(3) With ignition turned off, front oil pump is not running. If noise is still present and was not sensitive to engine speed, noise is in rear oil pump.

(4) If doubt exists whether noise originates in rear oil pump or axles, proceed as in (*a*) through (*g*) below.

(*a*) Disconnect and remove transmission-to-transfer propeller shaft (par. 229*c*).

(*b*) Remove oil filler cap and oil level indicator from transmission.

(*c*) Start engine and move transmission control lever into F–1, HIGH RANGE position.

(*d*) Accelerate engine until transmission shifts into fourth speed. If noise is in rear oil pump, it will be heard at approximately same speed as when road testing in (1) and (2) above.

(*e*) This test definitely eliminates axles as being source of noise. Report condition to ordnance maintenance personnel.

(*f*) Install transmission-to-transfer propeller shaft as described in paragraph 230*c*.

(*g*) Install transmission oil filler cap and oil level indicator.

201. Front Band Adjustment

a. General. Reference must be made to paragraph 10 for front band adjustment intervals during break-in period on new or rebuilt vehicles. The need for additional adjustment may vary, depending upon the service to which vehicle is subjected. In every case, where the shift does not conform to the automatic shift pattern indicated in table X, an immediate adjustment of the front band must be accomplished.

Caution: Do not attempt to adjust the rear band. Rear band adjusts automatically with vehicle in normal operation. Rear band adjusting screw is used only for initial adjustment at transmission assembly or overhaul. Rear band adjusting screw is located toward rear of transmission (away from engine) and is equipped with a cap to prevent unintentional external adjustment.

b. Inspection.

(1) Fold back companion seat.

(2) On late-type vehicles only, remove four bolts with lockwashers attaching foot rest to floor; then remove foot rest.

(3) Remove 14 bolts attaching floor pan to cab floor and dash; then remove floor pan to gain access to front band adjusting screw (C, fig. 191).

(4) Apply parking brake lever.

(5) Clean indicator pin plug (B, fig. 191) and adjacent surface of transmission case; then run engine at idling speed with transmission control lever in F–1, HIGH RANGE position.

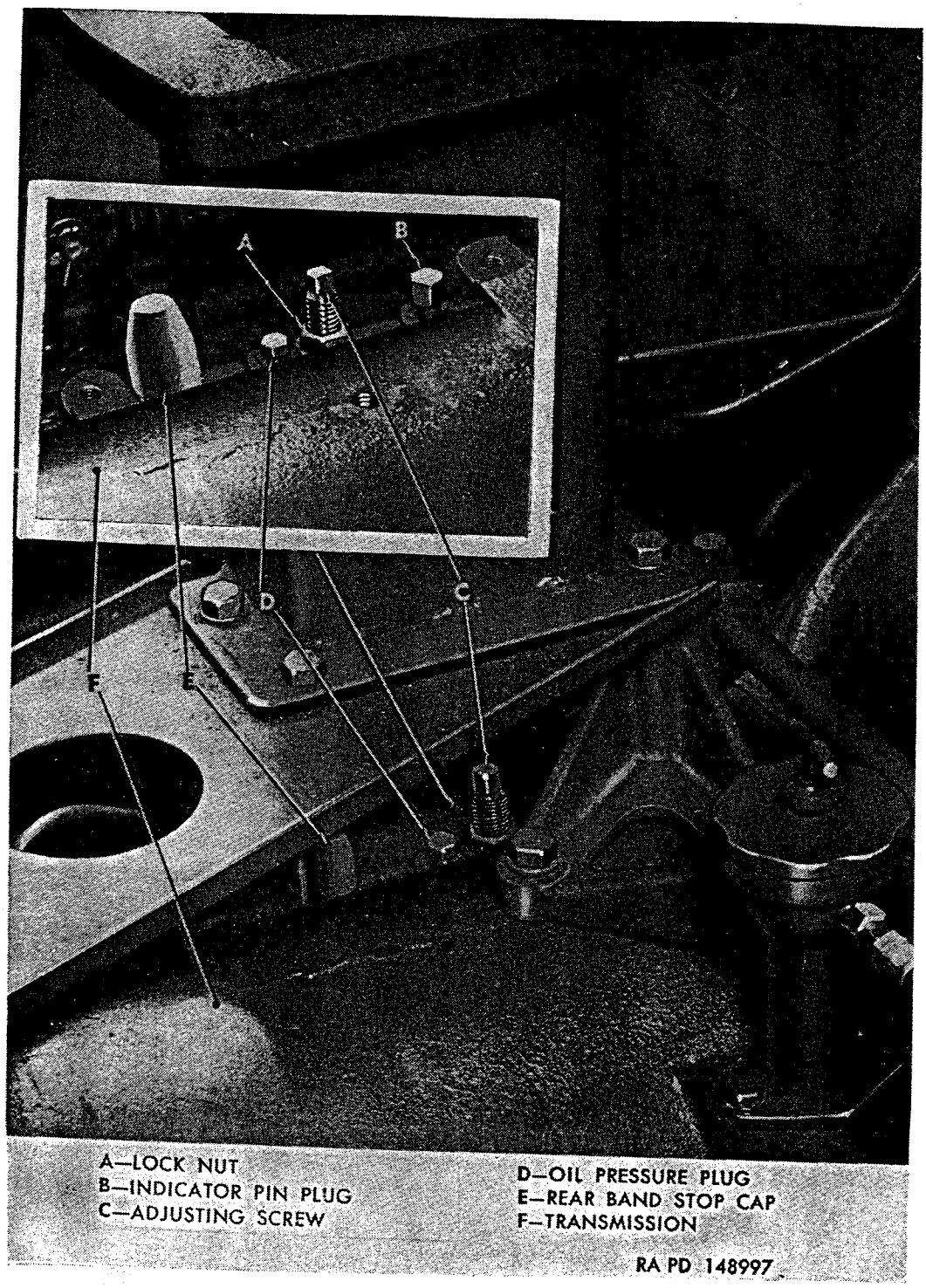

Figure 191. Location of band adjusting screws.

(6) Unscrew indicator pin plug (B, fig. 191). Indicator pin should be flush (± 1/64 inch) with machined surface of transmission case. Use straightedge to check pin position (fig. 192).

c. Adjustment.

(1) Loosen front band adjusting screw locknut (A, fig. 191).

Note. If end of indicator pin is more than one thirty-second inch above machined surface of transmission case, it is not necessary to loosen adjusting screw. In (2) below, if indicator pin checks high, turn adjusting screw in.

If indicator pin checks low, turn adjusting screw out.

(2) Turn adjusting screw (C, fig. 191) until pin is EXACTLY FLUSH with machined surface of transmission case. Use straightedge (fig. 192) to check adjustment.

(3) While holding adjusting screw (C, fig. 191) stationary, tighten adjusting screw locknut (A, fig. 191) to 40 to 50 pound-feet torque.

(4) Use a straightedge (fig. 192) to recheck indicator pin position to EXACTLY FLUSH with machined surface of transmission case.

(5) Install indicator pin plug (B, fig. 191) in transmission case. Tighten plug to 15 to 18 pound-feet torque.

(6) Install cab floor pan, attaching with fourteen 5/16–24 x 5/8 bolts and external-teeth lockwashers.

(7) On late type vehicles only, position foot rest on cab floor. Attach foot rest to floor with four 5/16–24 x 3/4 bolts with external-teeth lockwashers.

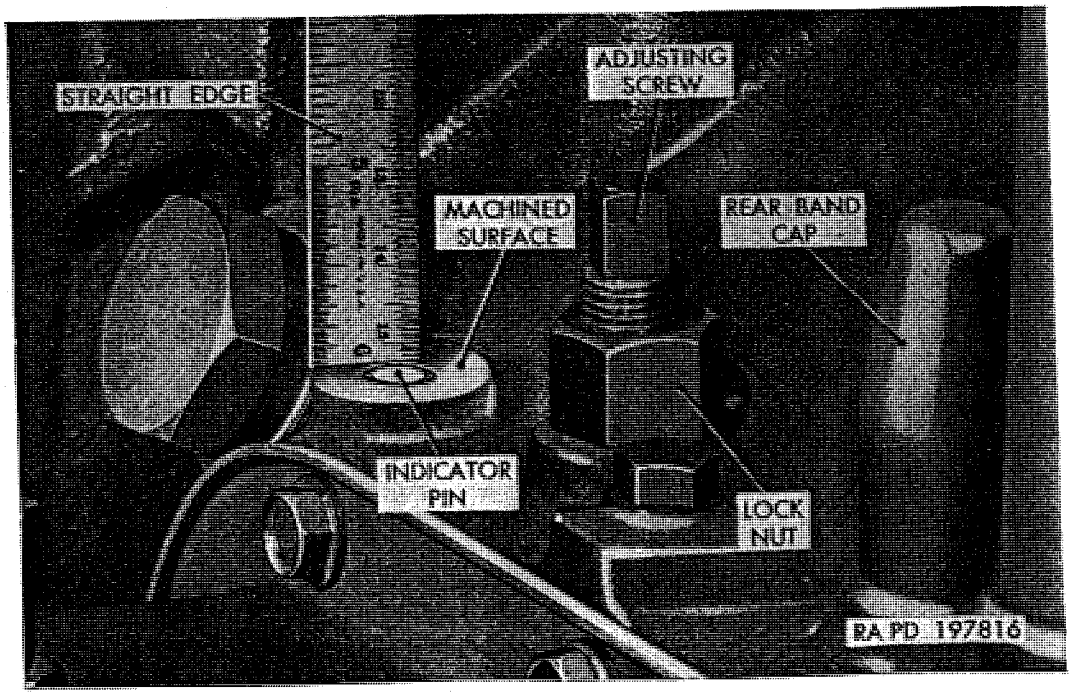

Figure 192. Checking position of indicator pin.

202. Transmission Manual and Throttle Linkage

a. General. Importance of correct transmission manual and throttle control linkage adjustments cannot be overemphasized. Performance of transmission is closely allied with performance of engine. Transmission shift pattern (table X) is balanced with and dependent upon inertia and torque characteristics of engine. Consequently, transmission and other controls must be correctly adjusted and maintained in order to provide correct performance. It should be kept in mind, that to assure efficient performance of power plant, transmission should be as carefully balanced with engine as are fuel and ignition systems.

b. Throttle Linkage Adjustment.

(1) *General.* Correct adjustment of throttle valve control lever on side of transmission is very important; therefore, gaging and bending procedures must be carefully performed. Always make adjustments in sequence listed. Before making throttle linkage adjustment, adjust engine idling speed (par. 127*b*) and thoroughly clean and oil all linkage adjustable yokes and clevis pins. Throttle valve control lever is connected to accelerator linkage as shown in figures 193 and 196.

Caution: Do not pry against or twist throttle valve control lever, as serious damage to transmission control valve assembly may result.

(2) *On early type vehicles only.* Refer to figure 193.

(*a*) Disconnect throttle valve control rod from throttle valve lever by removing cotter pin and clevis pin.

(*b*) Hold transmission throttle valve lever gage B7950168 against machined surface of fly wheel housing rear half as shown in figure 194. Using clevis pin previously removed, check for free pin in closed position of throttle valve lever (C, fig. 194).

(*c*) If clevis pin cannot be freely inserted through hole in throttle valve lever and hole in gage B7950168, bend throttle valve lever with bending tool C7950171. Place bending tool on lever as shown in figure 195, or on opposite side of lever depending on direction bend is required. Turn screw in tool with wrench to bend lever.

(*d*) After correct adjustment is made, connect throttle valve control rod to throttle valve lever with clevis pin and cotter pin.

(*e*) Disconnect throttle valve control rod adjustable clevis from idler shaft outer lever by removing cotter pin and clevis pin.

(*f*) While holding throttle valve lever against stop, loosen adjustable yoke locknut on throttle valve control rod and

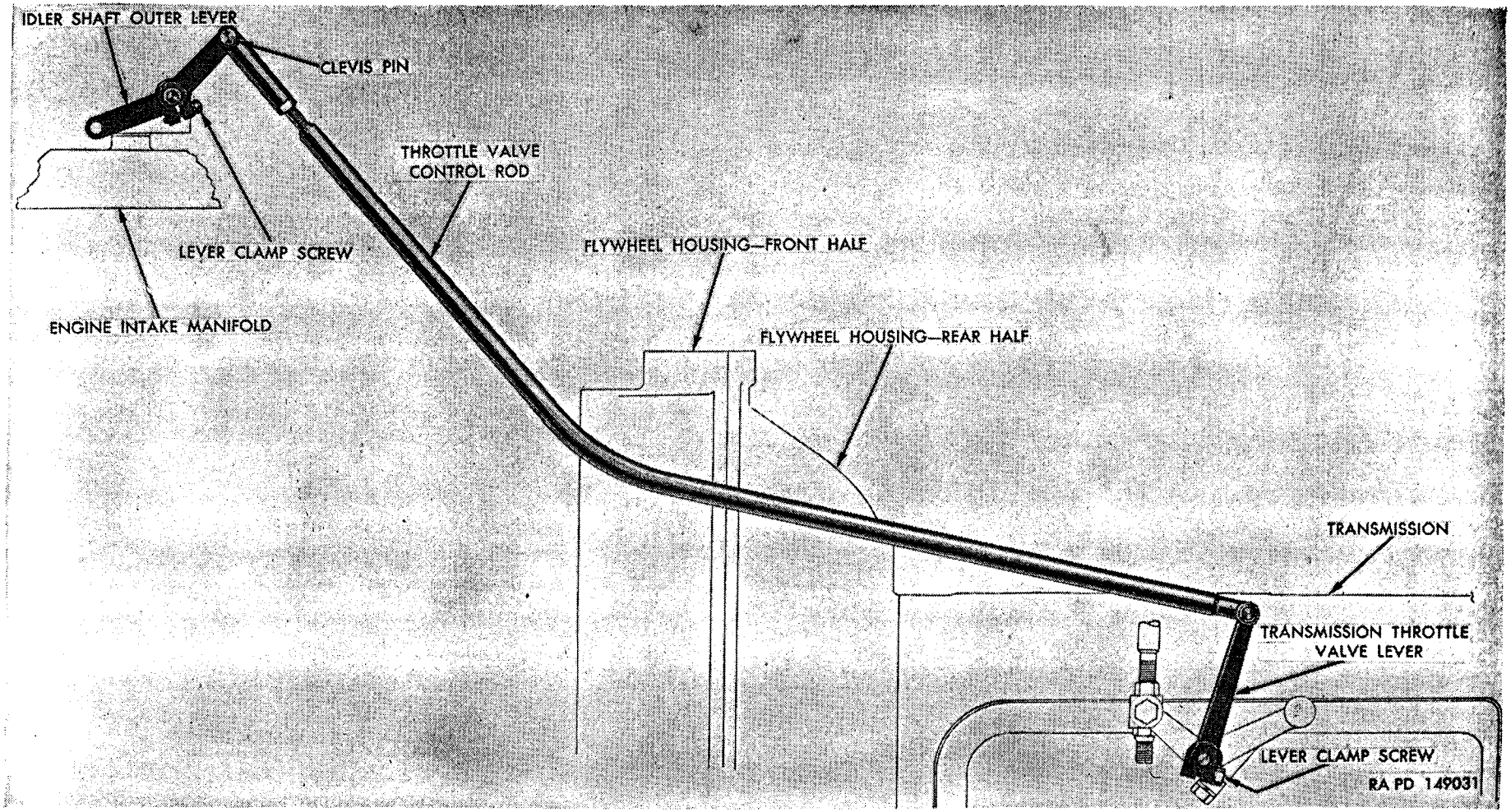

Figure 193. Throttle linkage arrangement (early type)

