940-48 V8

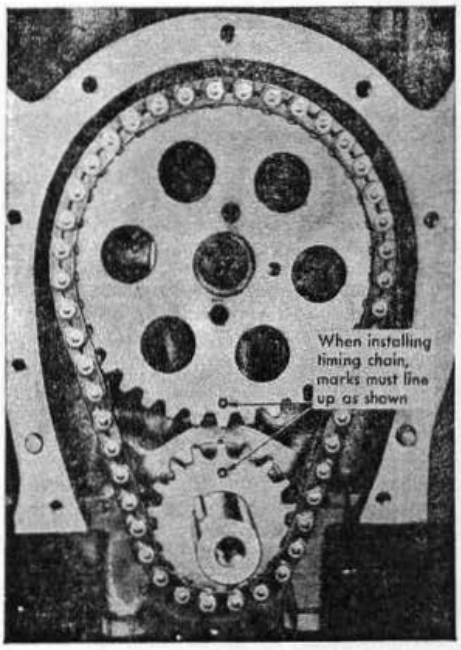


Fig. 13 Showing timing marks lined up for correct valve timing on 1949-54 engines

To remove the bearings, push them out of the bearing supports. To take out the rear bearing, remove the transmission and clutch housing.

Before replacing bearings, paint the outside surfaces with white lead. Then install the front bearing first, the rear bearing next, and then the center bearing, using pilot tool No. J-829 at the other two points in each instance. Be sure the oil holes in the bearings index with the oil holes in the crankcase.

1949-54—To remove the camshaft:

1. Remove radiator core and hood lock plate support.
2. Remove timing chain and sprockets.
3. Remove valve lifters.

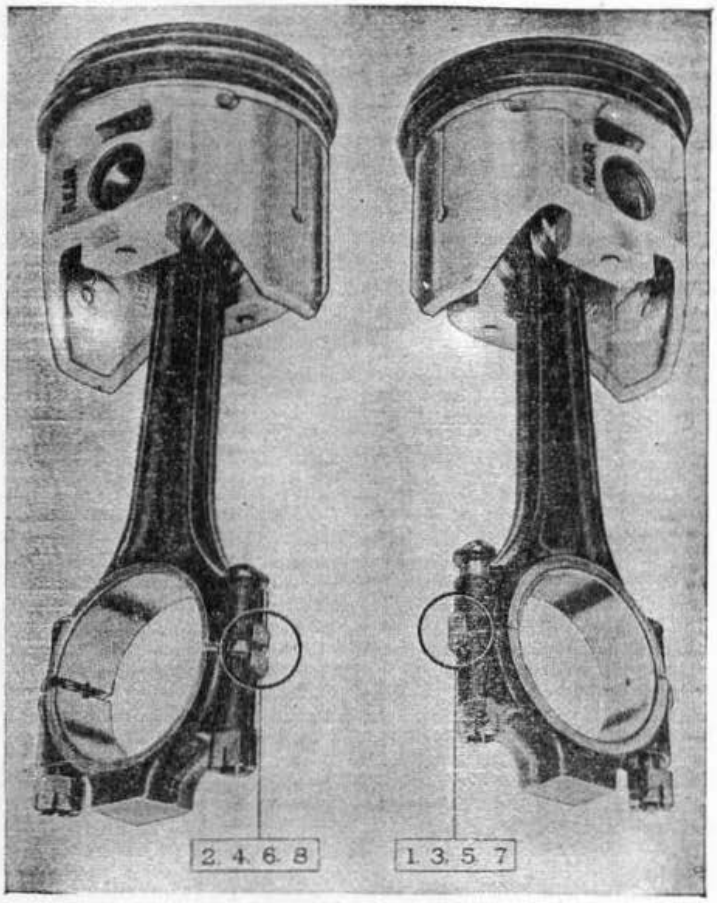


Fig. 14 1949-54 connecting rods and pistons

4. Remove distributor.
5. Remove distributor drive gear.
6. Slide camshaft forward carefully until it is out of engine.

Note—A special Camshaft Bearing Removing and Replacing Tool No. J-3063 is available to remove and install these bearings all at the same time. To install the camshaft, proceed as follows:

1. Lower the camshaft into position between the radiator grille and engine and guide it carefully into cylinder block. Extreme care should be used not to nick or scratch camshaft bushings.
2. Install timing chain and sprockets.
3. Install hood lock plate support and radiator core.
4. Install and adjust generator drive belt.
5. Install distributor drive gear over oil pump drive shaft with flat on gear engaged with flat on shaft. Be sure No. 1 piston is on top dead center and ready to fire. The timing mark "C" on the vibration damper should line up with the pointer on the timing case cover. Turn oil pump drive shaft until flat is on right side and in line with longitudinal centerline of engine.
6. Lower drive gear until it is fully meshed with camshaft gear. When the gear is installed, the slot in the top of the gear will point about 15 degrees to the right of the engine centerline. The gear must be installed in this manner or it will be impossible to time the engine. Check the drive gear to see that it seats freely and that it has a slight amount of backlash with the camshaft gear.
7. Install the distributor, turning the rotor until the tongue on the distributor shaft lines up with the slot in the distributor drive gear. Clamp distributor in place and install hydraulic valve lifters.

PISTONS & RODS, REMOVE

1940-54 — After removing the cylinder head, examine the cylinder bores above the ring travel area. If 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 connecting rod caps and push the pistons and rods out of cylinders, using care to prevent rod bolts from contacting and nicking crankshaft journals.

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

PISTONS & RODS, INSTALL

1940-48—The T-slot side of the piston should be toward the left-hand side of the engine, viewed from the driver's seat.

1949-54 — Assemble and install piston and rod assemblies as shown in Fig. 14.

PISTONS

1940-54—Service replacement pistons are furnished by Cadillac in standard sizes and .010, .020 and .030 in. oversizes, with rings and pins fitted.

Before ordering pistons for replacement, it is extremely important to determine the size of the cylinder bores by actual measurement. Actual measurement at the time of replacement is the only certain way to avoid errors.

Where no micrometer or dial gauge is available to measure piston clearance, the use of a feeler gauge will serve satisfactorily as there is a definite relation between feeler gauge pull in pounds and micrometer clearance in thousandths of inches, as shown in Fig. 15, which is set up for .002, .0025 and .003 in. feeler gauge thickness.

In order to obtain the piston clearance at the upper end of the skirt, it is necessary to insert the piston into its upper extreme position, along with the feeler ribbon, which must be kept located over the vertical slot and not in excess of ½ in. below the upper end of the skirt as shown in Fig. 16. It is advisable to mark the feeler ribbon adjacent to the piston head so that its proper location on the piston can be maintained. When the proper clearance is established, it should require the amount of pounds pull on the scale shown in Fig. 15 to withdraw the feeler, depending upon the thickness of the feeler ribbon being used.

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 (thrust side of piston). 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 important that refinished cylinder bores are trued up to have not over .0007 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.

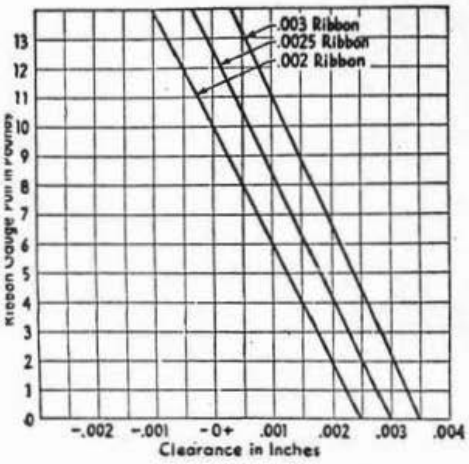


Fig. 15 Piston clearance chart, 1940-54

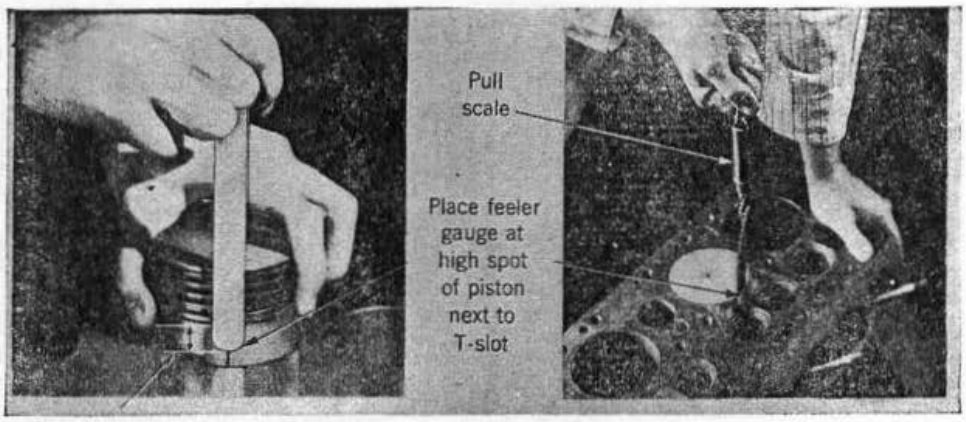


Fig. 16 Fitting pistons to cylinders, 1940-50

After final honing and before the piston is checked for fit, each bore must washed to remove all traces of abrasive and then dried thoroughly. The dry bore should be brushed clean with a power-driven fiber brush. If all traces of abrasive are not removed, rapid wear of new pistons and rings will result.

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 F. between parts is sufficient to produce a variation of .0005 in.

PISTON RINGS

1940-54—When new piston rings are installed without reboring cylinders, the glazed cylinder walls should be slightly dulled, but without increasing the bores' diameter. This is done with a "Glazebuster" or with a hone equipped with the finest grade of stones.

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 inserting feeler gauges *under* the ring. Any wear that occurs in the piston groove forms a step or ridge at 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 new rings and ring clearances will be excessive.. Piston rings are not furnished in oversize widths to compensate for ring groove wear.

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

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

PISTON PINS

1940 V8—To remove the pins, release the snap rings, heat the piston in boiling water and push the pin out by hand from the raised rib side of the piston pin hole boss. To install, heat the piston in boiling water and push the pin in by hand from the opposite side.

1941-49—As these pins are fitted with a free hand push fit in both sides of the piston at normal room temperature (about 70 degrees) it is not necessary to heat the piston to remove the pin. Remove the snap rings and push the pin out by hand from either side. When replacing, install new snap rings.

1950-54—Piston pins are a matched fit with the piston and are not available separately. Piston pins are pressed in the connecting rods and will not become loose enough to cause a knock or tapping until after very high mileages. In such cases a new piston and pin assembly should be installed.

Note—Cadillac recommends the use of the equipment shown in Figs. 17 and 18 when necessary to install a connecting rod to a new piston and pin assembly. This method is much faster than the

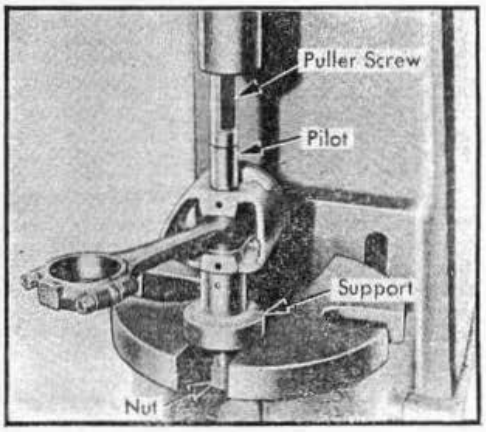


Fig. 17 Removing piston pin, 1950-54

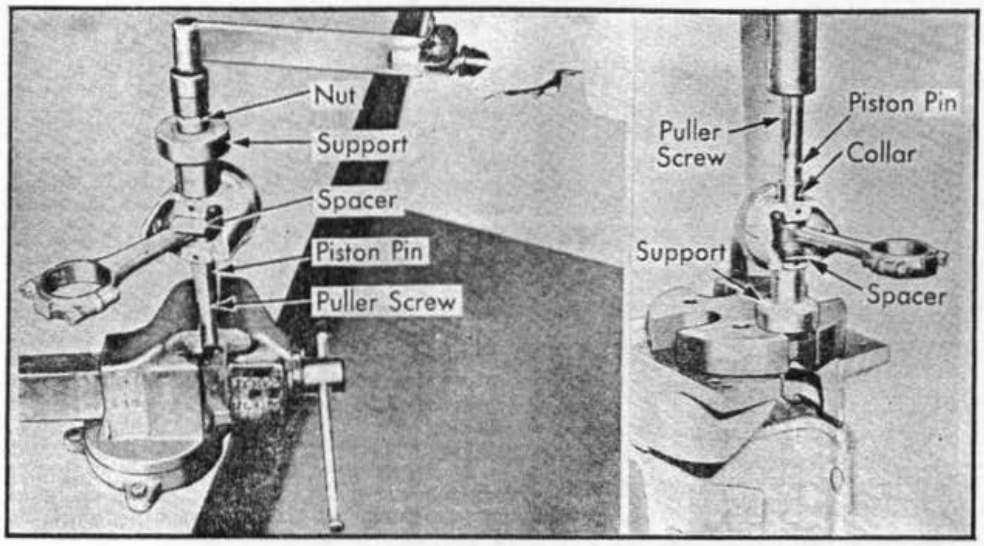


Fig. 18 Installing piston pin in piston and rod, 1950-54

piston heating method—which will do an adequate job if the special equipment is not available. The special equipment is used as follows:

Removing Pin—1. Install pilot of tool on puller screw.

