www.TeamBuick.com

SECTION 2-B

ENGINE DESCRIPTION

CONTENTS OF SECTION 2-B

Paragraph	Subject	Page
2-4	Engines and Mountings	2-8
2-5	Engine Construction	2-9
2-6	Engine Lubrication System	2-15
2-7	Crankcase Ventilation System	2-17
2-8	Engine Cooling System	2-17

SERVICE BULLETIN REFERENCE

Bulletin No.	Page No.	SUBJECT

2-4 ENGINES AND MOUNTINGS

a. Engines in Each Series

The engine used in Series 40 and 50 is of the same design as the larger engine used in Series 70. Both are valve-in-head 8-cylinder in-line engines, differing from each other principally in bore and stroke, compression ratio and horse power.

Series 40 and 50 engines are identical except for differences in compression ratio and horse power. The compression ratio of the *Series 40* engine is obtained by using a Steelbestos cylinder head gasket .050" thick. The compression ratio of the *Series 50* engine used with Syncro-Mesh transmissions is obtained by using a sheet steel head gasket .015" thick. The higher compression ratio of the *1949 Series 50* engine used with Dynaflow Drive is obtained by milling off the proper amount of metal from the gasket surface of cylinder head.

The *Series 70* engine used with Dynaflow Drive is identical with the *Series 70* engine used with Syncro-Mesh transmissions except in compression ratio, horsepower, crankshaft and flywheel. The higher compression ratio in the Dynaflow engine is obtained by milling off the proper amount of metal from the top surface of the cylinder crankcase. The crankshafts of these two engines are different at the mounting flange for the flywheel. The Dynaflow engine uses a very flexible stamped steel flywheel, whereas the Syncro-Mesh engine uses a conventional cast iron flywheel.

The bore, stroke, piston displacement, compression ratio and horsepower of all engines are given under Engines General Specifications, paragraph 2-2.

b. Engine and Transmission Mountings

The engine and transmission assemblies are supported at three points on "Controlled Frequency" mountings. See figure 2-3. Special synthetic rubber pads having the required friction characteristics are used to provide controlled damping properties.

The front engine mounting pads are located on opposite sides of the engine near the center, fore and aft, and approximately midway between top and bottom of the cylinder crankcase. The mounting pads are fastened between engine mounting brackets extending upward from the car frame and brackets extending outward from the crankcase. The front mountings are designed to support the weight of the engine and control its torsional characteristics.

The rear (transmission) mounting is composed of two parts; a mounting pad to support a portion of the weight of engine and transmission assembly, and a thrust pad to take the drive thrust from the rear wheels. The mounting pad is located between the transmission rear bearing retainer and the transmission support on car frame. The thrust pad is located between the rear edge of transmission support and a thrust plate extending downward from the rear end of transmission rear bearing retainer. Steel shims are used to take up all clear-

www.TeamBuick.com

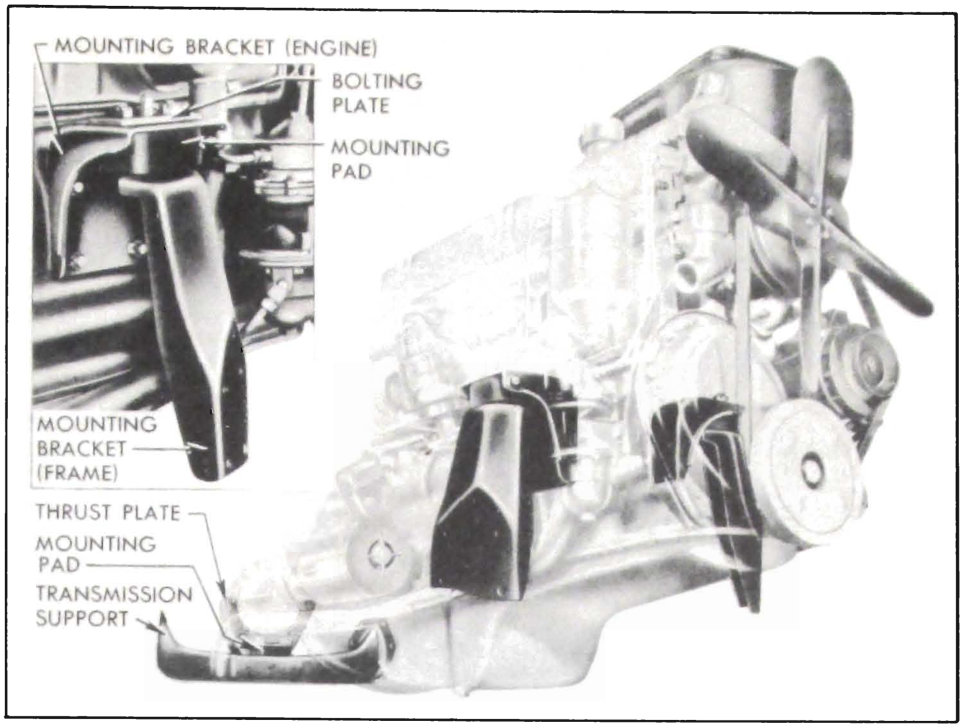

Figure 2-3—Engine and Transmission Mountings

ance between the thrust pad and transmission support.

2-5 ENGINE CONSTRUCTION

a. Cylinder Crankcase, Cylinder Head and Gaskets

The cylinder block and crankcase are cast integral to form the cylinder crankcase. This construction, together with liberal reinforcing ribs also cast integral, provides maximum rigidity with a minimum size and weight.

The cylinder bores are precision bored and double honed. The honing operations are controlled to leave minute pockets in the cylinder walls which are, in effect, small oil reservoirs which provide efficient piston lubrication.

When one or more bores in a cylinder crankcase cannot be properly finished to the nominal size, all bores are finished to .010" oversize and are fitted with .010" oversize pistons and rings. This practice is quite general in the automotive industry and engines having such cylinder crankcases are not to be considered as special or other than production standard. These engines are identified for service purposes by a dash mark about 1/4" long stamped directly following the engine number.

The detachable one-piece cast iron cylinder head contains the combustion chamber which are cast in place. The cylinder head mounts the overhead valve mechanism, spark plugs, intake and exhaust manifolds, and its attached to the cylinder crankcase by 22 special 7/16" alloy steel bolts.

Series 40 engines use a steelbestos cylinder head gasket which is approximately .050" thick. *Series 50 and 70* engines use a sheet steel gasket which is .015" thick. To insure a tight seal, the steel gasket is crimped around the edges of all openings where leakage may occur.

b. Pistons, Pins and Rings

Pistons are Anodized aluminum alloy. They have full skirts, are cam ground, and have two transverse slots cut in the skirt below the bottom ring groove and parallel to the piston pin. Two bosses cast inside the lower end of skirt below piston pin bosses provide points at which metal may be removed as required to bring the piston within the specified weight limit.

The piston head is specially shaped with a hump on one side and a rounded depression on the camshaft side. This unusual shape combined with the valve-in-head design forms a combustion chamber in which the fuel-air charge is compressed in the form of a flattened ball at the point of ignition. This "Fireball" design regulates the burning of the fuel-air charge and smooths out the power impulses. See figure 2-5.

