b. Check Valve Timing. Remove timing hole cover at flywheel housing. Crank engine until No. 1 piston is on compression stroke (both valves closed); then continue to turn crankshaft slowly in clockwise direction until UC mark on flywheel is alined with pointer (fig. 175). Set valve lash on No. 1 intake valve to exactly 0.020-inch clearance, using feeler gage. Next, crank the engine in clockwise direction (approximately one revolution) until the 0.020-inch clearance is all taken up and valve just starts to open. If valve timing is correct, the UC mark will be visible through timing hole opening in flywheel housing front half.

142. Rocker Arm Cover and Valve Push Rod Cover Installation

a. Place rocker arm cover gasket (E, fig. 102) on cylinder head, then set rocker arm cover assembly (D, fig. 102) in place on gasket and install two $\frac{3}{8}$–24 shoulder nuts (C, fig. 102). Tighten shoulder nuts to seat cover flange firmly on gasket.

b. Using plastic-type sealing cement, cement valve push rod cover gasket (U, fig. 159) to valve push rod cover (T, fig. 159). Locate cover and gasket at cylinder block, then install a $\frac{1}{4}$ x $\frac{1}{2}$ screw with lockwasher in all holes at push rod cover except where clips and brackets are attached as shown in figures 33 and 34.

143. Assembly of Intake and Exhaust Manifolds

a. General. Always use new gaskets when assembling manifolds. Paragraph 102 covers inspection and repair of manifolds, including replacement of heat control valve used on engine assemblies 7411599 and 8329440. Since manifold assembly for engine assembly 8726920 is different than the manifold assembly for engine assemblies 7411599 and 8329440, the assembling procedures are given separately.

b. Assemble Manifolds for Engine Assembly 7411599 or 8329440.

Note. The key letters shown below in parentheses refer to figure 97, except where otherwise indicated.

(1) Place new gasket (C) over $\frac{3}{8}$ x $3\frac{1}{16}$ studs (D) on exhaust manifold with shaft and valve assembly (F). Lower intake manifold (B) into place on exhaust manifold and attach with two $\frac{3}{8}$ x 1 bolts (E), but do not tighten bolts.

(2) Place spring anchor (J, fig. 40 or H, fig. 41) on rear stud, then install two $\frac{3}{8}$–16 nuts (A) on studs and tighten bolts and stud nuts to 6 to 11 pound-feet torque. Final tightening of bolts and stud nuts is done after manifold assembly is installed on engine.

c. Assemble Manifolds for Engine Assembly 8726920.

Note. The key letters shown below in parentheses refer to figure 99.

(1) Place vaporizer gasket (K) on studs in exhaust manifold with studs assembly (F). Place fuel vaporizer with studs assembly (L) over studs on exhaust manifold and install three $\frac{3}{8}$-

inch plain washers (E) at locations indicated in figure 169. Install five $\frac{3}{8}$–16 nuts (D) on vaporizer-to-exhaust manifold studs and tighten nuts to 20 to 25 pound-feet torque.

(2) Place gasket (C) on studs on fuel vaporizer (L), then install intake manifold (B) on vaporizer and install four $\frac{3}{8}$–24 nuts (A) on studs. Tighten nuts to 6 to 11 pound-feet torque. Final tightening is done after manifold assembly is installed on engine.

144. Manifold Installation

a. General. Intake and exhaust manifold assemblies for all engine assemblies are installed in same manner, using identical attaching parts except as indicated in following text.

b. Install Manifold Assembly.

(1) Position manifold front and rear and center gaskets (fig. 167) on studs at cylinder head assembly and install three intake manifold pilots in intake ports in cylinder head as shown in figure 167. Also place four mounting clamps on studs as shown, and start four $\frac{3}{8}$–16 nuts on studs. Turn mounting clamps to allow manifolds to be moved into place.

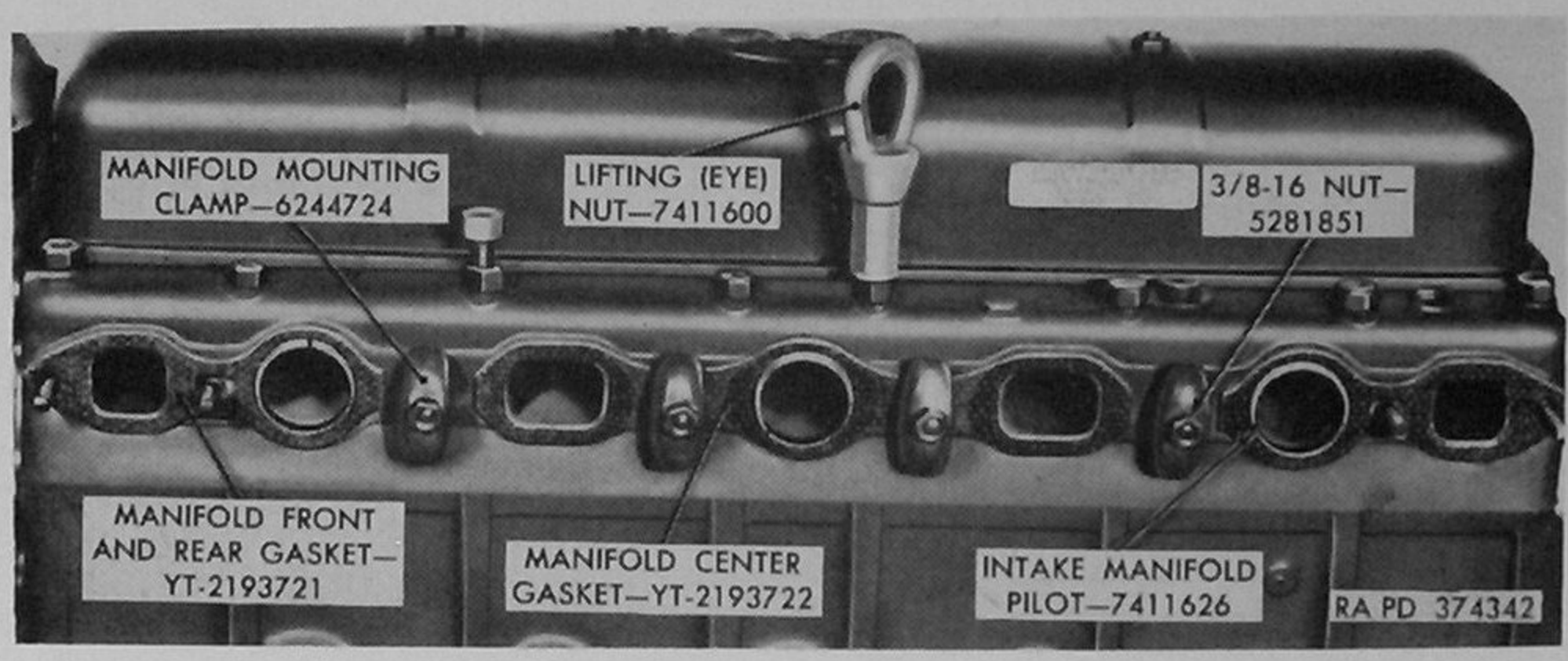


Figure 167. Location of manifold gaskets and clamps.

(2) Lift manifold assembly into place on studs and turn mounting clamps to hold manifold assembly in place.

(3) Assemble four special flat washers on two studs at front and two studs at rear of manifold assembly (fig. 168 or 169).

(4) On engine assembly 7411599, install line support on manifold rear stud as shown in main view in figure 168. On engine assembly 8329440, install line support on manifold rear stud as shown in inset in figure 168.

(5) Install $\frac{3}{8}$–16 nuts on two front and two rear manifold mounting studs and tighten nuts to 25 to 30 pound-feet torque. Tighten four nuts at mounting clamps to 15 to 20 pound-feet torque.

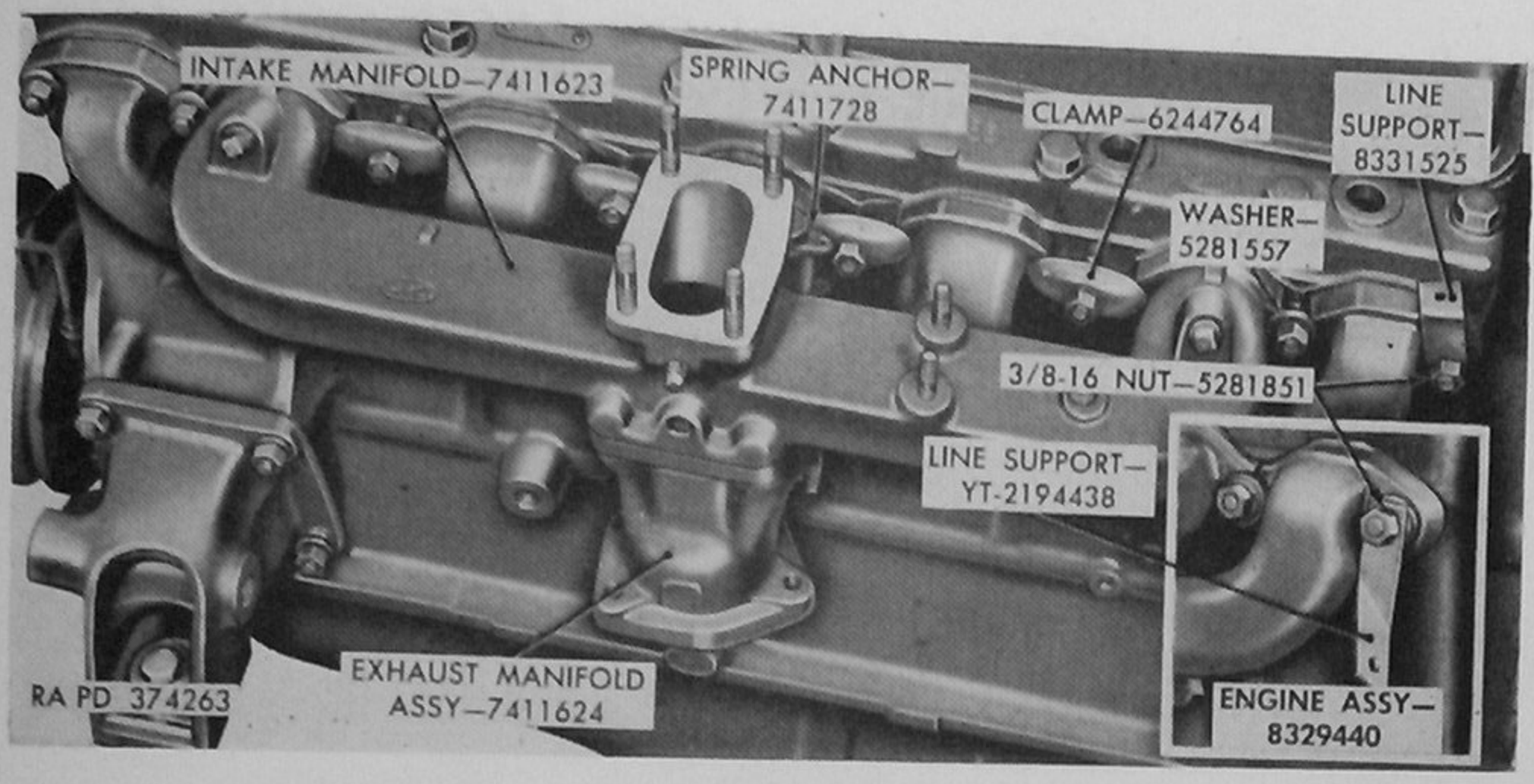


Figure 168. Intake and exhaust manifolds installed—engine assemblies 7411599 and 8329440.

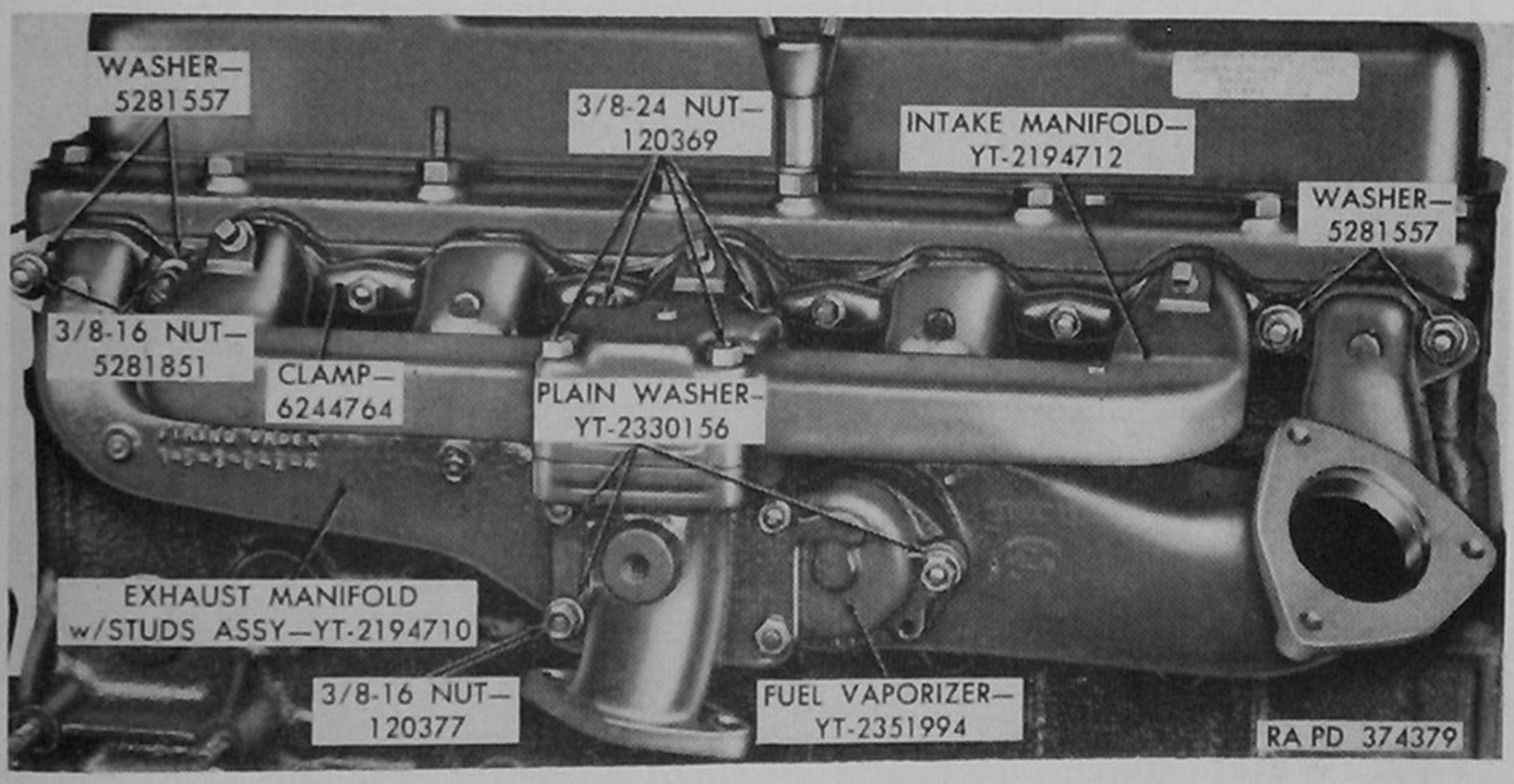


Figure 169. Intake and exhaust manifolds installed—engine assembly 8726920.

(6) After tightening manifold mounting stud nuts, tighten stud nuts and bolts which attach intake manifold to exhaust manifold to 20 to 25 pound-feet torque.

145. Valve Rocker Arm Shaft Oil Line Installation

a. Coat threads on outer diameter of $\frac{3}{8}$ x $\frac{1}{8}$ pipe bushing with plastic-type sealing cement except first two threads; then screw bushing (fig. 52) into tapped hole in front of cylinder block. Install 90° elbow in bushing and tighten. Opening in elbow must face upward.

b. Install rocker arm shaft oil line nipple into tapped hole at front of cylinder head, then install rocker arm shaft oil line assembly as shown in figure 52, and tighten line nuts.

Section II. INSTALLATION OF ACCESSORIES AND MISCELLANEOUS EXTERNAL PARTS

146. General

a. Stripped engine should be placed in engine repair stand which permits access to all points for accessory installation.

Caution: Do not support engine assembly at oil pan or cover.

b. Refer to chapter 5 for procedures covering rebuild of various engine accessories and subassemblies.

147. Starting Motor Installation

a. Place new starting motor gasket (fig. 47 or 48) over studs at engine flywheel housing.

b. Position starting motor assembly (fig. 47 or 48) on mounting studs; then install two ½–20 self-locking nuts on studs. Tighten nuts to 90 to 100 pound-feet torque.

148. Engine Wiring Harness Installation (Engine Assembly 7411599 Only)

Note. The key letters shown below in parentheses refer to figure 33.

a. Attach engine wiring harness assembly (B), using clamp (T) on ¼ x ½ cross-recess screw at upper rear corner of valve push rod cover, and attach single wire to engine water temperature gage sending unit to upper front corner of push rod cover, using clamp (E) and ¼ x ½ cross-recess screw.

b. Place one clamp (T) on wiring harness assembly at top center bolt hole of valve push rod cover and attach clamp, using ¼ x ½ cross-recess screw.

Note. Remaining clamps (D and T) are attached later when crankcase filler tube bracket (C) and engine thermostat upper housing are installed.

149. Water Pump, Thermostat Housings, and Cylinder Head Bypass Water Line Installation

a. Install Water Pump.

(1) *Engine assembly 7411599 or 8329440.*

(*a*) Apply plastic-type sealing cement to external threads of water pump bypass elbow (Q, fig. 45), then install elbow into water pump body.

(*b*) Using a new gasket between water pump assembly and engine cylinder block, install pump assembly on block and attach with one ⅜ x 1⅞ bolt (J or M, fig. 45) with ⅜-inch lockwasher in upper right hole, and one ⅜ x 1⅜ bolt (H, fig. 45) with ⅜-inch lockwasher in upper left hole. Install two ⅜ x 1¼ bolts (L, fig. 45) with ⅜-inch lockwashers in two lower mounting holes. Tighten all four bolts evenly to 18 to 24 pound-feet torque.

(*c*) On engine assembly 7411599, install pulley on water pump hub (fig. 170) and attach with six 5/16 x 5/8 bolts and 5/16-inch lockwashers. Tighten bolts to 8 1/2 to 11 pound-feet torque.