2. Install puller screw with pilot through piston and pin from side marked "REAR".

3. Install support over puller screw with small end of support against piston opposite from "REAR" on piston casting.

4. Install nut loosely on puller screw and place assembly in arbor press as shown in Fig. 17.

5. Press pin from piston and rod. Then remove assembly from press, remove tools and take piston pin from puller screw.

Installing Pin—1. Lubricate piston pin holes to make installation easier.

2. Position connecting rod in its respective piston, Fig. 14.

3. Enter pilot through piston and rod.

4. Lubricate piston pin and insert it in piston pin hole on side of piston marked "REAR".

5. Install puller screw through piston pin and pilot from side of piston marked "REAR".

6. Insert spacer between connecting rod and piston till it is seated on the pilot. Spacer must be installed between piston and rod on side opposite that marked "REAR".

7. Install support over puller screw with smaller diameter toward piston, opposite that stamped "REAR."

8. Install nut on puller screw and tighten with a torque wrench to start piston pin into connecting rod, Fig. 18. If pin can be started into rod with less than 25 lbs. ft. torque, the clearance between pin and rod is excessive and either piston and pin assembly or connecting rod must be replaced.

9. Install collar over piston pin. Press puller screw down until top of pin is level with top of collar.

10. Remove collar and spacer. The pin will now project slightly from rod and this pin should be guided into the piston pin boss next to the support by hand to assure correct alignment.

11. Press piston pin in until pilot bottoms in support, properly positioning the pin in the rod.

ROD BEARINGS

1940-54 V8s—Connecting rod bearings are of the precision insert type, and if worn beyond .0045 in. can be replaced without removing the rod assembly by removing the cap and replacing the upper and lower halves. The clearance between the connecting rod bearing and the crankshaft can be measured by the use of Plastigage as follows:

1. Remove bearing cap and wipe oil from crankshaft journal and bearing insert.

2. With crankpin at approximately bottom dead center, place a piece of Plastigage in the center of the cap.

3. Reinstall cap and tighten to the torque value given in the *Engine Bearing Data* table.

3. Remove bearing cap and determine bearing clearance by comparing the width of the flattened Plastigage at its widest point with the graduation on the Plastigage envelope. The number within the graduation on the envelope indicates the clearance in thousandths of an inch, Fig. 19. If this clearance is greater than .0045 in., replace the bearing.

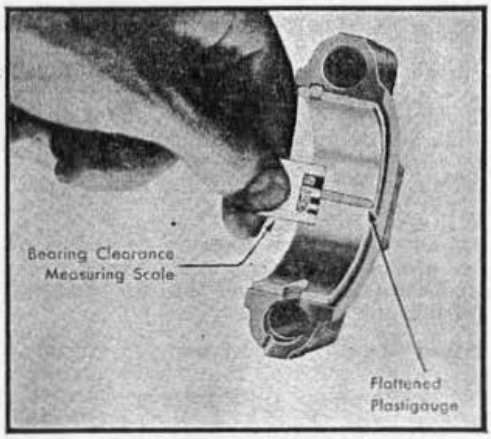


Fig. 19 Checking bearing clearance with Plastigage, 1940-54

MAIN BEARINGS

1940-48 V8—The crankshaft is supported by three main bearings. Main bearing caps are held in place by special cap screws and lock washers. Shell type bearings are used, and if worn more than .005 inch should be replaced. No attempt should be made to shim, file or otherwise take up worn bearings. To install new bearings:

1. Remove cap and take out worn lower shell.

2. Rotate crankshaft in reverse direction to turn upper shell out of crankcase, using a flattened cotter pin in the oil passage hole in the shaft to contact the bearing and force it out.

3. Place a new upper shell on the crankshaft journal, with the locating lug in the correct position, and rotate the shaft to turn the shell in place.

4. Install the lower shell in the cap and install the cap. Always use new cork plugs in the grooves at the sides of the rear bearing cap to prevent oil leaks. Grease the plugs to make installation easier.

1949-54—Shell type bearings are used. The front four bearings are interchangeable journal to journal and upper and lower halves are also interchangaable.

Bearings worn more than .005 in. should be replaced. Bearing wear can best be measured by the use of Plastigage as explained for connecting rod bearings. When one main bearing is being checked the other four caps should be tight unless the engine is out of the chassis and upside down.

Note—New bearings may be installed in the same manner as outlined for previous models. Each bearing cap is numbered on the left side starting from the front. Do not mis-match these caps or turn them around because they are individually matched when the cylinder block is machined. Casting numbers on the caps are read from the rear of the engine.

CRANKSHAFT END PLAY

1940-48—End thrust is taken at the center main bearing. If end play exceeds the limits as given in the *Engine Bearing Table,* replace the center main bearing shells.

1949-54—Crankshaft end thrust is taken on the rear main bearing. If end play is in excess of the limits given in the *Engine Bearing Data* table, replace the rear main bearing shells.

CRANKSHAFT OIL SEAL

1940-48—When installing the rear main bearing cap, new plugs should be inserted in the grooves in the sides of the bearing cap to prevent oil leaks at this

point. Grease the plugs liberally to facilitate their installation.

On all 1940-48 engines, packing is also used in the crankcase and rear main bearing cap. To install new packing, remove the crankshaft and take out all the old packing. To avoid damaging the rear main bearing shells, remove them also. Install a length of the packing in the groove of the crankcase and use a suitable oil seal compressor to drive the packing tightly into the groove, tapping the handle of the tool with a hammer. With the tool held in this position, cut off each end of the packing flush with the edge of the bearing. Repeat the operation in the bearing cap. The packing must fill the grooves entirely and must not be cut too short, otherwise a leak will develop.

1949-54—The oil seal corks used in previous engines have been eliminated from the side of the bearing cap because of the oil pan gasket arrangement. Packing is used in the groove in the crankcase and in the bearing cap and is installed in the same manner as described for previous engines, Fig. 20.

Fig. 20 Installing rear main bearing oil seal in 1949-54 engines

OIL PAN

1940-48—Whenever the oil pan is removed, it should be cleaned thoroughly. This applies as well to the oil float, screen and tube, being sure that all openings in the screen are free and clean. If the screen has been crushed, it is better to replace it rather than attempt to make a repair.

Removal, 1949-54

1. Remove cross-under pipe (1949-51) and heat control valve.
2. Take off starter and place on frame side bar.
3. Remove idler arm support screws and lower support from frame side bar.
4. Remove nuts and screws which hold pan to cylinder block.
5. Remove gaskets from sides of pan, rear main bearing cap and front cover.

Installation, 1949-54

1. Install new cork seals in rear main bearing cap and in front cover, being sure ends of gaskets are in recesses provided for them.
2. Cement pan gaskets to both sides of pan, lining up holes in gasket with those in pan.
3. Place a small amount of chassis grease on each of the four corners of the pan gasket which hang over the front and rear cut-outs which will permit the pan gasket to slide over the corks and insure a good seal.
4. Place pan in position on bottom surface of cylinder block over the four studs and install nuts and washers loosely.
5. Install remaining capscrews and tighten screws and nuts in rotation to 7-10 lbs. ft. torque.
6. Install idler arm in position on frame side bar and install screws.
7. Install starter and oil level indicator.

OIL PUMP

1940-54 V8s—To remove the pump, drain engine oil and remove oil pan. Unfasten pump from engine and disassemble as follows:

1. Remove oil pump float.
2. Remove oil pressure regulator valve and spring from pump body.
3. Remove pump bottom cover.
4. Slide idler gear out of pump body.
5. Remove pin from collar on end of drive shaft and press collar off of shaft.
6. Slide oil pump drive gear out of pump body.

Inspect strainer screen for dirt and float for leaks. Look for nicks or burrs or nicks on pressure regulator valve which might cause leaks or binding in pump body. Inspect pump gears for nicks and burrs. Inspect bottom cover for wear and dress down on a surface plate if necessary. Place bottom cover on pump and check drive shaft end play. If end play exceeds .006 in., replace drive and idler gears. Assemble and install oil pump in the reverse order of its removal and disassembly.

RADIATOR

1940—To remove the core, drain the radiator and remove the water hose and radiator tie rods. Disconnect the thermostat to shutter rod at the thermostat. Remove air cleaner, generator and fan. Disconnect the headlamp wiring at the terminal block on the right fender. Loosen the headlamp harness clinch straps on the radiator and remove the harness. Disconnect the core from the cradle and lift out the core assembly.

1941-48—To remove the core, drain radiator and remove hoses, air cleaner and fan. Disconnect the core from its cradle, and lift out the core.

1949-54—Drain radiator and remove upper and lower hose. Remove capscrews holding radiator to support. Remove radiator anchor nut and spacers at frame bracket. Be sure to check the number of spacers removed and reinstall the same amount. Lift out radiator.

When radiator is installed, check space between radiator core and fan blade. This should be ½ to 1 inch and is important for efficient fan operation.

When replacing the radiator thermostat, be sure that the thermostatic spring strap is parallel to the centerline of the car (fore and aft). This will reduce the possibility of the right-hand bank running at a higher temperature than the left-hand bank.

Service Note—When it is necessary to remove both the radiator and water pump to perform other work on the engine, time will be saved if these parts are removed as a unit rather than as separate units, because of the difficulty of removing the upper and lower radiator hoses.

Drain cooling system and disconnect heater hose at water pump. Remove generator drive belt and all radiator and water pump attaching screws. Then lift the radiator and pump as an assembly.

On cars so equipped, it will also be necessary to remove the oil filter and/or power steering pumps from their brackets.

WATER PUMP, REPLACE

1940-48 V8—Take off the fan belt, unfasten the pump from the engine and lift if off.

1949-54—To remove the water pump:

1. Drain cooling system.
2. Remove generator drive belt.
3. Remove upper and lower radiator hoses and heater hose.
4. Disconnect pipes from oil filter (if equipped).
5. Remove two screws which hold oil filter bracket and water pump outlet flange to right cylinder head and remove oil filter.
6. On cars equipped with power steering, the hydraulic pump must be removed from the cylinder head in order to remove the water pump left