Grooves for two compression rings and two oil rings are located above the piston pin. The oil ring grooves are drilled to provide drain back of oil to inside of skirt. A groove cut in the land above the top compression ring acts as a dam to deflect heat away from the top ring.

www.TeamBuick.com

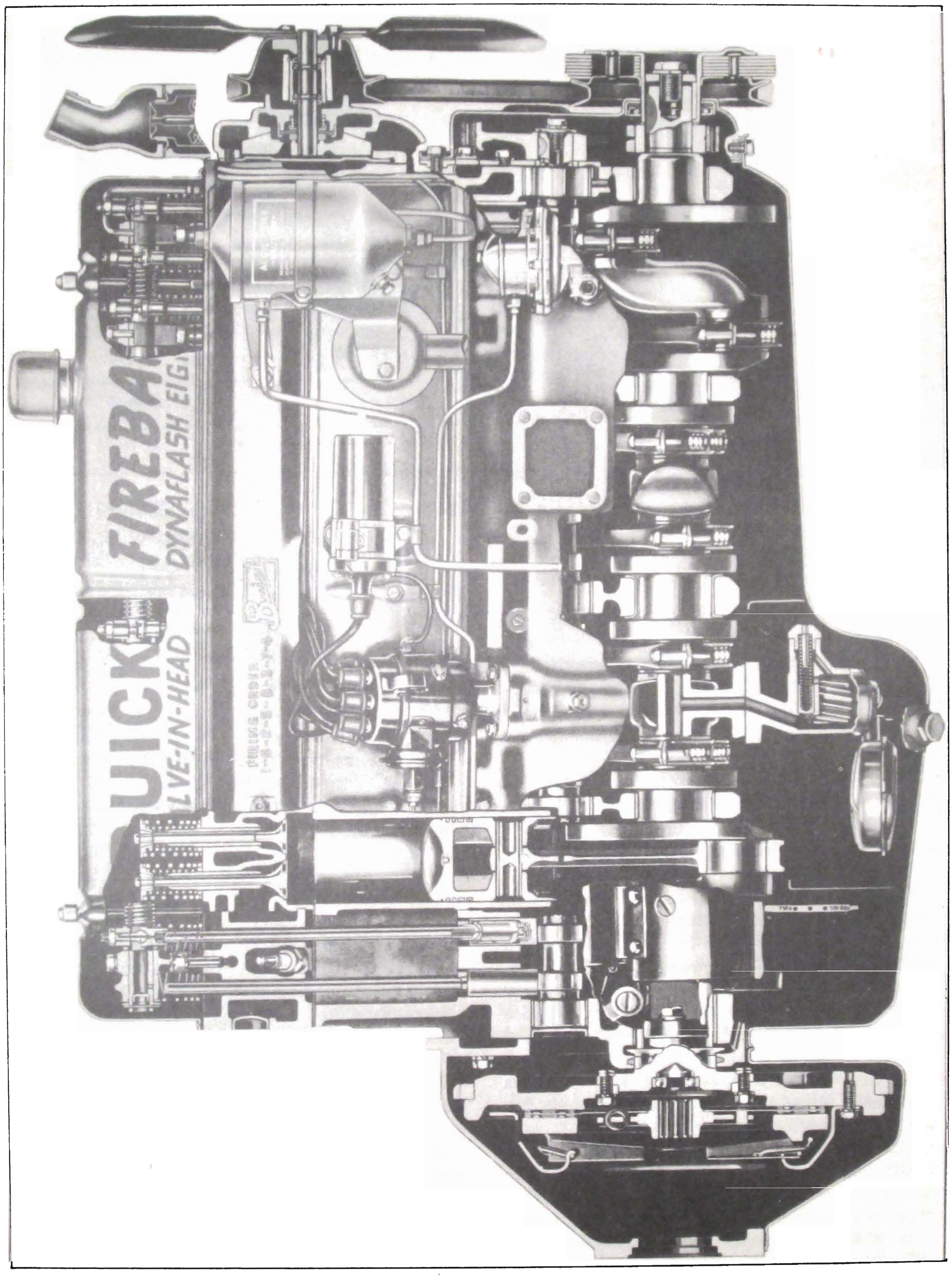

Figure 2-4—Engine, with Hydraulic Valve Lifters—Side Sectional View

www.TeamBuick.com

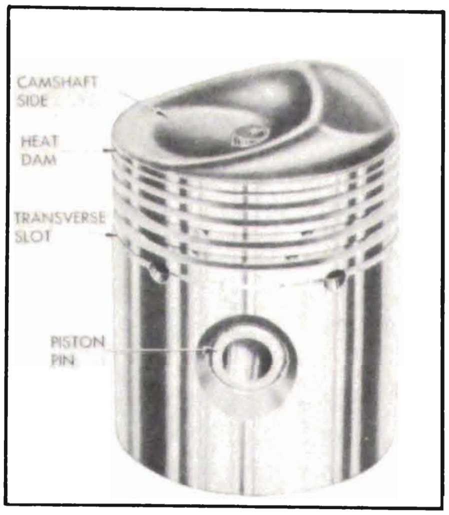

Figure 2-5—Piston and Pin Assembly

The piston pin bosses are diamond bored to form bearings for the piston pins. The piston pins float in the pistons and are held stationary in connecting rods by clamp bolts. A notch is ground at the middle of each pin for the clamp bolt, and the pin is solid at this point to prevent distortion.

The compression rings in the two upper grooves of piston are distinguished by a small groove (on some rings a bevel) cut around the inner edge on one side. This groove (or bevel), which must be on top side of ring when installed, permits the ring to warp very slightly in the groove so that only the lower outer edge contacts the cylinder wall to aid in controlling oil during light duty operation. Under heavy duty operation the force of explosion flattens the ring and pushes it outward to provide heavier contact with the cylinder wall and insure an effective compression seal. See figure 2-6.

The ring used in the third groove from top of piston is a conventional channeled type oil ring with oil return slots cut through the channeled section. Oil passing through these slots return to the crankcase through holes drilled in the piston. The narrow lands on this ring provide oil control and permit rapid wear in during the break-in period.

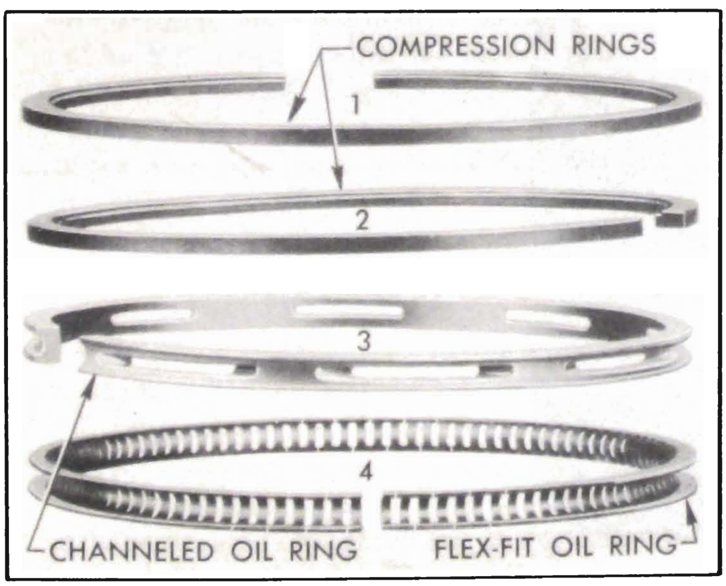

Figure 2-6—Piston Rings

The ring used in the fourth groove from top of piston is designated as the "Flex-Fit" oil ring. The name was derived from the shape of the ring and its extreme flexibility. The ring is made from strip steel and is composed of segments which are joined at the inner edge of ring and separated by narrow slots in the wiping edges. This flexible construction permits perfect contact between the piston ring and the cylinder wall. Oil passing through the inner slots returns to the crankcase through holes drilled in the piston.