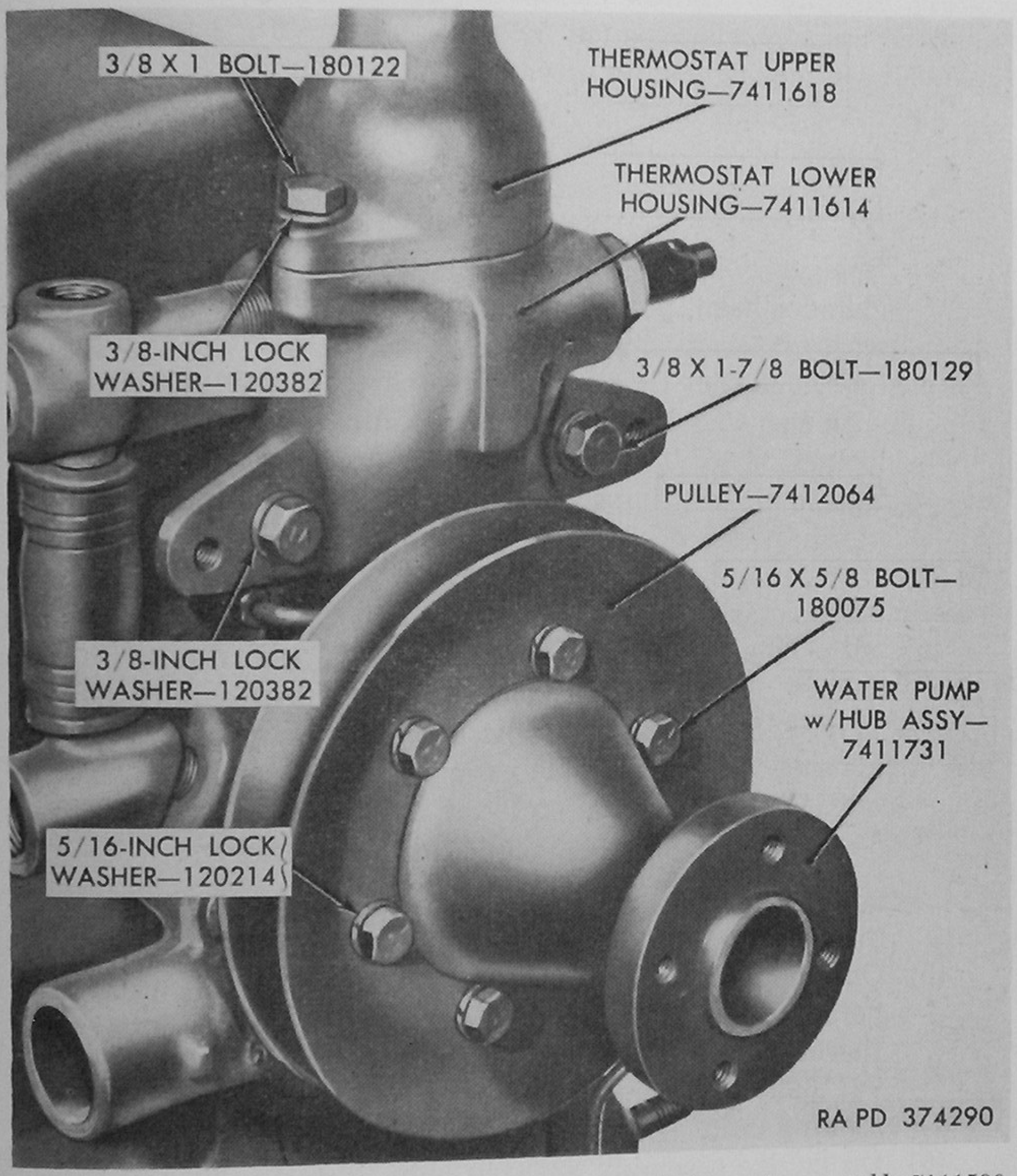


Figure 170. Water pump and thermostat housings installed—engine assembly 7411599.

(2) *Engine assembly 8726920.*

(*a*) Apply plastic-type sealing cement to external threads of water pump bypass elbow (F, fig. 46), then install elbow into water pump body.

(*b*) Using a new gasket between water pump assembly and engine cylinder block, install pump assembly on block and attach with two 3/8 x 1 3/4 bolts (D, fig. 46) with 3/8-inch lockwashers in upper mounting holes, and two 3/8 x 1 1/4

bolts (E, fig. 46) with 3/8-inch lockwashers in two lower mounting holes. Tighten bolts evenly to 18 to 24 pound-feet torque.

b. Install Water Bypass Fittings and Thermostat Housings.

(1) Assemble two hose clamps (S, fig. 45 or H, fig. 46) on water pump bypass hose (R, fig. 45 or G, fig. 46), then place hose on nipple extending upward on water pump bypass elbow at water pump.

(2) Apply plastic-type sealing cement to external threads of water pump bypass tee (U, fig. 45 or K, fig. 46), then install tee into thermostat lower housing (E, fig. 45 or A, fig. 46).

(3) Using new gasket between thermostat housing and engine cylinder head, position thermostat housing on cylinder head with attached water pump bypass tee inserted into bypass hose. Attach thermostat housing to engine cylinder head with two 3/8 x 1 7/8 bolts (F, fig. 45 or B, fig. 46) and 3/8-inch lockwashers. Tighten bolts to 18 to 24 pound-feet torque. Tighten hose clamps (S, fig. 45 or H, fig. 46) firmly on water pump bypass hose.

(4) On engine assembly 7411599 or 8329440 only, place engine thermostat assembly (fig. 171) into thermostat lower housing, with stamped arrow on thermostat pointing upward as shown. Thermostat is installed on engine assembly 8726920 as described in paragraph 150. Place new thermostat upper housing gasket (fig. 171) over thermostat, then install thermostat upper housing on lower housing and attach with two 3/8 x 1 bolts (B, fig. 45) and 3/8-inch lockwashers.

Note. On engine assembly 7411599 only, install engine wiring harness clamp (W, fig. 45) on attaching bolt at right side of thermostat housing. Tighten upper housing attaching bolts to 18 to 24 pound-feet torque.

(5) On engine assembly 7411599 or 8329440, install water temperature gage sending unit assembly (D, fig. 45) into engine thermostat lower housing (E, fig. 45). On engine assembly 7411599 only, connect engine wiring harness (C, fig. 45) to sending unit.

(6) On engine assembly 8329440 only, install engine high temperature thermoswitch assembly (fig. 37) into tapped hole at left rear side of engine cylinder head.

c. Install Transmission Water Outlet Front Line. On engine assembly 7411599 or 8329440, apply plastic-type sealing cement to external threads of 90° elbow (P, fig. 45), then install elbow into water pump bypass elbow (Q, fig. 45). Install transmission water outlet front line assembly (N, fig. 45) into elbow (P, fig. 45). Tighten line nut.

d. Install Cylinder Head Bypass Water Line. Apply plastic-type sealing cement to external threads of 45° elbow (V, fig. 45) or 90° elbow (J, fig. 46), then install elbow into water pump bypass tee (U,

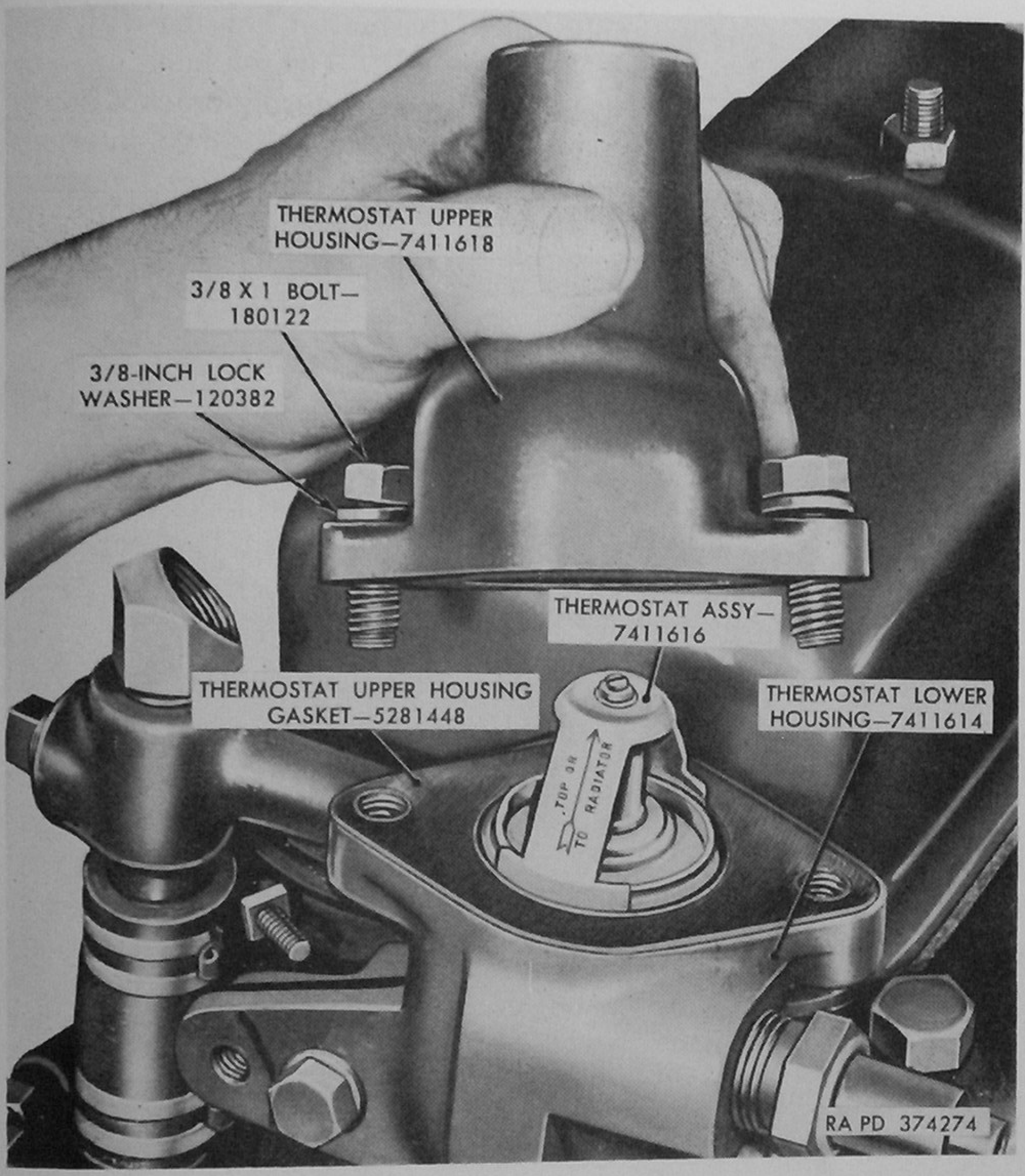


Figure 171. Removing or installing thermostat assembly—engine assemblies 7411599 and 8329440.

fig. 45 or K, fig. 46). Apply sealing cement to 90° elbow (fig. 36, 37, or 39) at rear of engine cylinder head; then connect cylinder head by-pass water line assembly between elbows. Tighten connections.

150. Oil Cooler, Cooler Lines, and Engine Thermostat Installation (Engine Assembly 8726920 Only)

Note. The key letters shown below in parentheses refer to figure 44, exceptw here otherwise indicated.

a. Place engine thermostat assembly (fig. 172) into thermostat housing with stamped arrow on thermostat pointing upward as shown. Place new oil cooler housing gasket (fig. 172) and oil cooler housing with attached housing bracket down over thermostat assembly with hole at end of housing bracket positioned over cylinder head stud. At-

tach oil cooler housing assembly (T) to thermostat housing with two $\frac{3}{8}$ x 1 bolts (V) and $\frac{3}{8}$-inch lockwashers (U). Tighten bolts to 18 to 24 pound-feet torque. Secure end of oil cooler housing bracket (Z) to engine cylinder head stud with one $\frac{7}{16}$–20 nut (R) and $\frac{1}{2}$-inch internal-teeth lockwasher (Q). Tighten nut to 33 to 43 pound-feet torque.

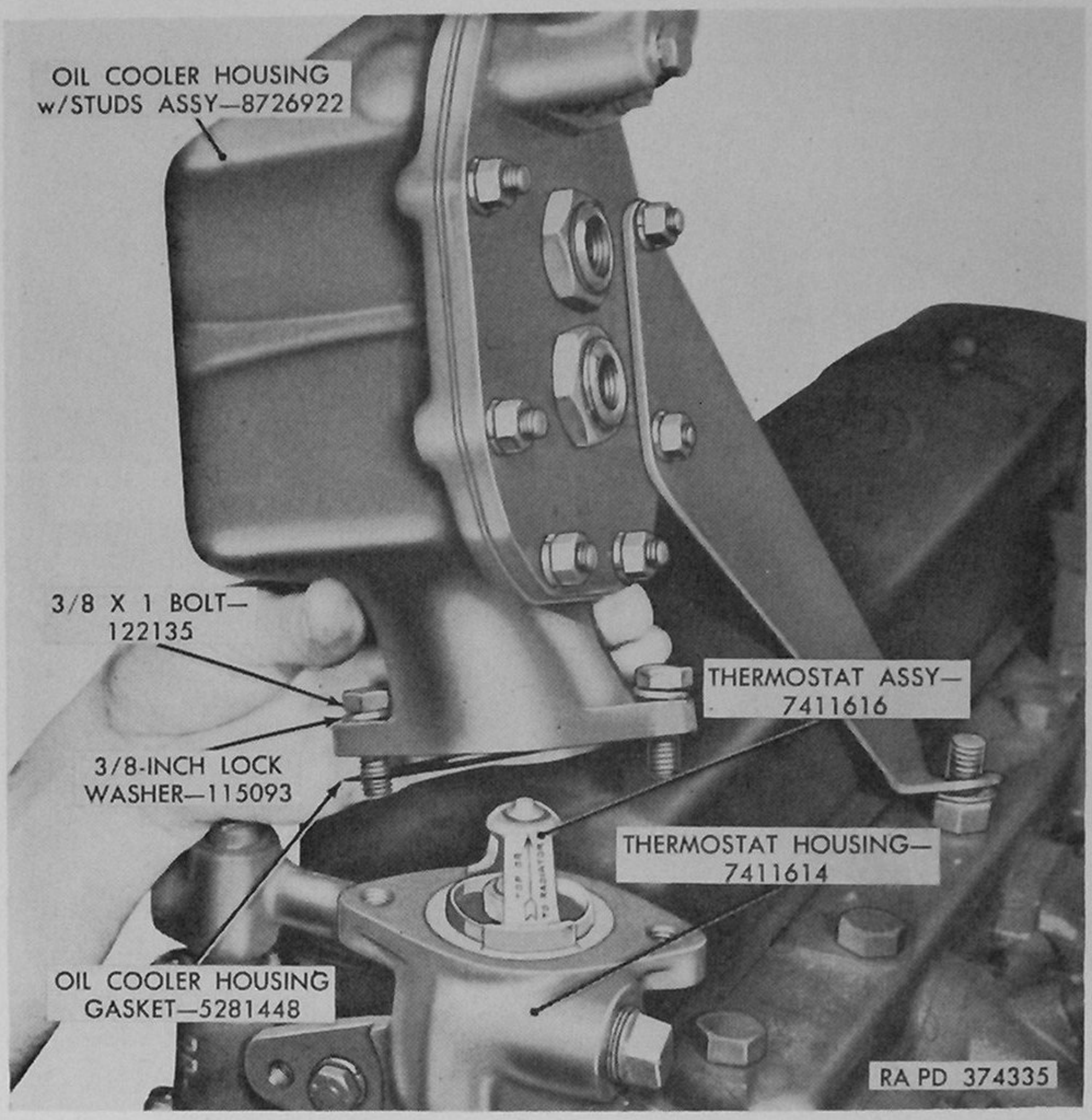


Figure 172. Removing or installing thermostat assembly—engine assembly 26920.

b. Apply plastic-type sealing cement to external threads of two bushings (Y) and two 90° elbows (X), then install bushings into oil cooler and install elbows into bushings.

c. Apply plastic-type sealing cement to external threads of tee (F, fig. 34), then install tee into tapped hole at right side of engine cylinder block. Install connector (E, fig. 34) into tee.

d. Position clips (D, fig. 34) on oil cooler inlet and outlet line assemblies (C and T, fig. 34), then connect lines to elbows (X) at oil cooler. Connect opposite end of oil cooler outlet line (T, fig. 34) to connector (E, fig. 34) at side of engine cylinder block. Tighten both line nuts to provide leak-proof connections.

e. Attach oil cooler inlet and outlet line clips (D, fig. 34) to engine push rod cover with $\frac{1}{4}$ x $\frac{5}{8}$ screws with internal-teeth lockwashers.

151. Engine Oil Bypass Valve Assembly Installation (Engine Assembly 8726920 Only)

Note. The key letters shown below in parentheses refer to figure 44.

a. Coat threads at both ends of nipple (N) with plastic-type sealing cement, then install nipple into tapped hole in engine cylinder block. Install oil bypass valve assembly (K) on nipple (N). Outlet of valve must be positioned as shown in figure 44 when valve is finally tightened.

b. Apply plastic-type sealing cement to external threads of bushing (L), then install bushing into outlet of oil bypass valve assembly (K). Install connector (M) into bushing (L), then connect oil cooler inlet line assembly (P) to connector (M). Tighten line nut.

152. Crankcase Ventilator Valve, Shutoff Valve, and Line Installation

Note. Shutoff valve is used on engine assembly 8726920 only.

a. Engine Assembly 7411599 or 8326440.

(1) Coat external threads of tee (fig. 43) with plastic-type sealing cement; then thread tee into tapped hole in intake manifold.

(2) Install ventilator valve assembly (fig. 43) into tee, then install 90° elbow into valve.

(3) Install 90° elbow into bushing at cylinder head rocker arm cover, then install crankcase ventilator line assembly (fig. 43) between elbow at cover and elbow at valve. Tighten nut at each end of line to provide leak-proof connections.

b. Engine Assembly 8726920.

Note. The key letters shown below in parentheses refer to figure 44.

(1) Coat external threads of elbows (J and H) with plastic-type sealing cement, then install 45° elbow (J) into tapped hole in fuel vaporizer assembly and install 90° elbow (H) into elbow (J). Install crankcase ventilator valve assembly (G) into elbow (H). Refer to figure 44 for final position of elbows and valve after tightening.

(2) Coat threads of nipple (B) and 90° elbow (A) with plastic-type sealing cement, then assemble 90° elbow (A) and crankcase ventilator line shutoff valve assembly (C) to nipple. Position crankcase filler brace (E) over neck of elbow (A), then install elbow with assembled nipple and valve into bushing at cylinder head rocker arm cover.

(3) Install two connectors (D), one in shutoff valve assembly (C) and one in ventilator valve assembly (G); then install crankcase ventilator line assembly (F) between connectors. Tighten nut at each end of line to provide leak-proof connections.

153. Carburetor and Controls Installation

a. Early Engine Assembly 7411599.

Note. The key letters shown below in parentheses refer to figure 40.

(1) Place carburetor to intake manifold spacer (M) with two carburetor to intake manifold spacer gaskets (N) on carburetor mounting studs. One gasket must be installed below and one above spacer.

(2) Place carburetor with governor assembly (A) over studs; then install four 5/16-inch lockwashers (P) and four 5/16–24 nuts (Q) on studs to attach carburetor assembly to intake manifold. Tighten nuts to 15 to 20 pound-feet torque.

(3) Place carburetor throttle control bracket assembly (F), which includes idler shaft, spring, and levers, on two studs of intake manifold (L). Install two 5/16-inch lockwashers (G) and two 5/16–24 nuts (H) retaining bracket to studs. Tighten nuts (H) to 15 to 20 pound-feet torque.

(4) Install idler shaft lever to carburetor rod (B), using a 9/32-inch plain washer (D) and 3/32 x 1/2 cotter pin (C) to attach rod at idler lever and at carburetor. Hook idler shaft lever return spring (E) into holes in return spring anchor (J) and lever of control bracket assembly (F).

b. Engine Assembly 8329440 or Late Engine Assembly 7411599.

Note. The key letters shown below in parentheses refer to figure 41 except where otherwise indicated.

(1) Place carburetor to intake manifold spacer (M) with two carburetor to intake manifold spacer gaskets (L) on carburetor mounting studs. One gasket must be placed below and one above spacer.