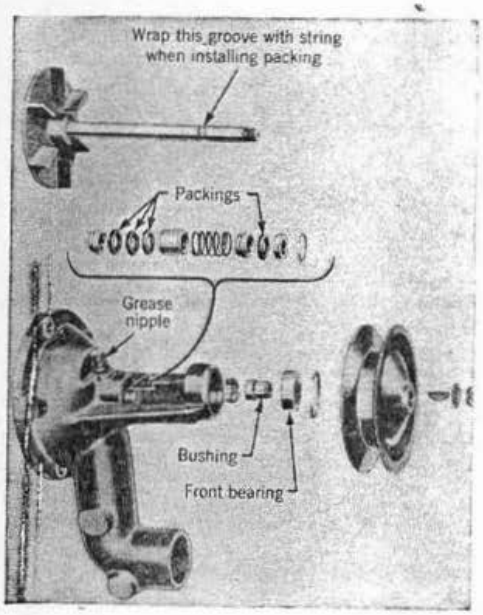


Fig. 21 Water pump. Typical of all 1940-48 V8

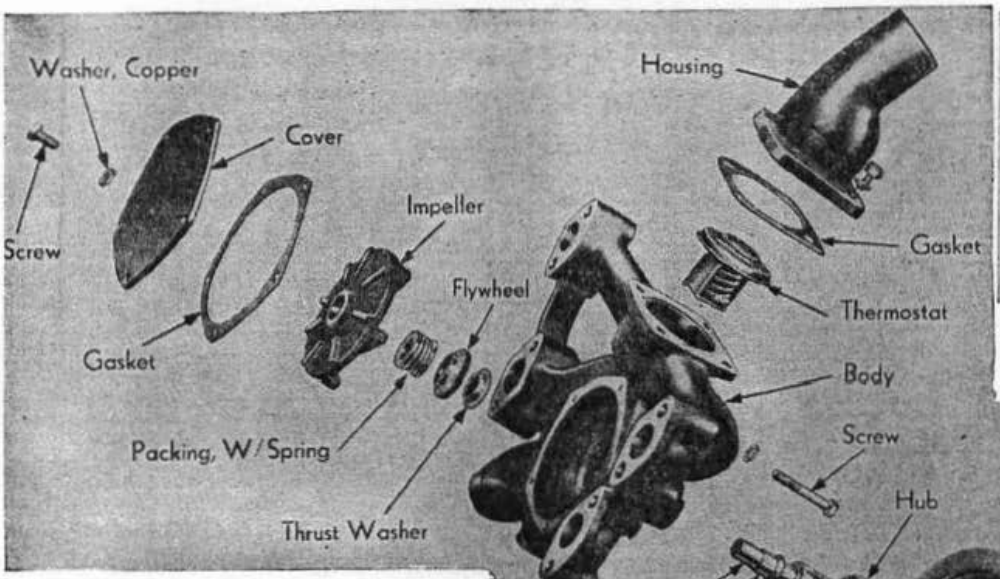


Fig. 22 1949-54 water pump and thermostat

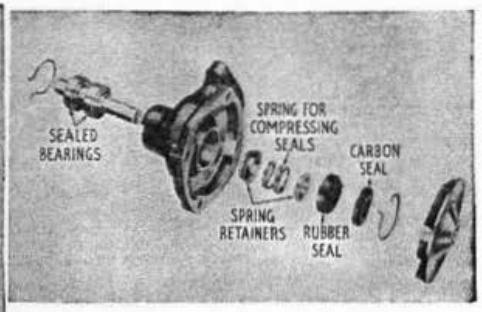
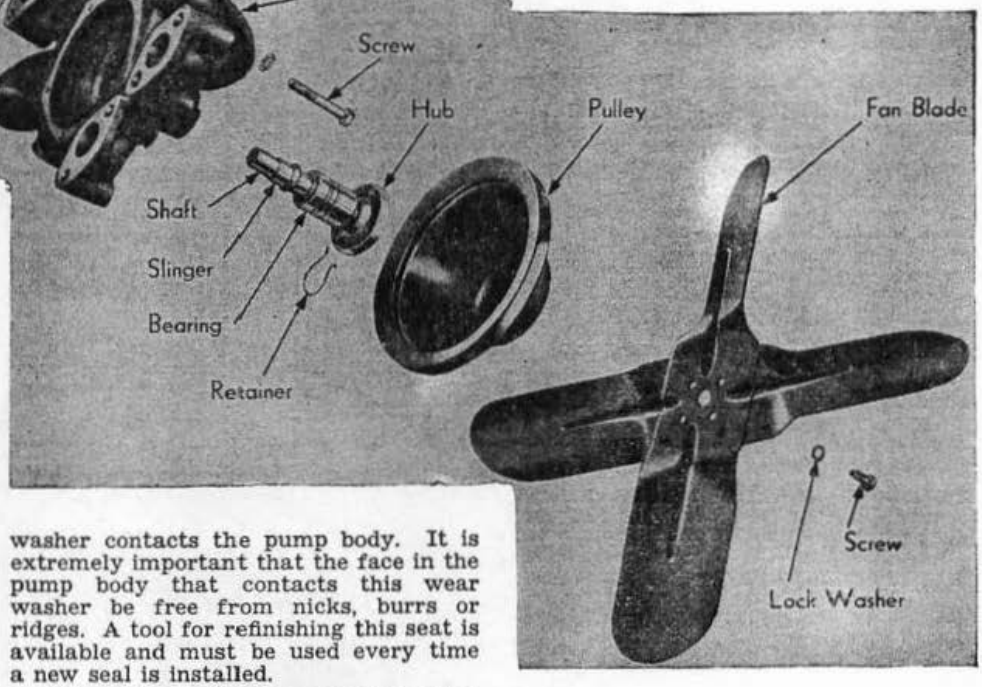


Fig. 22A Water pump on 1940 V16



outlet flange screws from the cylinder head.

7. Unfasten the pump from the cylinder block and lift it off.
8. Reverse the above sequence to install the pump.

WATER PUMP REPAIRS

1940-48 V8—Fig. 21.—Take off the pulley and remove the snap ring which retains the front bearing. Push the shaft to the rear and take out the split washer in back of the front bearing. Remove the lock ring at the front end of the rear bushing and take out the shaft and impeller. Push the rear bushing and related parts out toward the front, carefully noting their arrangement. Force the front bearing with its bushing out toward the front.

Assemble in the reverse order, but when replacing the packings on the shaft, wind the string around the recess near the end of the shaft so that a smooth surface will be provided on which to slide the packings. Coat the packings with water pump grease before installing. The grooved side of the rear bushing should be toward the rear packing.

1949-54—When disassembling the pump, Fig. 22, note that the thermostat is installed with the element downward and that the jiggle valve on the thermostat hangs open, thus making it easier to fill the radiator.

To disassemble, remove the thermostat housing and lift the thermostat from the pump body. Remove the pulley, and take the bearing retainer ring from the pump body. Be careful not to compress the retainer too far as this will weaken it and possibly allow the ring to come out.

Take off the cover plate. Press the shaft, bearing, hub and slinger out of the impeller and pump body toward the fan pulley end. Remove the impeller from the body, and take out the wear washer, spring and seal from the body.

It should be noted that the wear washer contacts the pump body. It is extremely important that the face in the pump body that contacts this wear washer be free from nicks, burrs or ridges. A tool for refinishing this seat is available and must be used every time a new seal is installed.

Note, also, that a permanently sealed bearing is used at the front end of the pump body and is retained by a wire retaining ring. The bellows type seal that slides over the water pump shaft holds the wear washer against the pump body. This is held in position when the impeller is pressed on the rear end of the pump shaft.

To assemble the pump, press the shaft bearing hub and slinger assembly into the body, making sure it is pressed against the end of the bearing bore in the body. Assemble the wear washer and seal over the driving lugs of the slinger from the rear side of the pump. It is important that the wear washer slides freely on the driving lug of the slinger, as any bind here will cause a leak.

Press the impeller on the shaft until the back of the impeller is .005 to .010" inside the cover face of the body but still does not touch the inner face. Be sure to support the opposite end of the shaft when pressing on the impeller to prevent damage to the housing and bearing.

IGNITION TIMING

1940-48 V8

To set the ignition timing, adjust the breaker gap to the clearance given in the *Tune Up Chart*, and on cars with an octane selector, set the pointer at O. Disconnect the vacuum advance line at the distributor and loosen the distributor housing clamp screw. Rotate the distributor housing until the contact points just separate, when the IG/A mark on the vibration damper or timing disc is opposite the pointer on the timing case cover, and the rotor lines up with No. 1 insert in the distributor cap. Hold the cam against distributor rotation and tighten the distributor housing clamp

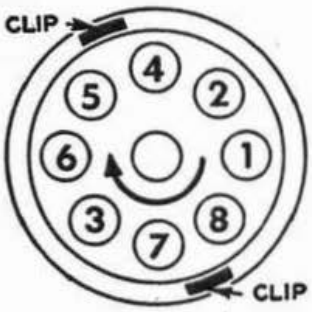


Fig. 23 Diagram of 1940-48 V8 distributor cap showing firing order, direction of rotation and location of cap clips

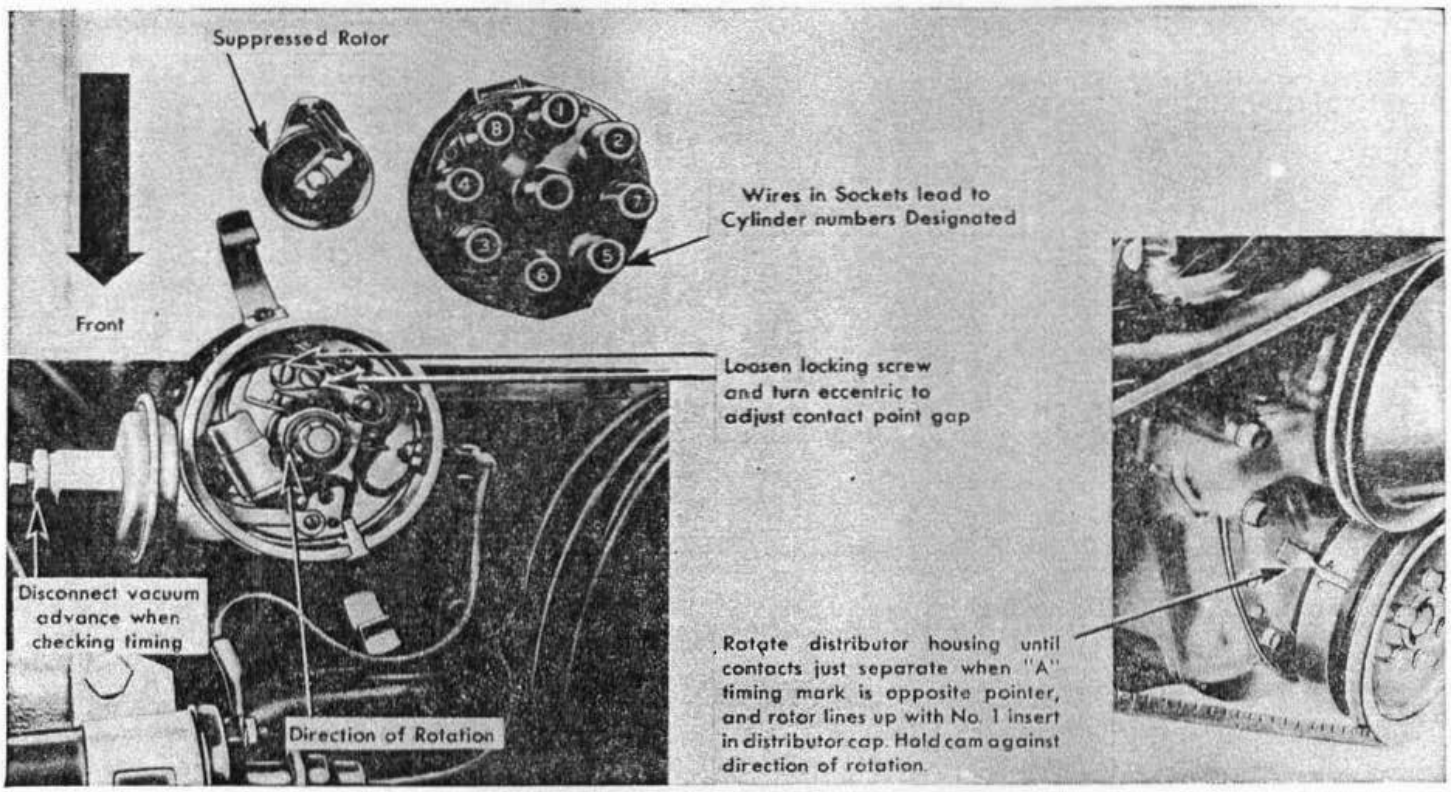


Fig. 24 Ignition timing on 1949-54 engines

screw, being sure the distributor does not rotate during the tightening process. (see Fig. 23).

1949-54

To set the timing, refer to Fig. 24 and proceed as follows:

1. Adjust distributor clamp nut to allow the distributor to be turned without excessive looseness.
2. Disconnect vacuum advance pipe to carburetor and plug hole in carburetor. *This is important as carburetor trouble can affect timing adjustments.*
3. Insert a rod or pin alongside No. 1 wire in distributor cap.
4. Connect a suitable timing light to the rod or pin.
5. Make certain that the timing marks and timing pointer are clean. Then draw a chalk line halfway between the "A" and "C" lines on the vibration damper.
6. Start the engine and warm up to operating temperature, making sure the carburetor is on slow idle before proceeding.
7. Observe the timing light flashes on the timing marks in relation to the pointer. Rotate the distributor so that the light flashes as the pointer and chalk line are opposite each other. *In localities where gasoline of the required octane rating is not available, the ignition timing may be retarded toward the "C" line on the vibration damper to eliminate spark knock.*
8. Insert the rod or pin alongside No. 6 wire and note the chalk line with relation to the pointer when the light flashes. If the light flashes before or after the chalk line, set the distributor to divide the variance. If this variance is excessive, the distributor and its alignment should be checked.
9. Tighten the clamp nut to 15-18 lbs. ft. torque and recheck the timing to make sure it did not change.
10. Remove the plug from the carburetor and connect the vacuum pipe. *Then if the timing advances with the engine idling, it is a fair indication that the throttle valves are open and the carburetor needs repairs.*

DISTRIBUTOR DRIVE GEAR

1949-54—The distributor drive gear and oil pump drive shaft may be removed after the intake manifold is taken off. To do this, hold down on the oil pump drive shaft, Fig. 25, and slide the drive gear up off the shaft. The oil pump drive shaft may then be lifted out.

To install the distributor and its drive gear, first install the oil pump drive shaft. Be sure the tang of the shaft is inserted into the oil pump slot, otherwise the drive gear will not seat. The shaft should be given a few turns by hand to make sure the shaft and pump are not binding. Lubricate the distributor drive gear teeth and thrust surface with engine oil before assembly (see Fig. 26).

When installing the distributor, first make sure No. 1 piston is at top dead center and ready to fire. The timing mark "C" on the vibration damper, Fig. 25, should be at the pointer. Turn the oil pump drive shaft until the flat is at the right and in line with the fore and aft centerline of the engine. Position the

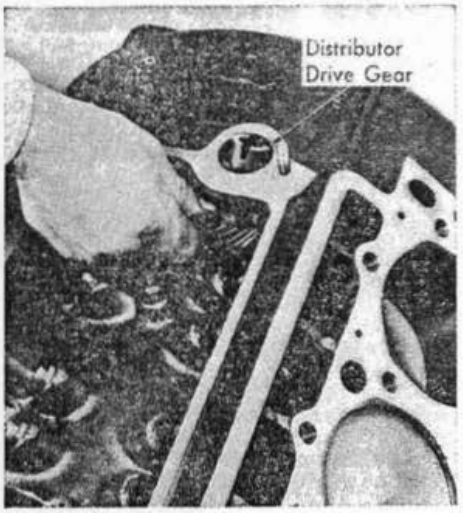


Fig. 25 Removing distributor drive gear from 1949-54 engines

drive gear on the oil pump drive shaft with flats engaged. Lower the drive gear until it is fully meshed with the camshaft gear. Slots in the top of the drive gear will point about 15 degrees to the right of the fore and aft centerline when gear is fully meshed. It will be impossible to time the engine unless the gear is installed exactly this way. Be sure the gear seats freely and that there is a slight amount of backlash with the camshaft gear.