The compression rings and the "Flex-Fit" rings are coated to aid in the seating of the rings and diminish the possibility of any scuffing or unnecessary wear during the break-in period.

c. Connecting Rods

Connecting rods are heat-treated steel drop forgings of I-beam section. Rods are forged with sufficient metal on bosses at both ends so that metal can be removed as required to secure correct weight and balance during manufacture.

The upper boss of connecting rod is bored, slotted, and tapped to receive and clamp the piston pin. The cap is attached to the rod with two special diameter ground bolts to insure correct alignment; bolts are provided with hex nuts and pal nuts. A small oil hole is drilled through the bearing and flange of rod to provide lubrication to cylinder walls on the heavy thrust (camshaft) side.

In all 1948 engines and in approximately 5,000 engines used at start of 1949 production, the connecting rods have bearings centrifugally cast and bonded directly to rod and cap, and solid shims are provided for adjustment. Later 1949 engines are equipped with connecting rods having replaceable precision bearings. Shims are not used with these bearings.

d. Crankshaft, Bearings, Flywheel and Balancer

The crankshaft is supported in the cylinder crankcase by five bearings. The crankshaft bearings and crankshaft journals are stepped up in diameter from front to rear.

www.TeamBuick.com

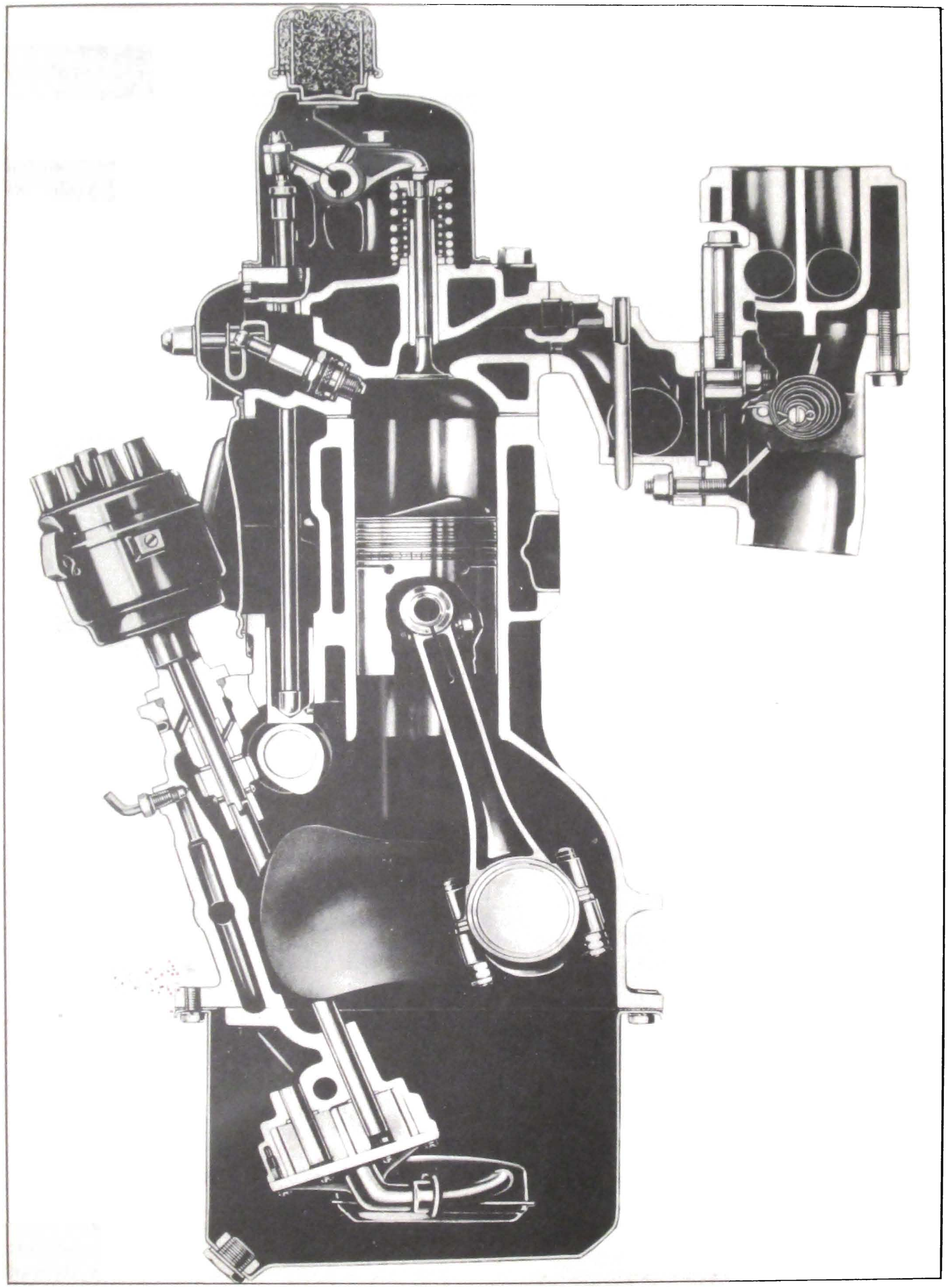

Figure 2-7—Engine, with Adjustable Valve Lash—End Sectional View

www.TeamBuick.com

Full precision crankshaft bearings are used in all engines. The bearings are made from Durex 100-A material having superior fatigue qualities. The babbitt lining is bonded to the steel back of the bearing by a fine textured nickel-copper matrix which gives continuous support to the bearing metal. No shims or other means of adjustment are required with these bearings as they are held to very close limits on size.

The crankshaft is counterbalanced by weights forged integral with crank cheeks, and is both statically and dynamically balanced during manufacture. A flange forged integral with rear end of shaft supports the flywheel which is separately balanced during manufacture.

The crankshaft in *Series 70* engines used with Dynaflow Drive are not interchangeable with crankshafts in *Series 70* engines used with Syncro-Mesh transmission. The difference is in the shape of the flywheel flange and the counterbore in rear end of shaft.

Flywheels used in *Series 40-50* and *Series 70* engines employed with Syncro-Mesh transmissions are cast iron, machined to form a driving face for the clutch plate. Flywheels used in *Series 70* engines employed with Dynaflow Drive are flexible steel stampings to which the Dynaflow primary pump is bolted. Both type flywheels carry a ring gear for cranking the engine.

A flywheel type harmonic balancer is mounted on the front end of crankshaft to dampen torsional vibration. The hub of the balancer is keyed to the crankshaft and retained by a clamp bolt threaded into the end of crankshaft.

e. Camshaft and Valve Mechanism

The forged steel camshaft is supported in the cylinder crankcase in five steel-backed babbitt-lined bearings and is driven from the crankshaft by a silent chain. The camshaft actuates the overhead valves through lifters, push rods, and rocker arms.