(2) Place carburetor with governor assembly (A) over studs; then install four 5/16-inch lockwashers (N) and four 5/16–24 nuts (P) on studs to attach carburetor assembly to intake manifold. Tighten nuts to 15 to 20 pound-feet torque.

(3) Place carburetor throttle control bracket assembly (D) with assembled idler shaft lever to carburetor rod assembly (C) on two studs on intake manifold assembly (K). Install two 5/16-inch lockwashers (F) and two 5/16–24 nuts (G) retaining bracket to studs. Tighten nuts (G) to 15 to 20 pound-feet torque.

(4) Attach idler shaft lever to carburetor rod assembly (C) to carburetor lever with 3/32 x 1/2 cotter pin (B). Hook idler shaft lever return spring (E) into holes in return spring anchor (H) and idler lever of control bracket assembly (D).

(5) Hold idler shaft lever to carburetor rod assembly (C) in full-throttle position, then thread 1/4 x 1 1/8 bolt (N, fig. 76) outward from idler shaft bracket until head of bolt contacts stop

on rod assembly (C). Tighten 1/4–20 nut (M, fig. 76) firmly after making adjustment.

c. Engine Assembly 8726920.

Note. The key letters shown below in parentheses refer to figure 42.

(1) Place three new gaskets (K) and two carburetor to governor spacers (L) on carburetor mounting studs. Install one gasket on each side of spacers as shown in figure 42; then position governor assembly (D) over studs.

(2) Place another new gasket (K) on top of governor assembly (D), then install carburetor assembly (G) with governor on fuel vaporizer with studs assembly (M) and attach with two 7/16-inch lockwashers (C) and two 7/16–20 nuts (B). Tighten nuts evenly to 3 to 43 pound-feet torque.

(3) Apply plastic-type sealing cement to external threads of 90° elbow (J), then install elbow into tapped hole at bottom of carburetor body. Install tee (H) into elbow (J), then connect carburetor to governor vent line assembly (F) to tee (H) under carburetor and to 90° elbow (E) at governor. Tighten line nuts firmly.

154. Oil Filter Bracket, Oil Level Indicator Tube Bracket, Oil Filter Rear Inlet Line, and Engine Oil Pressure Gage Sending Unit Installation

a. Place oil filter bracket (K, fig. 33 or H, fig. 34) in position at engine cylinder block with two holes at top alined with holes through engine push rod cover. Install 1/4 x 5/8 screw with lockwasher (V, fig. 33 or Q, fig. 34) in rear hole only on engine assembly 7411599, or in both holes on engine assembly 8329440 or 8726920. Tighten screw to 4 to 6 pound-feet torque.

Note. Do not install attaching screw in top front hole of bracket at this time on engine assembly 7411599.

b. At lower front corner of oil filter bracket, attach oil level indicator tube bracket (H, fig. 3, when used) and oil filter bracket to cylinder block, using 3/8 x 3/4 bolt (J, fig. 33 or G, fig. 34) and 3/8-inch lockwasher. Tighten bolt to 20 to 30 pound-feet torque.

Note. Oil level indicator tube bracket (H, fig. 33) is used on engine assembly 7411599 only.

c. Apply plastic-type sealing cement to external threads of tee (N, fig. 33 or K, fig. 34), then screw tee into bottom of oil pressure gage sending unit bracket (M, fig. 33 or L, fig. 34). Mount bracket at lower rear corner of oil filter bracket, using 3/8 x 1 bolt (L, fig. 33 or J, fig. 34) and 3/8-inch lockwasher. Tighten bolt to 20 to 30 pound-feet torque.

d. Apply plastic-type sealing cement to external threads of 90° elbow (H, fig. 16, M, fig. 20, or C, fig. 24), then install elbow into hole at left rear side of engine cylinder block. Install oil filter inlet rear

line assembly (P, fig. 33 or M, fig. 34) between tee at oil pressure gage sending unit bracket and elbow at left rear side of engine. Tighten line nuts firmly. On engine assembly 8726920, secure oil filter inlet rear line clip (N, fig. 34) to oil filter inlet rear line clip bracket (P, fig. 34) using ¼ x ⅝ bolt, ¼-inch lockwasher, and ¼–28 nut.

e. On engine assembly 7411599 or 8329440, apply plastic-type sealing cement to threads of engine oil pressure gage sending unit assembly (Q, fig. 33), then install unit into oil pressure gage sending unit bracket (M, fig. 33). Tighten unit firmly into bracket. Connect engine wiring harness assembly (B, fig. 33) to sending unit on engine assembly—7411599.

155. Crankcase Breather Lines Installation (Engine Assembly 7411599 Only)

Note. The key letters shown below in parentheses refer to figure 33.

a. Apply plastic-type sealing cement to external threads of 90° elbow (R), then install elbow into flywheel housing.

b. Assemble crankcase breather elbow to tee breather line assembly (A) and tee to flywheel housing elbow breather line assembly (S) to tee (U). Install end of line (S) into elbow (R) at flywheel housing, then install clip (W) and loom on line (A) and attach clip to oil filter bracket (K) with ¼ x ⅝ screw with lockwasher (V). Tighten screw to 5 to 10 pound-feet torque.

156. Governor Lines Installation

a. Engine Assembly 7411599 or 8329440.

(1) Attach two distributor flexible line assemblies (G, fig. 31) to governor air and vacuum line assemblies (B and D, fig. 31), using two ¼-inch unions (C, fig. 31). Tighten unions to lines firmly.

(2) Wrap and twist wire of seal (F, fig. 31) around connection at vacuum line union, then position governor vacuum line long sleeve (E, fig. 31) down over union with free end of seal wire through sleeve. Insert end of seal wire through hole in lead seal, then crush lead seal to prevent use of wrench at connection.

(3) Install two 90° elbows (A, fig. 35) into carburetor assembly. Place governor vacuum line short sleeve (E, fig. 35) on governor vacuum line assembly (C, fig. 35); then connect governor air and vacuum lines (B and C, fig. 35) to elbows. Tighten line nuts firmly.

Note. If necessary, turn elbows to allow governor air and vacuum lines to lie side by side at rear end of exhaust manifold.

(4) Wrap wire of seal (D, fig. 35) around neck of governor vacuum line elbow, then move governor vacuum line short sleeve

(E, fig. 35) down over line nut with free end of seal wire through sleeve. Insert free end of wire through hole in lead seal and crush lead to seal the connection.

(5) Engage governor lines into governor lines supporting clip (fig. 36 or 37) at rear of engine exhaust manifold. On engine assembly 7411599 (fig. 36), engage lugs of supporting clip into hole of line support; on engine assembly 8329440 (fig. 37), attach line supporting clip to line support with ¼ x ¾ bolt, ¼-inch lockwasher, and ¼–28 nut. Tighten nut to 5 to 10 pound-feet torque.

(6) Attach governor air and vacuum line assemblies (fig. 36 or (37) to top of engine oil filter mounting bracket by attaching governor lines supporting clip to bracket with ¼ x ¾ screw and ¼-inch lockwasher. Tighten screw firmly.

b. Engine Assembly 8726920.

(1) Attach two distributor flexible line assemblies (G, fig. 31) to governor air and vacuum line assemblies (B and D, fig. 31), using two ¼-inch unions (C, fig. 31). Tighten unions to lines firmly.

(2) Wrap and twist wire of seal (F, fig. 31) around connection at vacuum line union, then position governor vacuum line long sleeve (E, fig. 31) down over union. Insert end of seal wire through hole in lead seal, then crush lead seal to prevent use of wrench at connection (fig. 31).

(3) Install 90° elbow (F, fig. 38) into governor assembly (G, fig. 38). Place governor vacuum line short sleeve (E, fig. 38) on governor vacuum line assembly (A, fig. 38), then connect vacuum line to elbow. Tighten line connection firmly. Wrap wire of seal (D, fig. 38) around neck of governor vacuum line elbow; then move short sleeve (E, fig. 38) down over line nut with free end of seal wire through sleeve. Insert free end of wire through hole in lead seal and crush lead to seal the connection.

(4) Connect governor air line assembly (B, fig. 38) to tee (C, fig. 38). Tighten connection firmly.

(5) Attach governor air and vacuum line assemblies (fig. 39) to top of engine oil filter mounting bracket by attaching governor line supporting clip to bracket with ¼ x ¾ screw and ¼-inch lockwasher. Tighten screw firmly.

Note. Loom on governor lines must be positioned under line supporting clip as shown in figure 39.

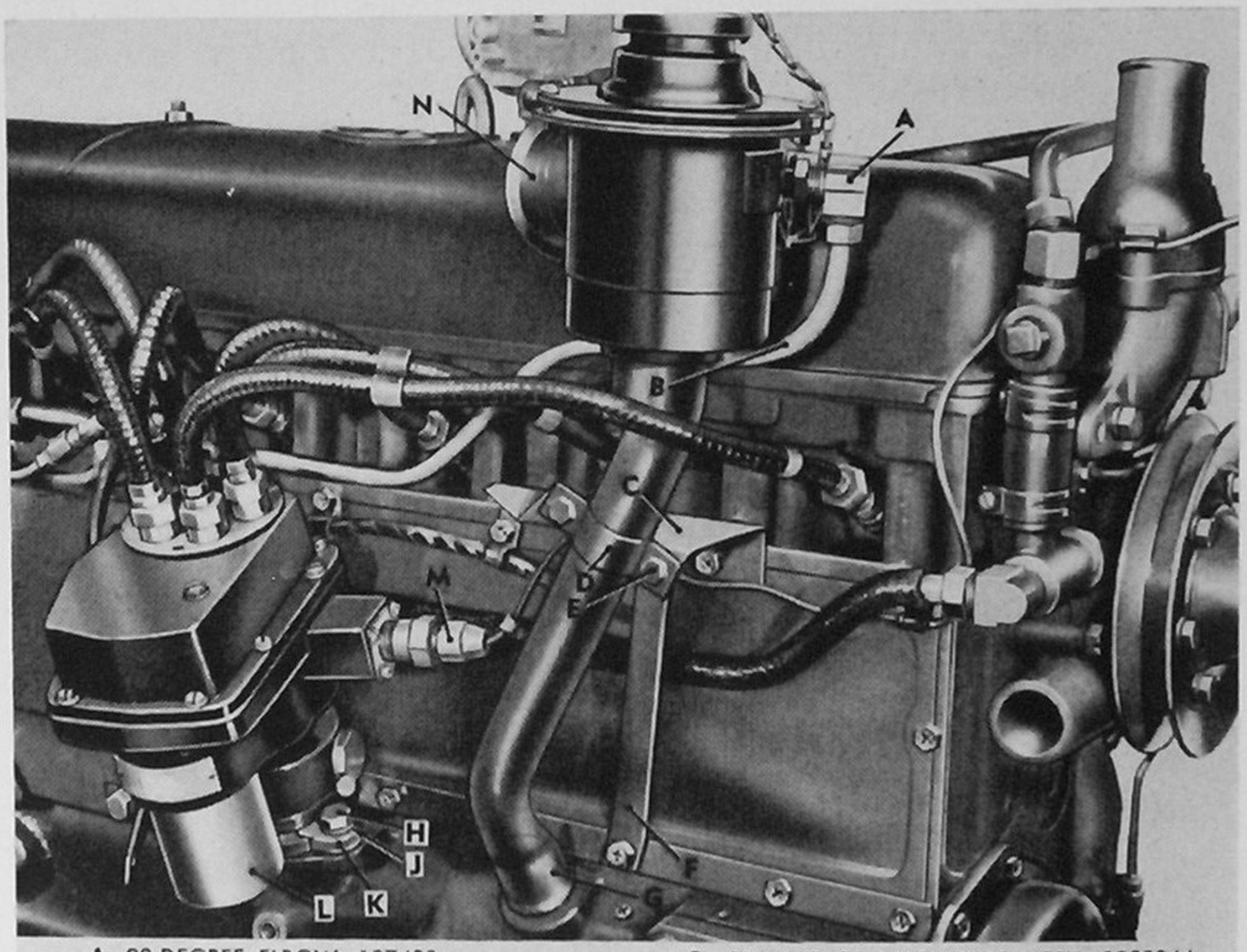
(6) Install two governor line clips (F, fig. 24) securing governor air and vacuum line assemblies (G and H, fig. 24) together at left side of engine. At rear of engine, install clip (fig. 39) attaching governor air line to oil filter inlet rear line assembly.

157. Crankcase Filler and Tube Installation

a. Engine Assembly 7411599 or 8329440.

(1) Attach crankcase filler tube bracket (C, fig. 33) and crankcase filler tube brace (F, fig. 33, when used) to valve push rod cover with three 1/4 x 5/8 screws with lockwashers (G, fig. 33). Upper end of brace must be behind extension on bracket. Tighten the three screws to 3 to 4 pound-feet torque.

(2) Assemble crankcase filler tube O-ring gasket (L, fig. 95) in groove at lower end of crankcase filler tube assembly (G, fig. 173); then insert end of filler tube assembly into filler tube opening in engine cylinder block. Work tube down to seat tube shoulder against boss on cylinder block. Assemble crankcase filler tube clamp (D, fig. 173) to hold tube to bracket, using two 1/4 x 7/8 bolts (E, fig. 173) and 1/4–28 self-locking nuts. Tighten nuts to 5 to 10 pound-feet torque.



A—90-DEGREE ELBOW—137423
B—CRANKCASE BREATHER ELBOW TO TEE BREATHER LINE ASSY—7411483 (ENGINE ASSY—7411599 ONLY)
C—CRANKCASE FILLER TUBE BRACKET—YT-2194277
D—CRANKCASE FILLER TUBE CLAMP—5281576
E—1/4 X 7/8 BOLT—181567
F—CRANKCASE FILLER TUBE BRACE—YT-2194563 (ENGINE ASSY—7411599 ONLY)
G—CRANKCASE FILLER TUBE ASSY—8328344
H—3/8 X 1 BOLT—180122
J—3/8-INCH LOCK WASHER—120382
K—MOUNTING CLAMP—7539532
L—IGNITION DISTRIBUTOR ASSY—7350410
M—ENGINE WIRING HARNESS ASSY—8328118 (ENGINE ASSY—7411599 ONLY)
N—CRANKCASE FILLER ASSY—7350553

RA PD 374331

Figure 173. Right view of engine showing distributor, crankcase filler, and filler tube bracket installed—engine assemblies 7411599 and 8329440.

(3) On engine assembly 7411599 only, install 90° elbow (A, fig. 173) into crankcase filler assembly (N, fig. 173), then connect end of crankcase breather elbow to tee breather line assembly (B, fig. 173) to elbow. Tighten line nut firmly.

b. Engine Assembly 8726920.

(1) Install crankcase filler tube bracket (S, fig. 34) on studs at cylinder head and attach with two 5/16–24 nuts (R, fig. 34) and 5/16-inch lockwashers. Tighten nuts to 9 1/2 to 13 pound-feet torque.

(2) Assemble crankcase filler tube O-ring gasket (L, fig. 95) in groove at lower end of crankcase filler tube assembly (C, fig. 174); then insert end of filler tube into filler tube opening in engine cylinder block. Work tube down to seat tube shoulder against boss on cylinder block. Assemble two crankcase filler tube clamps (J, fig. 174), one on each side of tube, to hold tube to bracket, using two 1/4 x 3/8 bolts (B, fig. 174) and 1/4–28 self-locking nuts. Tighten nuts to 5 to 10 pound-feet torque.

(3) Install crankcase filler plug (M, fig. 174) into crankcase filler assembly (A, fig. 174), then attach crankcase filler brace (L, fig. 174) to crankcase filler plug with 1/4 x 3/4 bolt (K, fig. 174) and 1/4-inch lockwasher. Tighten bolt to 5 to 10 pound-feet torque.

158. Spark Plugs, Ignition Distributor, and Spark Plug Cable Installation

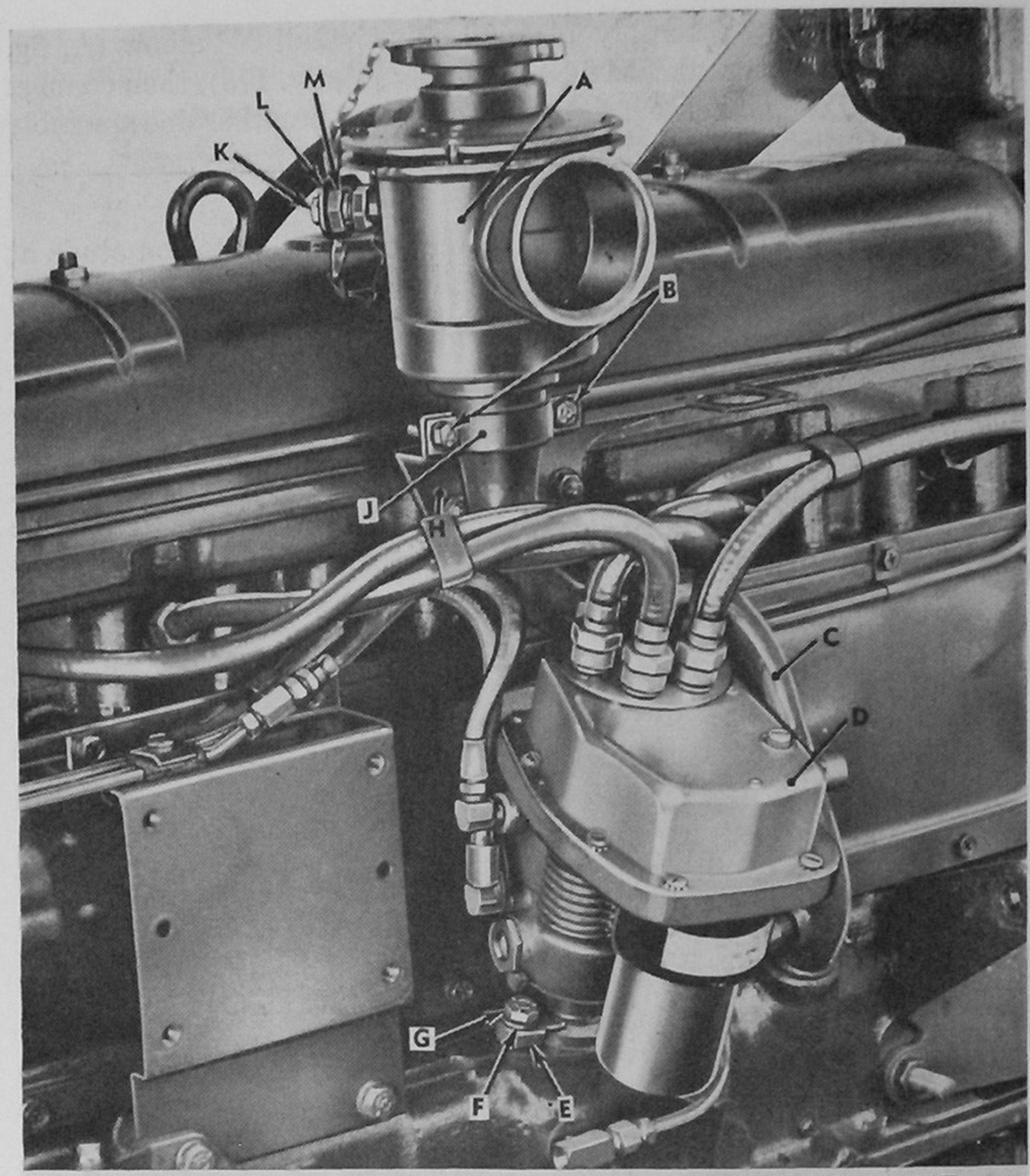
a. Using a conventional spark plug wrench, install spark plugs (fig. 32) with new gaskets into engine cylinder head. Tighten plugs to 23 to 27 pound-feet torque.

b. Turn engine to firing position on No. 6 cylinder, with both intake and exhaust valves closed on No. 6 cylinder and with timing pointer alined with steel ball (fig. 175) in flywheel, or with timing indicator (fig. 185 or 186) at front of engine alined with timing notch on crankshaft pulley.

c. Turn distributor shaft as necessary to aline mark on gear hub with mark on distributor body (fig. 176); then insert distributor assembly into opening in engine cylinder block so gear on distributor shaft engages camshaft gear (fig. 176).