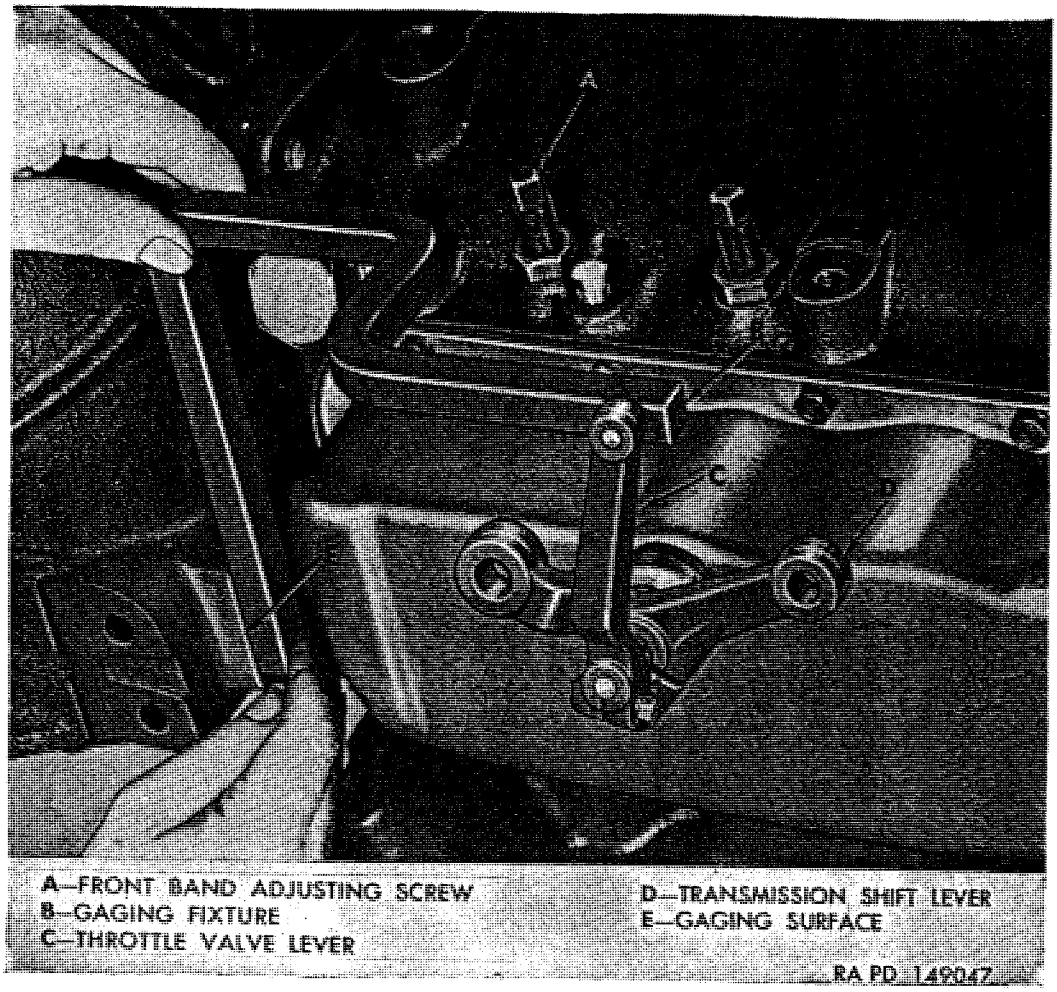

Figure 194. Using gage—B7950168 to adjust throttle valve lever.

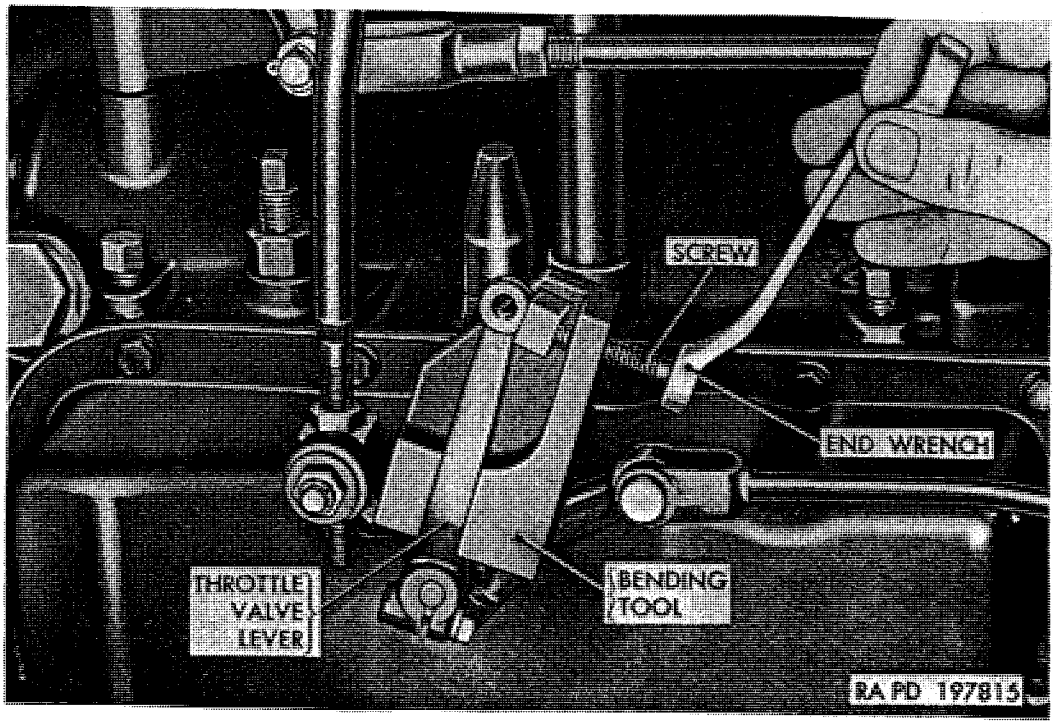

Figure 195. Using tool C7950171 to bend throttle valve lever.

adjust yoke on rod as necessary to obtain free installation of clevis pin through yoke and idler lever.

(*g*) After free pin adjustment is made, shorten throttle valve control rod by one to two turns of adjustable yoke; then secure clevis pin with cotter pin and tighten locknut against adjustable yoke.

(3) *On late type vehicles only.*

Note. The key letters noted in parentheses are in figure 196, except where otherwise indicated.

(*a*) Disconnect throttle valve control rod (K) from throttle valve lever (L) by removing cotter pin and clevis pin (M).

(*b*) Hold transmission throttle valve lever gage B7950168 against machined surface of flywheel housing rear half (N) as shown in figure 194. Using clevis pin (M) previously removed, check for free pin in closed position of throttle valve lever (L) as shown in figure 194.

(*c*) If clevis pin cannot be freely inserted through hole in throttle valve lever and hole in gage B7950168, bend throttle valve lever with bending tool C7950171. Place bending tool on lever as shown in figure 195, or on opposite side of lever, depending on direction bend is required. Turn screw in tool with wrench to bend lever.

(*d*) After correct adjustment is made, connect throttle valve control rod (K) to throttle valve lever (L) with clevis pin (M) and cotter pin.

(*e*) Disconnect throttle valve control rod adjustable yoke (H) from lever of throttle control cross shaft bracket (G) by removing cotter pin and clevis pin (F).

(*f*) Loosen jam nut (A) and turn adjusting screw (B) in as far as it will go; then push throttle cross shaft inner-lever-to-carburetor rod (C) against carburetor stop in open throttle position. While holding throttle cross shaft inner-lever-to-carburetor rod (C) in this position, back adjusting screw (B) out until it JUST TOUCHES stop on throttle cross shaft inner-lever-to-carburetor rod (C) Tighten adjusting screw jam nut (A).

(*g*) Push down on accelerator pedal (P) until carburetor throttle overrule spring (E) is compressed and spring sleeve (D) is against stop; then adjust yoke (H) so that transmission throttle valve lever (L) is against stop and clevis pins are free.

(*h*) Lengthen throttle valve control rod (K) by turning adjustable yoke (H) one turn; then tighten locknut. Secure clevis pin (F) with cotter pin.

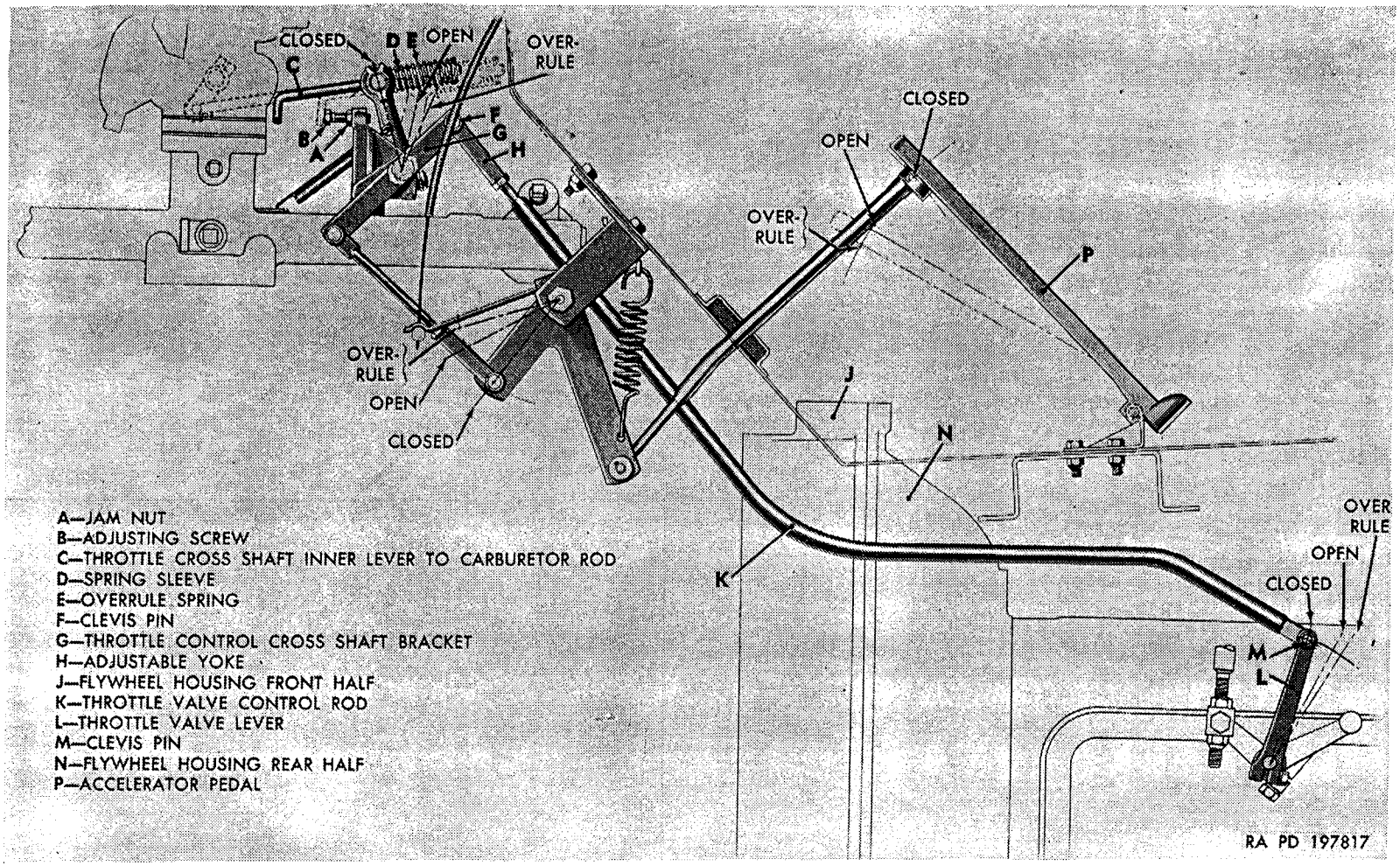

Figure 196. Throttle linkage arrangement (late-type).

(*i*) Recheck to make sure all clevis pins are secured with cotter pins.

c. Manual Shift Control Linkage Adjustment.

Note. The key letters noted in parentheses are in figure 197, except where otherwise indicated. Refer also to figure 198 for view of manual control linkage installed.

(1) Manual shift control linkage is shown in figure 197. Transmission throttle linkage is omitted from figure 197 for purpose of clarity. Manual shift linkage performs two functions: selects transmission range positions and shifts transfer front axle clutches for forward and reverse operation. Both transmission and transfer incorporate internal detents to locate control positions. In addition, control tower also has detents for control lever; however, detents in transmission govern adjustment of linkage. Always make adjustments in sequence listed.

(2) Press down on transmission control lever (A) and move lever into F–2, LOW RANGE position. Remove nut and washer from shift lever trunnion (J); then disconnect trunnion from transmission shift lever (K).

(3) Disconnect transfer reverse rod (M) from transmission shift lever (K) by removing cotter pin and clevis pin (JJ).

(4) Disconnect reduction unit control rod (CC) from reduction unit idler lever (G) by removing cotter pin and clevis pin (H).

(5) Make sure transmission control lever (A) is in F–2, LOW RANGE position. Move transmission shift lever (K) clockwise as far as it will go into first detent position; then move shift lever counterclockwise to second detent position felt, which is third detent position from the rear.

(6) Insert pin on shift lever trunnion (J) into transmission shift lever (K), adjusting trunnion nuts as necessary to provide free pin. Make sure trunnion pin does not bind when moving transmission control lever (A) into all other positions; then return control lever to F–2, LOW RANGE position. Install trunnion, $\frac{5}{16}$–24 safety nut, and 0.083-inch thick lockwasher.

(7) Move transmission control lever (A) into N, LOW RANGE position and reduction unit control lever (DD) into reduction (forward) position. Connect reduction unit control rod (CC) to reduction unit idler lever (G) with clevis pin (H) and cotter pin, adjusting clevis as necessary to provide free pin. Clevis pin (H) should also be free with transmission control lever (A) in N, HIGH RANGE position.