The valve lifters operate in guide holes reamed in crankcase above the camshaft. The tubular steel push rods have hardened steel ball plugs at lower ends which seat in valve lifters, and hardened steel ball sockets at upper ends which engage ball studs in rocker arms. The threaded ball studs provide for adjustment and are locked by hex nuts. The rocker arms pivot on a tubular steel shaft which is supported on the cylinder head by eight brackets. Inlet valves have streamlined heads and exhaust valves

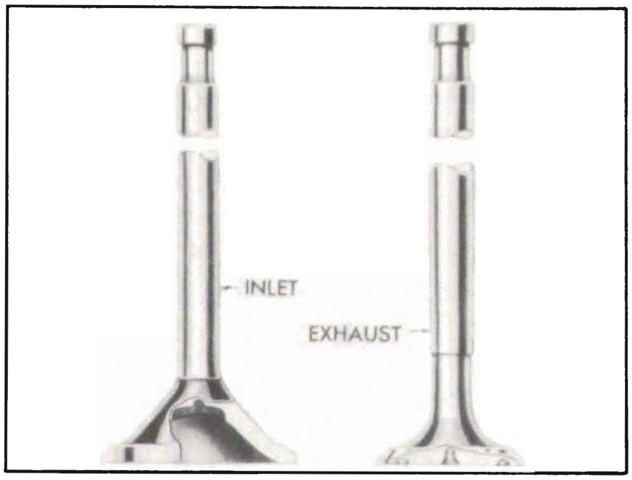

Figure 2-8—Inlet and Exhaust Valves—Sectional View

have mushroom heads, all ground for 45 degree seats. See figure 2-8. Each valve is closed by two coil springs.

Adjustable lash valve mechanism is used in all 1948 Series 40-50 engines and in 1948 Series 70 engines up to No. 5192693. The valve lifters are plain sleeve type, and the ball studs in rocker arms are used to adjust valve lash to specified limits to insure full seating and quiet operation of valves.

Hydraulic self-adjusting valve mechanism is used in 1948 Series 70 Dynaflow Drive engines starting with No. 5192694, and is used in all 1949 Series 50 and 70 Dynaflow Drive engines. See subparagraph *f* below.

f. Hydraulic Valve Mechanism

Engines equipped with hydraulic valve mechanism are identified by RED "Buick Fireball" lettering on the rocker arm cover; engines having adjustable valve lash mechanism have blue lettering. A label also is placed on rocker arm cover, stating—"This Engine Equipped With Hydraulic Lifters."

The hydraulic valve mechanism employs hydraulic lifters which automatically maintain zero valve lash under all operating conditions. The ball studs in rocker arms are used only for the initial adjustment of the hydraulic lifters.

The construction of a hydraulic valve lifter is shown in figure 2-9. The plunger and the body are ground to very close limits and are selectively fitted to obtain free movement with the least possible clearance, in order to control leakage of oil from the lower chamber within very close limits. The spring exerts a 10 pound load, which is enough to take up all lash clearances between parts in the valve train without affecting positive seating of the valve. The check valve ball seats in the plunger feed hole

www.TeamBuick.com

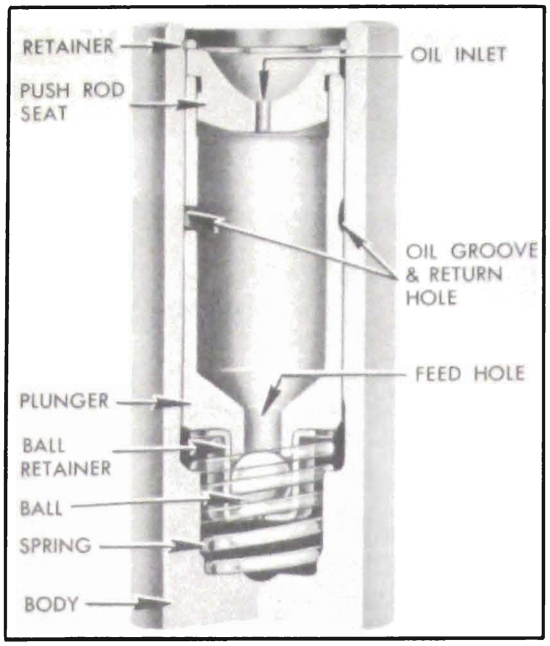

Figure 2-9—Hydraulic Valve Lifter, with Quarter Section Cut Out

and the retainer limits its travel to .004"-.008".

In operation, the plunger and lower chamber are kept filled with oil, being supplied through passages in the rocker arm shaft, rocker arm, ball stud, push rod ends, and the push rod seat in lifter. The tubular push rod serves as a reservior to maintain a head of oil above the lifter. When the valve lifter is on the camshaft base circle (off the cam) the spring raises the plunger to eliminate all lash clearances between parts in the valve train. If the lower chamber is not completely filled with oil at this time, oil will run down through the feed hole past the check valve ball to fill the chamber.

As the rotating camshaft raises the lifter body the pressure created in the lower chamber closes the check valve so that the plunger and push rod seat move with the body. This movement is transmitted to the push rod, rocker arm, and valve without lost motion. During the lifting movement any oil that leaks past the plunger is collected and returned to inside of plunger by the groove and return hole in plunger. When the parts in valve train expand due to heat, the volume of oil in lower chamber of lifter is automatically adjusted through the check valve to compensate for these changes and maintain zero valve lash.

In addition to the hydraulic lifters, the camshaft, push rods, rocker arms, ball studs, and valve springs are changed and therefore are not interchangeable with similar parts used in engines equipped for adjustable valve lash. A change made in the oil filter and connections in order to supply filtered oil to the hydraulic valve mechanism is also used in all 1949 engines. See paragraph 2-6.

Since the cam contours are different, use of a camshaft designed for plain lifters in place of camshaft designed for hydraulic lifters, or vice versa, will result in extremely rough and noisy engine operation. Camshafts for hydraulic lifters are identified by a machined cut, ½" wide and 60% of circumference, located between No. 6 and No. 7 cams.

The upper and lower ends of each push rod have centrally drilled oil holes, and the upper end is counterbored to form a shroud around a bleed hole drilled in the push rod tube. The bleed hole permits air and surplus oil to escape from the push rod, thus eliminating air locking and preventing excessive build up of oil pressure which would result in an over-supply of oil to the valve stems.