Note. If distributor assembly cannot be pushed down all the way, turning engine crankshaft will cause distributor to turn until tongue on shaft is alined with slot in oil pump shaft, allowing distributor to drop into position.

d. Install two mounting clamps (K, fig. 173 or E, fig. 174), using one 3/8-inch lockwasher (J, fig. 173 or F, fig. 174) on each of two 3/8 x 1 bolts (H, fig. 173 or G, fig. 174) attaching distributor to engine cylinder block. Tighten bolts to 20 to 30 pound-feet torque.



A—CRANKCASE FILLER ASSY—7350553
B—1/4 X 7/8 BOLT—181567
C—CRANKCASE FILLER TUBE ASSY—YT-2351988
D—IGNITION DISTRIBUTOR ASSY—7350410
E—MOUNTING CLAMP—7539532
F—3/8-INCH LOCK WASHER—120382
G—3/8 X 1 BOLT—180122
H—CRANKCASE FILLER TUBE BRACKET—YT-2351989
J—CRANKCASE FILLER TUBE CLAMP—YT-2351990
K—1/4 X 3/4 BOLT—123300
L—CRANKCASE FILLER BRACE—8727201
M—CRANKCASE FILLER PLUG—8727451

RA PD 374374

Figure 174. Right view of engine assembly 8726920 showing distributor, crankcase filler, and filler tube installed.

e. Connect engine wiring harness assembly (E, fig. 14) to front side of distributor assembly on engine assembly 7411599 only.

f. Make certain that ignition firing order dial (fig. 177) is in position on top of distributor cover, then connect spark plug cable assemblies to

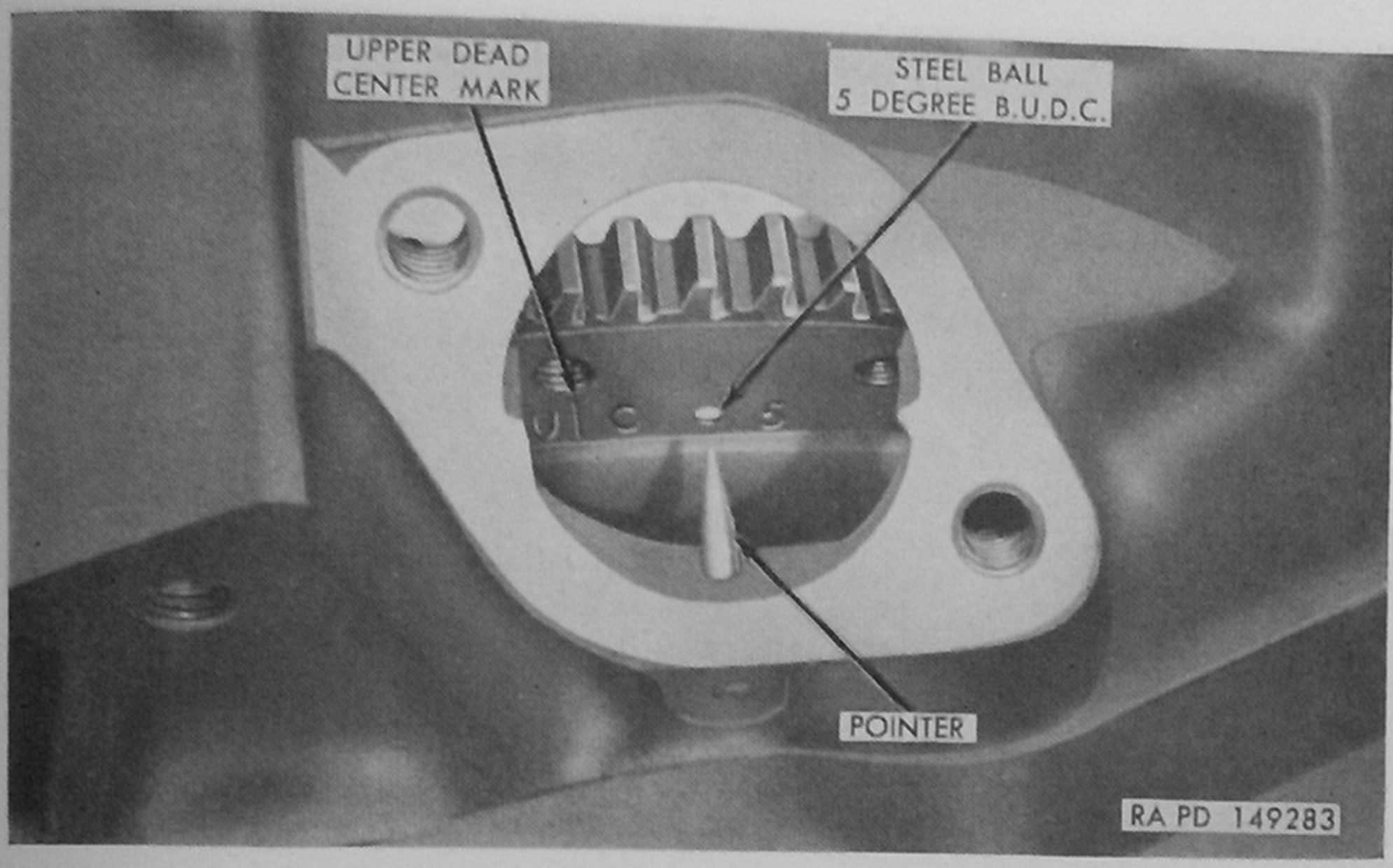


Figure 175. Timing marks on flywheel.

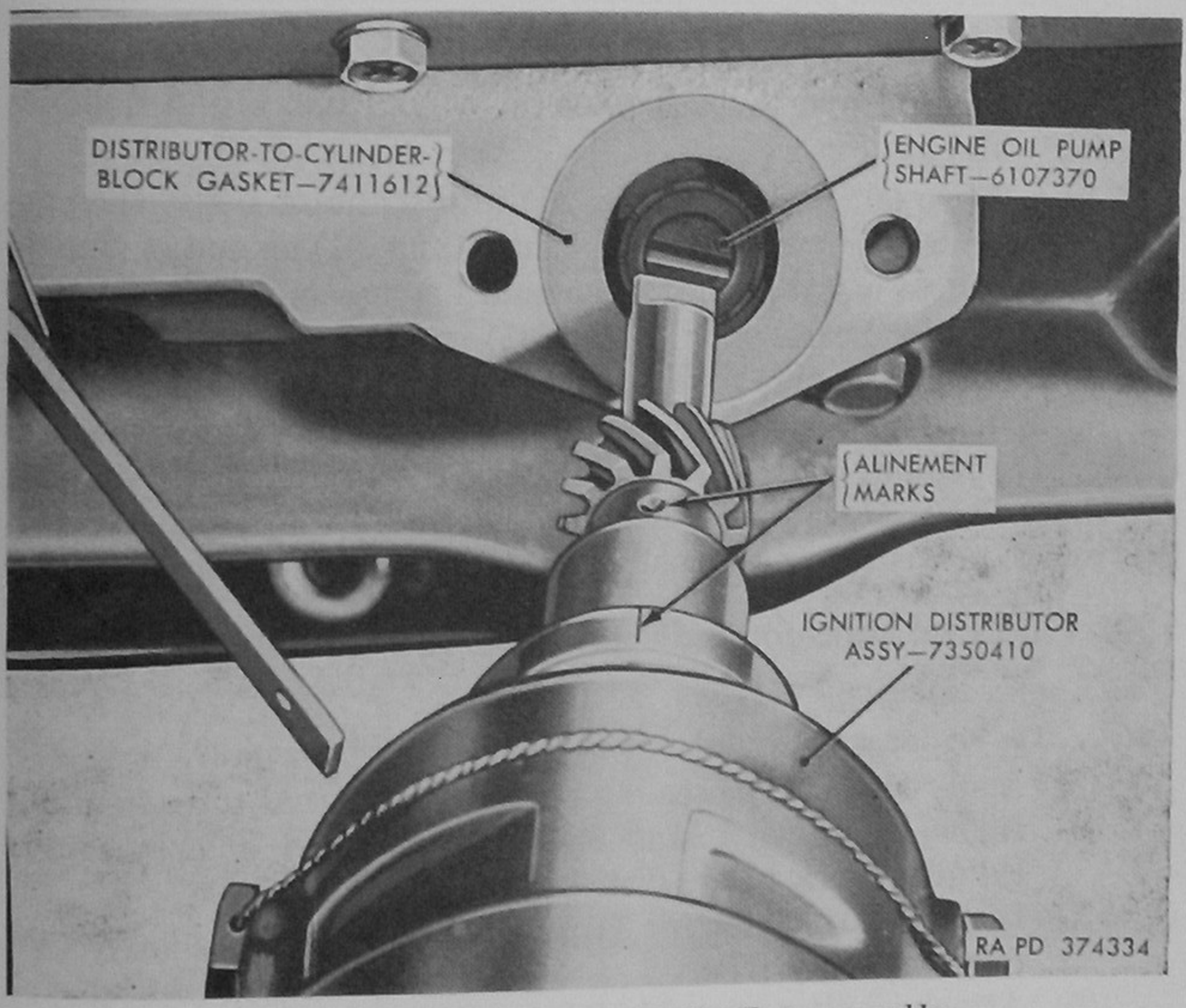


Figure 176. Installing ignition distributor assembly.

openings in distributor cover, making sure they are connected to provide correct firing order (1–5–3–6–2–4). Connect spark plug cables to respective spark plugs, using wrench 7950895 (fig. 32). Nuts should be hand-tight. Do not use additional leverage on wrench.

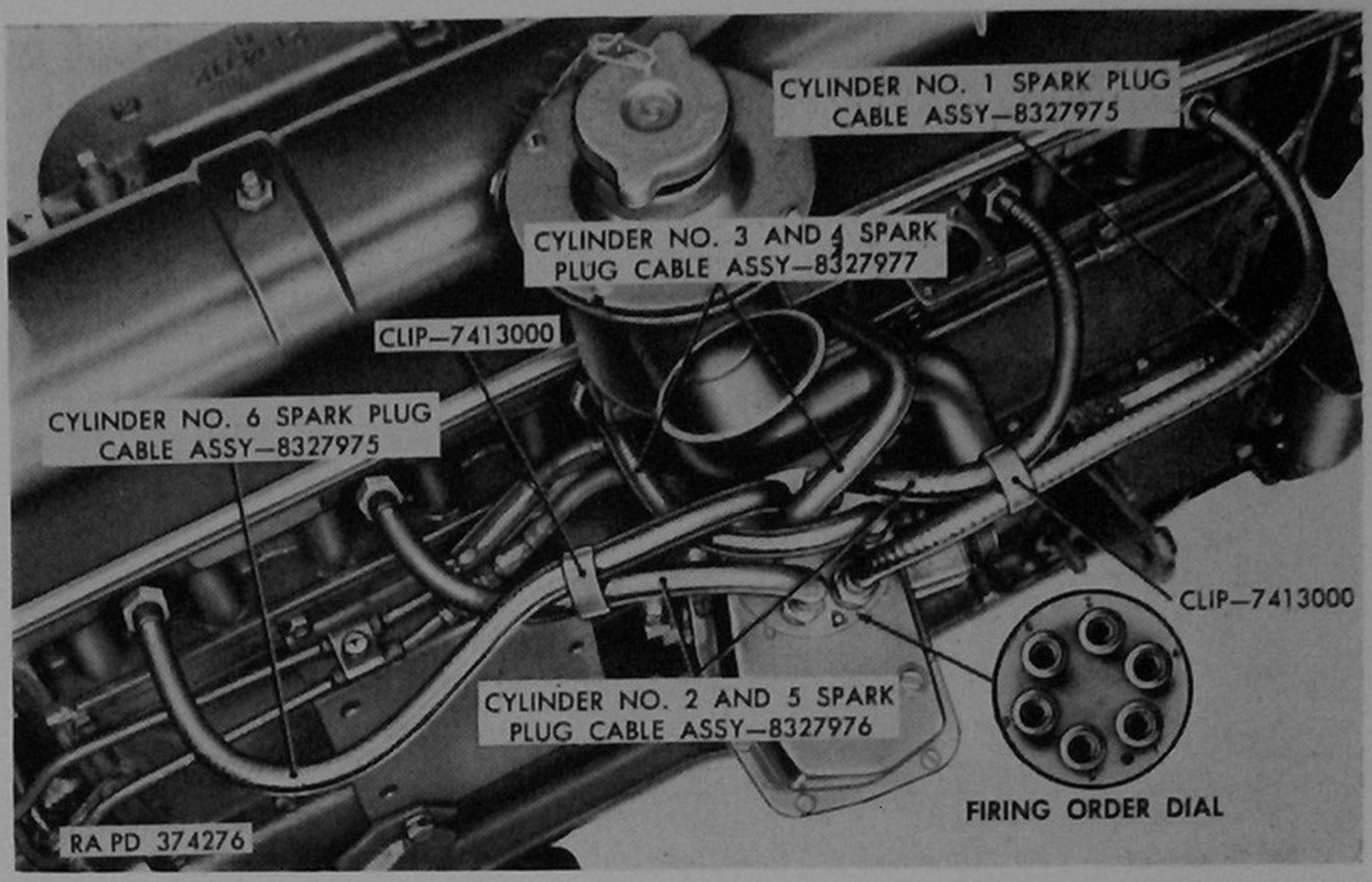


Figure 177. Spark plug cables installed—engine assembly 8726920 shown.

g. Attach No. 1 and 2 spark plug cables and No. 5 and 6 cables together with clips (fig. 177).

h. Install two 90° elbows (H, fig. 31) in distributor body, then assemble governor vacuum line short sleeve (J, fig. 31) on end of flexible line connected to metal governor vacuum line assembly (D, fig. 31). Install distributor flexible line (G, fig. 31) to lower elbow (H, fig. 31) on distributor and flexible governor air line (B, fig. 31) to upper elbow (H, fig. 31). Tighten line connections firmly. Install wire of seal (F, fig. 31) at elbow, passing free end of wire through governor vacuum line short sleeve (J, fig. 31), then through hole in lead seal. Crush lead seal to prevent use of wrench at vacuum line connection.

159. Oil Level Indicator, Indicator Tube, and Oil Filter Installation

a. Engine Assembly 7411599.

Note. The key letters shown below in parentheses refer to figure 29.

(1) Apply plastic-type sealing cement to external threads of 90° elbow (H), then install elbow into tapped hole in engine cylinder block below distributor.

(2) Install two 90° elbows (B and L) into tapped holes of oil filter assembly (N).

(3) Attach oil filter assembly (N) to oil filter bracket (J) with four $\frac{3}{8}$ x $\frac{7}{8}$ bolts (C), $\frac{3}{8}$-inch lockwashers, and $\frac{1}{32}$-inch plain washers. Tighten bolts to 20 to 30 pound-feet torque.

(4) Install oil filter inlet front tube assembly (D) connecting elbow (B) at top of oil filter to tee (M) under oil pressure gage sending unit bracket.

(5) Install oil filter outlet tube assembly (K) connecting elbow (L) at bottom of filter to elbow (H) below distributor. Tighten tube connecting nuts to provide leak-proof connections.

(6) Turn nut at bottom of oil level indicator tube assembly (E) into tapped hole in bracket on side of engine oil pan. Tighten nut firmly.

(7) Position clip (G) on tube, then attach clip to oil level indicator tube bracket (F) with $\frac{1}{4}$ x $\frac{5}{8}$ bolt, $\frac{9}{32}$-inch plain washer, and $\frac{1}{4}$–28 self-locking nut. Tighten nut firmly.

(8) Insert oil level indicator assembly (A) into oil level indicator tube assembly (E).

b. Engine Assembly 8329440 or 8726920.

Note. The key letters shown below in parentheses refer to figure 30.

(1) Install 45° elbow (H) into tee located in cylinder block below distributor assembly.

(2) Install two 90° elbows (C and L) into tapped holes of oil filter assembly (N).

(3) Attach oil filter assembly (N) to oil filter bracket (J) with four $\frac{3}{8}$ x $\frac{7}{8}$ bolts (D), $\frac{3}{8}$-inch lockwashers, and $\frac{11}{32}$-inch plain washers. Tighten bolts to 20 to 30 pound-feet torque.

(4) Install oil filter inlet front tube assembly (G) connecting elbow (C) at top of oil filter to tee (M) located under oil pressure gage sending unit bracket.

(5) Install oil filter outlet tube assembly (K) connecting 90° elbow (L) at bottom of oil filter to 45° elbow (H) below distributor. Tighten tube connecting nuts to provide leak-proof connections.

(6) Turn nut at bottom of oil level indicator tube assembly (B) into tapped hole in bracket on side of engine oil pan. Tighten nut firmly.

(7) Position clip (F) on tube, then attach clip to oil filter bracket (J) with $\frac{1}{4}$ x $\frac{1}{2}$ bolt (E), $\frac{9}{32}$-inch plain washer, and $\frac{1}{4}$–28 self-locking nut. Tighten nut firmly.

(8) Insert oil level indicator assembly (A) into oil level indicator tube assembly (B).

160. Deep-Water Fording Controls Installation (Engine Assembly 8726920)

Note. The key letters shown below in parentheses refer to figure 28 except where otherwise indicated.

a. Using new gasket (E, fig. 74), install crankcase breather shutoff valve assembly (K) with attached crankcase breather shutoff valve control link (H) on crankcase filler assembly (P) and attach with shut-off valve mounting clamp assembly (J). Tighten clamp, screw firmly.

b. Engage pin of shutoff valve screw with nut and pin assembly (A) through hole in lever of crankcase ventilator line shutoff valve assembly (D) and through end of crankcase breather shutoff valve control link (H). Secure link with 13/64-inch plain washer (B) and 1/16 x 3/4 cotter pin (C).

161. Carburetor Hand Choke Control Assembly Installation (Engine Assembly 8726920)

a. Insert wire of carburetor hand choke control assembly (C, fig. 25) through carburetor choke shaft lever trunnion and engage conduit of control assembly behind head of choke control conduit clamp screw (F, fig. 25). Tighten choke control conduit and wire clamp screws (F and G, fig. 25) snug only.

b. Engage clamp (E, fig. 28) around choke control conduit, then attach clamp to engine rocker arm cover stud with 3/8–24 nut (F, fig. 28). Tighten nut firmly.

162. Generator and Mounting Bracket Installation

a. Engine Assembly 7411599.

Note. The key letters shown below in parentheses refer to figure 26.

(1) Install generator mounting bracket (P) on engine right inner front support bracket, using three 3/8 x 1 1/8 bolts (N) and 3/8-inch lockwashers (M). Tighten bolts to 25 to 35 pound-feet torque.

(2) Position generator with pulley assembly (Q) at mounting bracket (P), and attach with two 7/16 x 1 5/16 bolts (K) and 7/16-inch lockwashers (L).