CLUTCH PEDAL, ADJUST

1940-53 (No Clutch on 1954)—Clutch pedal free play should be from ⅞ to 1⅛

inches and is adjusted by turning the adjusting nut on the release rod which is attached to the clutch release lever.

CLUTCH, REPLACE

1940-53 (No Clutch on 1954)—
1. Remove transmission, starter motor and lower flywheel housing.
2. Unfasten release yoke rod from release yoke.
3. Remove flywheel housing with clutch release yoke, bearing and bearing retainer.
4. Punchmark flywheel and clutch cover for correct location when assembling.
5. Loosen retaining screws that hold clutch on flywheel a turn or two at a time until spring pressure is fully released.
6. After screws are removed, lift clutch and driven disc from flywheel.

TRANSMISSION, REPLACE

1940-53

1940-53—Without removing floor boards:
1. Support rear of engine with jack.
2. Remove propeller shaft and universals.
3. Disconnect transmission support.
4. Remove transmission support cross member.
5. Unfasten shift rods from transmission levers.
6. Insert guide studs in upper mounting holes.
7. Remove other mounting bolts and slide transmission back and out.
8. Insert cork plug in drain plug hole for main drive gear bearing to prevent loss of lubricant.

Install in the reverse order, using the guide studs to guide the transmission in safely. Be sure to remove the cork plug from the main drive gear bearing drain hole before sliding the transmission in all the way

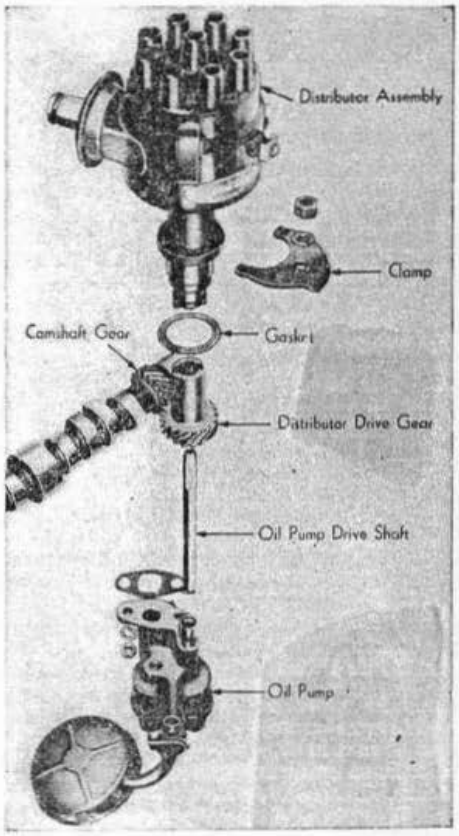


Fig. 26 1949-54 oil pump and distributor

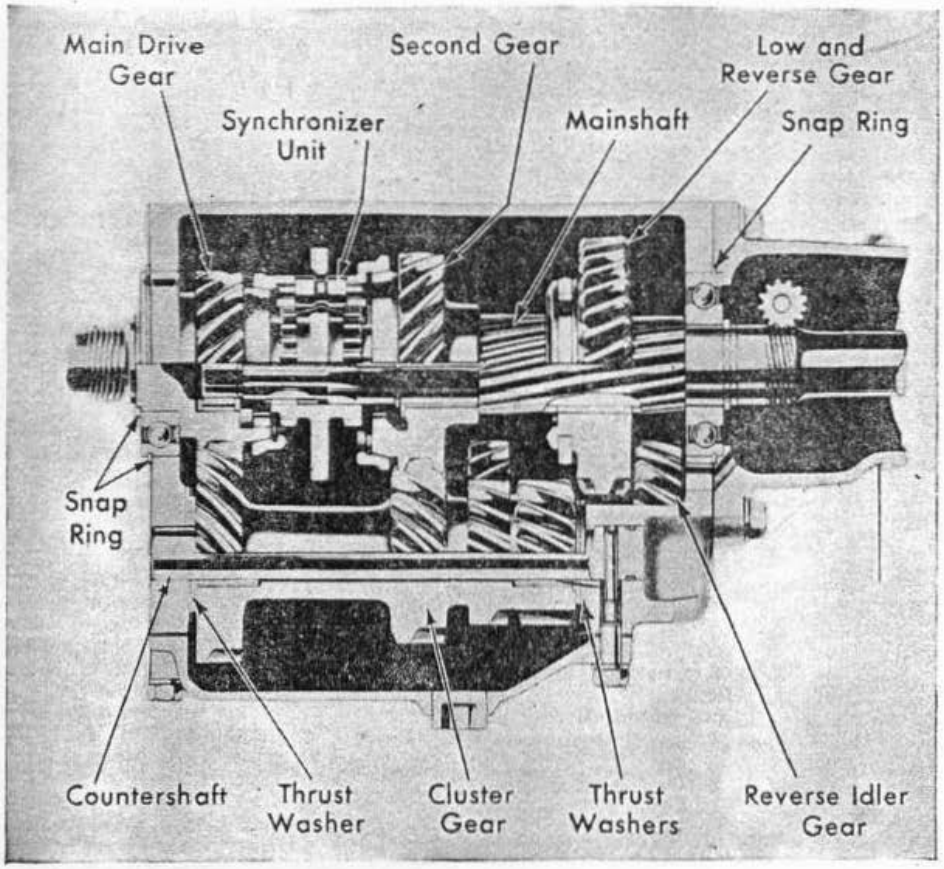


Fig. 27 Standard transmission. 1940-53 (Not used on 1954)

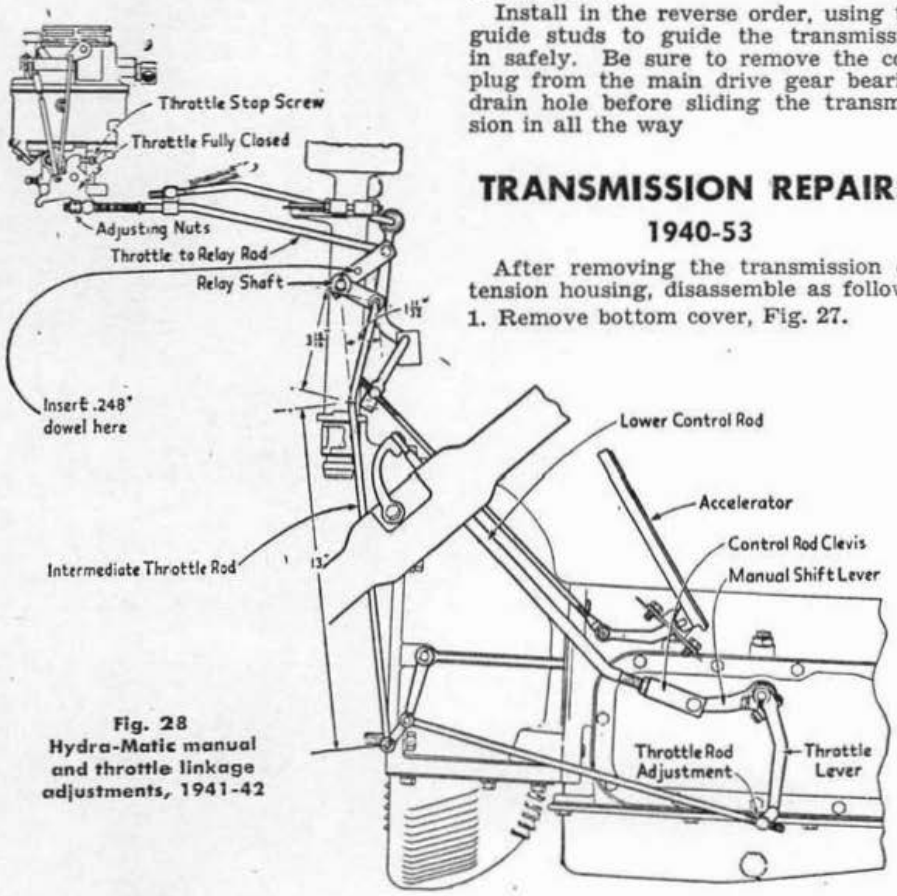


Fig. 28 Hydra-Matic manual and throttle linkage adjustments, 1941-42

TRANSMISSION REPAIRS

1940-53

After removing the transmission extension housing, disassemble as follows:
1. Remove bottom cover, Fig. 27.

2. Drive countershaft out rearward and lift out cluster gear.
3. Pry main drive gear out through the rear and remove gears.
4. Tap mainshaft out through the rear and remove gears.
5. Tap reverse idler shaft out rearward and lift out gear.
6. Remove shifting levers on outside of case and take shift shafts out from inside, being careful not to lose the interlock springs, balls and tubes.

Assemble in the reverse order.

HYDRA-MATIC DRIVE

1941-54—A step-by-step pictorial procedure for servicing the Hydra-Matic Drive is given in a special chapter elsewhere in this book. The following material covers external adjustments.

Manual Control Linkage, 1941-42

Fig. 28. To adjust the manual control lever:
1. Remove clevis pin from lower end of lower control rod.
2. Move hand control lever to reverse.
3. Move manual shift lever on transmission into reverse position.
4. Adjust length of control rod clevis so clevis pin slips in freely when shift lever is held all the way back.
5. Tighten lock nut against clevis, insert cotter pin in clevis pin, and check control lever in all positions for free operation.

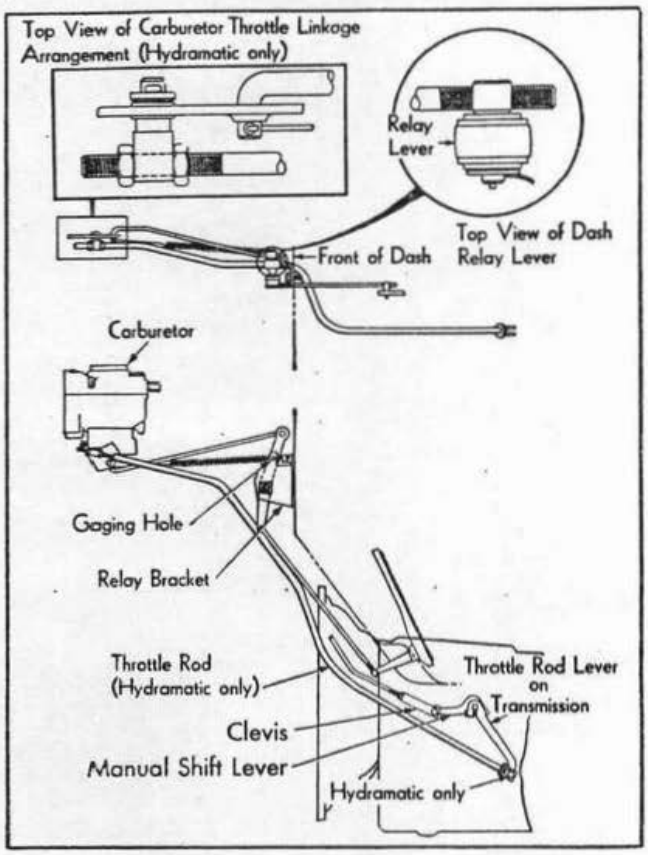


Fig. 30 1949-54 Hydra-Matic throttle linkage

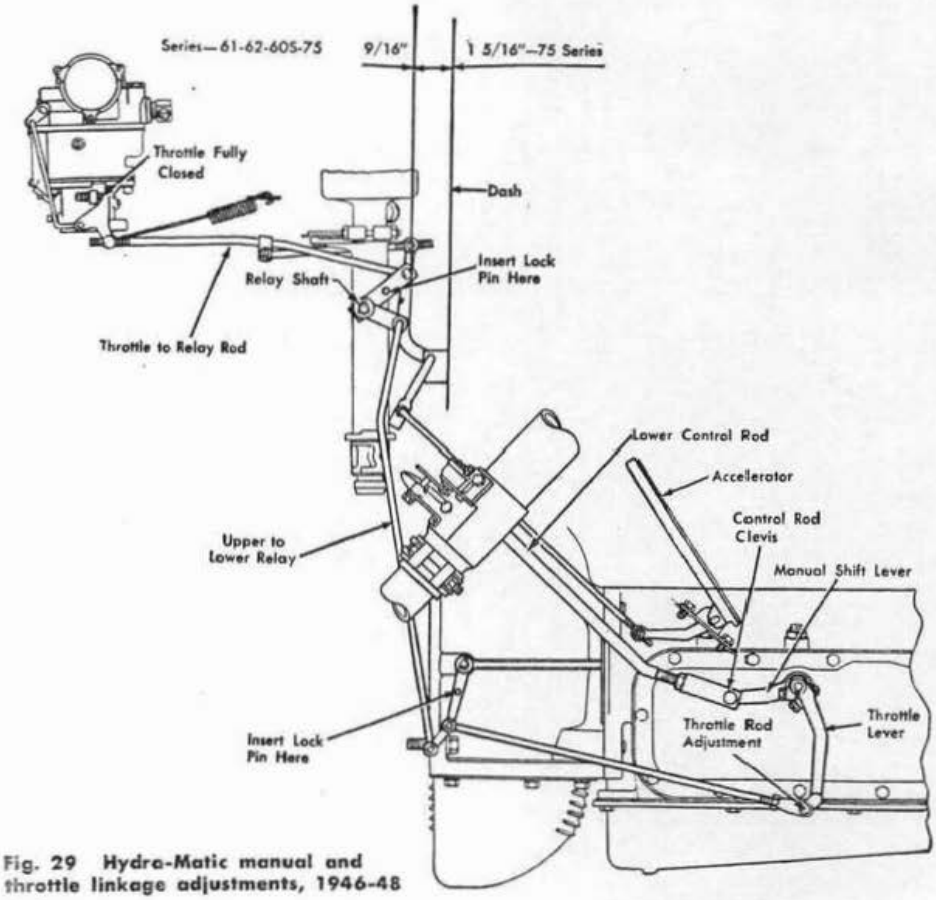


Fig. 29 Hydra-Matic manual and throttle linkage adjustments, 1946-48

1946-48

To adjust the manual control linkage, see Fig. 29.