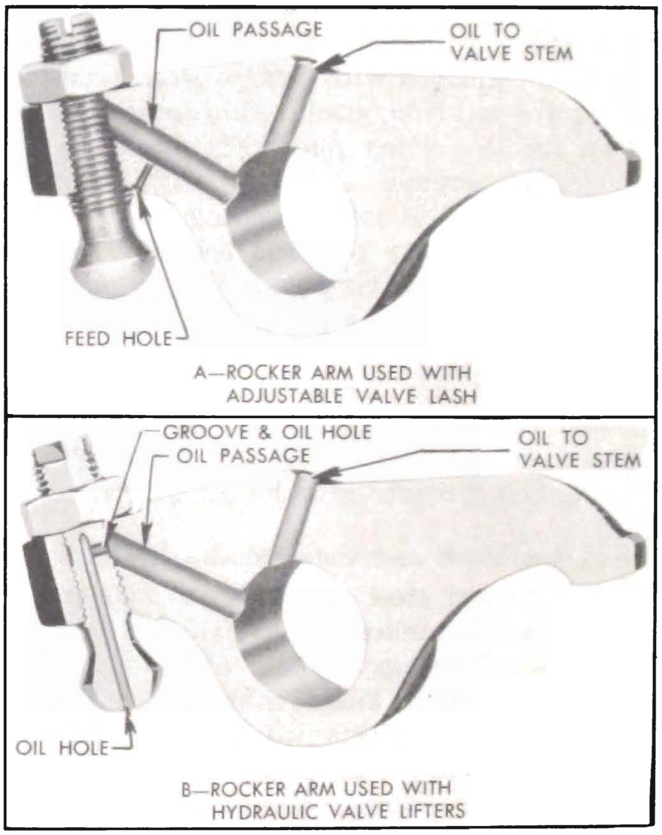

Figure 2-10—Oil Passages in Rocker Arms and Ball Studs

An oil passage is drilled between the bearing and the threaded ball stud hole in all rocker arms. In rocker arms used with adjustable valve lash, a small hole from this passage feeds oil into the push rod socket, and the end of passage is closed by the ball stud. See figure 2-10, view A. In rocker arms used with hydraulic valve lifters, the small feed hole is not present.

www.TeamBuick.com

The ball stud used with this rocker arm has a groove which aligns with the oil passage and has drilled holes which feed oil to the inside of the push rod. See figure 2-10, view B.

2-6 ENGINE LUBRICATION SYSTEM

The crankcase is filled with oil through the filler opening in the rocker arm cover. The filler opening is covered by a removable combination filler and ventilating cap which contains a filtering material to exclude dust. See figure 2-14. The supply of oil in crankcase may be checked by means of the removable oil gauge rod on right side of crankcase. The rod is marked "Full" and "Add Oil", and the range between marks is two quarts.

The engine lubrication system is of the force-feed type in which oil is supplied under full pressure to crankshaft, connecting rod, and camshaft bearings, and is supplied under controlled volume to the rocker arm bearings, push rods, and hydraulic valve lifters (where used). All other moving parts are lubricated by gravity flow or splash. See figure 2-11 or 2-13.

The supply of oil is carried in the lower crankcase, from which it is picked up and circulated by a gear type oil pump. The oil pump inlet is equipped with a floating screen which is hinged so that it follows the oil level under all conditions, thus drawing clean oil from near the top above any sediment which might collect at bottom of crankcase. See figure 2-1 or 2-13. Should the oil pump screen become clogged due to abnormally thick oil, sludge, or other cause. suction of the pump will cause the screen to collapse at its center and open a valve that will permit oil to be drawn into the pump.

The oil pump is driven by the distributor shaft which is driven from the camshaft through spiral gears. It contains two helical gears enclosed in the pump body and retained by the oil pump cover, to which the floating oil pump screen is attached. The oil pump body contains a non-adjustable spring loaded pressure valve, which regulates the oil pressure at 35 pounds at 35 MPH under normal operation.

Oil under pressure leaves the pump through a drilled passage in pump body, which connects to the main oil gallery in the right side of crankcase. Branch passages in the crankcase distribute oil from the oil gallery to the camshaft and crankshaft bearings. Holes drilled in the crankshaft carry oil to the connecting rod bearings.

Pistons and cylinder walls are lubricated by oil forced through a small hole in the lower end

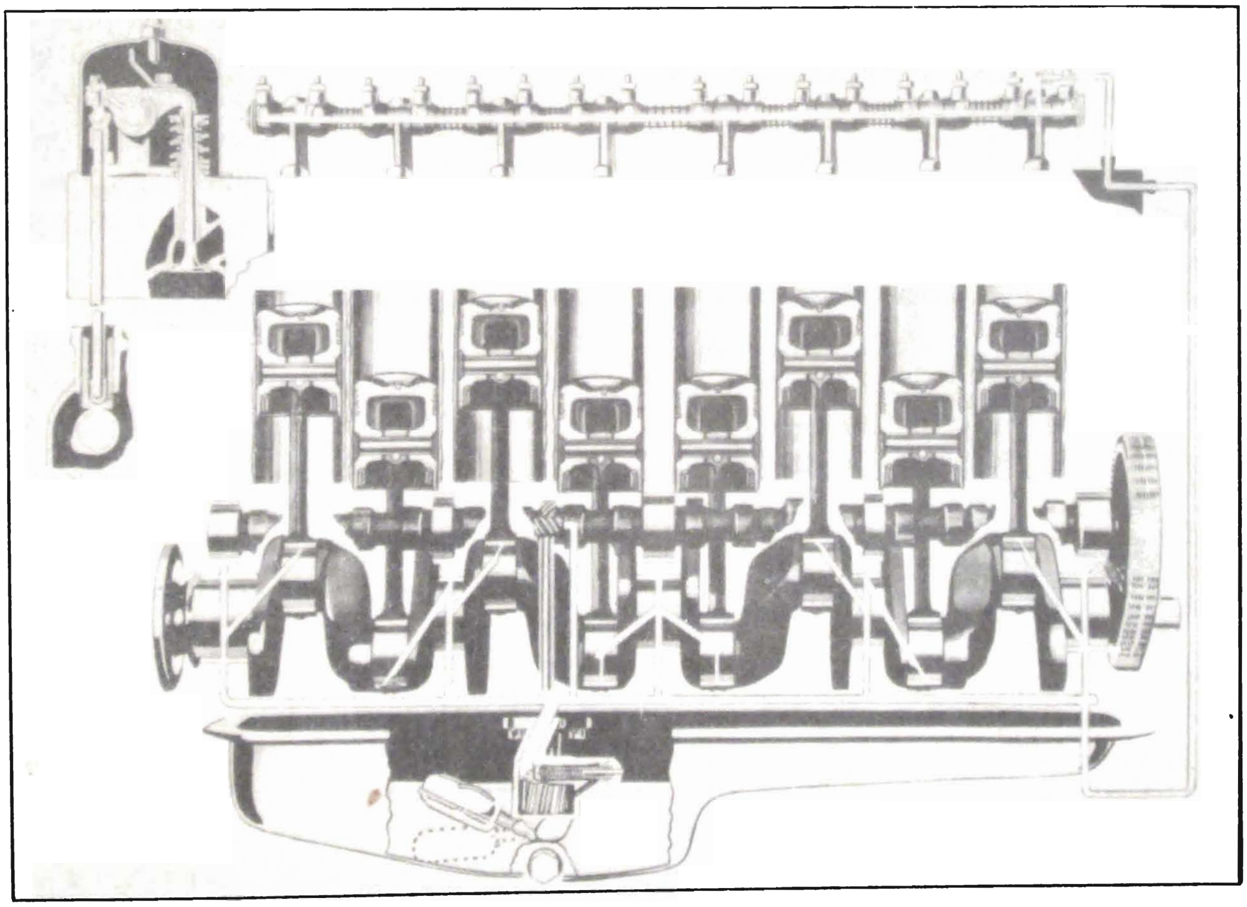

Figure 2-11—Engine Lubrication System—1948 Engines (Except Series 70 having Hydraulic Valve Lifters)

www.TeamBuick.com

of each connecting rod, which registers with the hole in crankshaft once in each revolution. Piston pins are lubricated by splash.