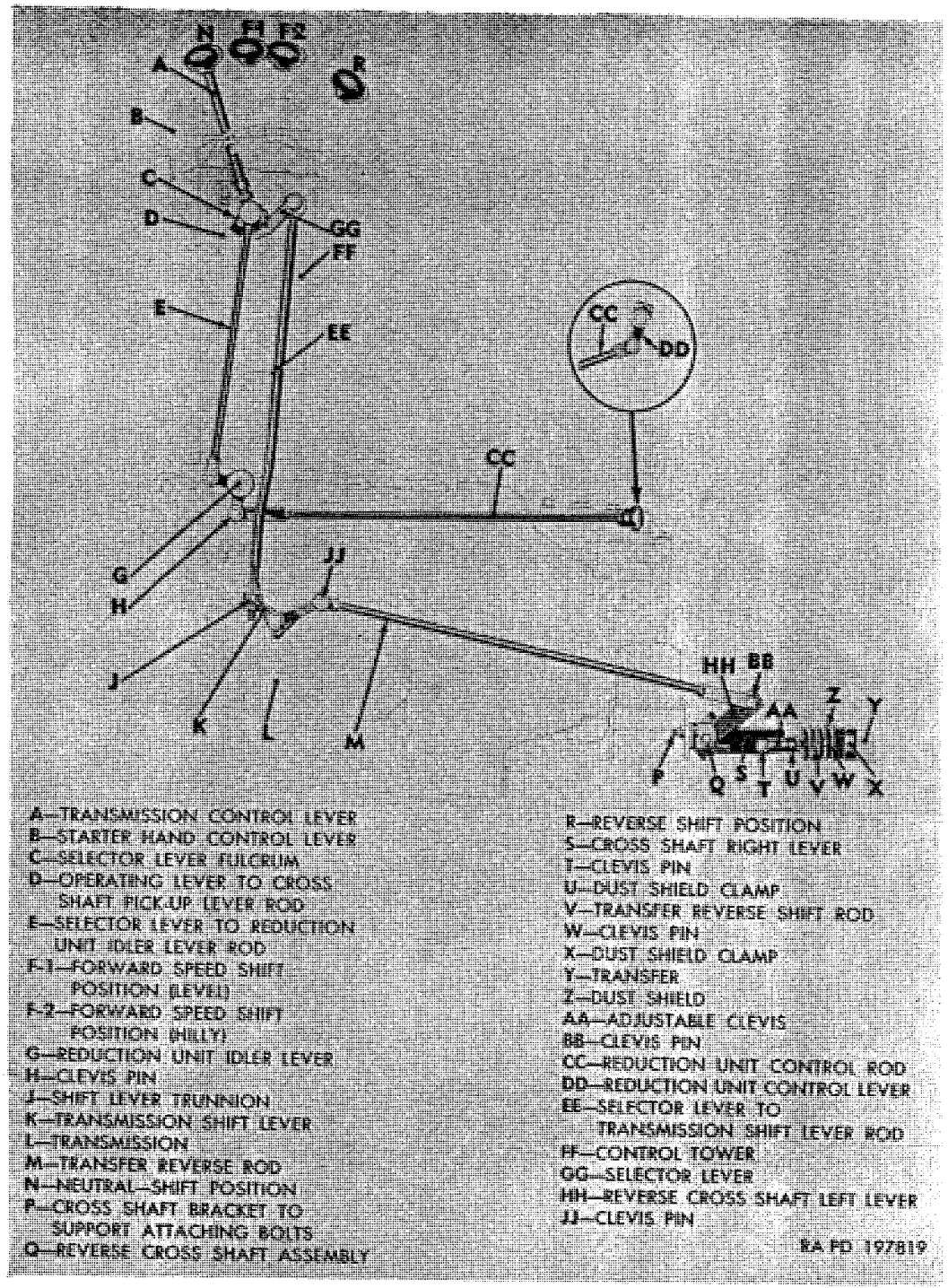

Figure 197. Transmission and transfer linkage arrangement.

(8) On late type vehicles only, remove two dust shield clamps (U and X); then remove transfer reverse shifter shaft dust shield (Z).

(9) Remove cotter pin and clevis pin (W) attaching transfer reverse shift rod assembly (V) to transfer shift rail.

(10) With stop on transfer reverse cross shaft right lever (S) against yoke and transfer shift rail in forward (toward rear) position, adjust reverse shift rod assembly (V) to permit free

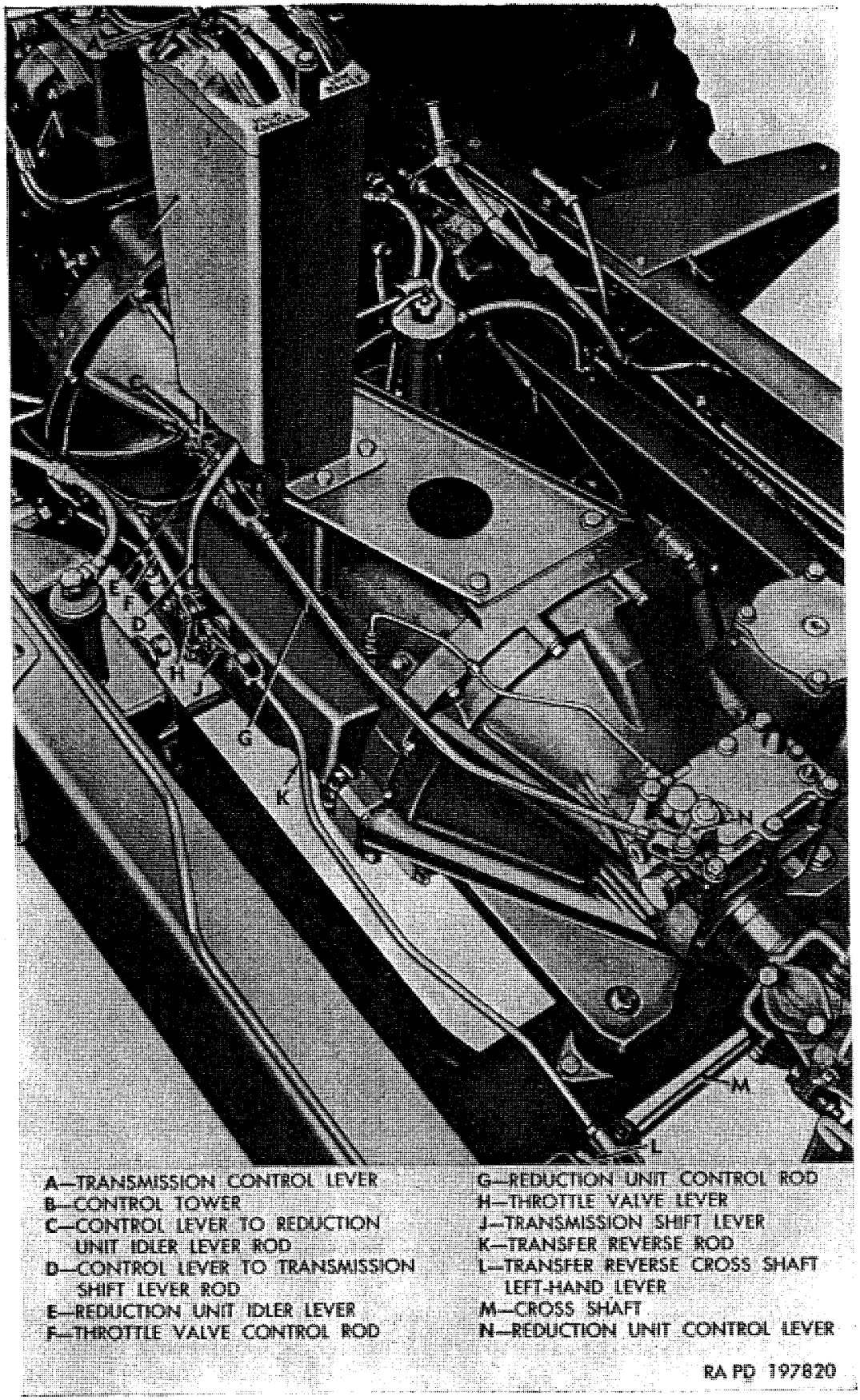

Figure 198. Transmission shift linkage installed.

assembly of clevis pin (W). Secure clevis pin with cotter pin and tighten locknut against yoke.

(11) With cotter pin and clevis pin (BB) attaching transfer reverse rod (M) to reverse cross shaft left lever (HH) removed, move transmission control lever (A) into F–1 HIGH RANGE position and push transfer reverse cross shaft left lever (HH) against pick-up lever on cross shaft assembly (Q). Adjust transfer reverse rod yoke to permit free installation of clevis pin (BB). Secure clevis pin with cotter pin. Tighten locknut against yoke.

(12) Recheck, making sure all clevis pins are secured with cotter pins.

d. Replacement of Rods and Levers. Linkage rods are connected at each end by clevis pins as shown in figures 197 and 198. Linkage rods are easily removed by removing cotter pins and clevis pins. Levers are removed after loosening clamp screws. Before installing adjustable yoke or clevis pins, make sure parts are not worn excessively. Worn parts will not permit accurate linkage adjustment. Transmission throttle valve control lever and transmission shift lever are attached to control valve shaft by means of clamp screws. Serrations on levers and shafts position levers in relation to shafts. Do not force levers on shafts in wrong position.

203. Transmission Control Tower

a. Replacement.

Note. The key letters noted in parentheses are in figure 199, except where otherwise indicated.

(1) *Removal.*

(*a*) On late type vehicles only, remove four bolts with lockwashers attaching foot rest to floor; then remove foot rest.

(*b*) Remove 14 bolts with lockwashers attaching cab front floor pan to cab floor; then remove floor pan from vehicle.

(*c*) Disconnect transmission shift lever trunnion (F) from transmission shift lever (H) by removing safety nut (G) and washer.

(*d*) Disconnect reduction unit control rod (L) from reduction unit idler lever (M) by removing cotter pin and clevis pin.

(*e*) Disconnect transmission vent line (J, fig. 200) from oil filler tube by unscrewing fitting.

(*f*) Unhook cross shaft lever pull back spring from extension hook; then disengage extension hook from cotter pin on control tower support. Remove pull back spring (K, fig. 200) from cross shaft lever (F, fig. 200).

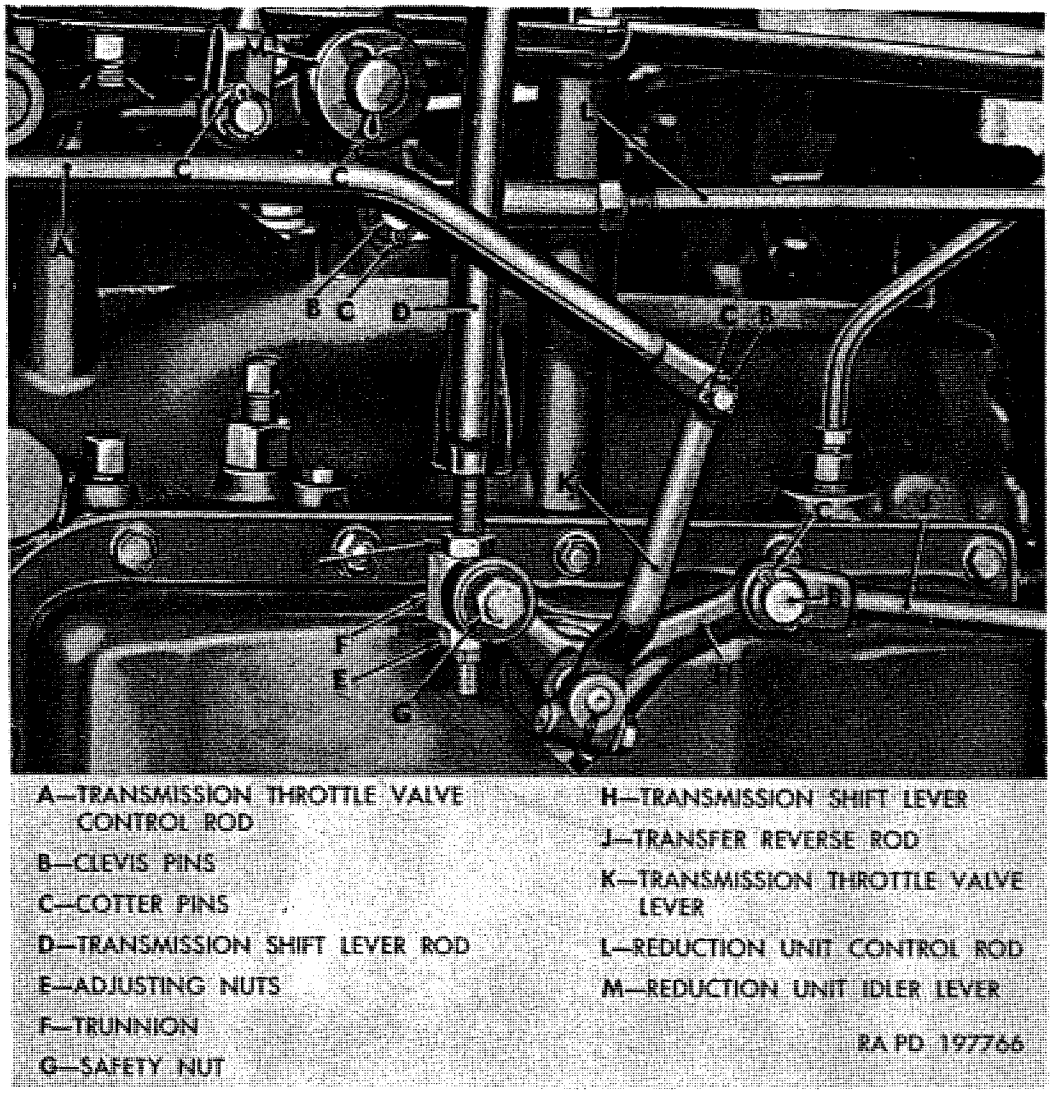

Figure 199. Transmission control linkage at side cover.

(*g*) Remove three cap screws, one bolt, and four lockwashers attaching shift control tower and support to transmission (E, fig. 200); then remove control tower and support from transmission.

(2) *Installation.*

(*a*) Position transmission control tower and support (B and N, fig. 200) on transmission and attach with two 7/16–14 x 1 cap screws, one 3/8–16 x 4 1/4 cap screw, one 3/8–16 x 5 3/4 bolt, two 7/16-inch lockwashers, and two 3/8-inch lockwashers.

(*b*) Engage cross shaft lever pull back spring (K, fig. 200) with cross shaft lever (F, fig. 200). Engage extension hook with cotter pin on control tower support; then stretch spring and engage spring end with end of extension hook (M, fig. 200).

(*c*) Attach transmission vent line (J, fig. 200) to oil filler tube (L, fig. 200). Tighten fitting.