1. Disconnect manual control rod from lever at transmission.
2. Move control lever at transmission to extreme forward and upward position.
3. Move hand lever at steering wheel against stop in neutral position.
4. Adjust clevis on lower end of control rod until clevis pin can be inserted freely through clevis and lever. Reconnect rod to lever.

1949-54

Fig. 30. Disconnect manual control rod from control lever at transmission. Move the control lever at the transmission to its normal drive position. The drive position can be found by moving the manual lever at the transmission fully forward and upward and then moving it rearward until the first detent is felt.

Move the selector lever on the steering column to the stop for the "DR" position on 1949-51 models. On 1952-54, move the lever to the "DR-4" (left hand arrow) position.

Adjust the clevis pin the lower end of the control rod until the clevis pin can be inserted freely through the clevis and manual control lever. Assemble clevis, pin and lever and install cotter pin.

Throttle Linkage, 1941-42

Before adjusting the throttle linkage,

make sure the idling speed is set correctly, then proceed as follows:
1. See that throttle is completely closed against slow idle step of fast idle cam.
2. Loosen throttle rod adjusting nut at carburetor.
3. Insert a .248 inch dowel pin in the relay arm, Fig. 28, to hold rods in correct position.
4. Tighten adjusting nuts at carburetor end of throttle-to-relay rod.
5. Adjust trunnion at throttle valve rod so that pin can be installed freely when throttle lever is against stop.
6. Remove dowel from relay arm.

If these adjustments are correctly made and transmission does not shift in proper ranges, the cause is probably a bent intermediate throttle rod. Check rod against dimensions shown in Fig. 28.

1946-48

To make throttle linkage adjustments, see Fig. 29 and proceed as follows:

To adjust the throttle rod, set the engine idle at 375 R.P.M. Disconnect the throttle rod trunnion at the carburetor by removing the forward end of the retracting spring. Install the gauge pin through the hole in the upper relay and into the hole in the distributor support. Adjust the trunnion so that it slides freely into the throttle lever with the throttle valve on slow idle. Install retracting spring.

To adjust the lower relay, leave the gauge pin in place and disconnect the clevis at the throttle lever at the transmission and the lower end of the vertical rod from the upper relay. Insert another gauge pin through the hole in the lower lever and into the hole in the bell housing. Adjust the vertical rod by bending fore and aft at the original bend, taking care to preserve the original alignment.

To adjust the throttle valve lever, remove the gauge pin from the lower lever. Do not remove the pin from the distributor relay. Hold the throttle lever at the transmission against its stop toward the rear of the car and pull the lower horizontal rod back to remove all play in the linkage. Adjust the clevis so that the pin freely enters the hole in the throttle lever. Then screw the clevis three complete turns forward on the rod and connect by installing the clevis pin and cotter pin.

To adjust the relay on the dash, leave the gauge pin at the distributor relay in position. Disconnect the trunnion on the horizontal rod to dash relay upper lever and turn the trunnion until it will slide freely into the relay upper lever when the center of the hole in the upper lever is $\frac{3}{16}$ inch from the face of the dash. On 75 models, the method for adjusting remains the same but the distance should be $1\frac{3}{16}$ inch from the center of the hole to the face of the dash.

To adjust the accelerator pedal rod, remove the gauge pin from the upper relay. Disconnect the accelerator pedal rod at the dash relay lower lever. With the throttle rod held wide open and accellerator pedal on the floorboard, turn the rod in the trunnion until the rod slips freely into the dash relay lower lever. Recheck this adjustment to be sure that the throttle lever is against

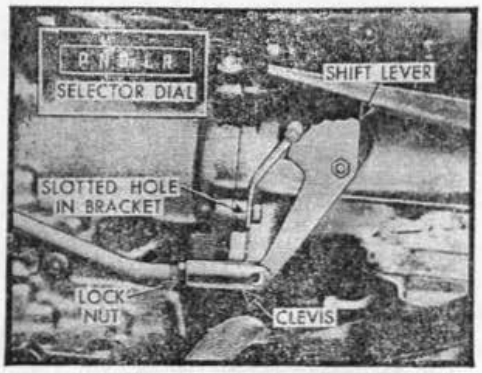


Fig. 31 Twin Turbine Dynaflow control linkage

its wide open stop when the tip of the accelerator pedal is on the floorboard.

1949-54

To adjust the throttle control linkage, Fig. 30, remove the transmission throttle lever clevis pin and check the lever position with Throttle Lever Checker Tool No. J-3065, by fitting the tool to the rear face of the transmission case and inserting the clevis pin through the lever and the hole in the tool while the lever is in its rearward position. If the throttle lever is misaligned, bring it into alignment by bending with Throttle Lever Bending Tool No. J-2029. Then adjust the throttle control as follows:
1. Assemble linkage to transmission throttle lever and install a new cotter.
2. Remove spring clip from carburetor-to-dash relay rod trunnion at relay and remove trunnion from dash relay lever.
3. Place ¼" drill shank through hole in dash relay lever and into dash relay bracket.
4. Set carburetor throttle in hot idle position.
5. Adjust carburetor-to-dash relay rod trunnion to allow it to enter freely into dash relay lever.
6. Install spring clip in trunnion.
7. Back off both jam nuts on throttle rod on carburetor to allow free movement of rod in trunnion.
8. Push on end of throttle rod to position transmission throttle valve against its stop.
9. Bring rear jam nut up against trunnion and back off two complete turns.
10. Tighten front jam nut, making certain linkage moves freely.
11. Remove ¼" drill shank from dash relay and check wide open throttle position of accelerator pedal. Pedal should just touch floor mat (allow ½" clearance if mat has been removed) when throttle is wide open.
12. Adjust accelerator pedal position at pedal end of dash relay-to-accelerator pedal rod.

Hydramatic, Replace, 1941-54

1. To remove the transmission, raise car approximately 12 in. off floor at all four wheels.
2. Disconnect propeller shaft at rear universal joint flange and remove shaft with front universal and yoke.
3. Disconnect battery and remove starter motor.
4. On 1952-54 models, remove slush deflector from lower flywheel housing.
5. Remove flywheel housing lower cover and drain transmission at oil pan and torus cover.
6. Place a jack under the engine at rear of oil pan, using a wood block to prevent damage to oil pan.
7. On 1952-54 models, remove transmission filler tube from transmission oil pan.
8. Place a transmission lift under car and raise transmission just enough to take strain off rear engine support.
9. Disconnect engine rear support at transmission extension housing. Remove bracket cross member that carries support.
10. Remove control rods from transmission. Remove levers from transmission to prevent damage from bending.
11. Disconnect speedometer cable.
12. Remove spark plugs.
13. Remove 30 bolts holding torus cover to flywheel and push cover toward rear of car to disengage dowels locating it on flywheel. *Cover should not be pried away from flywheel.*
14. Lower jack under engine oil pan until top of flywheel housing clears floor pan.
15. Remove four bolts holding flywheel housing to engine crankcase.
16. Remove transmission and flywheel housing as a unit by moving back toward rear of car and lower assembly to floor.
17. Reverse the foregoing sequence to install the transmission and check the adjustment of the control linkage.

DYNAFLOW

Used on some 1953 cars, this device is fully covered in the *Automatic Transmission Section of this manual.* The following outlines the procedure for adjusting the control linkage.

Manual Control Rod

1. To adjust, place the selector lever in the Park (P) position.
2. Disconnect manual rod at shift lever, Fig. 31.
3. Shift lever should be in Park position. Make sure parking pawl is completely engaged in the ratchet wheel. This can be done by rotating the propeller shaft by hand until a definite "click" can be heard as the pawl is engaged.
4. Loosen mounting screw on detent roller bracket and position bracket so that the roller is in the parking notch on the quadrant. From this position it should be possible to move the shift lever forward ⅛ to $\frac{3}{16}$ in. as measured at the clevis pin hole.
5. The hole in the manual rod trunnion should line up with the hole in the shift lever. If not, adjust the trunnion on the manual rod to secure the correct alignment. Then connect manual rod to shift lever.
6. Place selector lever in Reverse (R) and note position of roller on detent quadrant. Roller should be in the reverse notch of quadrant.

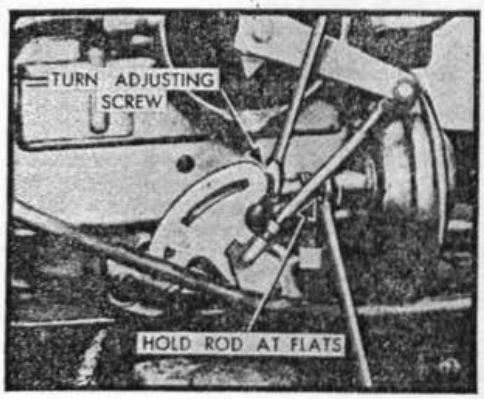


Fig. 32 Throttle control adjustment on Dynaflow equipped cars

Throttle Return Check

1. To adjust the throttle return check on cars with either Carter or Rochester carburetor, check the alignment of throttle return check adjusting screw with the contact on the secondary throttle lever. If necessary, bend the return check bracket to center the adjusting screw on the radius of the contact lever.
2. Place selector lever in Drive (Dr) or Low (L) range and apply hand and foot brakes to prevent car movement.
3. With throttle valves in hot idle position, adjust throttle return check by turning the adjusting screw, Fig. 32, until ⅛ in. clearance is obtained between the throttle lever and plunger when the plunger diaphragm is fully compressed. *To prevent diaphragm damage, hold flats on screw shaft with a wrench while adjusting screw is being turned.*
4. Open throttle halfway, then quickly release accelerator pedal. If engine does not stall, the adjustment is correct.

SHIFTER RODS, ADJUST

1940-53 — On cars with synchromesh transmission, see Fig. 33 and adjust the shifter connecting rods as follows:
1. Place control lever in neutral.
2. Lengthen or shorten adjustable end of low and reverse connecting rod until control rod can be fitted onto low and reverse shifter lever without interference.
3. Repeat the adjustment for high and second gears.

REAR AXLE

1940-54—To remove the differential carrier assembly, disconnect the rear universal joint and remove the axle shaft as described further on. Remove the cap screws holding the carrier to the axle housing and take out the carrier.

Note — Any service on the differential carrier should be made by replacement of the complete assembly. Cadillac does not recommend any disassembly or adjustments of this unit.

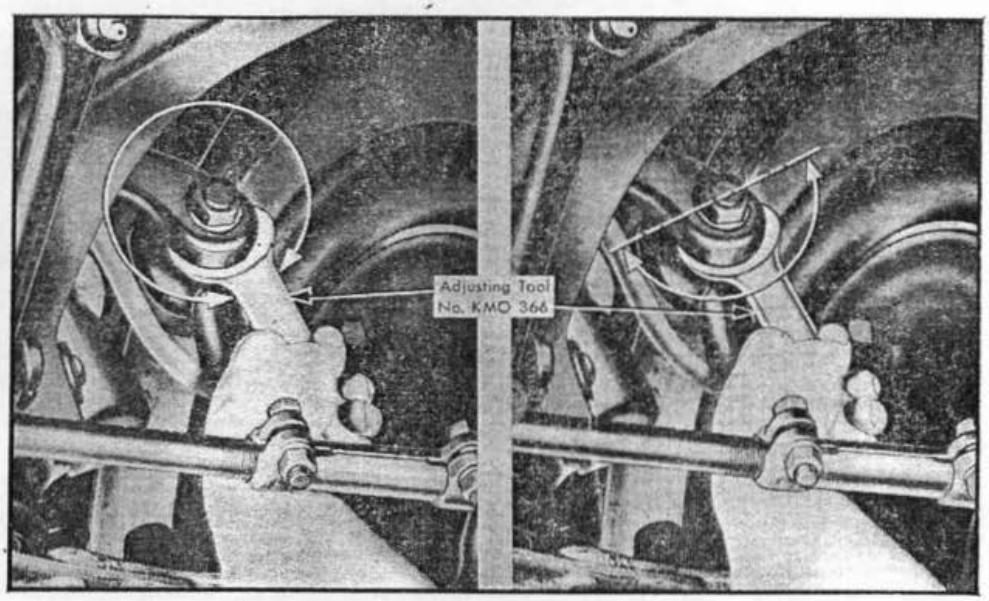


Fig. 34 Caster (left) and camber (right) adjustments, 1950-54. Procedure is the same on previous models except that an eccentric pin is used instead of an eccentric bushing

Note—In case of lubricant seepage between the differential carrier and the axle housing, first make sure that the cap screws are tightened to the recommended tension of from 30 to 35 pounds feet. If this does not stop the leakage, install an extra gasket, using a good sealing compound. The additional cushioning effect of the extra gasket will prevent further seepage.