The timing chain and sprockets are supplied with oil through a small passage which connects the main oil gallery with a recess and drilled hole in the camshaft thrust plate. The hole through the thrust plate is blocked by the camshaft sprocket hub except when a slot in hub registers with the hole once in every revolution of the camshaft, at which time oil is thrown into the inside area of sprocket. Three holes in the camshaft sprocket allow oil to pass to the timing chain. See figure 2-11 or 2-13.

The rocker arms are supplied with oil by pipes which connect the hollow rocker arm shaft with the main oil gallery in crankcase. Oil is piped to a drilled passage in cylinder head and a short pipe under the rocker arm cover connects this passage to the top of No. 1 rocker arm shaft bracket. Holes in bracket and shaft conduct oil into the shaft, which is closed at both ends.

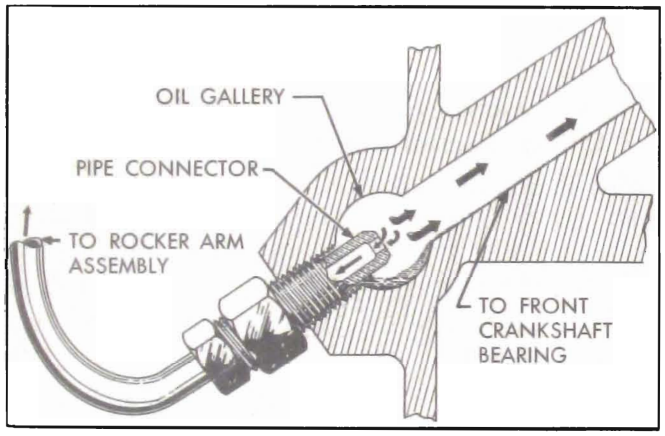

Figure 2-12—Sectional View of Oil Pipe Connection to Oil Gallery

In *1948 engines* having adjustable valve lash, a special connector extends into the main oil gallery so that oil is drawn from center of gallery where oil is clean. See figure 2-12. An external pipe joins the connector with the drilled passage in cylinder head. See figure 2-11. The special connector is drilled to a size which controls the volume of oil supplied to the rocker arm shaft.

On *1948 Series 70* engines equipped with hydraulic valve lifters, and *all 1949 engines*, the outlet side of oil filter is connected to the drilled passage in cylinder head so that all oil supplied to valve mechanism passes through the filter. See figure 2-13. The upper pipe fitting in cylinder head has a restricted opening to control the volume of oil supplied to the rocker arm shaft.

Holes in the rocker arm shaft feed oil to each rocker arm bearing. A small hole in each rocker arm feeds a slight amount of oil to the contact point between the arm and valve stem. A baffle mounted above the rocker arms prevents oil spraying from rocker arms onto the valve stems in excess of the amount required for proper lubrication of valves and guides.

A passage drilled in each rocker arm conducts oil to the ball stud. On engines having adjustable valve lash, a small hole feeds oil into the socket on push rod, from which the oil flows down into the valve lifter to drain into crankcase through a hole in the lifter. On engines equipped with hydraulic valve lifters, the small feed hole is not used; the passage in rocker arm connects with a groove and hole in the ball stud through which oil is fed into the push rod. See figure 2-10. The push rod serves as a reservoir to maintain a head of oil above the hydraulic valve lifter.

The ignition distributor gears are given position lubrication by means of an oil passage in the crankcase running from the main oil gallery to a point in the distributor housing from which oil flows over the gears.

1948 engines having adjustable valve lash are equipped with an AC oil filter containing a cotton packed element, No. C-115. The inlet side of filter is connected by a pipe to the No. 3 tapped port in the engine main oil gallery. On Series 40-50 engines, the filter outlet is piped to a tapped hole in the crankcase. On Series 70 engines, the outlet is piped to a special drilled push rod cover bolt through which the filtered oil returns to crankcase.

1948 Series 70 engines equipped with hydraulic valve lifters and all *1949 engines* are equipped with an AC oil filter containing a folded paper low-restriction element, No. P-127. The inlet side of filter is connected by a pipe to the No. 3 tapped port in the engine main oil gallery. The filter outlet is piped to the drilled passage in cylinder head so that the valve mechanism is supplied with filtered oil. The filter contains a valve which will open at 7-9 pounds pressure to by-pass oil to the outlet in case the filter element becomes plugged or otherwise inoperative.

The filter elements described above are not interchangeable. Each filter bears a label which gives the number of the filter element that must be used for replacement.