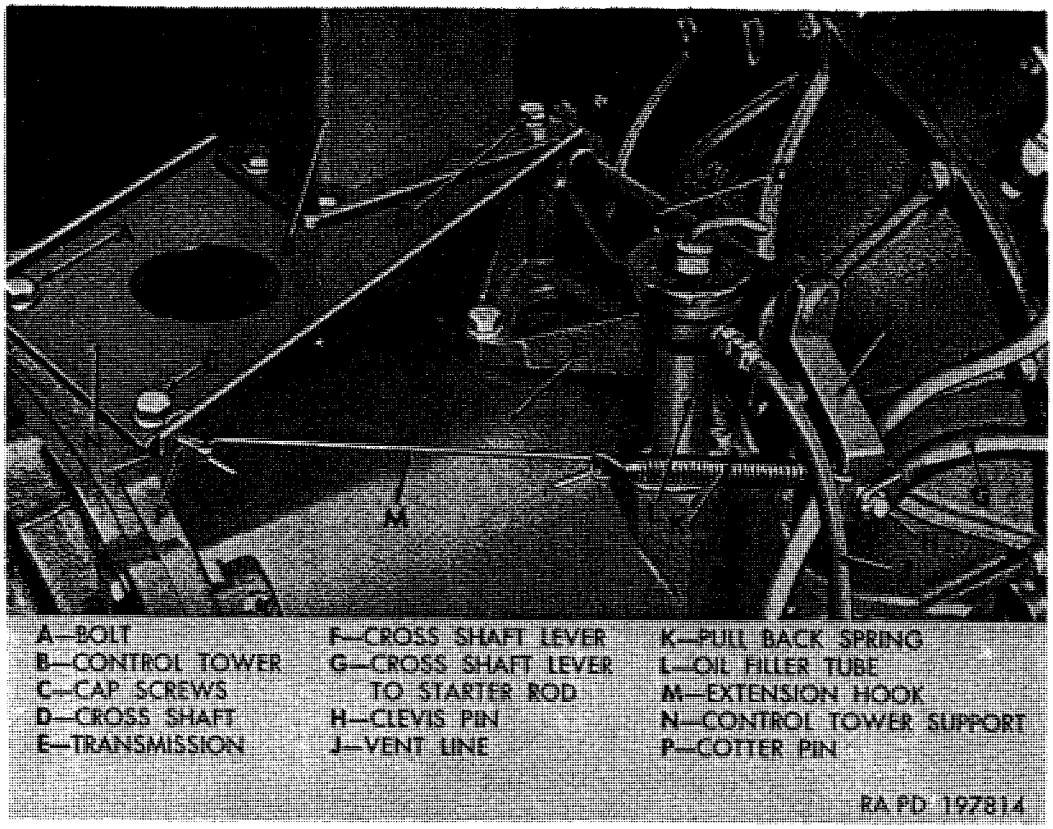

Figure 200. Control tower disconnect points.

(*d*) Attach reduction unit control rod (L) to reduction unit idler lever (M) with clevis pin and cotter pin. Adjust rod if necessary (par. 202*c*).

(*e*) Attach transmission shift lever trunnion (F) to transmission shift lever (H) with $\frac{5}{16}$–24 safety nut (G) and 0.083-inch thick lockwasher. Adjusting nuts (E) (par. 202*c*).

(*f*) Position cab front floor pan on cab floor and attach with fourteen $\frac{5}{16}$–24 x $\frac{5}{8}$ bolts and lockwashers.

(*g*) On late type vehicles, position foot rest on cab floor and attach with four $\frac{5}{16}$–24 x $\frac{3}{4}$ bolts and lockwashers.

b. Disassembly.

Note. **The key letters noted in parentheses are in figure 201.**

(1) Remove transmission control tower assembly from vehicle (*a*(1) above).

(2) Remove two screws (QQ) and two nuts (AM) attaching control tower support (AL) to control tower (SS).

(3) Remove cotter pin and clevis pin (WW) attaching transmission-selector-lever-to-reduction-unit-idler-lever rod (AF) to idler lever (XX); then remove tower support (AL) from control tower (SS).

(4) Remove cotter pin and flat washer (ZZ) attaching reduction unit idler lever (XX) to control tower support (AL); then remove idler lever from support.

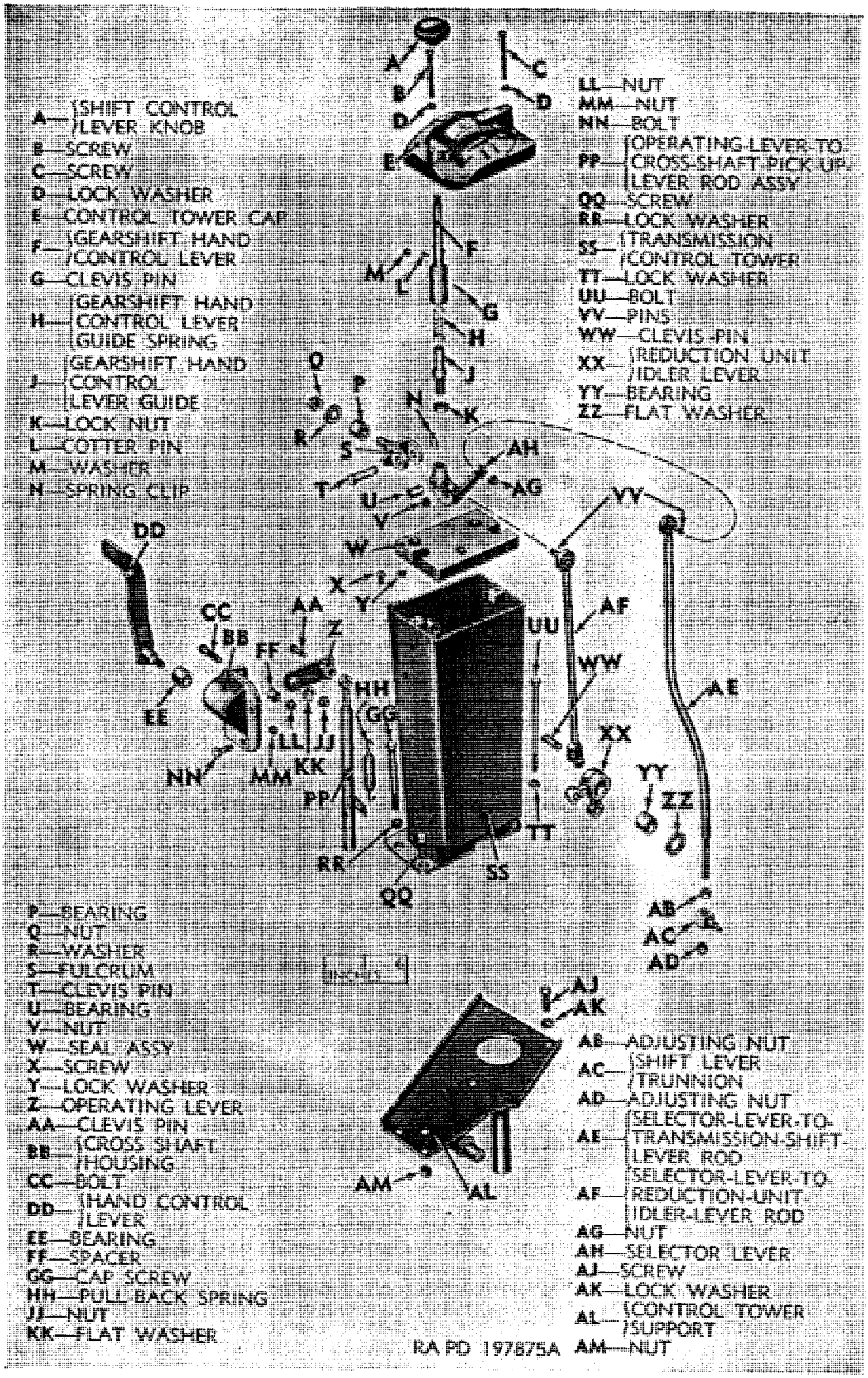

Figure 201. Control tower components.

(5) Remove bushing-type bearing (YY) from reduction unit idler lever (XX) only if inspection shows necessity for replacement.
(6) Remove cotter pin from control tower support (AL) only if new pin is to be installed.
(7) Slide control-tower-to-cab-floor seal off control tower.
(8) Remove adjusting nuts (AD and AB) and shift lever trunnion (AC) from selector-lever-to-transmission-shift-lever rod (AE).
(9) Unscrew transmission shift control lever knob (A) from gearshift hand control lever (F).
(10) Remove two screws (B and C) and lockwashers (D); then remove control tower cap (E) from control tower (SS).
(11) Remove bolt (CC), nut (LL), spacer (FF), two bolts (NN), and two nuts (MM) attaching cross shaft housing (BB) to control tower (SS).
(12) Unhook pull-back spring (HH) from operating-lever-to-cross-shaft-pick-up-lever rod assembly (PP); then unhook spring from bracket inside control tower (SS). Remove spring (HH) from control tower.
(13) Pull cross shaft housing (BB) away from control tower (SS) as shown in figure 202; then remove cotter pin and clevis pin (AA) attaching cross shaft housing (BB) and

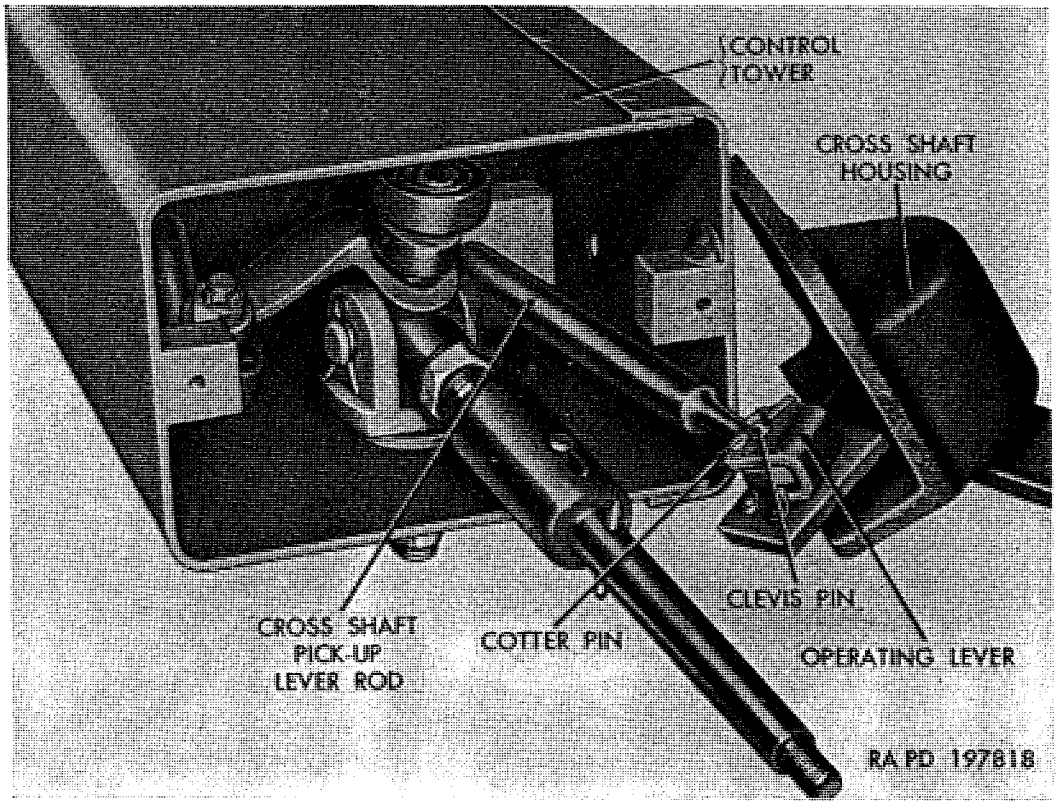

Figure 202. Removing cross shaft housing.

operating lever (Z) to operating-lever-to-cross-shaft-pick-up-lever rod (PP). Remove housing and lever.

(14) Remove nut (JJ) and flat washer (KK); then remove operating lever (Z) and hand control lever (DD) from cross shaft housing (BB).

(15) Remove bearing (EE) from cross shaft housing (BB) only if inspection shows necessity for replacement.

(16) Remove operating-lever-to-cross-shaft-pick-up-lever rod (PP) through opening at bottom of control tower (SS).

(17) Remove spring clip (N) from clevis pin (T); then remove clevis pin from fulcrum (S).

(18) Pull rods as an assembly from top of control tower (SS).

(19) Remove nut (AG); then remove selector-lever-to-transmission-shift-lever rod (AE) from selector lever (AH).

(20) Remove nut (V); then remove selector-lever-to-reduction-unit-idler-lever rod (AF) from selector lever (AH).

(21) Loosen locknut (K) and remove selector lever (AH) from gear-shift hand control lever guide (J). Remove bearing (U) from selector lever (AH) only if inspection shows necessity for replacement.

(22) Remove cotter pin (L) and washer (M); then while holding assembly against spring pressure as shown in figure 203, remove clevis pin (G) from gearshift hand control lever (F).

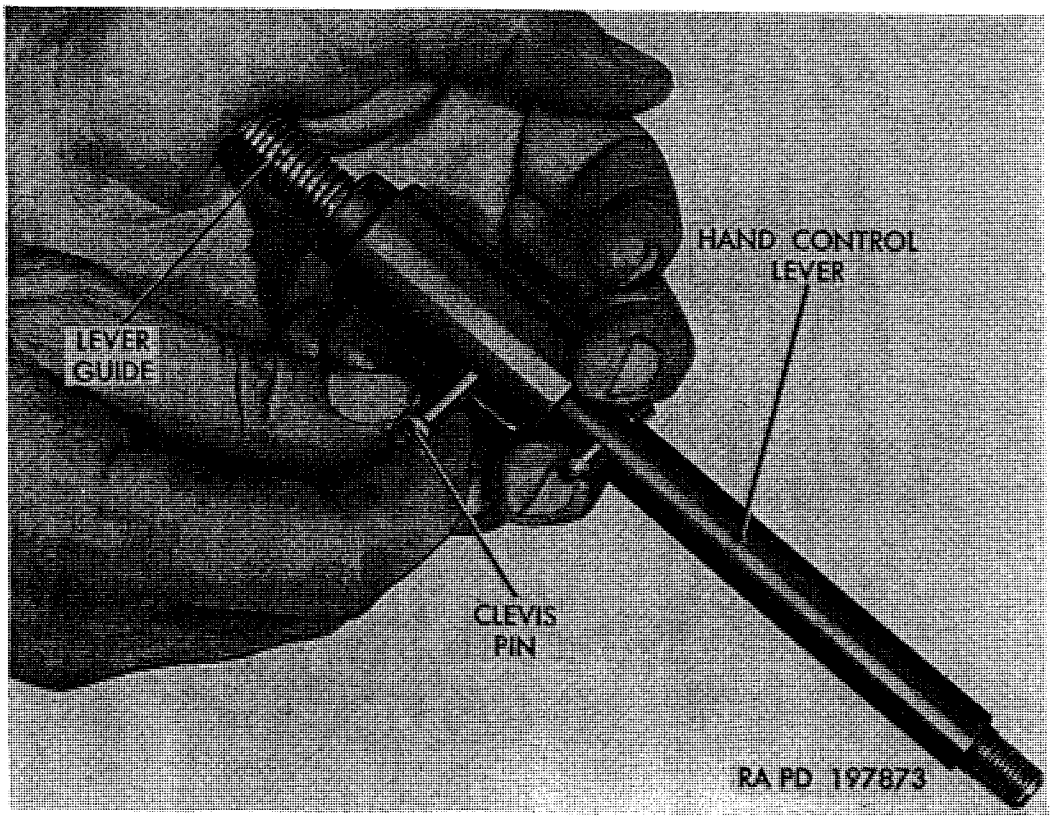

Figure 203. Disassembling gearshift hand control lever.

(23) Remove gearshift hand control lever guide (J) and gearshift hand control lever guide spring (H) from gearshift hand control lever (F).

(24) Remove nut (Q), washer (R), and fulcrum (S) from control tower (SS). Remove bearing (P) from control tower (SS) only if inspection shows necessity for replacement.

(25) Remove two screws (X) and lockwashers (Y) attaching seal assembly (W) to control tower (SS). Remove seal assembly from control tower.

c. Assembly (fig. 201).

Note. When assembling transmission control tower, lubricate each moving part liberally with automotive and artillery grease (GAA) as part is installed. Replace all parts inspection shows to be worn or not in good condition.