Note. Generator mounting bolt nuts are welded to bracket.

(3) At engine end of belt tension adjusting arm (J), install 3/8 x 1 bolt (F), 3/8-inch lockwasher (G), and 7/16-inch plain washer (H) attaching arm to thermostat lower housing (E).

(4) Attach opposite end of belt tension adjusting arm (J) to generator assembly with 3/8 x 1 bolt (D), 3/8-inch lockwasher (C), and 7/16-inch plain washer (B), with spacing washer (A) positioned between arm and generator end frame. Do not tighten bolts until after drive belt is installed (par. 165*a*).

b. Engine Assembly 8726920.

Note. The key letters shown below in parentheses refer to figure 27.

(1) If generator mounting bracket assembly (M) was removed from engine, attach bracket to engine crankcase studs with four 7/16–20 nuts (L). Tighten nuts to 40 to 50 pound-feet torque.

(2) Position generator with pulley assembly (N) at mounting bracket assembly (M) and attach with two 7/16 x 1 1/4 bolts (H), 7/16-inch lockwashers (J), and 7/16-inch plain washers (K).

Note. Generator mounting bolt nuts are welded to bracket.

(3) At engine end of belt tension adjusting arm (G), install 3/8 x 1 bolt (E) and 3/8-inch lockwasher (F) attaching arm to thermostat housing (D).

(4) Attach opposite end of belt tension adjusting arm (G) to generator assembly with 3/8 x 7/8 bolt (C), 3/8-inch lockwasher (B), and 3/8-inch plain washer (A). Do not tighten bolts until after drive belt is installed (par. 165*c*).

163. Air Compressor Installation (Engine Assembly 7411599 Only)

Note. The key letters shown below in parentheses refer to figure 17 except where otherwise indicated.

a. Apply plastic-type sealing cement to external threads of 90° elbows (D and G, fig. 178) and to bushing (F, fig. 178), then install elbows and bushing in engine cylinder block. Apply sealing cement to elbows (B, K, and L, fig. 178) and to elbow (T), then install elbows in air compressor assembly (K). Tighten elbows to positions shown.

b. Place new base to crankcase gasket (E) on air compressor mounting base (G). Attach air compressor assembly (K) to mounting base with four 7/16 x 1 1/4 bolts (D) and 7/16-inch lockwashers. Tighten bolts evenly to 30 to 40 pound-feet torque.

c. Position air compressor assembly on engine left inner front support mounting bracket (F). Place 3/4-inch lockwasher (L, fig. 16) on 3/4 x 6 1/4 bolt (K, fig. 16), then insert bolt through mounting holes in mounting base and engine support bracket. Install 3/4–16 nut (H) on bolt. Do not tighten bolt until after drive belt is installed (par. 165*d*).

d. Attach air compressor belt adjusting arm (R) to thermostat lower housing (P) with 3/8 x 1 bolt (Q) and 3/8-inch lockwasher. Place one 3/8-inch lockwasher and 7/16-inch plain washer on 3/8 x 7/8 bolt (S), then insert bolt through opposite end of adjusting arm and through adjusting arm bracket (U) at air compressor cylinder head. Install 3/8-inch lockwasher and 3/8–24 nut on bolt (S). Do not tighten bolts until after drive belt is installed (par. 165*d*).

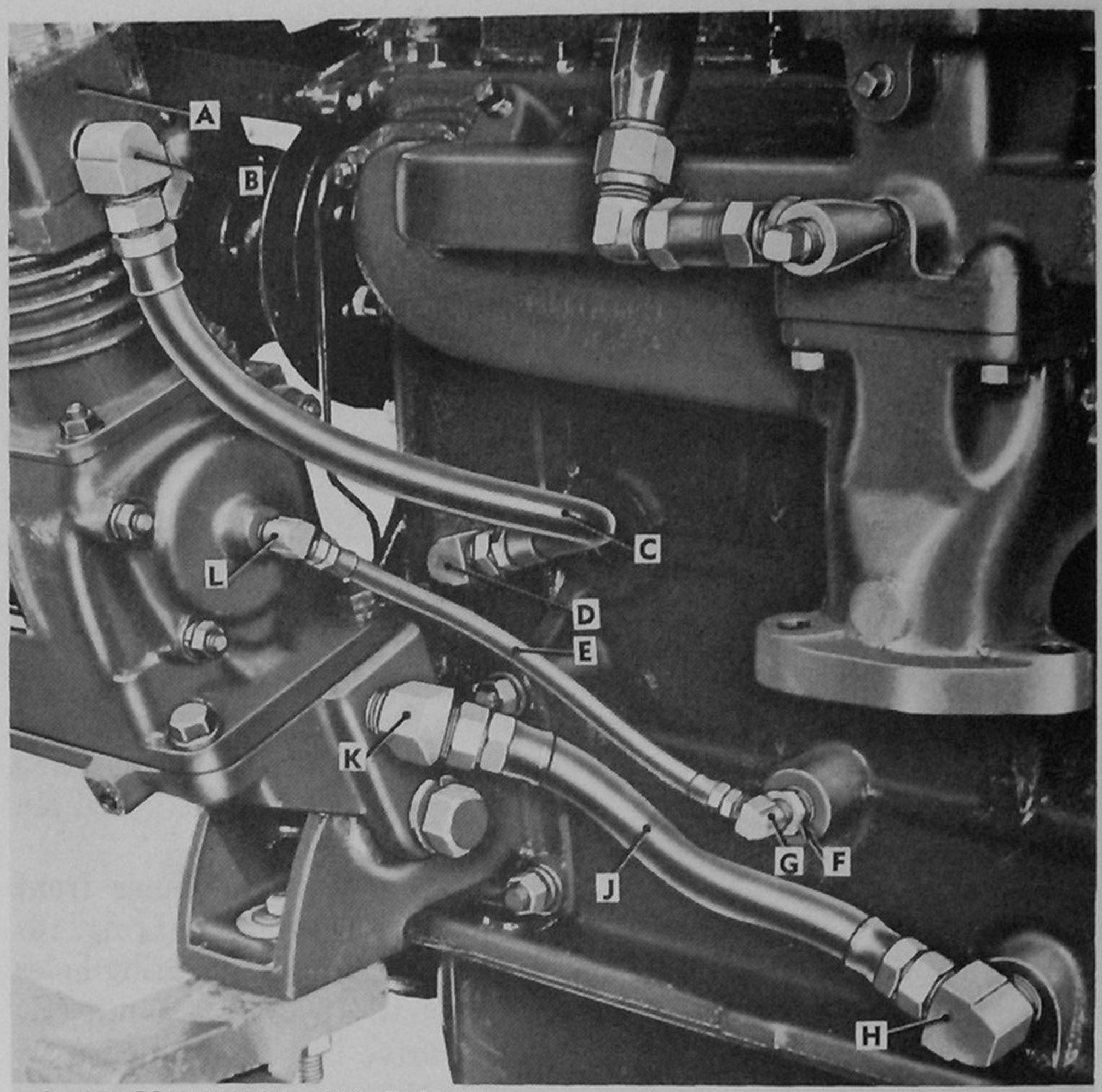
e. Attach air compressor water outlet hose assembly (N) to 90° elbow (T) at front of air compressor. Tighten connection firmly.

Note. Free end of compressor water outlet hose assembly is not connected until engine is assembled to power plant and transmission cooler lines are installed.

f. At rear of air compressor assembly, install compressor water inlet hose assembly (C, fig. 178) and compressor oil inlet and outlet hose assemblies (E and J, fig. 178). Tighten hose connections firmly.

164. Water Pump Drive Belt Idler and Bracket Installation (Engine Assembly 8329440 Only)

a. Install water pump drive belt idler bracket assembly (H, fig. 18) on engine right inner front support mounting bracket (J, fig. 18) and



A—AIR COMPRESSOR ASSY—7350423
B—90-DEGREE ELBOW—137425
C—WATER INLET HOSE ASSY—7410884
D—90-DEGREE ELBOW—137425
E—OIL INLET HOSE ASSY—7350443
F—BUSHING—127956
G—90-DEGREE ELBOW—137421
H—90-DEGREE ELBOW—137426
J—OIL OUTLET HOSE ASSY—7350444
K—45-DEGREE ELBOW—143341
L—90-DEGREE ELBOW—7350445

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Figure 178. Air compressor water and oil lines installed—engine assembly 7411599.

attach with three $\frac{3}{8}$ x 1 bolts (K, fig. 18) and $\frac{3}{8}$-inch lockwashers. Tighten bolts to 18 to 24 pound-feet torque.

b. Position water pump drive belt idler assembly (fig. 179) over studs on idler bracket assembly, then install $\frac{13}{16}$-inch plain washer, $\frac{3}{4}$-inch lockwasher, and $\frac{3}{4}$–16 nut (fig. 179) on idler bracket upper mounting stud. Install $\frac{1}{2}$-inch lockwasher and $\frac{1}{2}$–20 nut (fig. 179) on idler bracket lower mounting stud. Do not tighten nuts until after making water pump drive belt tension adjustment (par. 165*b*).

165. Drive Belt Installation

a. Generator and Water Pump Drive Belt (Engine Assembly 7411599).

Note. The key letters shown below in parentheses refer to figure 26 except where otherwise indicated.

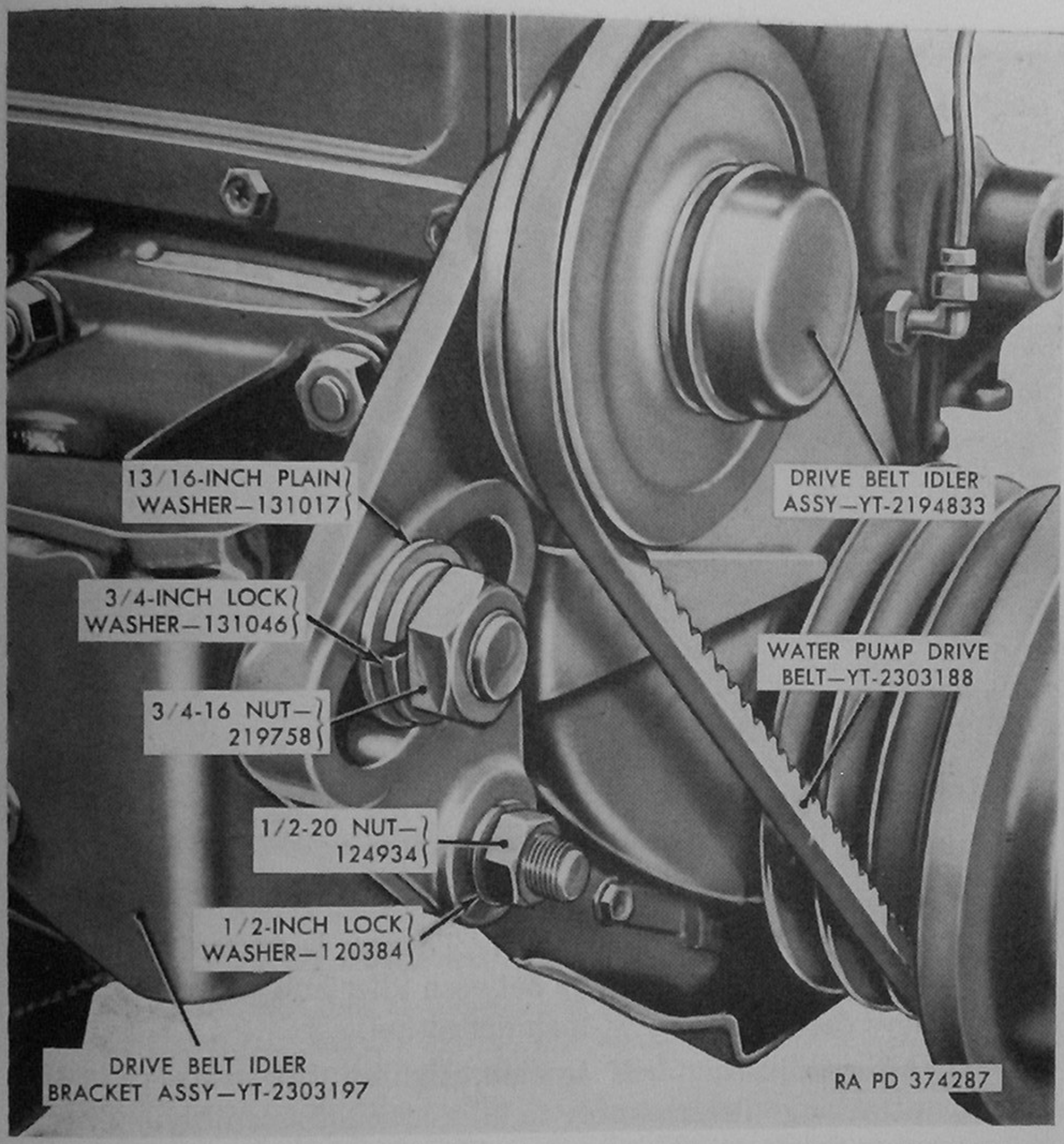

Figure 179. Drive belt idler pulley adjustment points—engine assembly 8329440.

(1) Place generator and water pump drive belt (C, fig. 14) over pulleys. Adjust belt tension by moving generator with pulley assembly (Q) as necessary to obtain correct tension. Tension is correct when light pressure applied midway between generator and water pump pulleys causes $\frac{1}{2}$ to $\frac{3}{4}$-inch deflection (fig. 180).

(2) After adjusting tension, tighten $\frac{3}{8}$ x 1 bolts (D and F) attaching belt tension adjusting arm (J) to generator end frame and to engine thermostat lower housing (E) to 20 to 30 pound-feet torque. Tighten generator mounting $\frac{7}{16}$ x $1\frac{5}{16}$ bolts (K) to 50 to 60 pound-feet torque.

b. Water Pump Drive Belt (Engine Assembly 8329440).

(1) Place water pump drive belt (fig. 179) over pulleys. Adjust belt tension by moving drive belt idler assembly (fig. 179) as necessary to obtain correct tension. Check belt tension in

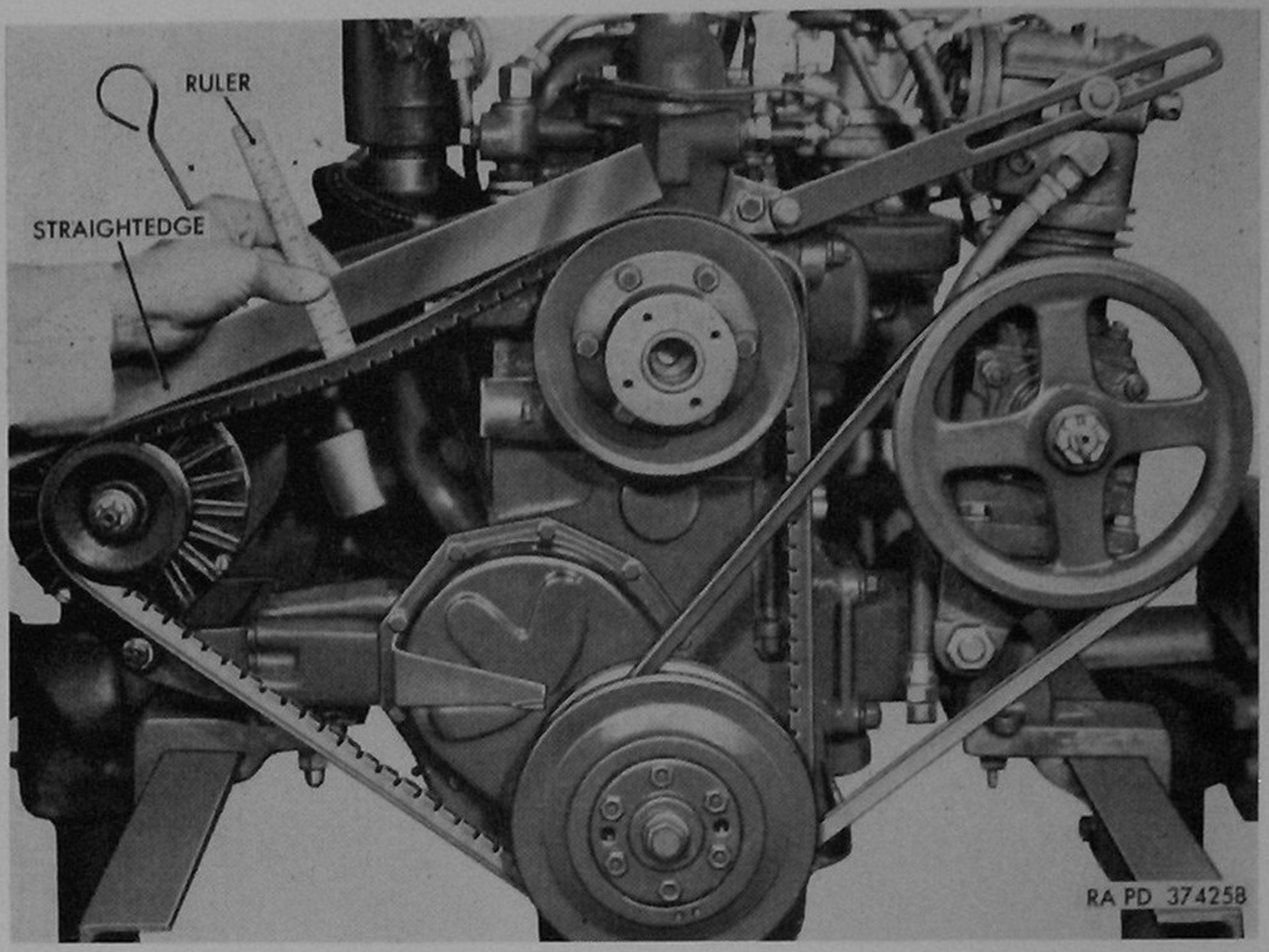

Figure 180. Checking drive belt tension—engine assembly 7411599 shown.

manner shown in figure 180. Tension is correct when light pressure applied midway between idler and water pump pulleys causes a ½ to ¾-inch deflection.

(2) After adjusting belt tension, tighten two nuts (fig. 179) attaching idler assembly to idler bracket assembly. Tighten nuts firmly.

c. Generator and Water Pump Drive Belt (Engine Assembly 8726920).

Note. The key letters shown below in parentheses refer to figure 27 except where otherwise indicated.

(1) Place generator and water pump drive belt (F, fig. 22) over pulleys. Adjust belt tension by moving generator with pulley assembly (N) to obtain correct tension. Check tension in manner shown in figure 180. Tension is correct when light pressure applied midway between generator and water pump pulleys causes a ½ to ¾-inch deflection.

(2) After adjusting tension, tighten bolts (C and E) attaching belt tension adjusting arm (G) to generator end frame and to engine thermostat housing (D) to 20 to 30 pound-feet torque. Tighten generator 7/16 x 1¼ bolts (H) to 50 to 60 pound-feet torque.

d. Air Compressor Drive Belt (Engine Assembly 7411599 Only).

Note. The key letters shown below in parentheses refer to figure 17 except where otherwise indicated.

(1) Install air compressor drive belt (J) over pulleys and move compressor to adjust belt tension in manner shown in figure 180. Tension is correct when light pressure applied midway between pulleys causes ½ to ¾-inch deflection.
(2) After adjusting belt tension, tighten nut on ⅜ x ⅞ bolt (S) and tighten the ⅜ x 1 bolt (Q) to 20 to 30 pound-feet torque. Tighten the ¾ x 6¼ bolt (K, fig. 16) to 100 to 150 pound-feet torque.