www.TeamBuick.com

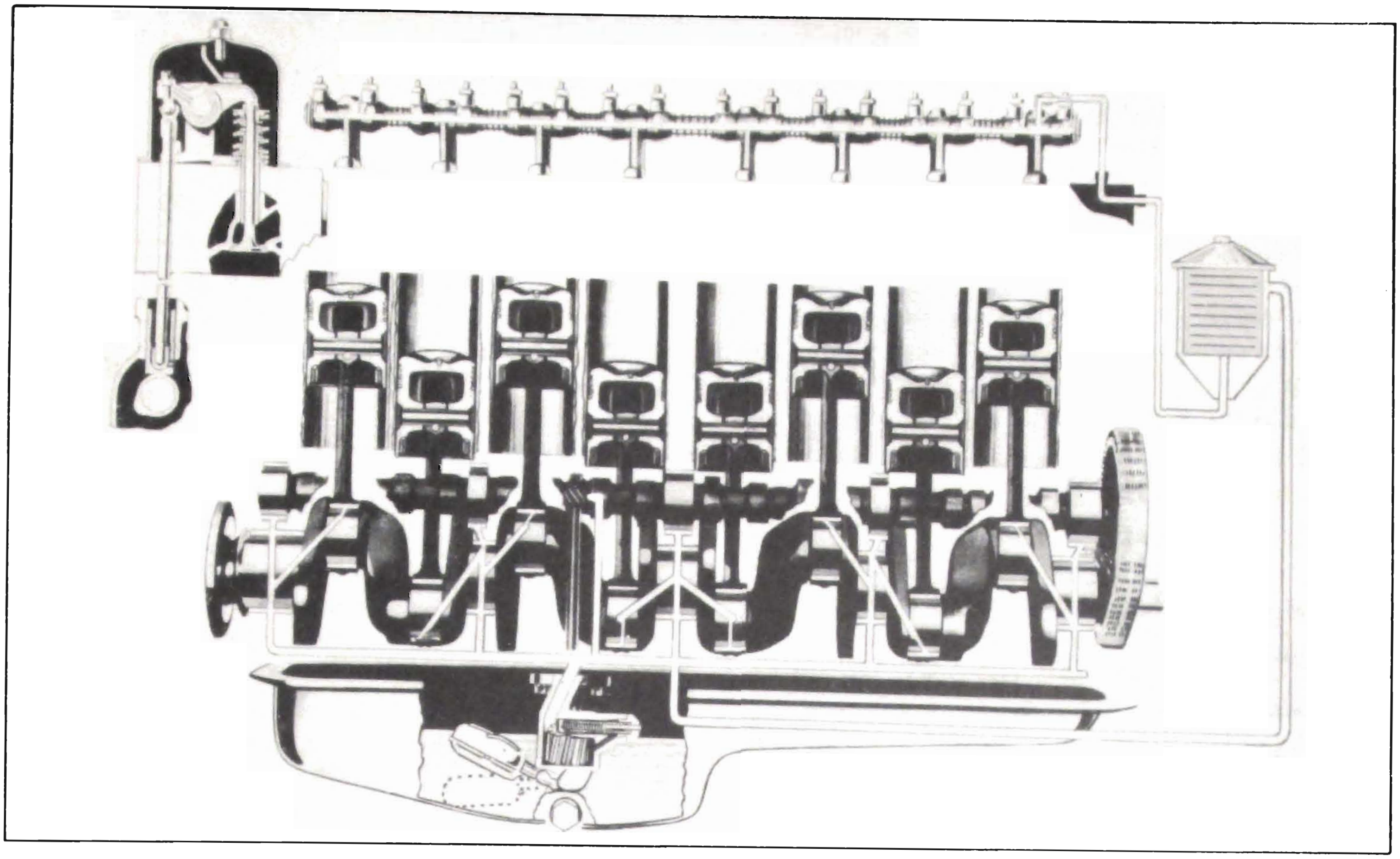

Figure 2-13—Engine Lubrication System—1949 Engines (Also 1948 Series 70 Having Hydraulic Valve Lifters)

2-7 CRANKCASE VENTILATION SYSTEM

A crankcase ventilator inlet, containing a gauze filter element, and an outlet suction pipe are used to provide crankcase ventilation. Ventilation of the crankcase is accomplished by the vacuum created by the outlet pipe.

The outlet pipe is connected to the push rod cover, and extends rearward at a low level on right side of engine. Suction created by air passing the open end of the outlet pipe, when car is moving forward, causes air to be drawn into crankcase through the crankcase inlet, and into the rocker arm cover through a ventilating type oil filler cap which contains a gauze filtering element. The ventilating streams of air are drawn out of crankcase and rocker arm cover through the push rod compartment and outlet pipe. See figure 2-14.

The air passing through the crankcase, push rod compartment, and rocker arm cover picks up fuel and water vapors and removes them from the engine. The ventilating system does not remove all fuel dilution in cold weather as a small amount is advantageous in low temperature operation. It does, however, prevent an accumulation of more than 20% fuel dilution and removes all water under average driving conditions.

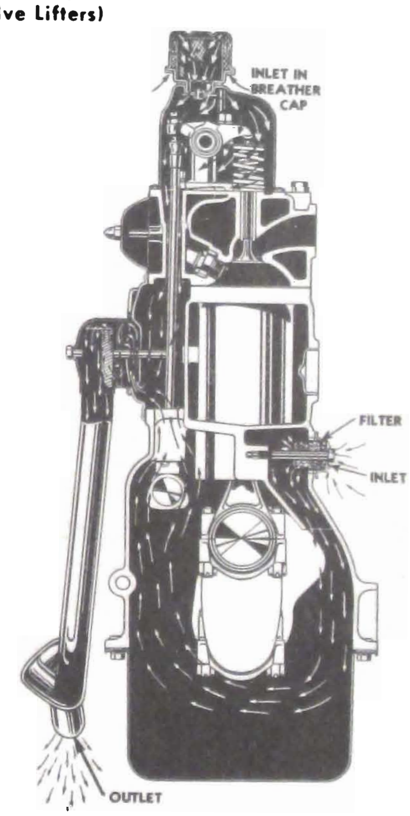

Figure 2-14—Crankcase Ventilation, Sectional View

2-8 ENGINE COOLING SYSTEM

The engine water cooling system is the pressure type, with thermostatic water temperature control and water pump circulation. A fan located behind the radiator provides air circulation.

www.TeamBuick.com

The cooling system is sealed by a pressure type radiator filler cap which causes the system to operate at higher than atmospheric pressure. The higher pressure raises the boiling point of coolant and increases the cooling efficiency of the radiator. Cars equipped with the cellular type radiator core use a 7 pounds pressure cap which permits a possible increase of approximately 20° F. in boiling point of coolant. Cars equipped with the tube and fin type radiator core use a 13 pound cap which permits a possible increase of approximately 30° F. in boiling point of coolant.

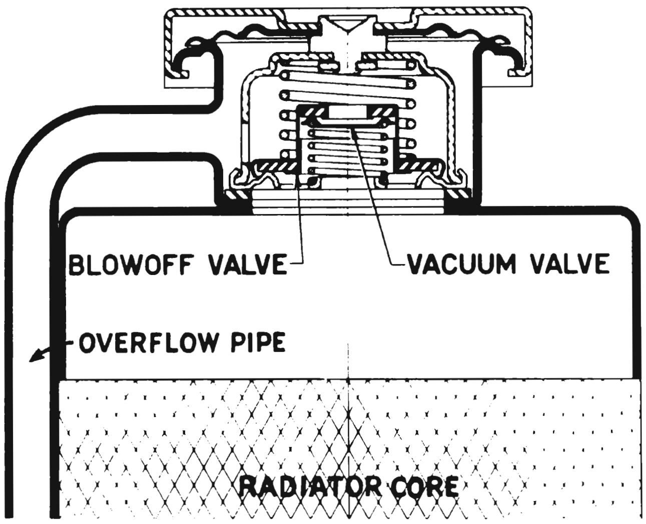

Figure 2-15—Pressure Type Radiator Filler Cap Installation

The pressure type radiator filler cap contains a blow off or pressure valve and a vacuum or atmospheric valve. See figure 2-15. The pressure valve is held against its seat by a spring of predetermined strength which protects the radiator by relieving the pressure if an extreme case of internal pressure should exceed that for which the cooling system is designed. The vacuum valve is held against its seat by a light spring which permits opening of the valve to relieve vacuum created in the system when it cools off and which otherwise might cause the radiator to collapse.

The thermostatically operated by-pass type of water temperature control permits the engine to reach its normal operating temperatures quickly, by causing the water pump to circulate coolant through the engine, but not through the radiator during the warm-up period. This is accomplished by a thermostat valve located in the cylinder head water outlet, and a fixed by-pass passage located between the water outlet and the water pump inlet. See figure 2-16 and 2-17.

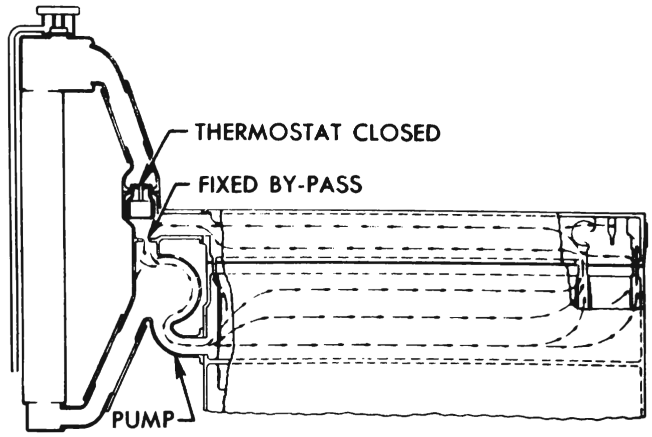

Figure 2-16—Recirculation, Thermostat Closed

When the coolant is below normal operating temperature, the thermostat valve closes and blocks circulation through the radiator. The water pump pressure forces the coolant through the by-pass passages to recirculate through the cylinder block and head. See figure 2-16. When the coolant in cylinder block and head reaches the proper temperature the thermostat valve starts to open and the circulation proceeds through the radiator in the normal way. At normal operating temperatures the thermostat is full open. See figure 2-17.