(1) Position seal assembly (W) in transmission control tower (SS) and attach with two 1/4–28 x 3/8 cross-recess screws (X) and 1/4-inch lockwashers (Y). Tighten screws.

(2) If bushing-type bearing (P) was removed from control tower (SS), tap new bearing into place in tower, using plastic hammer.

(3) Install fulcrum (S) in control tower (SS), attaching to tower with 17/32-inch plain washer (R) and 1/2–20 safety nut (Q). Tighten nut.

Note. Install fulcrum with lug on fulcrum alined with slot in control tower as shown in figure 204.

(4) Install 1/2–20 locknut (K) on gearshift hand control lever guide (J); then thread guide into selector lever (AH) to 1 29/32-inch dimension shown in figure 205, measured from gearshift hand control lever guide spring (H) seat on gear shift hand control lever guide (J) to centerline of bearing hole in selector lever. Tighten locknut against selector lever.

(5) If bearing (U) was removed from selector lever (AH), tap new bearing into place, using plastic hammer.

(6) Position gearshift hand control lever guide spring (H) over end of gearshift hand control lever guide (J).

(7) Install gearshift hand control lever guide spring (H) and guide (J) into end of gearshift hand control lever (F), alining hole in guide with slot in lever.

(8) While compressing assembly against spring pressure in manner shown in figure 203, install clevis pin (G) through slot in gearshift hand control lever (F) and into hole in gearshift hand control lever guide (J).

(9) Retain clevis pin (G) in assembly by installing 7/32-inch plain washer (M) and cotter pin (L) on end of clevis pin.

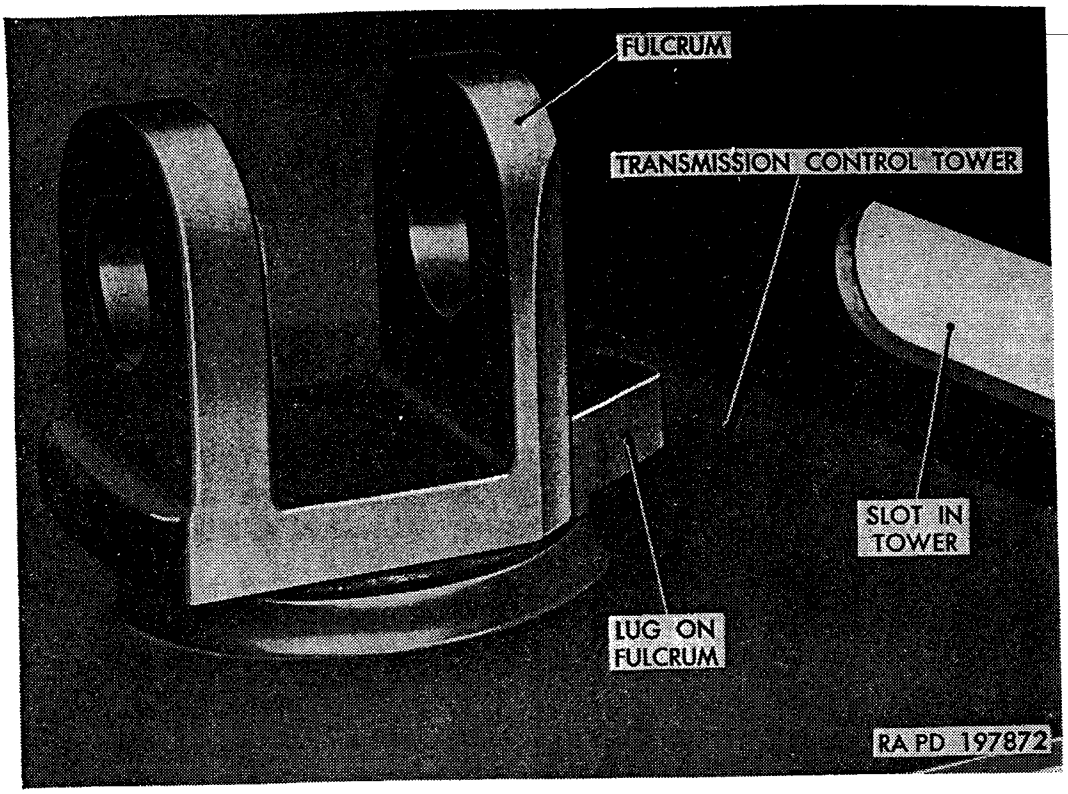

Figure 204. Positioning lug on fulcrum.

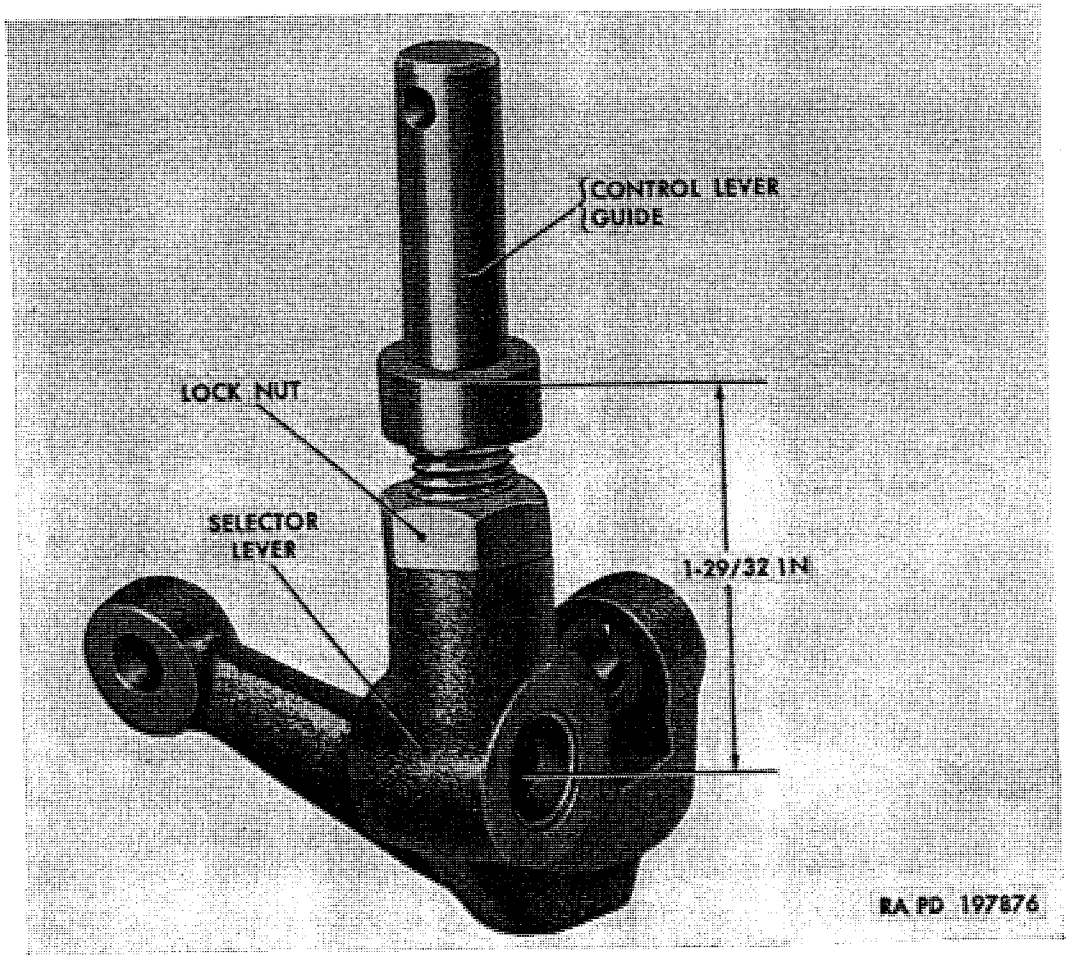

Figure 205. Adjusting guide and selector lever.

(10) Insert pin (VV) on selector-lever-to-reduction-unit-idler-lever rod (AF) through hole in selector lever (AH); then attach rod to lever with 5/16-inch locknut (V). Tighten locknut.

(11) Insert pin (VV) on slector-lever-to-transmission-shift-lever rod (AE) through hole in selector lever (AH); then attach rod to lever with 5/16–24 locknut (AG). Tighten locknut.

(12) Install rod assembly through top of transmission control tower (SS).

(13) With end of selector lever (AH) positioned in fulcrum (S), insert clevis pin (T) through hole in fulcrum and hole in selector lever. Secure clevis pin with spring clip (N).

(14) Insert shaft of hand control lever (DD) through hole in cross shaft housing (BB); then position operating lever (Z) on shaft of hand control lever (DD). Attach operating lever to control lever with 13/32-inch flat washer (KK) and 3/8–24 safety nut (JJ).

(15) Insert operating-lever-to-cross-shaft-pick-up-lever rod assembly (PP) through opening at bottom of control tower (SS), positioning rod so pull-back spring bracket on rod is facing center of control tower and end of rod is inserted into hole in bottom of control tower.

(16) With other end of operating-lever-to-cross-shaft-pick-up-lever rod assembly (PP) in operating lever (Z) attach rod to operating lever with clevis pin (AA) and cotter pin.

(17) Hook one end of pull-back spring (HH) to bracket on operating-lever-to-cross-shaft-pick-up-lever rod (PP) and other end of spring to bracket inside control tower (SS).

(18) Make sure end of operating-lever-to-cross-shaft-pick-up-lever rod (PP) is entered into hole in bottom of control tower (SS); then install 5/16–24 x 1½ bolt (CC), spacer (FF), and 5/16–24 locknut (LL) attaching cross shaft housing (BB) to control tower (SS). Before tightening bolt and nut, install two 5/16–24 x 7/8 bolts (NN) and 5/16–24 locknuts (MM). Tighten all attaching bolts and nuts.

(19) Position control tower cap (E) on control tower (SS); then install one 1/4–28 x 2 front screw (B), one 1/4–28 x 2¾ rear screw (C), and two 1/4-inch lockwashers (D).

(20) Install transmission shift control lever knob (A) on end of gearshift hand control lever (F).

(21) Position control-tower-to-cab-floor seal on transmission control tower (SS).

(22) Install reduction unit idler lever (XX) on control tower support (AL); then attach lever to support with 21/32-inch flat washer (ZZ) and cotter pin.

(23) Mount control tower (SS) on tower support (AL); then attach tower to support with two 3/8–24 x 7/8 screws (QQ) and 3/8–24 safety nuts (AM). Tighten nuts.

(24) Connect selector-lever-to-reduction-unit-idler-lever rod (AF) to reduction unit idler lever (XX) with clevis pin (WW) and cotter pin.

(25) Install 3/8–24 adjusting nut (AB), shift lever trunnion (AC), and 5/16–24 adjusting nut (AD) on selector-lever-to-transmission-shift-lever rod (AE).

(26) Install transmission control tower and support assembly on transmission in vehicle (*a*(2) above).

(27) Adjust transmission manual control linkage (par. 202*c*).

204. Transmission Removal

a. General. The following procedures cover removal of transmission from vehicle with engine installed in vehicle. Procedures necessary to remove transmission from vehicle together with engine are covered in paragraph 117. Before removing transmission, make certain of necessity for transmission replacement by first accomplishing adjustments and tests described in this section, and by correct analysis of trouble symptoms as described in table VI.

b. Coordination with Ordnance Maintenance Unit. Refer to paragraph 2 for information on coordination with an ordnance maintenance unit.

c. Preliminary Procedures.

(1) *Disconnect transmission control linkage and remove shift control tower.*

(*a*) Remove transmission control tower (par. 203*a*(1)).

(*b*) Disconnect transfer reverse rod from transmission shift lever by removing cotter pin and clevis pin (B and C, fig. 199).

(*c*) Remove reduction unit control rod (CC, fig. 197) from reduction unit control lever by removing cotter pin and clevis pin.

(*d*) Disconnect throttle valve control rod from throttle valve lever by removing cotter pin and clevis pin (M, fig. 196).

(*e*) Remove two bolts and locknuts attaching transfer control cross shaft left bracket to transmission rear support.

(2) *Remove exhaust pipe rear section.*

(*a*) Remove rear exhaust pipe supporting strap (E, fig. 135) from transmission rear support by removing cap screw and nut.

(*b*) Loosen exhaust pipe clamp nuts at muffler and front exhaust pipe; then remove connecting clamps and seal (A, fig. 135) and rear exhaust pipe. Discard seals.

(3) *Remove transmission-to-transfer propeller shaft.*

(*a*) Remove four bolts and nuts securing front and rear universal joints (fig. 240) together.

(*b*) Remove four bolts and nuts attaching rear universal joint flange to transfer flange; then remove rear universal joint flange.

(*c*) Slide front universal joint flange toward rear and off transmission output shaft.

(4) *Detach power plant from rear support mountings.* Remove two bolts and lockwashers (X and Y, fig. 108) attaching transmission to rear mountings.

(5) *Raise power plant from rear support.* Using a suitable floor jack, raise transmission just enough to relieve load from rear support cross member. Place blocking under engine to support power plant while removing transmission from engine.

(6) *Disconnect transfer-to-front-axle propeller shaft.* Remove four bolts and nuts attaching front propeller shaft universal joint to transfer driving flange; then lower rear end of propeller shaft to floor.

(7) *Remove transmission rear support cross member.* Remove four bolts and locknuts attaching transmission rear support cross member to support brackets; then remove transmission rear support.

(8) *Disconnect starter control.* Remove cross-shaft-lever-to-starter rod from cross shaft lever by removing cotter pin and clevis pin (H, fig. 200).

(9) *Drain coolant and disconnect cooler lines.*

(*a*) Drain water from cooling system as described in paragraph 142*b*.

(*b*) Remove cooler line nuts at transmission and pull lines free from fittings at oil pan and cooler assembly.

(10) *Drain transmission oil.* Remove drain plugs (fig. 186) and drain transmission oil from transmission and fluid coupling (par. 194*d*).

d. Transmission Removal from Engine.

Caution: Make sure transmission is positioned on floor jack so there will be no danger of transmission falling during removal from engine. Be sure engine is properly supported with blocking during transmission removal.

(1) *Remove torus-cover-to-flywheel attaching bolts.* Through opening provided previously by removal of flywheel housing lower cover, remove 30 torus-cover-to-flywheel attaching bolts (B, fig. 206) and lockwashers. Turn engine to turn flywheel to gain access to all bolts.