166. Fan Blade Installation (Engine Assembly 7411599 or 8726920)

a. Referring to figure 17 or 22, place proper side of fan blade assembly against water pump hub as shown for respective engines.

Note. Concave side of blades must face engine on engine assembly 7411599. On engine assembly 8726920, concave side of blades must face away from engine.

b. Install four ⅝ x 1 bolts with lockwasher (M, fig. 17) to attach fan blade assembly (L, fig. 17) to hub on engine assembly 7411599. Install four ⅝ x 1¼ bolts (D, fig. 22) and four ⅝-inch lockwashers to attach fan blade assembly (C, fig. 22) and water pump drive pulley (E, fig. 22) to water pump hub on engine assembly 8726920. Tighten fan blade attaching bolts to 8½ to 11 pound-feet torque.

167. Flywheel Housing Rear Half Installation (Engine Assembly 7411599 or 8329440)

Note. Until such time as transmission assembly is installed on engine, the flywheel housing rear half (C, fig. 16 or G, fig. 20) should be attached to matched flywheel housing front half (G, fig. 16 or L, fig. 20) on engine assembly.

a. Remove engine assembly from repair stand, then attach flywheel housing rear half (C, fig. 16 or G, fig. 20) to flywheel housing front half (G, fig. 16 or L, fig. 20). Refer to figure 140 and install one ⅜ x 1⅝ bolt, ⅜-inch lockwasher (B and E, fig. 141), and ⅜–24 nut in top center hole of housing, two ⅜ x 1 bolts with ⅜-inch lockwashers (D and E, fig. 141) in the lower hole at each side, and six ⅜ x 1⅛ bolts with ⅜-inch lockwashers (C and E, fig. 141) in balance of holes. Tighten attaching bolts firmly.

b. Install flywheel housing cover (F, fig. 16 or J, fig. 20), with new flywheel housing cover gasket (D, fig. 16 or H, fig. 20) between cover and flywheel housing front and rear halves. Attach cover with eight ⅜ x 1 bolts (E, fig. 16 or K, fig. 20) and ⅜-inch lockwashers. Tighten cover bolts firmly.

Section III. TEST AND RUN-IN OF REBUILT ENGINE

168. General

a. After engine has been rebuilt, it is essential that the engine with accessories be tested and run in. The test must be made to cor-

rect any minor deficiencies that may develop and to perform checks and adjustments that can only be made when engine is running prior to installation in the vehicle.

b. It is recommended that engine go through a run-in period on a dynamometer, and final adjustments be made to insure maximum operating efficiency when engine is installed in a vehicle. A test stand can also be used in lieu of dynamometer equipment for final check, adjustments, and to some degree, a minor run-in can be accomplished on a test stand. The test stand can also be used to check previously run-in engines or to check operation of a disabled unit.

169. Equipment

a. Test Stand. A test stand similar to that illustrated in figure 181, 182, or 183 should be available. The stand should be rigidly mounted and equipped with holding brackets so that engine can be mounted and operated under its own power. A fuel and preheated water supply should be available, as well as an exhaust outlet to protect personnel. The test stand should also be equipped with an instrument panel with standard temperature gage, oil pressure gage, and battery charge indicator. In addition, an electric tachometer, vacuum gage, and timing light, with suitable adapters, must be used.

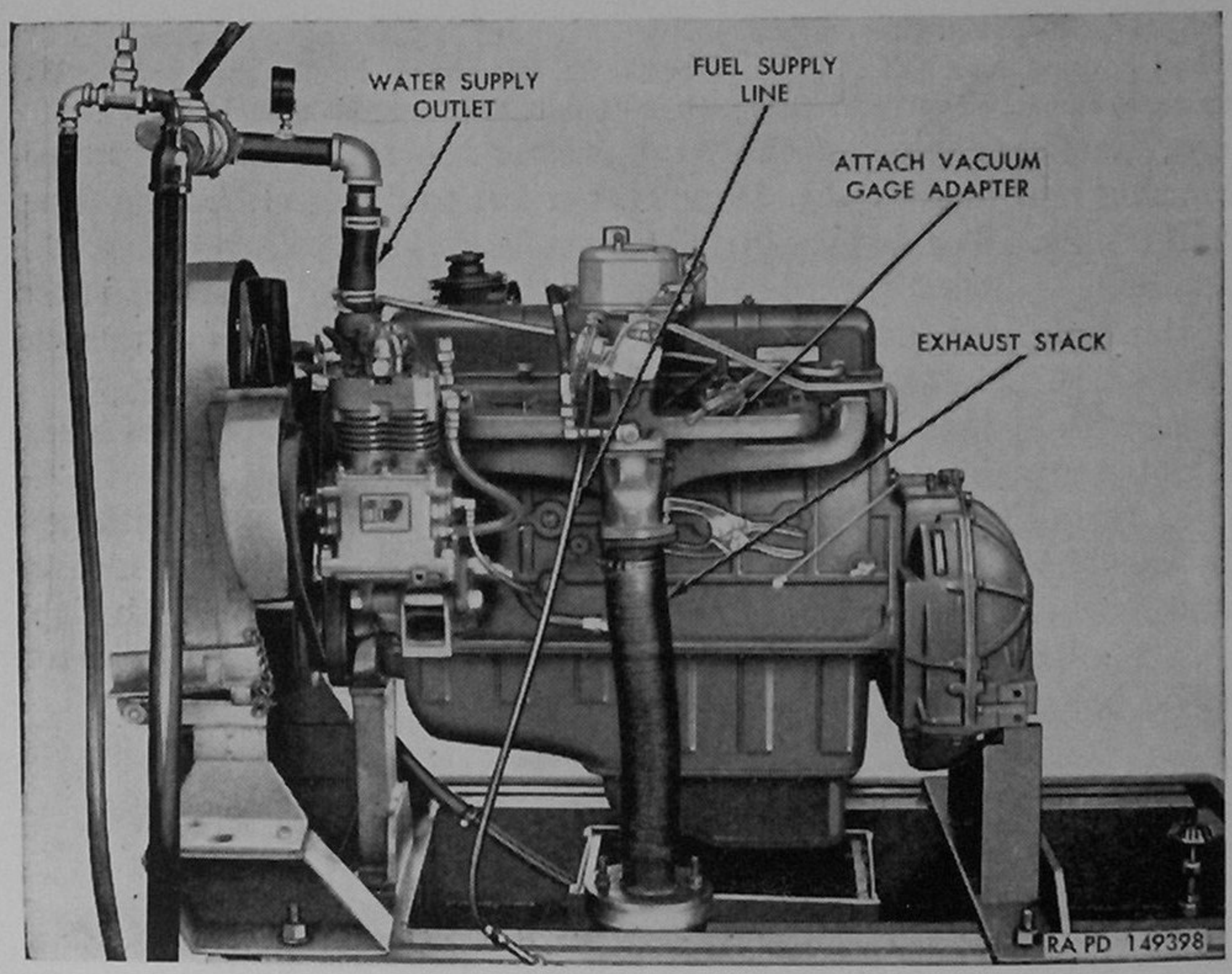

Figure 181. Engine assembly 7411599 in typical test stand (left side view).

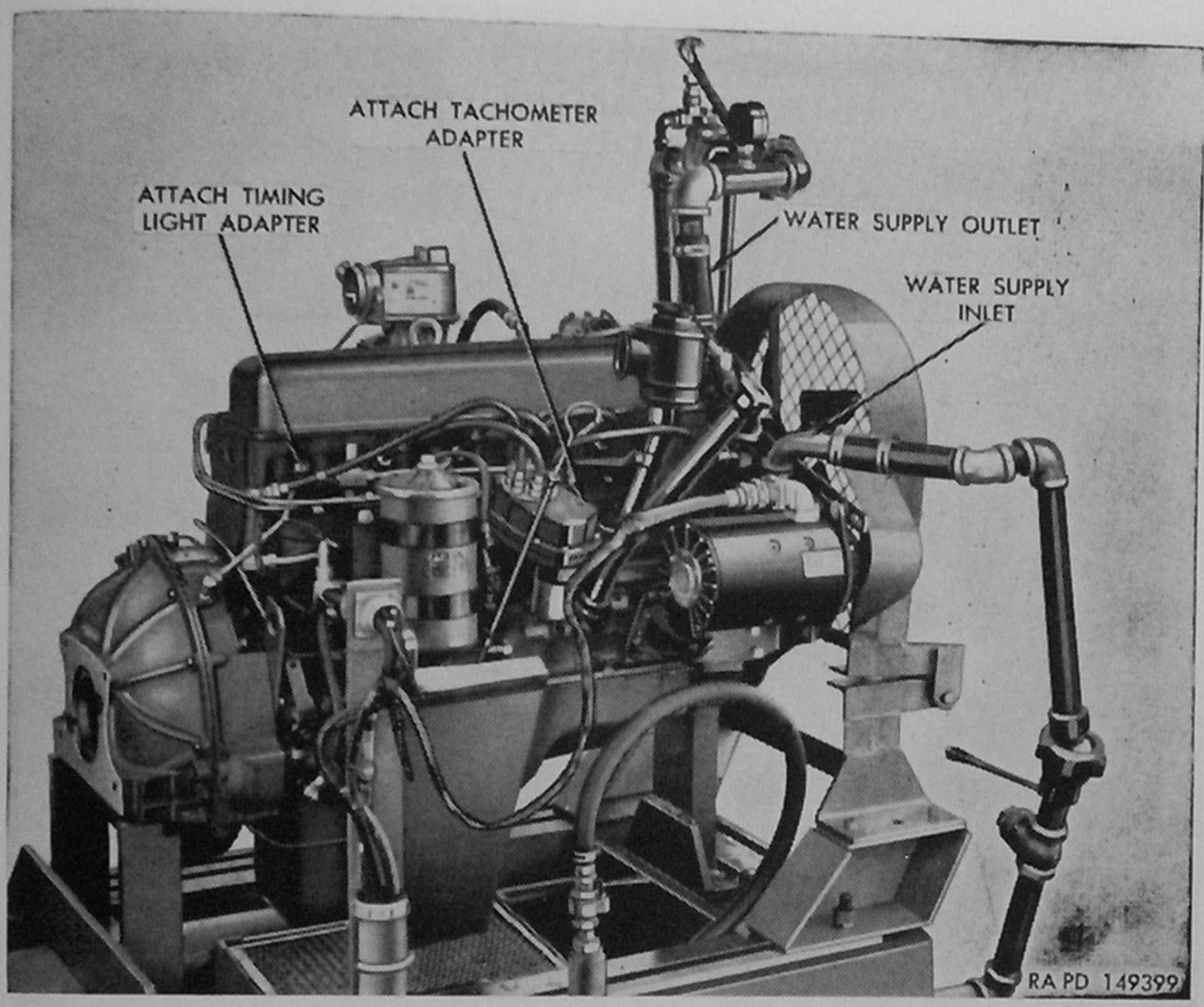

Figure 182. Engine assembly 7411599 in typical test stand (right side view).

b. Dynamometer. Conventional engine dynamometer equipment should be used. The equipment should be such that variable loads can be placed on the engine during run-in period. Instruments and gages comparable to those used with test stand should be available on the dynamometer equipment.

c. Fuel, Oil, and Water Supplies.

(1) *Fuel.* Use fresh supply of low gum content fuel as required. To the above motor fuel, add a gum preventing compound in the ratio of 1 fluid ounce to each 5 gallons of fuel. The gum preventive compound must be used in the fuel to prevent corrosion of carburetor during storage of rebuilt engine after run-in.

(2) *Oil.* Use seasonal grade engine oil (OE) in engine crankcase.

(3) *Water.* Water supply should be preheated to approximately 140° F. Do not preheat water to degree higher than opening point of thermostat (160° F.).

170. Test Stand Run-In Procedures

a. Preliminary Procedures.

(1) Mount engine in stand securely. Make secure connections at exhaust manifold to exhaust stack. Connect external water lines to engine inlet and outlet connections.

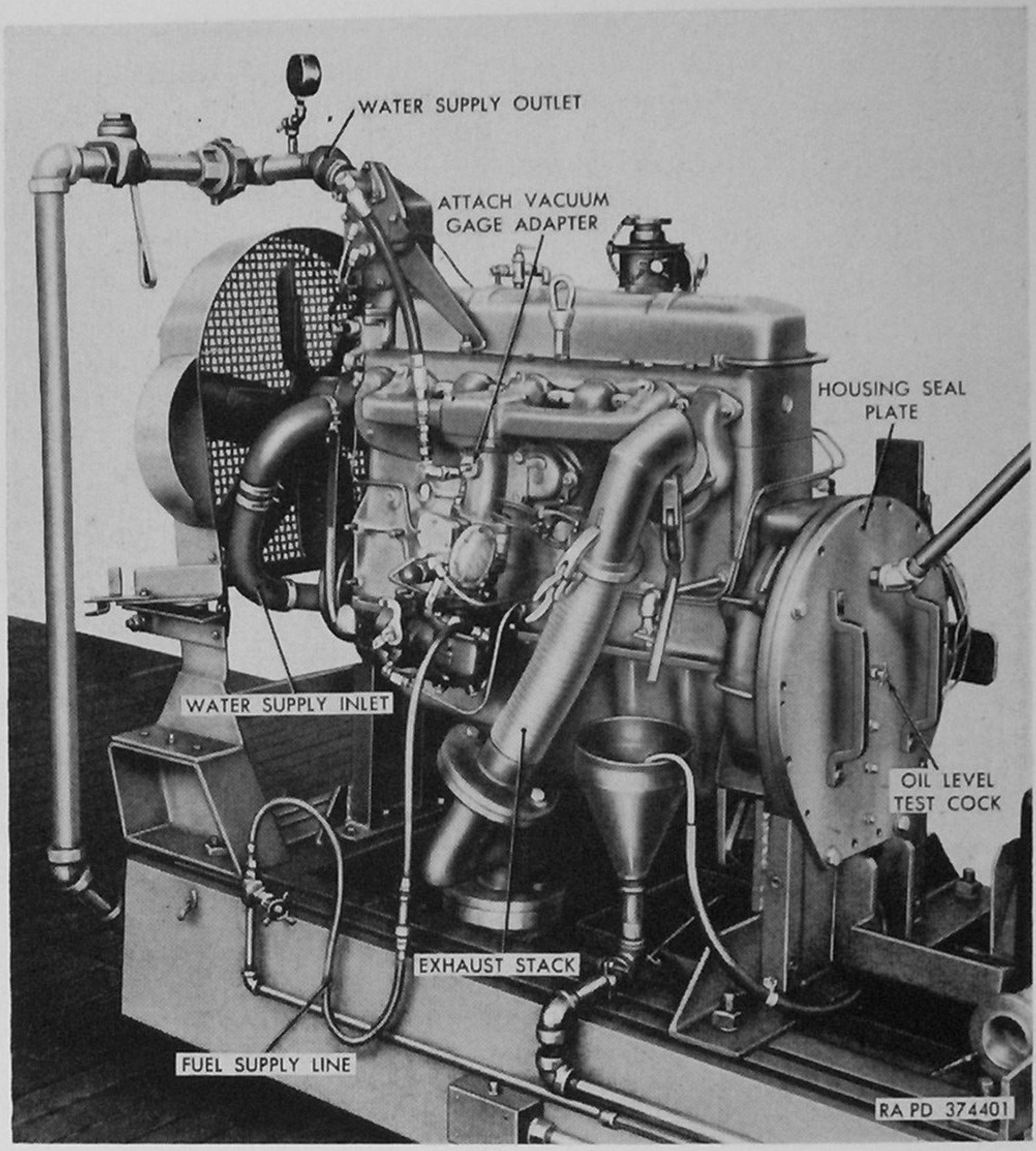

Figure 183. Engine assembly 8726920 in typical test stand (left side shown).

(2) When preparing engine assembly 7411599 for run-in, disconnect transmission water outlet front line at connection at right front of engine, then with a temporary tube, connect air compressor water outlet hose to transmission water outlet line connection at engine. Also connect engine wiring harness connector to test stand wiring connectors.

(3) Connect fuel supply line to carburetor.

(4) Remove screw in distributor cap and install tachometer adapter. Connect adapter to electric tachometer.

(5) Disconnect No. 1 spark plug cable from distributor cover, using wrench 7950895. Thread timing light adapter onto distributor cover; then connect No. 1 spark plug cable to adapter (fig. 184).

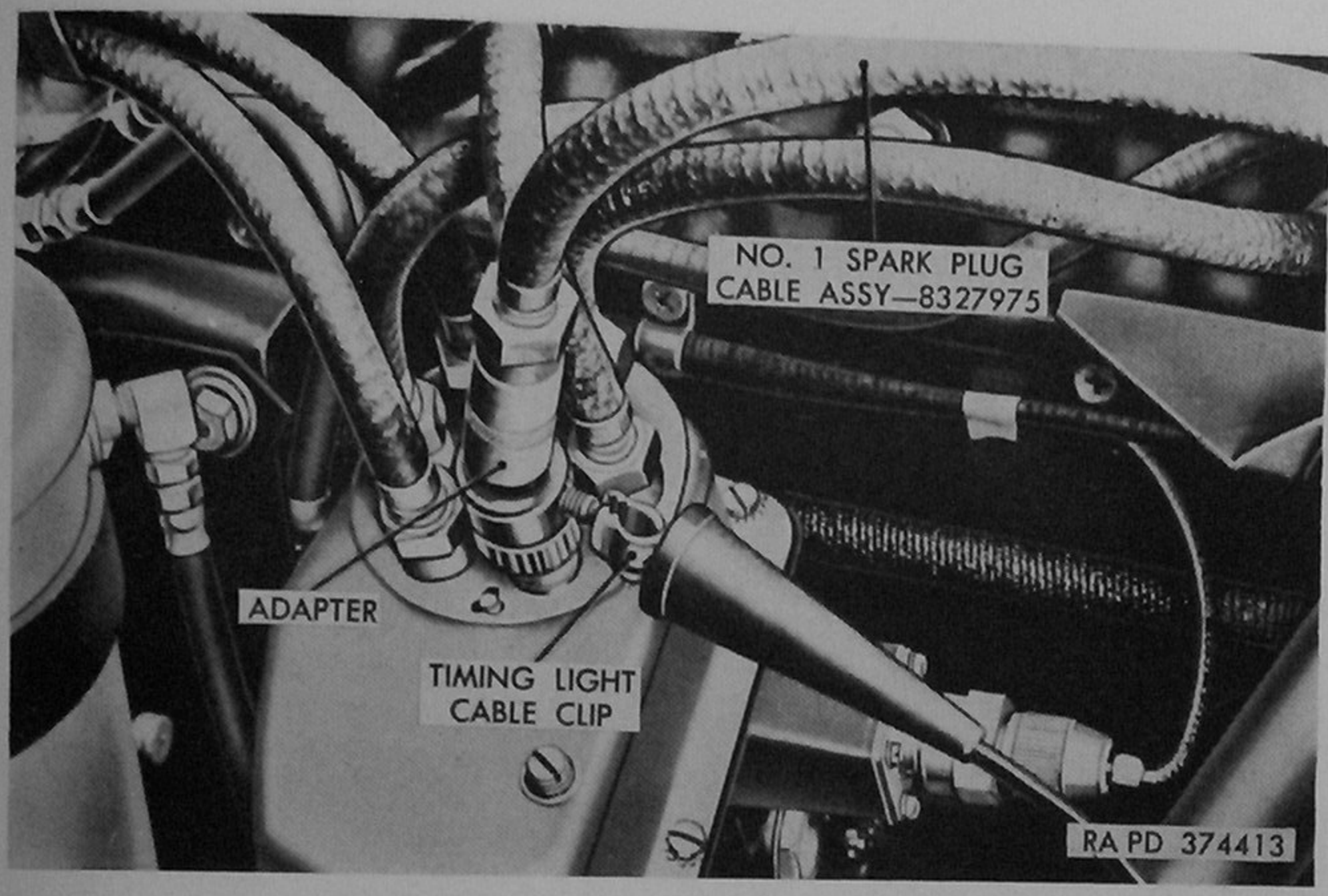

Figure 184. Ignition timing light adapter installed.