AXLE SHAFTS

1940-54—To remove an axle shaft, dismount the wheel. Use a puller to remove the hub and brake drum from the axle shaft. Disconnect the hydraulic brake line and remove the brake backing plate. The axle shaft is held in place in the housing by the backing plate which bears against the outer race of the wheel bearing. Use a puller to remove the axle shaft and bearing.

Note—The axle shaft oil seals are located at the outer ends of the axle tubes and may be replaced after the axle shaft and bearing are removed. However, before installing a seal, wipe the counterbore in which the seal is pressed and carefully remove any nicks or burrs. That portion of the shaft against which the seal bears should also be polished to remove any minute nicks or burrs. Never install an oil seal unless it has been thoroughly soaked in oil until its leather is soft and pliable.

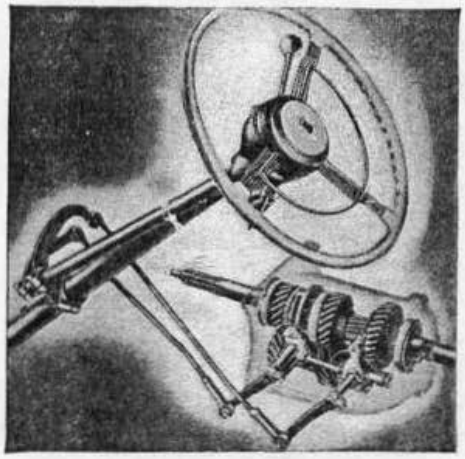


Fig. 33 Gearshift, 1940-53 cars with synchromesh transmission

CASTER, ADJUST

1940 Series 75, 90

Loosen the clamp screw at the upper end of the steering knuckle support and remove the lubrication fitting from the front bushing at the upper suspension arm. Insert an Allen wrench through the hole from which the fitting was removed and adjust the caster by turning the threaded pin until the desired caster setting is secured.

Turning the threaded pins in a clockwise direction increases caster and counter-clockwise decreases it.

1940-49 Except 40-75, 90

Loosen the clamp screw at the upper end of the steering knuckle support. Remove the lubrication fitting from the front bushing at the upper control arm. Insert an Allen wrench in the hole from which the fitting was removed and adjust the caster by turning the threaded pin until the desired caster is obtained.

Note—It is important to turn the pins in complete turns only so as not to change the camber setting. Turn the pins clockwise to increase caster, and vice versa.

1950-54

Loosen the clamp screw at the upper end of the steering knuckle support. Turn the eccentric bushing in complete

turns only until correct caster angle is obtained, Fig. 34.

If it is necessary to secure a greater range of adjustment than is provided by the eccentric bushing, this can be made by removing the lower control arm inner shaft from the frame and turning the shaft so that the threaded ends move the entire suspension arm assembly forward or rearward as required. Screwing the shaft rearward moves the control arms forward and increases the amount of positive caster.

Tighten the clamp screw on the steering knuckle support.

CAMBER, ADJUST

1940 Series 75, 90

Remove the retaining nut and spacers from the steering knuckle support yoke at the lower suspension arm. Remove this yoke and reinstall with spacers rearranged so as to secure the correct camber.

Normally, there is one spacer between the yoke and the suspension arm, and one between the suspension arm and the retaining nut. To decrease the camber, place both spacers between the yoke and the suspension arm. To increase camber, place both spacers between the suspension arm and the retaining nut.

1941-49 Except 40-75, 90

Loosen the clamp screw at the upper end of the steering knuckle support and remove the lubrication fitting from the front bushing at the upper support yoke. Insert an Allen wrench through the hole from which the fitting was removed and adjust the camber by turning the threaded pin until the desired adjustment is secured. Make adjustments on each side as nearly equal as possible.

Note—Since the camber adjustment is controlled by the eccentric action of the threaded pin, ½ turn in either direction gives the maximum adjustment.

1950-54

Loosen the clamp screw at the upper end of the steering knuckle support. Rotate the eccentric bushing, Fig. 34, to give the correct camber setting at each front wheel.

Do not rotate the bushing more than ½ turn as this will give maximum camber adjustment at the eccentric bushing and any additional turning will affect the caster adjustment.

If correct camber adjustment cannot be obtained, the angle of the steering knuckle pin should be checked. An incorrect angle indicates damaged control arms or a bent steering knuckle support.

After adjustment has been made, tighten the clamp screw and recheck.

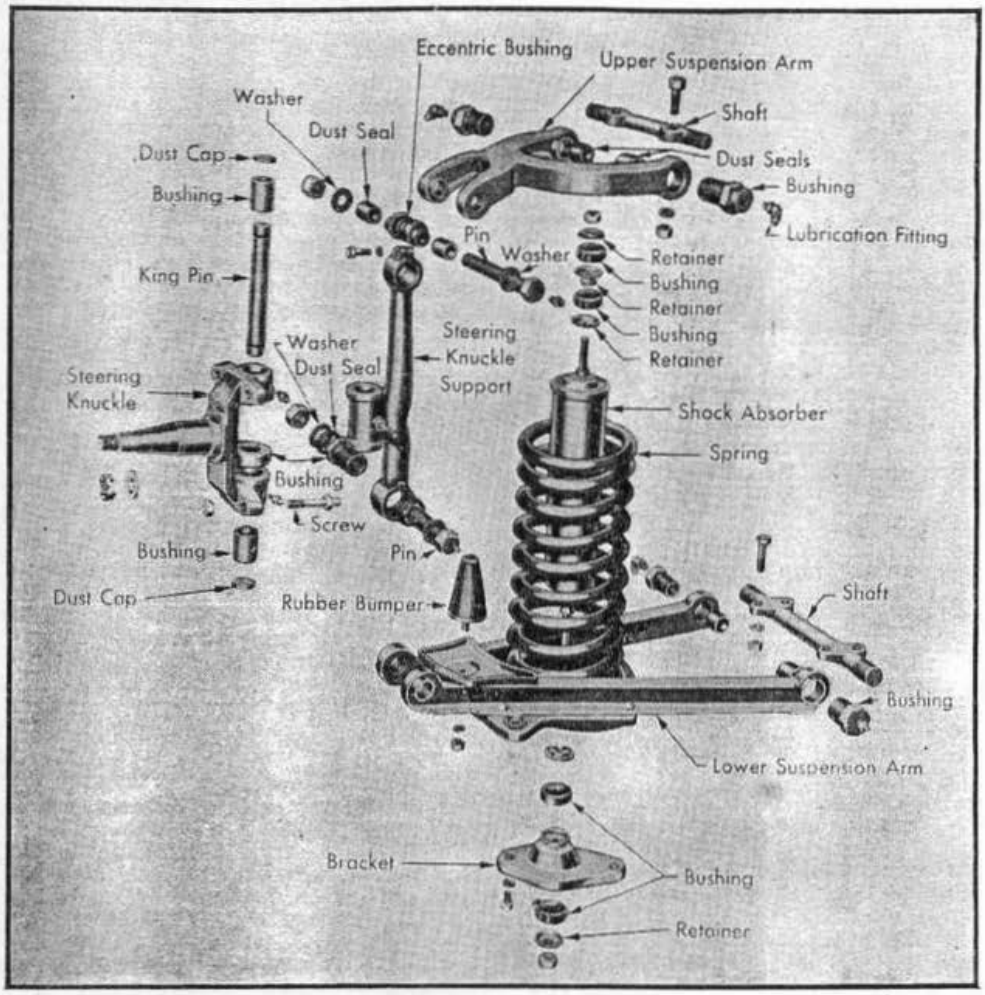


Fig. 36 Front suspension, 1950-54

TOE-IN, ADJUST

1940-54

As shown in Fig. 35, a cross drag link and an idler lever are used. With the idler lever parallel to the fore and aft centerline of the car, adjust both tie rods an equal amount.

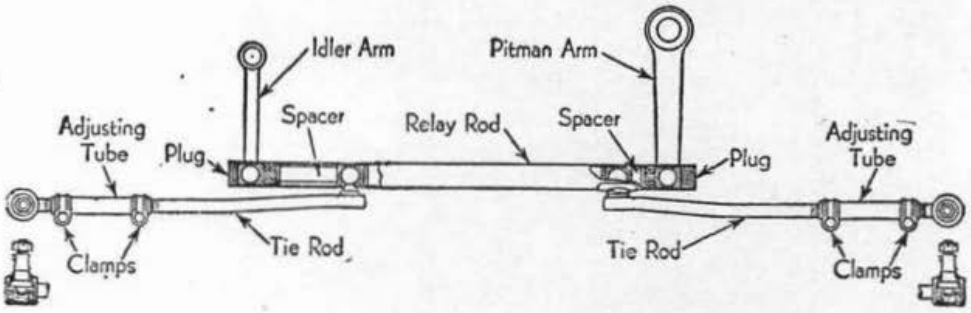


Fig. 35 Steering linkage on 1940 series 50, 52, 62, 72; all 1941-54

FRONT END, 1950-54

Wheel Bearings

In adjusting the front wheel bearings, first make sure that the wheel is all the way on the spindle. Tighten the adjusting nut to 16 lbs. ft. torque to be sure all parts are properly seated and threads are free. Then back off nut and retighten to approximately 4 lbs. ft. torque. If the cotter pin cannot be installed in this position, loosen the adjusting nut until it can be installed.

When adjusting front wheel bearings, care should be taken not to mistake play in the kingpin bushings for play in the wheel bearings.

Steering Knuckle, Remove

1. Lift front end of car from floor with jack.
2. Remove front wheel, hub, brake drum and wheel bearings.
3. Remove brake dust shield with brake shoes attached. Do not damage the hydraulic line which does not have to be removed in this operation.
4. Drive lock pin from steering knuckle support, Fig. 36.
5. Remove dust caps at upper and lower knuckle pin holes, and remove steering knuckle and thrust bearing from knuckle support.

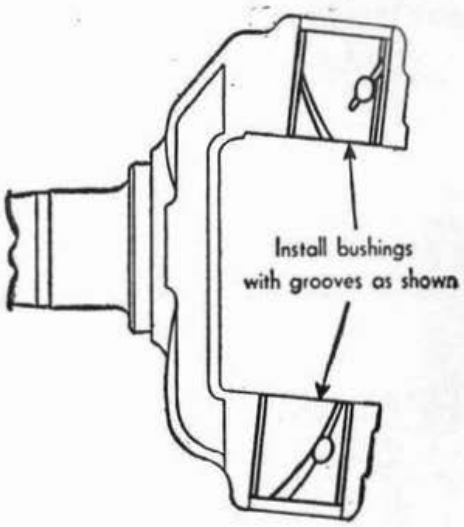


Fig. 37 Kingpin bushing installation, 1940-54

Kingpins, Install

1. If these bushings are to be replaced, slot them lengthwise with a hacksaw and drive them out with a chisel.
2. Press new bushings into steering knuckle, being sure that the oil hole in each bushing lines up with the oil hole in the knuckle, Fig. 37. Reaming of bushings is not necessary provided care is used when making the installation.

Steering Knuckle, Install

1. Assemble steering knuckle to support with thrust bearing in position between support and lower face of steering knuckle.
2. Drive lock pin in from front of support.
3. Use new plugs at both ends of kingpin.
4. Install grease fittings and lubricate thoroughly.
5. Install brake assembly, lubricate and adjust front wheel bearings after installing wheel.

Knuckle Support, Remove

1. Remove steering knuckle as outlined previously.
2. Place jack under lower control arm to support coil spring while disconnecting knuckle support.
3. Remove nut from rear end of upper pivot pin.
4. Remove threaded pivot pin and rubber dust seals.
5. Remove nut from rear of lower pivot pin.
6. Remove lower pivot pin and rubber dust reals.
7. Place support in vise and loosen clamp screw at upper end of knuckle support.
8. Remove upper and lower bushings from support.