(23) Mount ft. attac and rear uni-
and
(24) rsal joint
l joint
ns-

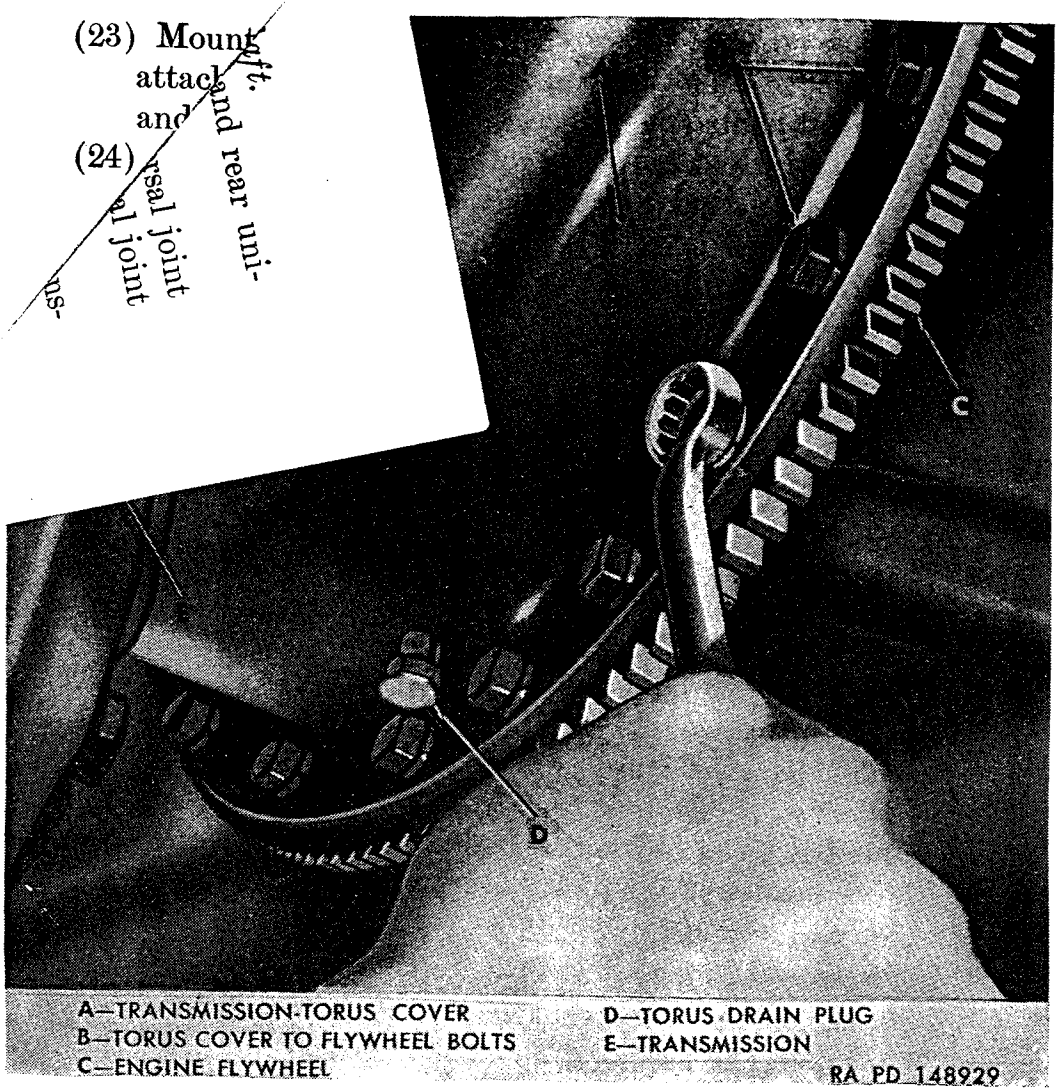

Figure 206. Removing torus-cover-to-flywheel bolt.

(2) *Remove flywheel housing rear half to front half attaching parts.* With transmission positioned on saddle jack to support its weight, remove nine cap screws, one nut, and nine lockwashers attaching flywheel housing rear half to front half. Leave flywheel housing front half bolted to engine.

Note. On gasoline tank truck M217 and water tank truck M222, Mechanovac governor speed unit and bracket will come off when flywheel housing attaching parts are removed.

(3) *Remove transmission from vehicle.* Carefully move transmission away from engine a short distance for clearance as shown in figure 207; then lower jack with transmission to floor. Remove transmission from beneath vehicle; then using lifting eye-bolts A266327 (fig. 76) in holes in top of transmission and reduction unit, lift transmission and position on work bench or suitable repair stand. Remove pilot bearing spacer from end of transmission input shaft.

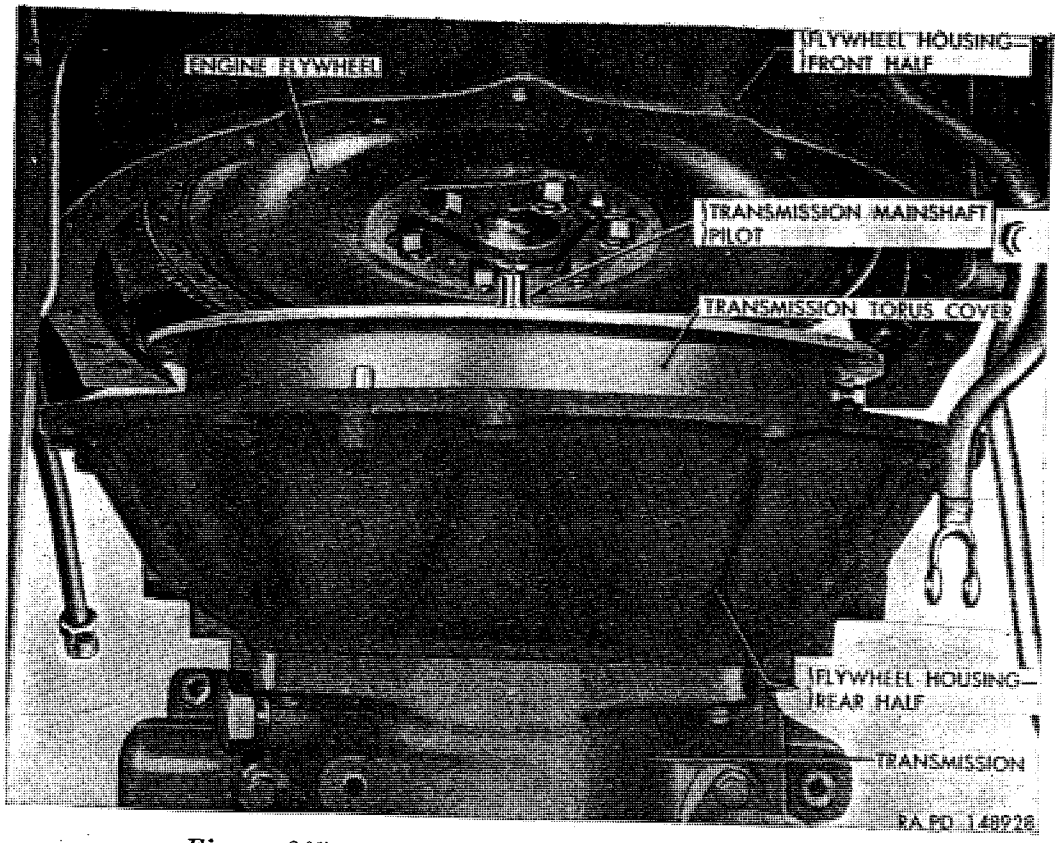

Figure 207. Removing transmission from engine.

(4) *Remove flywheel housing rear half.* Flywheel housing rear half, attached to transmission case, is matched with flywheel housing front half attached to engine.

Note. Flywheel housing front and rear halves comprise a matched set which must remain with engine on which originally installed. A metal plate attached to each half of flywheel housing bears engine serial number (fig. 208). Operations described in (*a*) through (*d*) below must be performed if transmission is not to be reinstalled on engine from which it was removed, or if it is found necessary to remove flywheel rear housing from transmission.

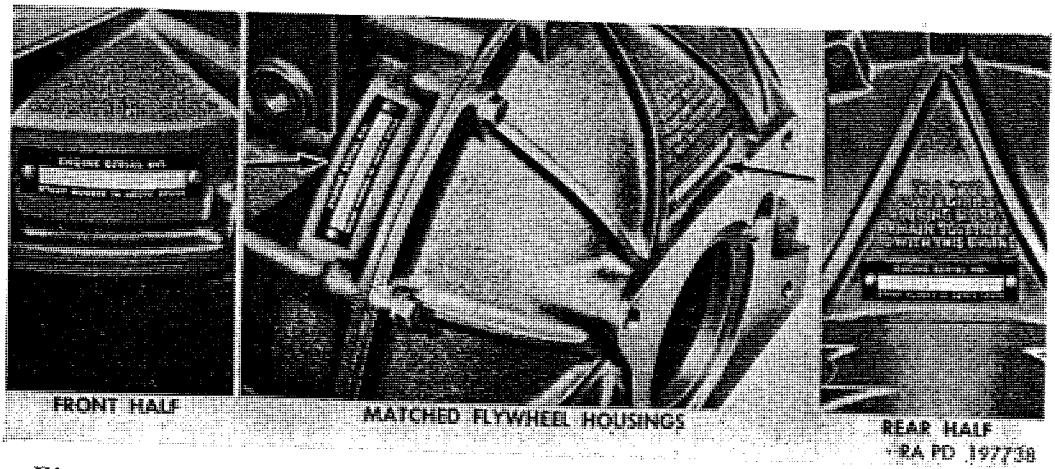

Figure 208. Location of engine serial number plates on flywheel housings.

(23) Mount ... ft. ... attach ... and rear uni-

(24) ... rsal joint ... el joint ... us-

...way from transmission input shaft nut; ... fluid coupling with wrench B7950256 ...-inch wrench and remove input shaft ...

... torus member and pull driven torus ... put shaft. If torus member sticks, ...aft lightly with rawhide or plastic ... time pulling out at hub of driven ...

...cles, torus check valve and check valve ... with driven torus or remained on trans- ...ve torus check valve and check valve ... vehicles, torus check valve and check valve spring are held in position in driven torus by a retainer and two cap screws.

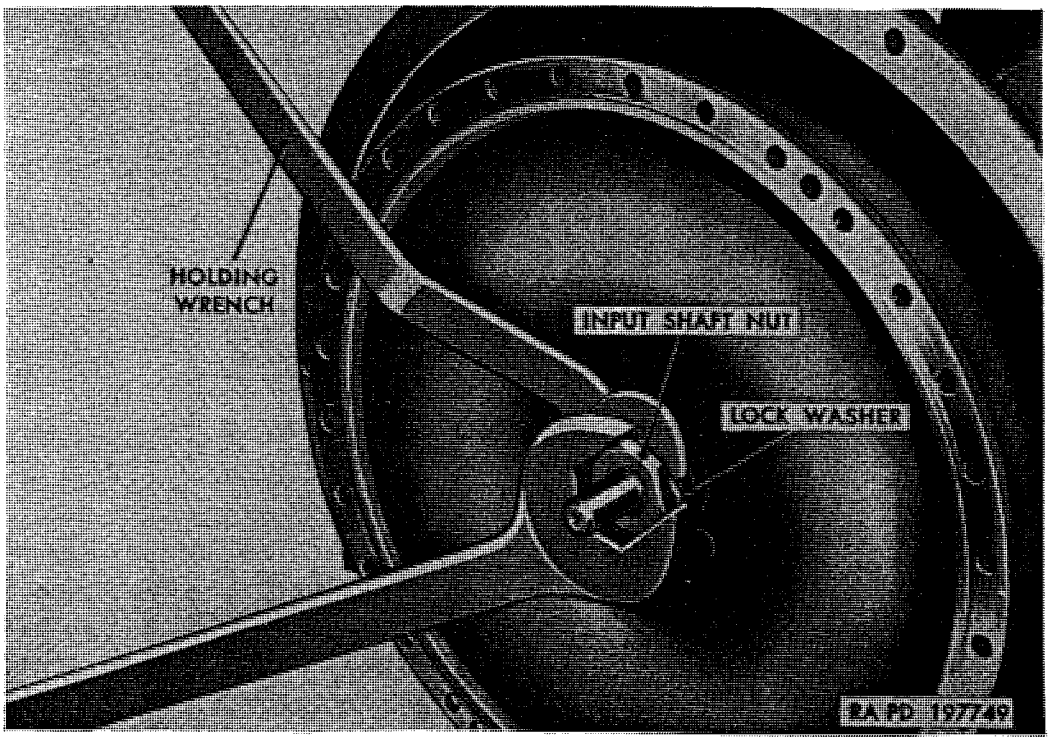

Figure 209. Using holding wrench B7950256 to hold fluid coupling.

(*c*) Using snap ring pliers, remove driving torus member retainer (fig. 210); then remove driving torus member and torus cover together by sharply pulling straight out on torus cover.

Caution: Do not rock torus cover from side to side when removing, as damage to oil seal or seal ring at front oil pump may result.

(*d*) Remove four bolts attaching flywheel housing rear half to transmission case. Remove flywheel housing rear half

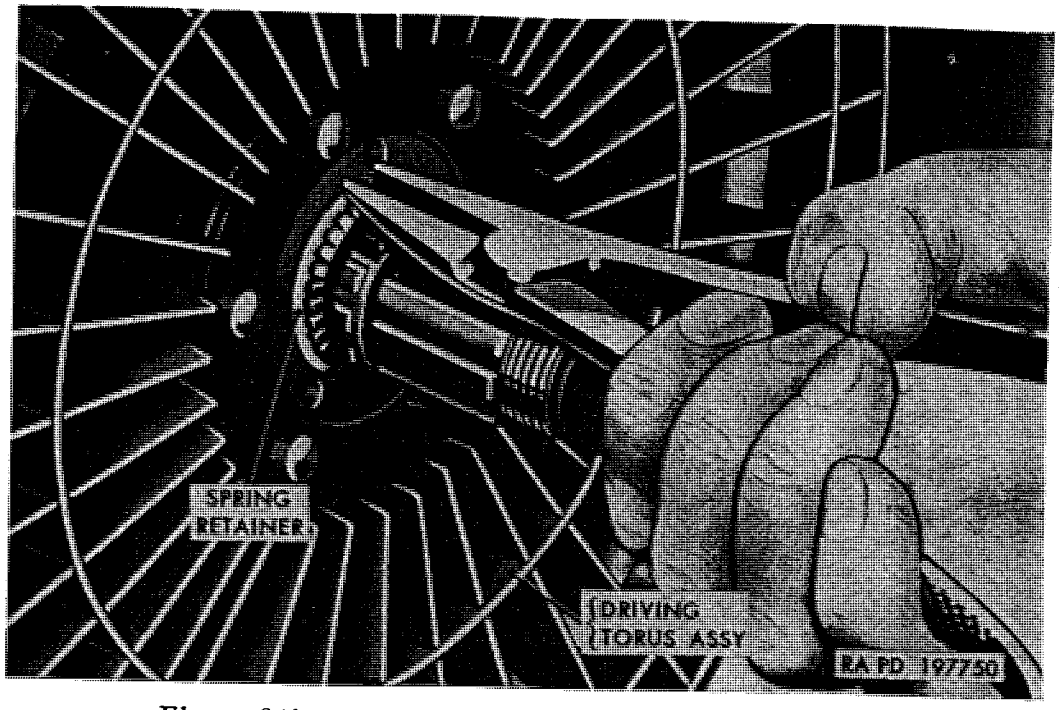

Figure 210. Removing driving torus member retainer.

from transmission and temporarily attach to flywheel housing front half installed on engine.

Note. Flywheel housing front and rear halves (fig. 208) must be kept together and with engine on which they were originally installed.

205. Transmission Installation

a. General. The following procedures cover installation of transmission with engine installed in vehicle. Procedures necessary to install transmission together with engine into vehicle are covered in paragraph 120. Before assembling flywheel housing rear half to transmission, accomplish procedures in *b* below.

b. Preliminary Procedures.