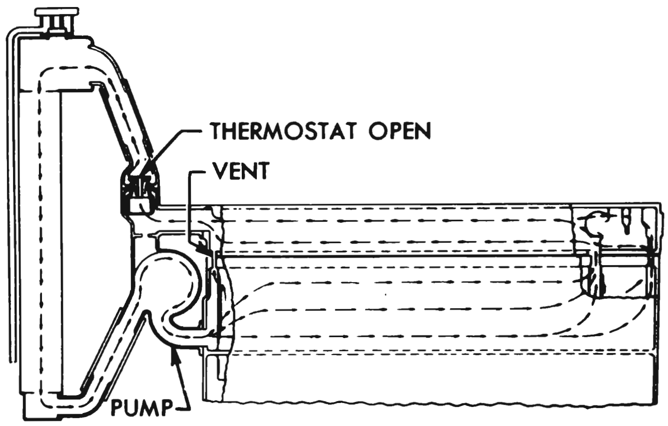

Figure 2-17—Normal Circulation, Thermostat Open

Water entering the cylinder block water jacket from the pump moves to the rear end of the block before flowing upward into the cylinder head water jacket and thence forward to the radiator. This path of circulation provides maximum and uniform flow of coolant over all water-jacketed surfaces.

A small vent passage is located forward of number one cylinder to permit any steam forming in the cylinder block water jacket to escape into the cylinder head water jacket. See figure 2-17.

www.TeamBuick.com

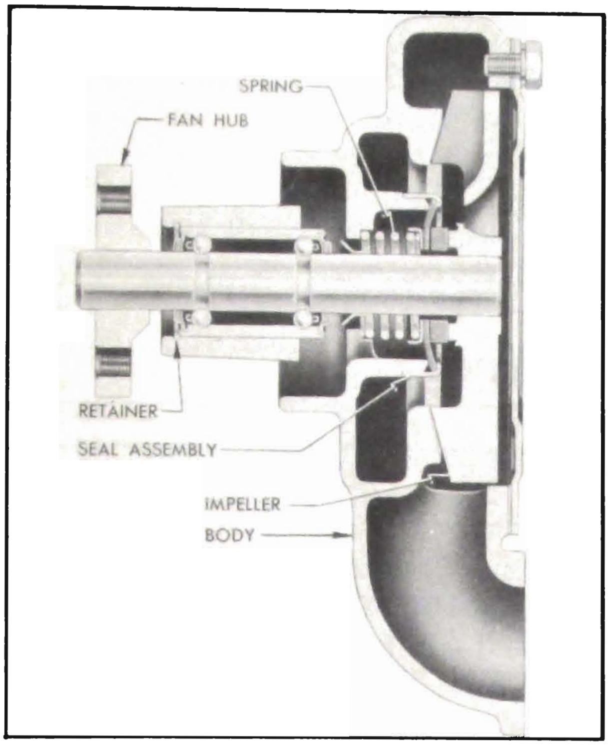

Figure 2-18—Sectional View of First Type Water Pump—1948 Engines

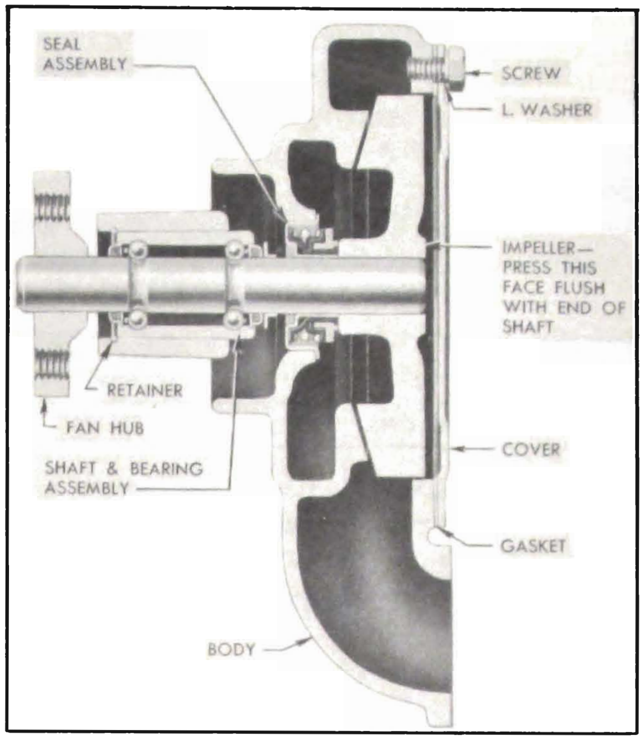

Figure 2-19—Sectional View of Water Pump—2nd Type 1948 and All 1949

The coolant is circulated by a heavy duty centrifugal water pump mounted on the front end of the cylinder crankcase. The fan and pulley are mounted on the outer end of the pump shaft so that the pump and fan are driven by a belt from a pulley on the crankshaft. The pump shaft is incorporated in a double-row ball bearing which is sealed at both ends to exclude dirt and water and is lubricated during manufacture so that no further lubrication is required. The pump is sealed against leakage by a packless non-adjustable seal assembly mounted in the pump body in position to bear against the hub of impeller. See figures 2-18 and 2-19.

Two different water pumps, differing principally in the design of the seal, are used on *1948 model engines*. The first type water pump is used on engines in cars equipped with Syncro-Mesh transmissions. The second type pump is used in cars equipped with Dynaflow Drive and in last production cars equipped with Syncro-Mesh transmissions. The second type pump is used on all 1949 model engines.

In the *first type 1948 water pump* the seal assembly is composed of a brass shell, a carbon ring and rubber washer bonded together. The brass shell is pressed on the hub of pump body and a helical spring presses the carbon ring against the hub of impeller to seal against passage of water. See figure 2-18.

In the *second type 1948 water pump* (used in 1949), the seal assembly is composed of a brass sleeve, a helical spring, a rubber bellows, and a carbon washer. The brass sleeve is pressed into the hub of pump body. The spring presses the flanged ends of the rubber bellows against the sleeve and the carbon washer, and also presses the carbon washer against the hub of impeller to seal against passage of water. See figure 2-19. Two ridges pressed in the brass sleeve engage notches in the carbon washer to prevent the washer from turning with the impeller.

All Series 40-50, and 1948 Series 70 when equipped with Syncro-Mesh transmissions, use Harrison V-type cellular radiator cores having copper water passages and copper cooling fins. Series 70 cars equipped with Dynaflow Drive use Harrison tube and fin type radiator cores.

A thermo-gauge to indicate temperature of coolant is mounted on instrument panel. The gauge assembly includes a capillary tube with a bulb which attaches to the cylinder head so as to extend into the water jacket.