Knuckle Support, Install

1. Install eccentric bushing in knuckle support so that it is centralized and install clamp screw lightly.
2. Install bushing in lower end of knuckle support, tightening bushing firmly so that there is no clearance between bushing shoulder and knuckle support.
3. Install lower end of knuckle support, with bushing, between outer ends of lower control arm. Install rubber dust seals between control arm and support on both sides.
4. Install threaded pivot pin, holding support so that space between support and arms is equal on both sides.
5. Install upper end of support in position between ends of upper control arms and install rubber seals.
6. Install upper pivot pin and nut with upper end of support centralized between ends of upper control arms.
7. Install steering knuckle and adjust caster, camber and toe-in.

Upper Arm, Remove

1. Jack up car at front frame cross member and also place a jack under the lower control arm on the side that is being serviced.
2. Remove upper steering knuckle support pivot pin and nut.
3. Remove bolts attaching upper control arm inner shaft to frame.
4. Remove arm and shaft as a unit.
5. Place mounting shaft in vise and remove bushings from arm and shaft and remove shaft from control arm.

Upper Arm, Install

1. Install new seals on inner shaft and lubricate threads of shaft.
2. Install shaft in position in control arm and install bushing into arm and onto one end of shaft.
3. Tighten bushing to 140-150 lbs. ft. torque.
4. Install upper control arm spreader, Fig. 38, and tighten finger tight. Then, using a wrench, tighten tool two additional flats.
5. Install bushing in arm and onto shaft, tightening to 140-150 lbs. ft. torque.
6. Remove tool from arms and center shaft between arms by turning shaft in bushings.

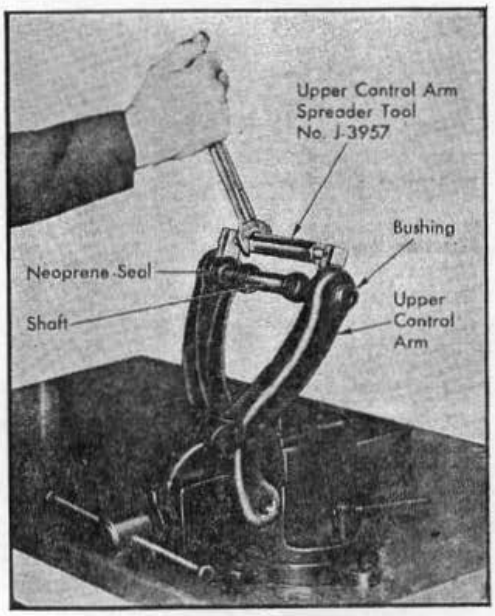


Fig. 38 Spreading upper control arm, 1950-54

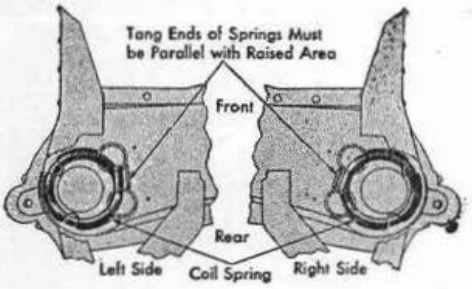


Fig. 39 Front spring location in upper seat, 1950-54

7. Install grease fittings in bushings.
8. Install control arm on frame member and install and tighten mounting bolts to 150-160 lbs. ft. torque.
9. Position knuckle support in fork of upper control arm and install rubber seals on both sides of support.
10. Install upper pivot pin while holding knuckle support so that space between arm and support is equal on both sides.
11. Tighten pivot pin nut to 70-90 lbs. ft. torque.
12. Remove jacks and check caster and camber.

Lower Arm & Spring, Remove

1. Jack up car at center of front cross member and also place a jack under the lower control arm to be removed, to support spring.
2. Disconnect front stabilizer link from side being serviced.
3. Remove shock absorber as outlined further on.
4. Remove lower pivot pin and nut from steering knuckle support.
5. Lower jack under control arm to remove spring.
6. Unfasten lower control arm shaft from frame and remove assembly.
7. Place assembly on bench and remove threaded bushings and rubber seals and remove shaft from control arm.

Lower Arm & Spring, Install

1. Assemble mounting shaft to lower control arm, centralizing it in arms and install rubber seals and threaded bushings. Tighten bushings to 195-205 lbs. ft. torque.
2. Bolt mounting shaft to frame, tightening bolts to 60-70 lbs. ft. torque.
3. Install spring with tang end in cross member upper seat, Fig. 39.
4. Place jack under lower control arm, guiding bottom of spring into lower spring seat as control arm is raised by jack. It may be necessary to drive or pry bottom of spring into seat after it has been compressed about 2 in. due to the fact that the bottom of the spring will not set in its seat when fully distended.
5. Raise jack under lower control arm until outer end of arm can be attached to knuckle support.
6. Install rubber seats between support and arms and install pivot pin and nut while holding support midway between outer arms.
7. Connect stabilizer link to lower spring seat.

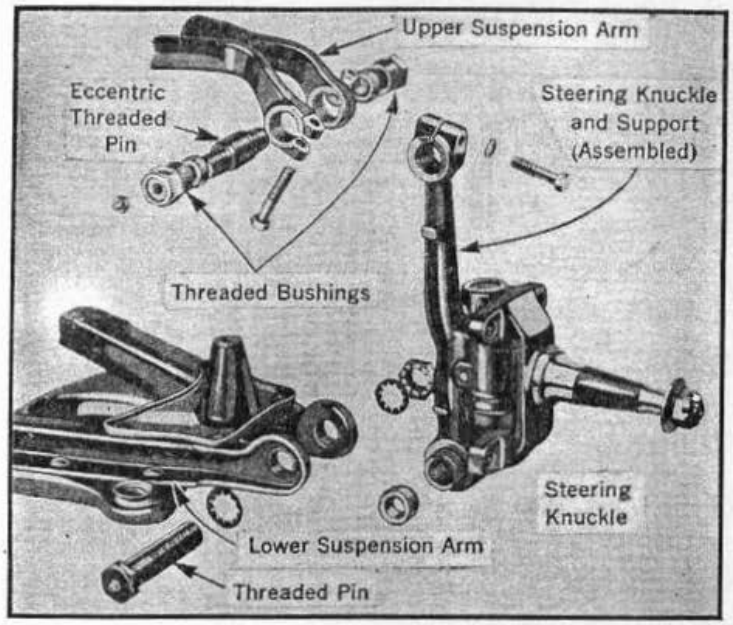


Fig. 40 Steering knuckle assembly which is typical of all 1940-49 models not equipped with removable knuckle support yokes

8. Remove jacks and check caster, camber and toe-in.

Shock Absorber

1. Raise hood and remove shock absorber upper retaining nut, retainer and rubber grommet. The shock absorber upper stem is square at the top so that it may be held by a wrench to prevent stem from turning when removing nut.
2. Remove two nuts holding lower shock absorber retaining bracket to spring seat.
3. Remove shock absorber and lower bracket from spring.
4. Remove lower bracket, rubber grommets and retainers from shock absorber stem.
5. Reverse the above procedure to install the shock absorber.

FRONT END, 1940-49

Front Wheel Bearing Adjustment—Follow procedure outlined previously for 1950-54 models.

Steering Knuckle, Remove—Fig. 40.

1. Lift front end of car from floor with jack or hoist.
2. Remove front wheel, hub and brake drum, and wheel bearings.
3. Disconnect tie rod at steering knuckle arm pivot ball joint.
4. Remove brake dust shield and steering knuckle arm.
5. Drive lock pin from steering knuckle support.
6. Remove dust caps at upper and lower kingpin holes, tap out kingpin, and disassemble steering knuckle from knuckle support.

Kingpin Bushings, Install—Follow procedure outlined previously for 1950-54.

Steering Knuckle, Install — Reverse removal procedure to install the knuckle, lubricate thoroughly and adjust caster, camber and toe-in.

Knuckle Support, Remove—Fig. 40.

1. Remove steering knuckle.
2. Place jack under lower control arm to support coil spring while disconnecting knuckle support.
3. Disconnect front stabilizer on side being serviced.
4. Loosen clamp screw at upper end of knuckle support.
5. Loosen clamp screw in upper control arm at threaded pin.
6. Remove threaded bushing at rear end of eccentric (upper) threaded pin.
7. Remove threaded bushing at front of eccentric pin.
8. Insert an Allen wrench in the front end of the eccentric pin and turn pin out of knuckle support.
9. Swing support outward at top. The front spring can be removed at this point by lowering the jack under the lower control arm.
10. Take off nut and remove threaded pin at lower control arm, which will release steering knuckle support.

Knuckle Support, Install—Fig. 40.

1. Centralize lower end of knuckle between the lower control arms, line up the holes and screw the threaded pin with washer in from the front.
2. Install washer and nut on rear end of pin.
3. Install car spring (if removed).
4. Hold knuckle support so that hole in upper end is in line with holes in upper control arms.
5. Insert eccentric pin into knuckle support, making certain that the hole for the hexagon wrench is toward the front. See that the eccentric on the pin is centralized between both surfaces of knuckle support.
6. Install rubber seals on each end of eccentric pin.
7. Start rear bushing (threaded on outside) on threads of pin and in threads of upper control arms and tighten to 145 to 155 lbs. ft. torque with the shoulder against seat.
8. Start front bushing (threaded on inside) on threads of pin. Then tighten, leaving approximately $\frac{1}{32}$ in. between shoulder and seat. This distance may need to be slightly changed to allow free fit of threads between bushing and eccentric pin.
9. Assemble steering knuckle, front brake mechanism, and front wheel.
10. Connect front stabilizer and check and adjust caster and camber.

Lower Control Arm & Spring — Follow the procedure outlined for 1950-54 models for removing and installing a lower control arm and front spring. However, disregard the item referring to front shock absorber.

Front Shock Absorber — A front shock absorber can be removed by removing the knuckle support upper pivot pin as outlined previously, and the shock absorber attaching bolts.

When the shock absorber is installed by reversing the removal procedure, caster and camber must be checked and adjusted.

STEERING WHEEL & HORN BUTTON

1940-41—To remove the wheel, press the horn button down and turn it in either direction until catch is released, and remove the cap. Remove the gasket, contact and cushion, horn button spring and steering wheel hub nut, after which, take off the wheel.

To install, slip the steering wheel over the end of the steering column shaft so that the middle spoke is vertical and directly opposite the notch in the end of the steering column shaft on standard wheels, or that the two spokes are exactly horizontal on "Special" wheels. Tighten the wheel hub nut down, using a wrench with an 18-inch handle. Place the small end of the horn button spring over the horn terminal and install the contact. Place the sponge rubber ring around the edges of the wheel hub and press the horn cap down in place, turning it in either direction until the lugs slip under the hub clips.

1942-51—To remove the wheel, depress the horn button and turn it counterclockwise until the catch is released and remove the button. Remove the horn button retainer ring and spring, and the steering wheel hub nut. On the "Special" wheel, remove the horn ring, take out three screws holding the retainer and rubber gasket to the horn ring and remove them. Use a suitable puller to remove the wheel.

To install, slip the wheel over the shaft so that the center spoke points directly toward the driver. On the "Special" wheel, install the retainer and gasket in the horn ring, and replace the ring. Screw on the wheel hub nut and replace the horn button retainer ring and spring, after which, install the horn button making sure the emblem is in proper position.

1952-54—To remove the steering wheel and horn button, disconnect the wire from the terminal at the lower end of the steering column on *mechanical steering gears* and from the upper steering cover underneath the instrument panel on the *power steering gear.*

Depress the horn button, turn counter-

clockwise until locking ears are released and remove button. Remove the horn button spring and steering wheel hub nut. Take out the horn ring retainer, cushion and horn ring.

Make a mark on the steering wheel hub and steering shaft so that the wheel may be reinstalled in the correct position on the splines. Then use a suitable puller to remove the wheel.

Install the wheel and horn contact parts in the reverse order of removal, being sure to stake the wheel hub nut to the steering shaft after tightening it to 45-50 lbs. ft. torque.

STEERING GEAR, REPLACE

1940-41

1. To remove the gear, take off the wheel and horn contact parts as outlined above.
2. Remove gearshift mechanism from steering column.
3. Loosen clamp screw on steering column-to-instrument panel bracket.
4. Remove horn wire from terminal on steering column.
5. Remove shifting tube support bracket from lower end of steering tube.
6. Disconnect steering connecting rod at pitman arm.
7. Loosen three bolts holding steering gear to frame.
8. Remove steering gear and column by sliding down toward bottom of car.
9. To install, reverse the above procedure. When tightening the shifting mechanism to the steering column, it is important to see that it is aligned correctly so that it will shift properly.

1942-53

1. To remove the steering gear, raise front of car 6 in. off floor.
2. Remove steering wheel and horn contact parts as outlined previously.
3. Remove anti-rattle spring under steering wheel.
4. Remove horn wire from terminal at lower end of steering column.
5. Loosen clamp holding lower steering jacket to upper steering jacket.
6. Tap clamp down over lower jacket.
7. Disconnect steering connecting rod from pitman arm.
8. Remove three bolts holding steering gear to frame side bar.
9. Strike steering gear housing firmly with a *lead* hammer to drive the lower steering jacket down out of the upper jacket.
10. Remove steering gear, lower jacket and steering column from bottom of car.
11. Reverse the removal procedure to install the steering gear.