(1) Assemble torus cover to engine flywheel, using four $\frac{5}{16}$–24 x $1\frac{1}{16}$ torus-cover-to-flywheel attaching bolts and $\frac{5}{16}$-inch lockwashers, two at dowels and two 90° from dowels. Torus must fit freely on dowels. Tighten bolts evenly to 12 to 15-pound-feet torque.

Note. On some early type vehicles, torus cover can be assembled to flywheel in one position only, because flywheel dowel pins have different diameters. On late vehicles, torus cover can be assembled to engine flywheel in either of two positions, 180° apart. On these vehicles, aline dowel pin with hole in cover marked as shown in figure 211.

(2) Attach test indicator supporting bracket B7950331 (fig. 212) to flywheel housing front half, using two $\frac{3}{8}$–16 x 1 cap screws.

(3) Assemble a suitable dial-type test indicator to supporting bracket B7950331 so tip of indicator set rocker arm attachment contacts oil seal area of torus cover neck as shown in figure 212.

(4) Turn engine and observe reading on dial of indicator. Runout must not exceed 0.005 inch.

(5) If runout exceeds 0.005 inch ((4) above), on vehicles having same size flywheel dowels only, remove torus cover from flywheel. Remount torus cover on flywheel 180° from original

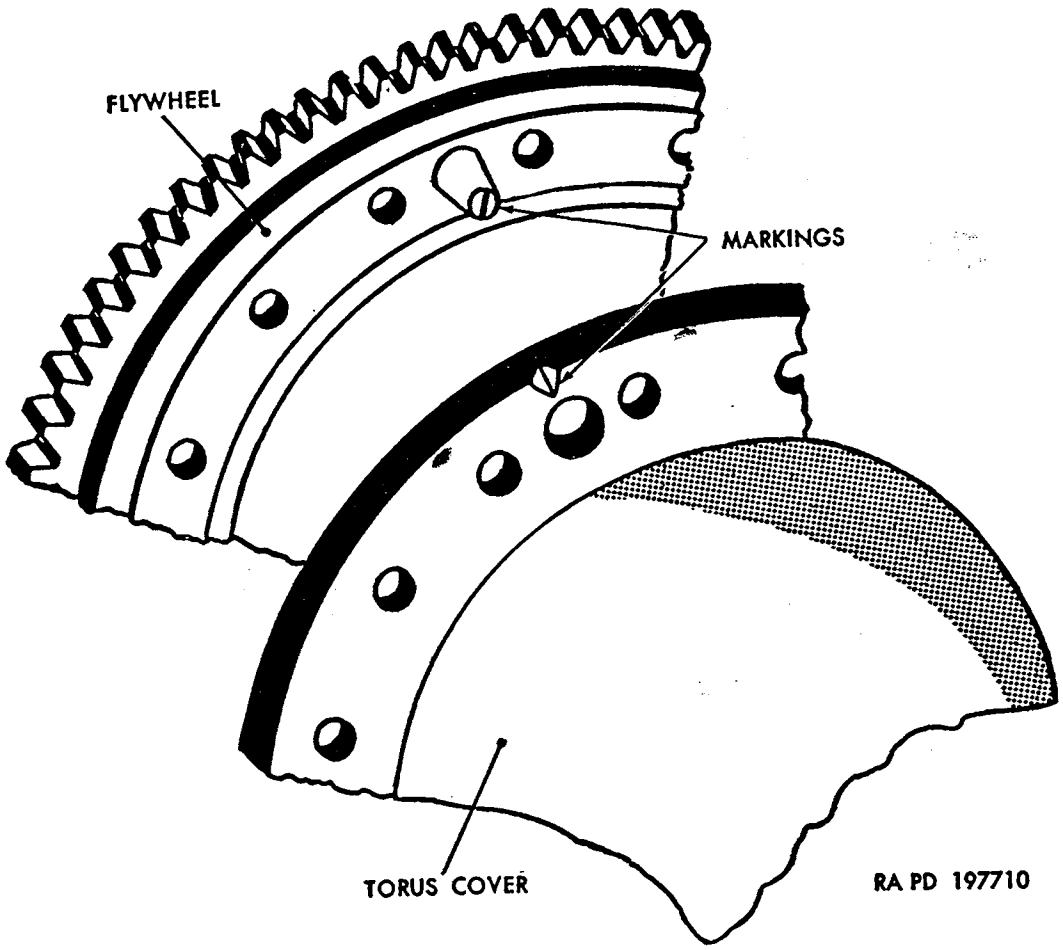

Figure 211. Flywheel and torus cover markings.

position and recheck runout. Runout must not exceed 0.005 inch. If runout checks satisfactorily with torus cover installed in the new position, remark torus cover and flywheel dowel so parts can be properly positioned when transmission is installed on engine. Be sure to use type of mark that will not become confused with previous mark (fig. 211).

(6) If runout checked satisfactorily in (4) or (5) above, remove torus cover from flywheel. If runout exceeds 0.005-inch maximum, check engine flywheel runout as in (*a*), (*b*), and (*c*) below.

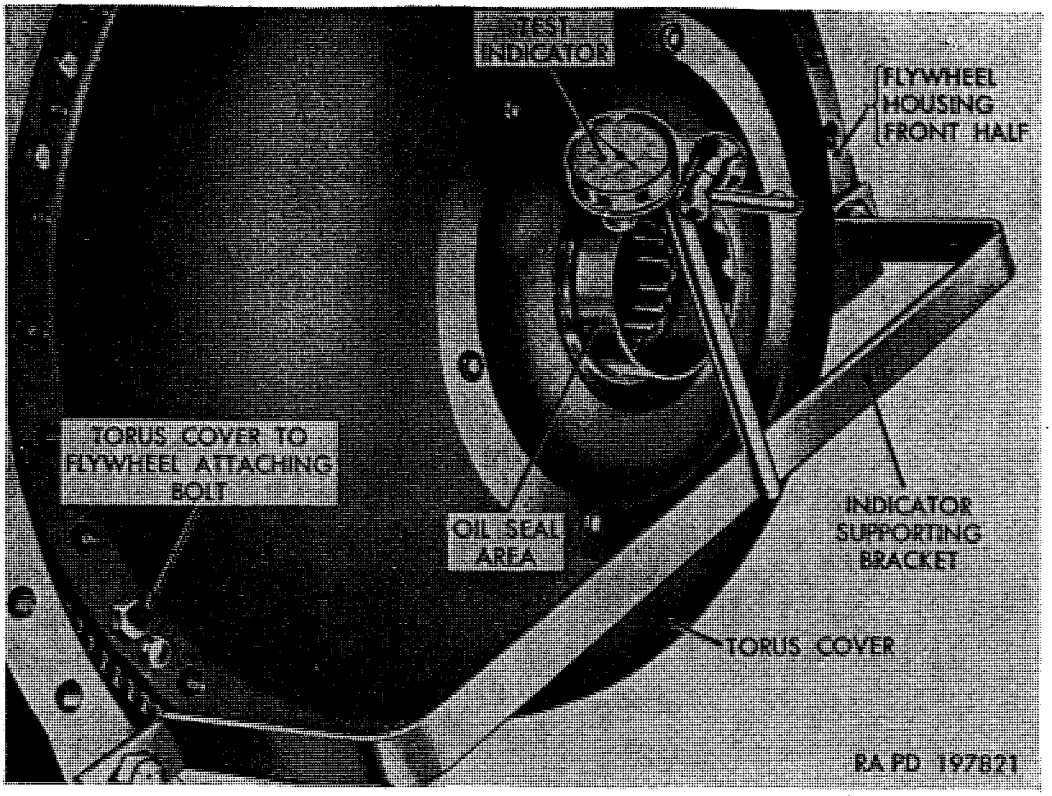

Figure 212. Checking torus cover runout, using test indicator and supporting bracket B7950331.

(*a*) With torus cover removed, mount test indicator on flywheel housing front half so stem of indicator will contact sealing surface of flywheel, just inside the row of torus cover bolt holes as shown in figure 213.

(*b*) Rotate engine to turn flywheel, noting reading on dial of indicator. Flywheel runout should not exceed 0.005 inch.

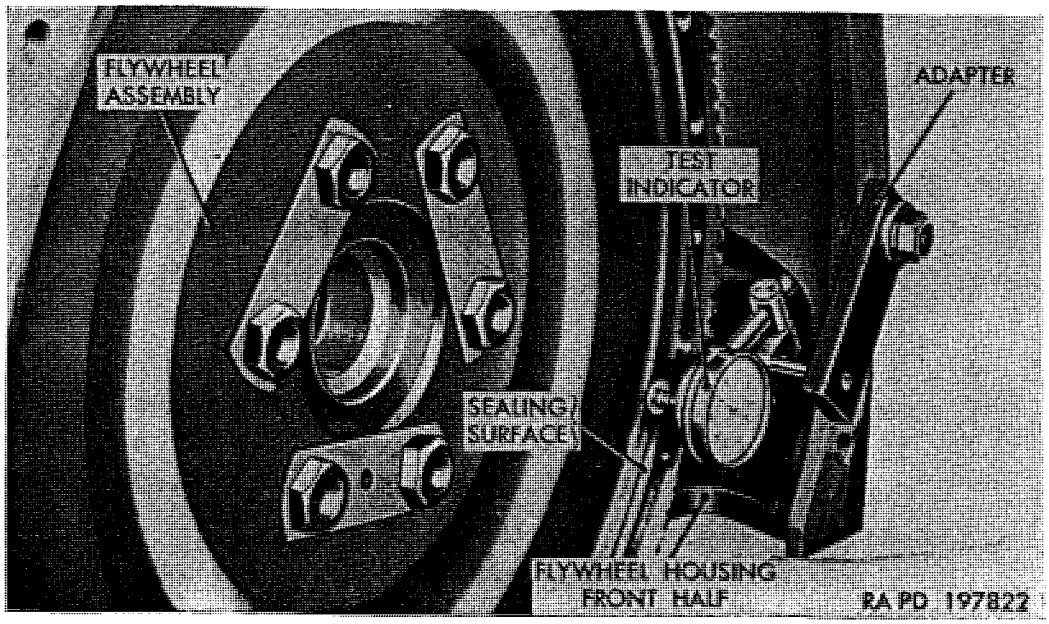

Figure 213. Checking engine flywheel runout.

(*c*) If flywheel runout exceeds 0.005 inch, report condition to ordnance maintenance personnel.

(7) If new torus cover is used, a final check for runout should be made before transmission is assembled to engine.

c. Flywheel Housing Rear Half Installation. Flywheel housing front and rear halves comprise a matched set which must remain with engine on which they were originally installed. A metal plate attached to each half of flywheel housing bears engine serial number (fig. 208) which must agree with serial numbers on plates and stamp on engine (figs. 24 and 25).

(1) Position flywheel housing rear half to transmission assembly and attach with four ½–13 x 1½ self-locking bolts. Tighten opposite bolts alternately to 70 to 75 pound-feet torque.

(2) Push torus cover into place on splines of transmission front drive gear, using care to avoid damage to oil seal and oil ring at front pump cover as torus cover is pushed into place.

(3) Install driving torus assembly on splines of intermediate shaft of front planet carrier.

(4) Using snap ring pliers, install new driving torus retainer in groove of shaft to retain driving torus.

(5) On some early vehicles, torus check valve and spring are held in position in driven torus by a retainer and two bolts. On these vehicles, install driven torus on splines of transmission input shaft. On late vehicles not having the retainer and two bolts to hold torus check valve and spring in place, proceed as in (*a*) through (*d*) below.

(*a*) Slide torus check valve over driven torus hub to check for freeness, then remove torus check valve.

(*b*) Install torus check valve and check valve spring over transmission input shaft as shown in figure 214.

(*c*) Start driven torus member on input shaft, at the same time positioning torus check valve spring over hub of driven torus (fig. 214).

(*d*) Locate driven torus member against driven torus snap ring in groove of transmission input shaft.

(6) Place new lockwasher over transmission input shaft against driven torus member; then install ⅞–16 input shaft nut.

(7) With torus holding wrench B7950256 (fig. 209), hold torus and tighten input shaft nut to 50 to 60 pound-feet torque.

(8) Bend lug of lockwasher against face of nut to hold nut tight; then install pilot bearing spacer on end of input shaft.

d. Transmission Assembly to Engine.

(1) Thoroughly clean torus cover gasket surface on flywheel, using dry-cleaning solvent or volatile mineral spirits.

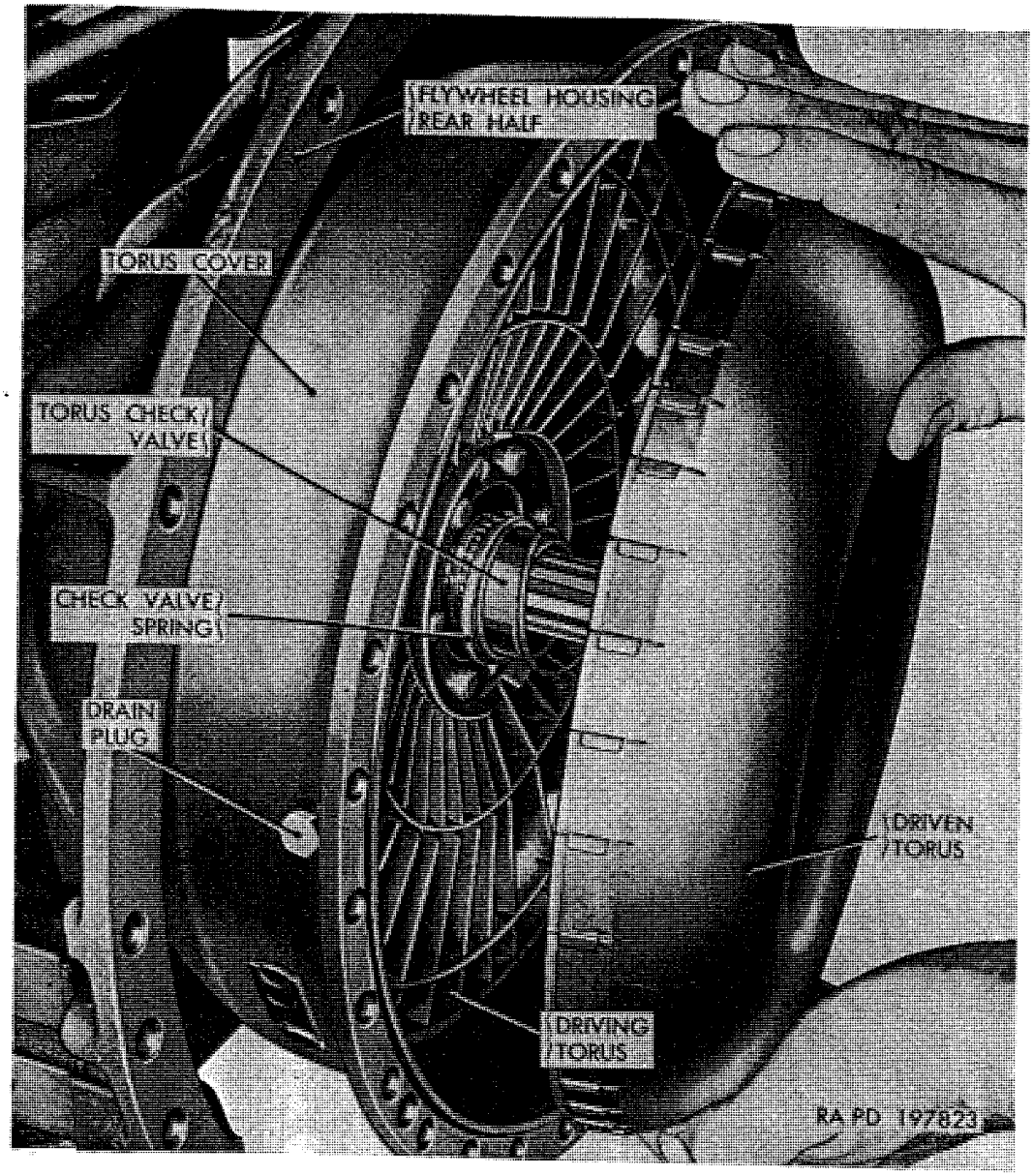

Figure 214. Installing driven torus member.