(6) Remove pipe plug from rear of intake manifold on engine assembly 7411599 or 8329440, or from fuel vaporizer on engine assembly 8726920. Install vacuum gage connections into hole.

(7) Connect generator connector on engine assembly 7411599 or 8726920 to test stand wiring connectors.

(8) When preparing engine assembly 8726920 for run-in, cover rear opening of flywheel housing with temporary vented housing seal plate (fig. 183), then fill flywheel chamber with 4 quarts of engine oil (OE 10).

(9) Connect water temperature gage and oil pressure gage sending units on engine assembly 8329440 or 8726920 to test stand wiring connectors.

(10) Preoil the engine by forcing engine oil (OE) under pressure into the oil system to insure adequate lubrication to all parts until the normal oil pump supply reaches them. Access to the main oil gallery is attained by disconnecting the oil filter inlet line from 90° elbow (H, fig. 16, M, fig. 20, or C, fig. 24) at left side of cylinder block. If preoiling equipment is not available, fill the oil pan with the proper seasonal grade engine oil (OE) to the correct level on the oil level indicator (11 quarts for engine assembly 7411599 or 8329-440; 10 quarts for engine assembly 8726920).

(11) Engine crankshaft should be turned over several revolutions before starting to determine whether any parts are binding.

b. Warmup. Start engine and run approximately 15 minutes at fast idle (600 to 700 r.p.m.), until engine is thoroughly warmed up. Note that oil pressure is indicated on gage. Engine should be warmed up to normal operating temperature (160° F.). After engine has warmed up, remove rocker arm cover.

c. Ignition Timing. With engine idling (375 rpm), check ignition timing. Direct beam of timing light toward end of timing indicator (fig. 185 or 186) on timing gear cover. Timing light flashes make timing notch on crankshaft pulley appear stationary. Loosen $\frac{3}{8}$ x 1 bolts (fig. 187), which secure the distributor clamp, and turn distributor housing clockwise or counterclockwise as necessary to synchronize flashes with timing notch when it is alined with edge of timing indicator. Tighten bolts.

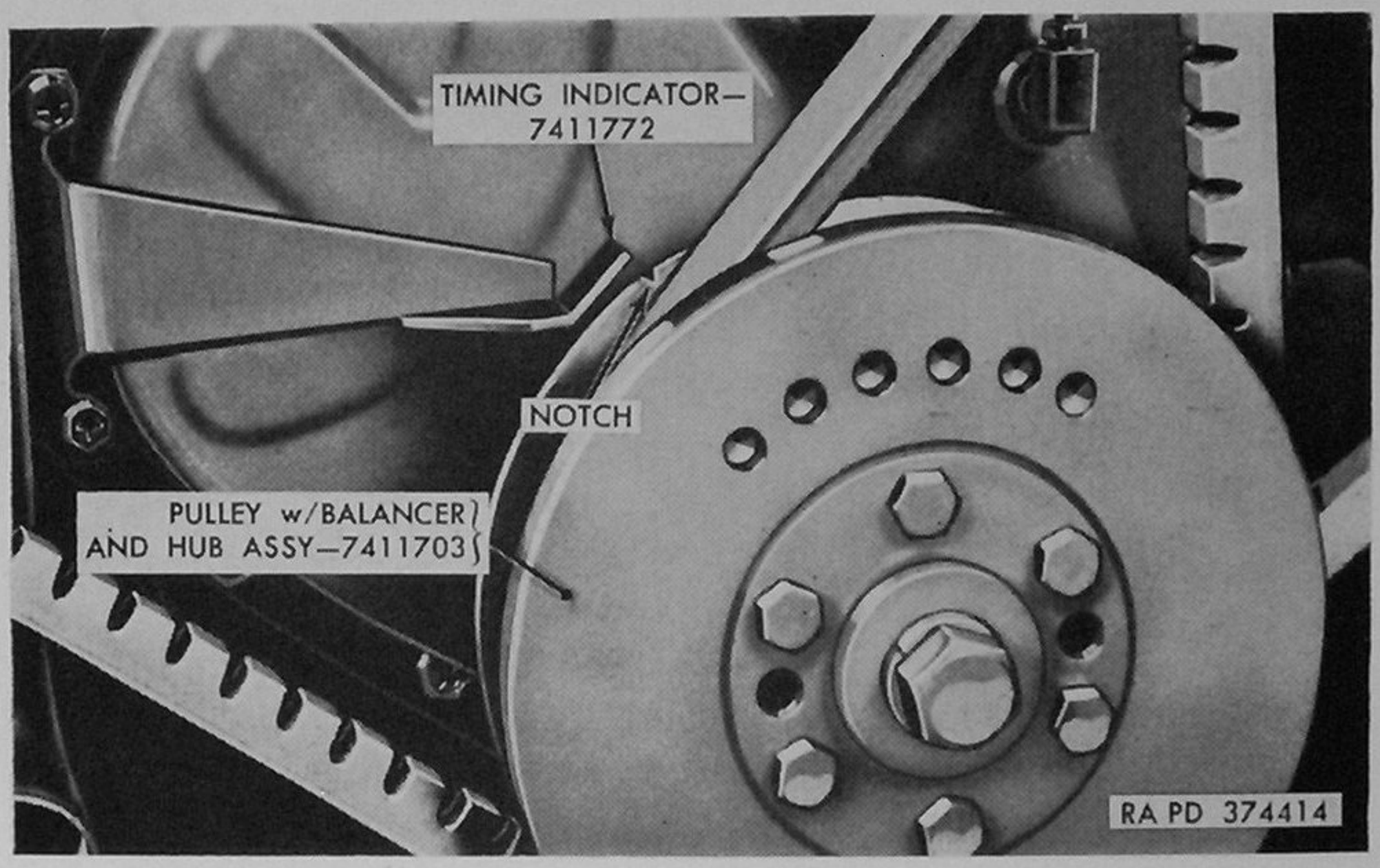

Figure 185. Location of timing notch on crankshaft pulley—engine assemblies 7411599 and 8726920.

d. Carburetor Adjustment. One idle speed or mixture (adjustment) screw (fig. 188 or 189) is provided at carburetor for setting idle speed. Idling mixture is adjusted by two screws (fig. 188) on engine assemblies 7411599 and 8329440 or by one screw (fig. 189) on engine assembly 8226920. Adjust in the following manner.

(1) *Idling speed.* Turn idle speed (adjusting) screw until engine idles at 375 r.p.m.

(2) *Idling mixture.*

(*a*) *Engine assembly 7411599 or 8329440.* Turn idle mixture screws (fig. 188) one at a time to obtain highest reading on vacuum gage with steady indicator. Check idle speed on tachometer. Adjust idle speed if necessary ((1) above).

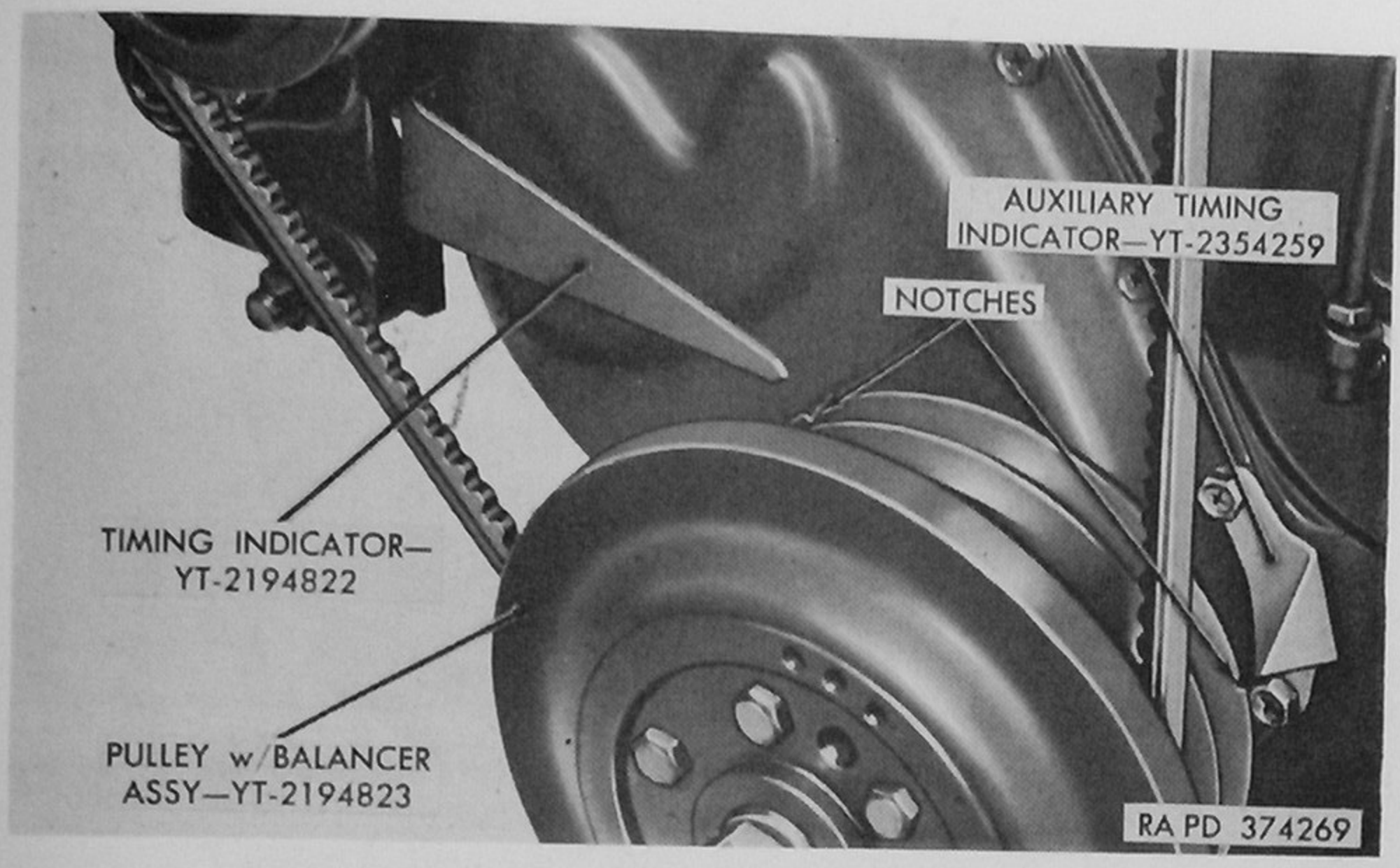

Figure 186. Location of timing notches on crankshaft pulley—engine assembly 8329440.

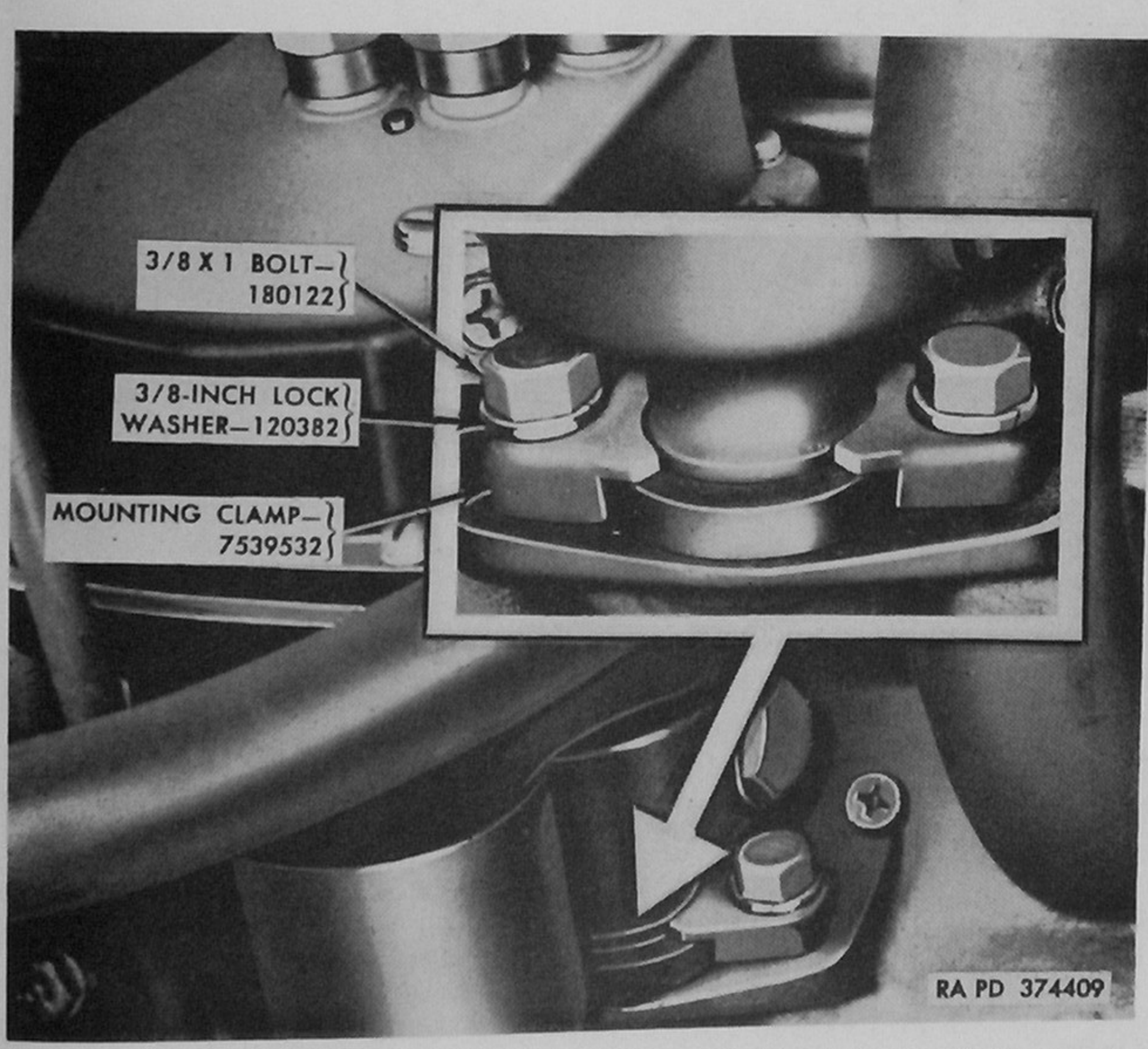

Figure 187. Distributor mounting clamp attaching bolts ins.alled.

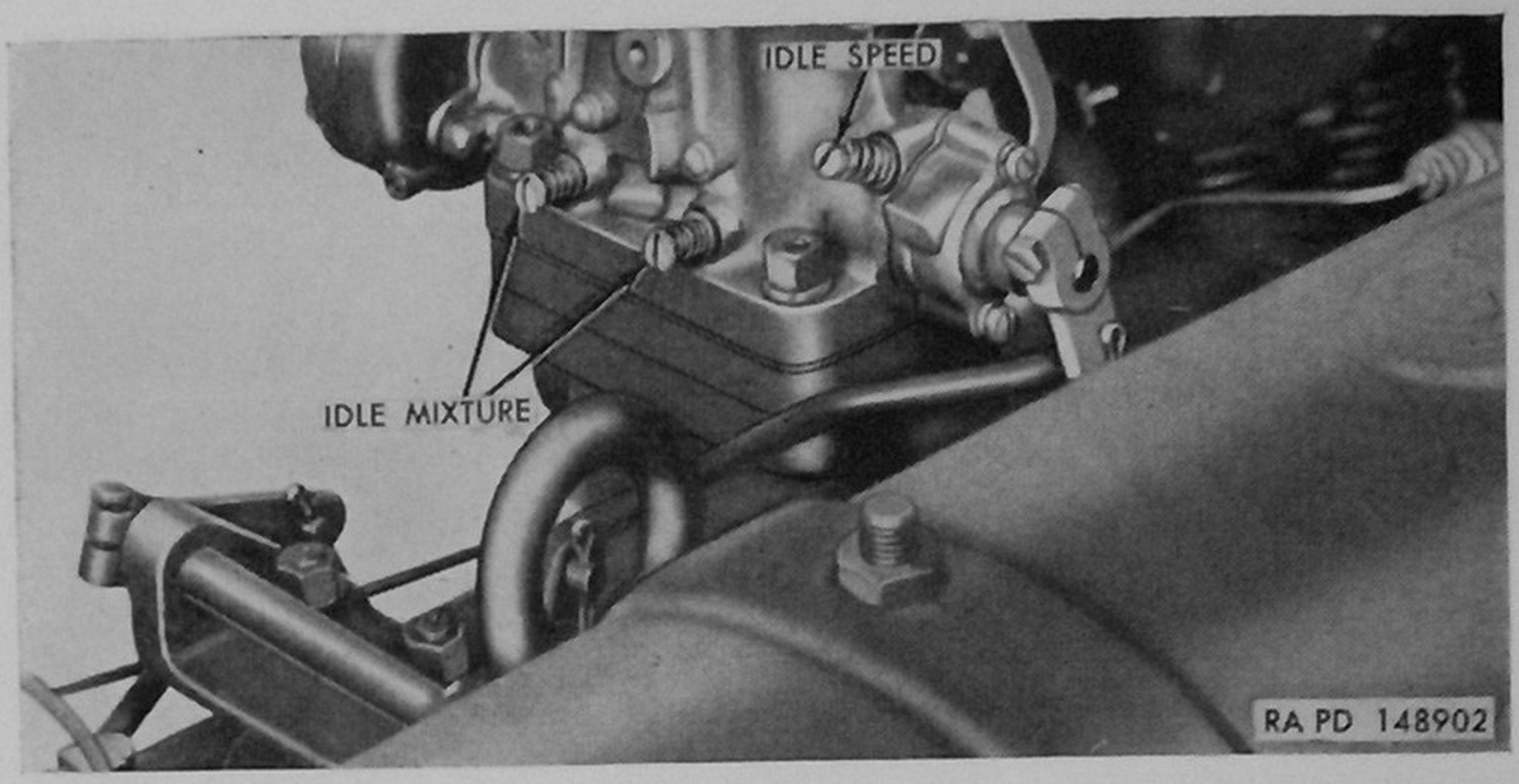

Figure 188. Location of carburetor idle speed and mixture adjusting screws—engine assemblies 7411599 and 8329440.