POWER STEERING, REPLACE

1952-54

1. To remove the power steering unit, raise front end of car 10 in. off floor and place jack stands near outer ends of lower suspension arms.
2. Remove steering wheel and horn contact parts as outlined previously.
3. Remove steering column upper and lower covers and steering column support bracket screws from instrument panel.
4. Remove three screws from steering column cover on toe board.
5. Remove heater blower motor from heater and flexible air intake hose.
6. Disconnect hydraulic steering pump-to-power unit hoses at power unit.
7. Loosen steering column lower jacket clamp.
8. Disconnect steering connecting rod at pitman arm and remove left exhaust pipe at manifold.
9. Remove three bolts holding steering gear to frame. *Remove any shims found at mounting bolts, keeping them intact for reinstallation.*
10. Carefully slide steering gear down out of upper jacket and remove complete assembly from car.
11. Reverse the foregoing procedure to install the gear. Measure gap between bottom edge of horn ring and upper edge of turn signal switch carrier. This should be $\frac{3}{16}$ in. with the horn ring in released position. Slide steering jacket up or down as required to obtain this clearance.

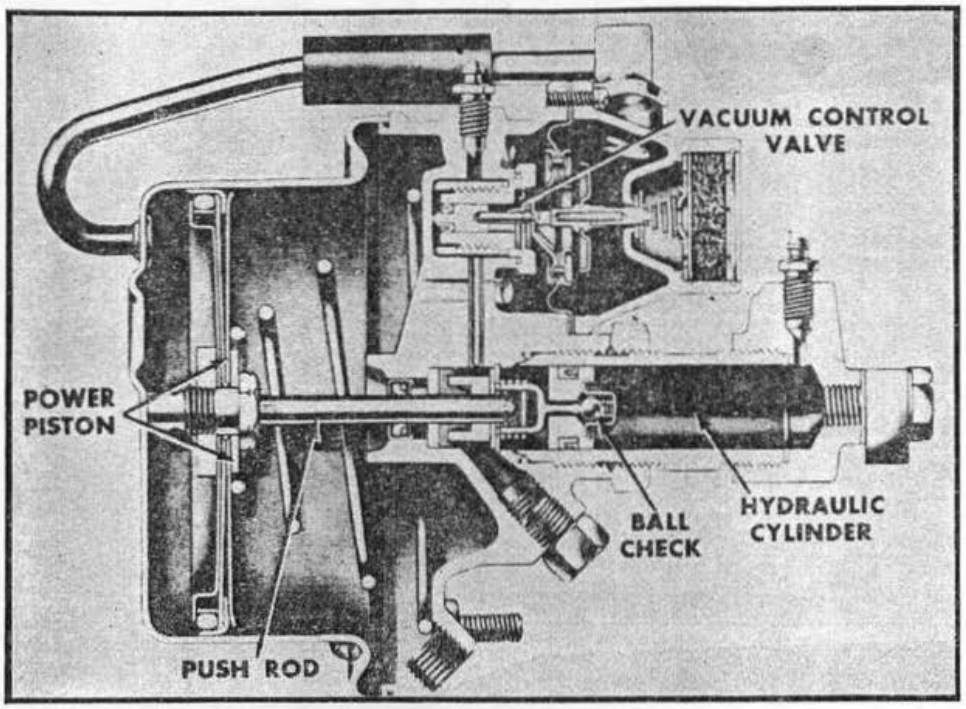


Fig. 41 Bendix Hydrovac power brake. 1954

BRAKE MASTER CYLINDER, REPLACE

1940-51

1. Disconnect front and rear brake lines at master cylinder.
2. Depress brake pedal a few times to force all fluid from master cylinder.
3. Remove stoplight switch.
4. Disconnect pedal operating rod at clevis on brake pedal. Disconnecting the rod at this point retains approximate adjustment.
5. Remove two bolts holding cylinder to frame bracket and remove unit from car.
6. Install in the reverse order. Then fill the reservoir with approved brake fluid and bleed the system.

1952-54

1. To remove the cylinder, remove splash shield from flywheel housing.
2. Disconnect brake line at front of master cylinder. And on 1954 models, loosen remote filler reservoir pipe fitting in master cylinder cover.
3. Depress brake pedal a few times to force all fluid from cylinder.
4. Disconnect pedal operating rod at clevis on brake pedal. Disconnecting at this point retains approximate adjustment.
5. Unfasten master cylinder from frame bracket and lift unit off car.
6. Install in the reverse order. Then fill reservoir with approved brake fluid and bleed system.

BENDIX HYDROVAC

Power Brake, 1954

This unit, Fig. 41, consists of three basic units which have been so combined that they function as a single unit, all of which are controlled by hydraulic pressure developed within the hydraulic master cylinder of the vehicle brake system.

The three basic units are:

1. A hydraulically-actuated vacuum control valve which controls the degree of brake application or release. The control valve consists of a hydraulic-actuated piston, a diaphragm, and a vacuum and atmospheric poppet.
2. A vacuum power cylinder which contains a single piston and a push rod that connects the vacuum piston to

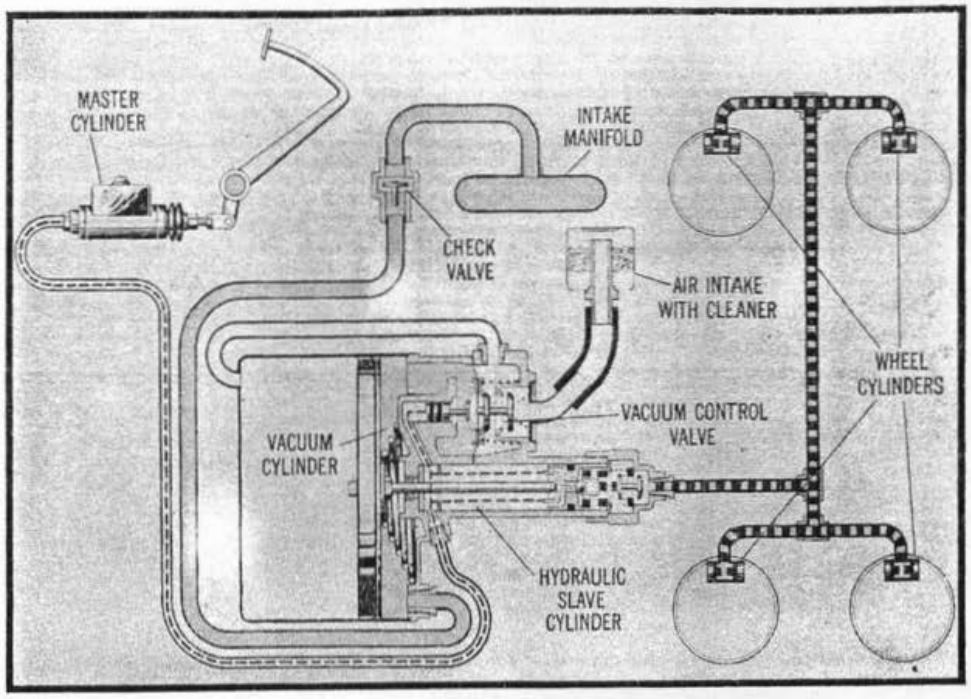


Fig. 42 Schematic drawing of the Hydrovac

the hydraulic piston of the hydraulic (or slave) cylinder.

3. A hydraulic slave cylinder which contains a piston with a check valve.

Operation

Fig. 42 shows a schematic drawing of the Hydrovac. As the brake pedal is depressed, the hydraulic pressure developed within the master cylinder is transmitted to the hydraulic piston of the control valve and to the hydraulic slave cylinder. With pressure applied to the control valve piston, the vacuum valve closes and the atmospheric valve opens to admit air to the control side of the vacuum power cylinder. As air is admitted, the forces acting upon the vacuum power cylinder piston are transmitted directly to the hydraulic piston through the push rod. As the hydraulic piston starts to move, the piston check valve closes, trapping fluid under pressure ahead of the piston.

The total hydraulic pressure created and transmitted to the wheel cylinders is the sum of the pressure developed as a result of the vacuum power cylinder push rod thrust and the pressure received by the Hydrovac from the master cylinder.

As the brake pedal is released, the pressure within the control valve hydraulic piston chamber is reduced, allowing the atmospheric poppet to close and reopen the vacuum poppet. The vacuum power cylinder piston is again balanced in vacuum and returns to release position. When the hydraulic piston nears the release end of its stroke, its check valve reopens, thus permitting the full release of the brakes.

Maintenance

If trouble develops in the system it is recommended that before actually checking within the Hydrovac unit itself, the following points be checked which contribute to proper operation.

Master Cylinder Primary Cup-to-Compensating Port Clearance—Make certain the linkage is properly adjusted to permit opening of the compensating port with the brake pedal in normal full released position. Failure to properly uncover the compensating port may cause sufficient pressure to be maintained in the brake system to hold the Hydrovac valve in a partially applied position and thus cause dragging brakes.

Restricted Vacuum Lines—Check for vacuum at the Hydrovac by disconnecting the vacuum line at the Hydrovac vacuum connection fitting and holding a thumb over the line, with the engine running. If no vacuum exists, or if air flow is slow, check vacuum line to manifold for kinks in tubing and collapsed liners in hoses. Also test the check valve to be sure it opens.

Restricted Air Line—Disconnect the air line at the Hydrovac and blow into the line. If the line is restricted, check for collapsed hose or tubing. Clean or replace air cleaner.

Brakes—Check brake shoe adjustment for proper clearances. Excessive shoe clearance will cause loss of pedal reserve travel. Insufficient shoe clearance may cause dragging brakes.

NOTE—If, after checking the above items, the Hydrovac still does not operate satisfactorily, the following checks and corrections can be made by removing the unit from the vehicle and checking as outlined below for the complaints as listed.

Brakes Won't Release or They Drag

This complaint may not be noticeable until after two or more brake applications.

Sticking Control Valve Piston—Check movement of the control valve piston in the fitting bore. Piston must move freely without bind. Stickiness may cause the piston to fail to return to the released position.

To correct, clean the piston and bore thoroughly. If the piston cup is swollen, replace it and determine the cause of the swelling. Flush the complete brake system with clean brake fluid, if necessary, to remove all foreign substance.

Bent or Broken Vacuum Push Rod—A bent push rod prevents the vacuum cylinder piston from returning to full released position. This also prevents proper opening of the hydraulic cylinder check valve, causing pressure to be maintained in the brake system. A broken push rod will cause complete failure of the Hydrovac to operate properly, and in addition to dragging brakes, may cause brake fluid leakage past the hydraulic cylinder stationary cup.

Repair the unit by replacing all damaged parts. Careful inspection for damage should be made of the push rod seal, push rod cup, and push rod washer.

Brake Pedal Kickback

Defective or Damaged Hydraulic Cylinder Piston Cup—This can be checked *only* by removing the cylinder for inspection of the cup. A defective or damaged cup will permit leakage of brake fluid from the high pressure to the low pressure side of the piston. The increase in pressure on the low pressure side of the piston will cause a return movement or kickback on the brake pedal.

Improperly Seated Hydraulic Cylinder Ball Check Valve—This may be due to a defective seat on the piston, or to dirt, chips or other foreign matter on the seat. It can be checked *only* by removing the hydraulic cylinder for inspection of the ball and seat. A leak past the ball check valve will cause the same effect as a defective or damaged cylinder piston cup.

Replace the piston assembly and remove all foreign matter from the ball and seat before assembly. Make sure all parts are cleaned thoroughly with clean brake fluid before assembly.

Loss of Fluid From Brake System

The Hydrovac must be disassembled for checking any of the following causes of this complaint.

Defective or Damaged Push Rod Seals—A defective or damaged rubber seal will permit leakage of fluid from the hydraulic cylinder into the vacuum cylinder, in front of the piston. From this chamber it will be drawn into the engine intake manifold through the vacuum line.

Defective or Damaged Vacuum Control Valve Piston Cup—A defective or damaged piston cup will also permit loss of fluid from the hydraulic system into the vacuum cylinder through the opening between the vacuum chamber in the control valve and the constant vacuum side of the piston in the vacuum cylinder.

In inspecting this cup be sure to check

for a crack or split in the lip in the center of the cup, as well as for chips or other foreign matter under this lip.

Dirt or Foreign Matter Under Push Rod Rubber Seal or Valve Piston Cup—Any foreign matter under the lips of either of these parts will have the same effect as damaged cups, in permitting fluid leakage into the vacuum cylinder portion of the Hydrovac.

Power Brake Unit, Replace

1. Disconnect brake lines at power cylinder end plate.
2. Loosen vacuum line hose clamp at check valve and slide hose off check valve.
3. Remove three nuts and washers from cylinder mounting bracket and remove power cylinder from car.
4. Install in reverse order and bleed system as outlined below.

Bleeding the System

1. Fill the master cylinder remote filler reservoir with approved brake fluid. Keep reservoir at least partially filled at all times during bleeding operation.
2. Remove screw from end of bleeder valve in the power cylinder end cap and install a bleeder hose, allowing it to hang in a clean container partially filled with new brake fluid.
3. Back off the fitting ¾ turn and depress the brake pedal until air bubbles cease. Next, bleed the upper fitting on the end plate above the vacuum control valve housing and then proceed to bleed the wheel cylinders.