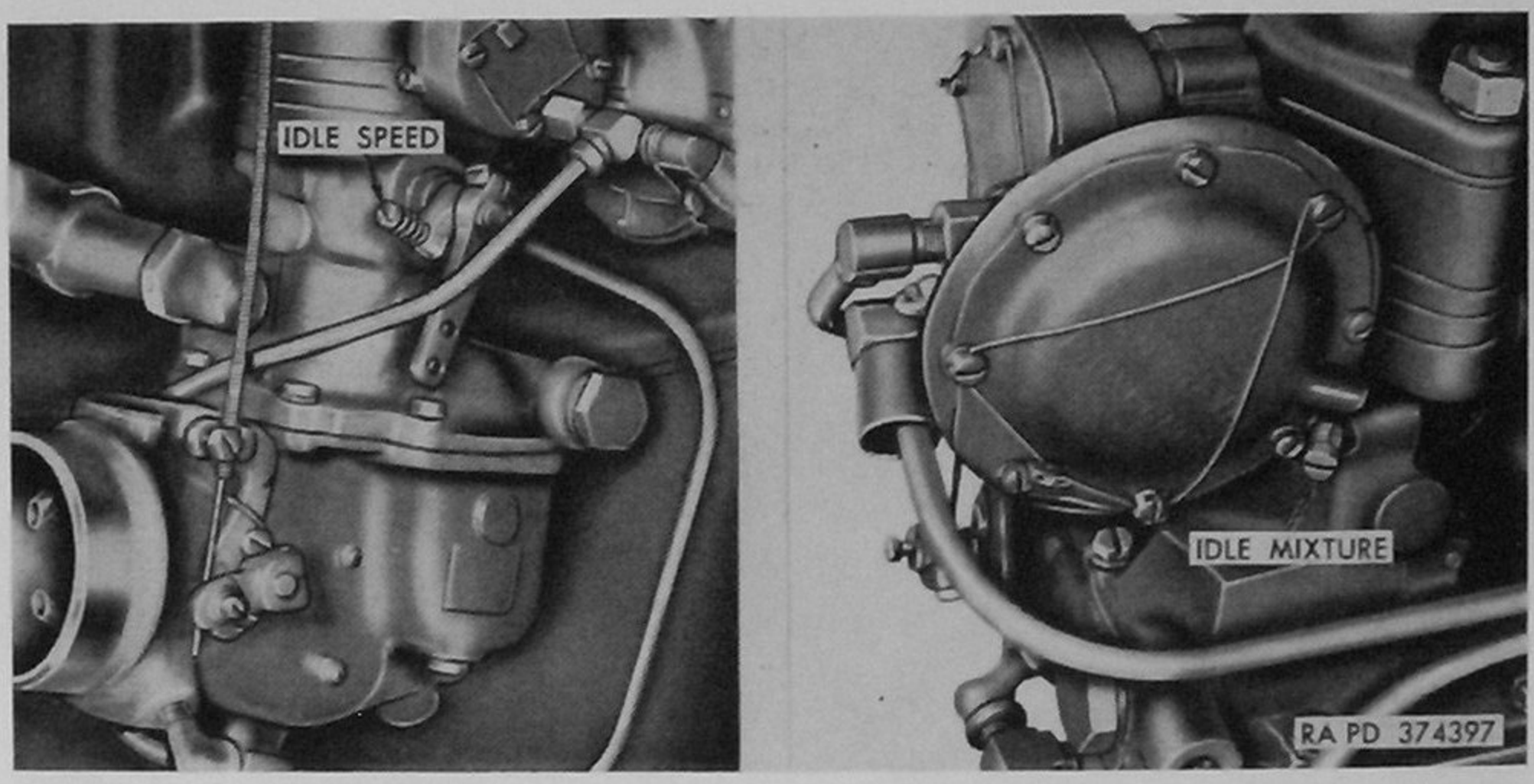

Figure 189. Location of carburetor idle speed and mixture adjusting screws—engine assembly 8726920.

(*b*) *Engine assembly 8726920.* Turn idle mixture screw (fig. 189) to obtain highest reading on vacuum gage with steady indicator. Check idle speed on tachometer. Adjust idle speed if necessary ((1) above).

e. Cylinder Head Bolts. Tighten cylinder head bolts (fig. 164) to specified torque (par. 191), using adapter and torque wrench.

f. Valve Adjustment. After warmup and while idling, tighten valve rocker shaft bracket attaching bolts, then adjust valve clearance (intake 0.012 inch; exhaust 0.020 inch).

g. Oil Cooler Bypass Valve Adjustment (Engine Assembly 8726920 Only).

(1) With engine not operating, remove valve cap (C, fig. 77) from valve body (A, fig. 77) which will expose valve adjusting screw (F, fig. 77).
(2) Disconnect oil cooler inlet line assembly (K, fig. 25) from oil cooler bypass valve assembly (J, fig. 25).
(3) Start and idle engine, then while observing the engine oil pressure gage, gradually increase engine rpm and note at what pressure the engine oil starts to flow from outlet of valve assembly. Oil should start to flow from valve when engine oil pressure reaches approximately 15 p.s.i. Turning valve adjusting screw (F, fig. 77) into valve assembly will cause opening of valve at a higher engine oil pressure, whereas turning screw outward will cause valve to open at a lower pressure. After making adjustment, tighten 7/16–20 nut (E, fig. 77); then reinstall gasket (D, fig. 77) and valve cap (C, fig. 77). Connect oil cooler inlet line assembly (K, fig. 25) to valve assembly. Tighten line nut firmly.

h. Run-In Period. Engine should be run-in approximately 1½ hours, varying speeds from 375 r.p.m. (idle) to not over 1,500 r.p.m.

Note. Do not attempt to check governor action on test stand. This should only be done under full load on dynamometer (par. 171).

i. Inspection During Run-In. Inspect exterior of engine thoroughly for oil or water leaks. Examine oil line connections for leaks. Tighten intake and exhaust manifold connections. Check oil pressure. With engine idling, oil pressure should be approximately 5 p.s.i. Check for any unusual noises.

j. Final Procedures.
(1) Shut off fuel supply and permit engine to stop of its own accord.
(2) Disconnect all test stand connections.
(3) Drain water from engine by opening drain cock at rear left side of engine.
(4) Drain oil from engine. Also drain oil filter by removing plug at bottom of filter shell. Install drain plugs after draining is completed.
(5) On engine assembly 8726920 only, drain oil from flywheel housing, then remove temporary vented housing seal plate (fig. 183) from rear opening of flywheel housing.
(6) Flush engine water passages with a mixture of 60 percent noncorrosive antifreeze compound (ethylene glycol type) and 40 percent water. Add to mixture 5 percent soluble corrosion preventive oil. Allow mixture to circulate throughout the engine water passages. Drain thoroughly, leaving drain cock open.
(7) Clean exterior of engine thoroughly of all water and oil. Prepare engine for storage (par. 172).

171. Dynamometer Run-In Procedures

a. After engine is mounted in dynamometer, the preliminary procedures of attaching the various gages and timing light, and other operations preparatory to running engine are the same as described in paragraph 170*a*.

b. Start and run engine for 15 minutes without load at 700 r.p.m. Check oil pressure.

c. After engine has reached operating temperature make the following checks:

(1) Check ignition timing (par. 170*c*).
(2) Check carburetor idling (par. 170*d*).
(3) Tighten cylinder head bolts (par. 170*e*).
(4) Check oil pressure at idle (par. 170*g*).
(5) Adjust valve clearances (par. 170*f*).
(6) Check for oil and water leaks. Listen for unusual trouble noises.

d. Run in engine according to the schedule provided in table V.

Table V. Engine Run-In Schedule

Period	Time (minutes)	Speed (r.p.m.)	Load (h.p.)
1	20	1020	0
2	20	1325	32
3	20	1530	44
4	20	1770	50
5	20	1970	60
6	30	2210	67
7	30	2620	71
8	30	3060	80
9	5	1970	46
10	10	1090	0

e. Run engine at idle speed (375 r.p.m.) no load for 15 minutes. During this period again check valve clearance, idling mixture, and ignition timing. Check also for water and oil leaks.

f. Check action of governor with engine under full load. Slowly open throttle to full open. Governor should limit speed to 3,350 r.p.m., plus or minus 50 r.p.m. Do not permit engine to run faster than 3,600 rpm. Hold engine "against governor" only long enough to check governor action.

Caution: The governor mechanism in distributor is calibrated at the time of distributor assembly, and on a bench test stand with proper instruments. If the governor action is not correct at the governor check (*f* above), a new or rebuilt distributor, properly calibrated, should be installed. However, the governor unit in distributor can be adjusted on engine while mounted on dynamometer. This method, however, is not recommended except in case of emergency.

g. Adjust governor in following manner:

(1) With engine stopped, remove seals from two plugs at lower part of distributor housing; then remove the two plugs.

(2) Crank engine over until No. 8 x 32 nut (fig. 190) retaining governor valve spring is in line with one of the plug openings.

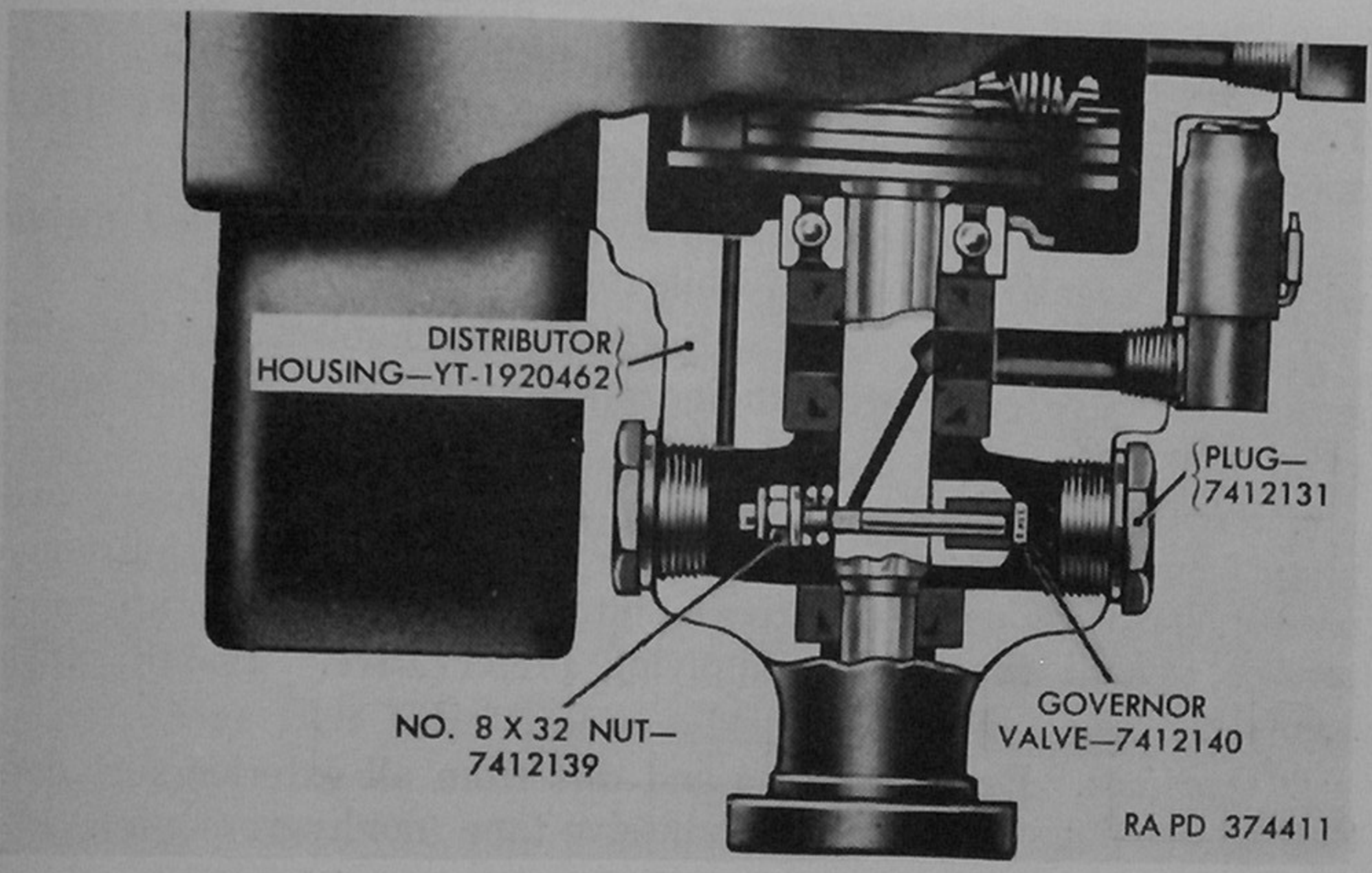

Figure 190. Governor mechanism in ignition distributor assembly.

(3) Insert a thin body socket wrench through plug hole over nut. Insert a small screwdriver through opposite plug hole to engage slot in end of governor valve.

(4) While holding governor valve with screwdriver, turn nut retaining governor valve spring slightly clockwise if engine speed is to be raised, or counterclockwise if engine speed is to be reduced. Do not turn more than one-eighth of a turn in either direction at a time. Install plugs securely, start engine, and check action of governor again (*f* above). Repeated adjustments may be necessary before governor is properly adjusted.

(5) After adjustment has been made, make certain that plugs are firmly tightened and seals installed.

h. After engine has been run in on dynamometer, shutoff fuel supply and permit engine to stop as fuel is depleted in carburetor.

i. Drain oil and water from engine (par. 170*j*).

j. Flush engine coolant passages with ethylene glycol mixture (par. 170*j* (6)).

k. Prepare engine for storage (par. 172).

172. Preparation or Storage for Shipment

a. General. If engine assembly is to be stored or shipped, engine parts should be processed as explained in *b* through *h* below. These procedures are necessary to prevent corrosion and rust.

b. Internal Processing. Remove all spark plugs. With an air-atomizing gun and dry air, spray or "fog" approximately 2 ounces of engine preservative oil into each cylinder through spark plug holes. Turn engine by hand or starter at least five revolutions during spray operations at each spark plug hole. Install spark plugs.

c. Flywheel and Housing. Spray flywheel and interior of housing with rust preventive compound while rotating engine.

d. Valve Mechanism. Coat entire valve mechanism and interior surface of valve cover with engine preservative oil. Install valve cover securely.

e. Air Compressor (Engine Assembly 7411599 Only). Remove two plugs from top of compressor cylinder head. While rotating compressor, spray engine preservative oil into each cylinder. Rotate compressor several times while applying preservative. Install plugs securely.

f. Openings. Remove grease and dirt from all exterior surfaces. Seal all openings in engine with adhesive tape (nonhygroscopic).

g. Engine Lines. Secure all loose lines to engine with adhesive tape.

h. Engine, Accessories, Wiring, and Drive Belts. Spray exterior surfaces of the engine, accessories, and all electrical wiring with ignition insulation compound. Drive belts should be removed from engine and packed in waterproof packages, then attached to engine.

CHAPTER 8
REPAIR AND REBUILD STANDARDS

173. General

The repair and rebuild standards included herein give the minimum, maximum, and key clearance of new or rebuilt parts. They also give wear limits for some parts which indicate that point to which a part or parts may be worn before replacement, in order to receive maximum service with minimum replacement. Normally, all parts which have not been worn beyond the dimensions shown in the "Wear limits" column or damaged from corrosion will be approved for service. In the "Sizes and fits of new parts" column, the letter L indicates a loose fit (clearance) and the letter T indicates a tight fit (interference).

174. Drive Belt Idler Components (Engine Assembly 8329440 Only)

Fig. No.	*Ref. letter*	*Point of measurement*	*Sizes and fits of new parts*	*Wear limits*
191	A	Diameter of adjusting arm bore.	0.6242 to 0.6252	--
	B	Diameter of bore in pulley	1.1805 to 1.1815	--
	C	Diameter of shaft	0.6262 to 0.6267	--
	D	Diameter of bearing	1.1806 to 1.1811	--
	C–A	Fit of shaft in adjusting arm	0.0010T to 0.0025T	--
	D–B	Fit of bearing in pulley	0.0009L to 0.0006T	--

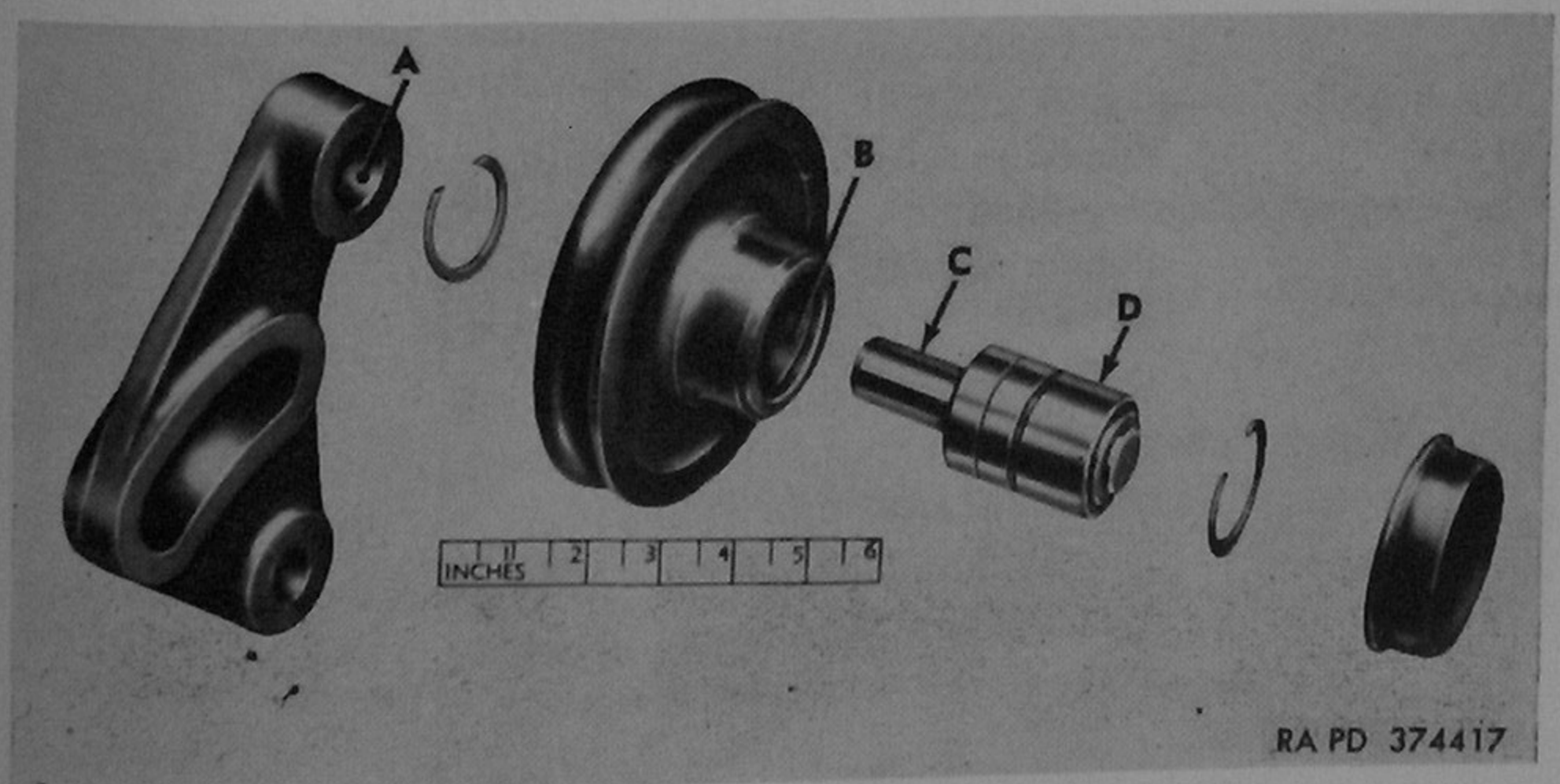

Figure 191. Repair and rebuild standard points of measurement for drive belt idler components (engine assembly 8329440 only).