(2) Coat torus cover gasket with automotive and artillery grease (GAA); then position gasket to flywheel, alining holes in gasket with holes in flywheel.

Note. Gasket must be free from creases or wrinkles, and there must be no nicks or burs at gasket surface on torus cover or flywheel.

(3) Transmission installation can be facilitated by use of two guide studs in flywheel housing front half. Make guide studs by cutting off heads of two 3/8–16 x 4 bolts and cutting screwdriver slots in ends of bolts. Install the guide studs, one in first or second hole to left and one in the third hole to the right of the dowel in top of flywheel housing front half.

(4) Make sure pilot bearing spacer is installed on end of transmission input shaft; then with transmission seated on suit-

saddle jack, move transmission under vehicle and into
on with engine.

transmission (fig. 207) so input shaft pilot is alined
lot bearing in crankshaft, and holes in flywheel hous-
ar half are alined with guide studs.

urn torus cover or flywheel until dowels in flywheel are alined with dowel holes in torus cover.

Note. On some early vehicles, it will be necessary to aline large dowel in flywheel with large hole in torus cover.

(7) Move transmission toward engine so input shaft pilot enters pilot bearing, and dowel holes in flywheel housing rear half fit over dowels in flywheel housing front half. Remove guide studs.

(8) Install two 3/8–16 x 1 cap screws, six 3/8–16 x 1 1/8 cap screws, one 3/8–24 x 1 1/2 cap screw, one 3/8–24 nut, and nine 3/8-inch lockwashers attaching flywheel housing front and rear halves. Tighten cap screws and nut to 27 to 32 pound-feet torque.

(9) Install thirty 5/16–24 x 11/16 torus-cover-to-flywheel attaching bolts and 5/16-inch lockwashers. Tighten attaching bolts finger-tight only.

(10) First tighten two bolts at dowels and two bolts 90° from dowels to 12 to 15 pound-feet torque. Tighten bolts alternately to avoid distorting torus cover.

(11) Tighten all torus-cover-to-flywheel attaching bolts alternately and evenly to 25 to 28 pound-feet torque.

(12) Make sure torus cover drain plug (fig. 186) is tightened to 6 to 7 pound-feet torque.

(13) Position flywheel housing cover on housing and attach with eight 3/8–16 x 1 cap screws and 3/8-inch lockwashers. Tighten cap screws to 25 to 30 pound-feet torque.

(14) Connect transmission oil cooler lines at each side of oil pan and cooler assembly. Tighten nuts.

e. Final Procedures.

(1) *Connect starter control.* Aline cross-shaft-lever-to-starter rod with cross shaft lever; then attach rod to lever with clevis pin (H, fig. 200) and cotter pin.

(2) *Install transmission rear support cross member.* Position transmission rear support cross member on support brackets at each side member; then attach support to brackets with four 1/2–20 x 2 1/4 bolts and four 1/2–20 safety nuts. Tighten nuts.

(3) *Attach transfer control cross shaft.* Attach transfer control cross shaft left bracket to transmission rear support with two

5/16–24 x 7/8 bolts (P, fig. 197) and 5/16–24 safety nuts. Tighten nuts.

(4) *Connect transfer-to-front-axle propeller shaft.* Raise rear end of transfer-to-front-axle propeller shaft into position; then attach propeller shaft universal joint to transfer driving flange with four 7/16–20 x 1 3/16 bolts and 7/16–20 safety nuts. Tighten nuts.

(5) *Install transmission-to-transfer propeller shaft.*

(*a*) Slide front universal joint flange on transmission output shaft.

(*b*) Attach rear universal joint flange to transfer flange with four 1/2–20 x 1 3/8 bolts and 1/2–20 safety nuts. Tighten nuts.

(*c*) Install four 1/2–20 x 1/2 bolts and 1/2–20 safety nuts attaching front and rear universal joint. Tighten nuts.

(6) *Attach power plant to transmission rear support.*

(*a*) With power plant carefully supported by saddle jack, lower power plant until weight rests on cushioned mountings at rear of transmission, installed on transmission rear support. Refer to figure 108.

(*b*) Attach transmission to rear support cushions with two 1/2–20 x 1 3/8 bolts and 1/2-inch lockwashers. Tighten bolts. Remove saddle jack from beneath vehicle.

(7) *Install exhaust pipe rear section.* Using a new seal at each end fo exhaust pipe rear section, attach rear exhaust pipe to muffler and front exhaust strap to transmission rear support with a 5/16–24 x 1 5/8 cap screw and 5/16–24 safety nut. Tighten nut firmly.

(8) *Install transmission shift control tower and connect linkage.*

(*a*) Install transmission control tower (par. 203*a* (2)).

(*b*) Position throttle valve control rod at throttle valve lever and attach with cotter pin and clevis pin (M, fig. 196).

(*c*) Connect reduction unit control rod (CC, fig. 197) to reduction unit control lever with clevis pin and cotter pin.

(*d*) Aline transfer reverse rod with transmission shift lever, then attach rod to lever with clevis pin and cotter pin (B and C, fig. 199).

(9) *Adjust linkage.* Adjust manual shift control linkage and transmission throttle linkage as described in paragraph 202.

(10) *Fill cooling system.* Fill engine cooling system as described in paragraph 142*a*.

(11) *Fill transmission with lubricant.* Fill transmission with oil as described in paragraph 194*e*.

f. Record of Replacement. Record the replacement on DA Form 478.

III. TRANSFER AND CONTROLS

Data

ansfer is essentially a single-speed auxiliary gears, and output shafts for transferring driving axles. Mounted on frame cross f transmission, transfer is driven from ed propeller shaft. Transfer includes a ting axles from power plant, to permit ment without driving vehicle. Transfer incorie jaw-type clutch in front axle drive gearing to promatic engagement and disengagement of front driving axle. Except when required for tractive effort, front axle runs free. Opening is provided at left side of transfer case to accommodate a power-take-off assembly used to operate such equipment as winch, dump body hoist, and pumps on trucks with tank bodies. Parking brake mechanism is assembled at rear of transfer, and speedometer is driven by gears assembled at idler shaft front bearing retainer. The two shifter shafts mounted in support at front side of transfer case are operated by mechanical linkage. Lower shifter shaft is interconnected with transmission control and automatically positions front axle output shaft gear for forward and reverse driving. Upper shift shaft is connected to manually operated shift linkage connected to transfer lever in cab, which enables driver to place transfer case in neutral.

b. Data.

Type	single-speed with automatic front axle declutching
Make	GMC Truck and Coach
Ordnance number	7411327
Ratio	1.16:1

207. Checking, Draining, and Filling Transfer

a. General. Refer to lubrication chart (par. 69) for type of lubricant and intervals of checking and draining.

b. Checking Lubricant Level. Remove filler plug (AA, fig. 83). Add sufficient lubricant to bring level to one-half inch below filler plug opening if unit is cold (before operation). If unit is hot, immediately after operation, lubricant level should be even with bottom of filler plug opening. Clean plug thoroughly and install new gasket if old gasket is damaged. Install and tighten plug.

c. Draining and Filling. Unit should be drained while hot, immediately after operation. Remove bottom plug (BB, fig. 83) in case to drain lubricant. If vehicle is equipped with a power-take-off, also remove plug at bottom of power-take-off to drain unit. Clean drain plug thoroughly. Install new gaskets. Install and tighten plugs. Refill to one-half inch of bottom of filler plug opening (*b* above).

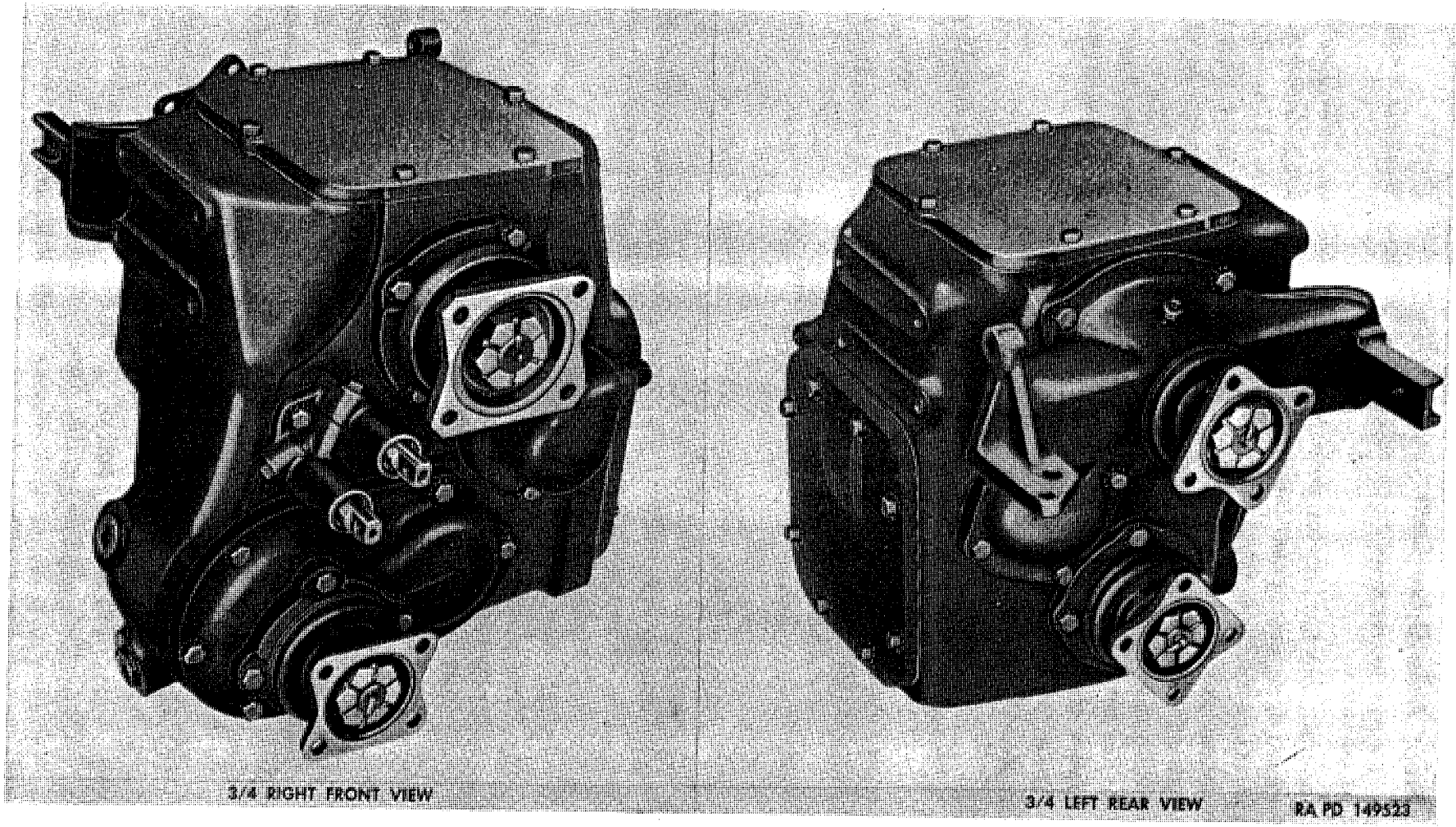

Figure 215. Front and rear external views of transfer assembly.

208. Front Axle Drive Shift Linkage

Note. The key letters noted in parentheses are in figure 197, except where otherwise indicated.

a. General. Mechanism for positioning front axle drive jaw clutch for forward or reverse operation is interconnected to transmission shift linkage. Consequently, from driver's viewpoint, operation of transfer is automatic, except when necessary to place into neutral. Adjustment of transfer forward and reverse shift linkage must be made whenever transmission manual shift linkage is adjusted or replaced.

b. Adjustment. Since transfer forward and reverse linkage is interconnected with transmission manual shift linkage, refer to paragraph 202*c* for adjustment information.

c. Replacement.

(1) *Removal.*

(*a*) Remove clevis pins (BB and JJ) at each end of transfer reverse rod (M); then remove rod.

(*b*) Remove front and rear dust shield clamps (U and X) on reverse shifter shaft dust shield (Z). Slide dust shield toward front.

(*c*) Remove cotter pin from clevis pin (W), then remove clevis pin.

(*d*) Remove cotter pin and plain washer from right end of reverse cross shaft (M, fig. 217).

(*e*) Remove two bolts (P) attaching reverse cross shaft left bracket to transmission rear support. Remove reverse cross shaft and bracket assembly.

(2) *Installation.*

(*a*) Position reverse cross shaft assembly, with lever and bracket as a unit, at transmission rear support.

(*b*) Slide right end of reverse cross shaft into right support bracket (L, fig. 217). Install two 5/16–24 x 7/8 bolts (P) and 5/16–24 locknuts which attach reverse cross shaft left support bracket to transmission rear support. Tighten locknuts to 9½ to 13 pound-feet torque.

(*c*) Place 17/32-inch plain washer on right end of reverse cross shaft; then install 1/8 x 7/8 cotter pin through end of reverse cross shaft (M, fig. 217).

(*d*) Connect transfer reverse rod (M) to transmission shift lever (K) with 3/8-inch clevis pin (JJ). Install 3/32 x 5/8 cotter pin through end of clevis pin. Do not connect adjustable end of rod at this time.

(*e*) Adjust forward and reverse shift linkage (par. 202*c*); then install 3/8-inch clevis pin (BB). Secure clevis pin with 3/32 x 5/8 cotter pin.

(*f*) Position reverse shifter shaft dust shield (Z) over clevis yoke and shifter shaft; then install and tighten front and rear dust shield clamps (U and X).

209. Manual Shift Linkage

Note. Key letters noted in parentheses are in figure 216.

a. General. Transfer is placed into neutral and driving positions with manually operated transfer lever, located above floor slightly to right of driver's seat (A). Through linkage, manually operated lever actuates power-take-off shifter shaft in transfer. With transfer lever raised to UP-ENGAGED position, transfer is in driving position. When transfer lever is lowered to DOWN-NEUTRAL position, transfer is in neutral.

b. Adjustment. With handoperated transfer control lever (S) in UP-ENGAGED position, and with lever resting on lower edge of guide slot in companion seat riser (T), make sure shifter shaft (H) in transfer is pulled out (forward) to detent stop. Loosen jam nut

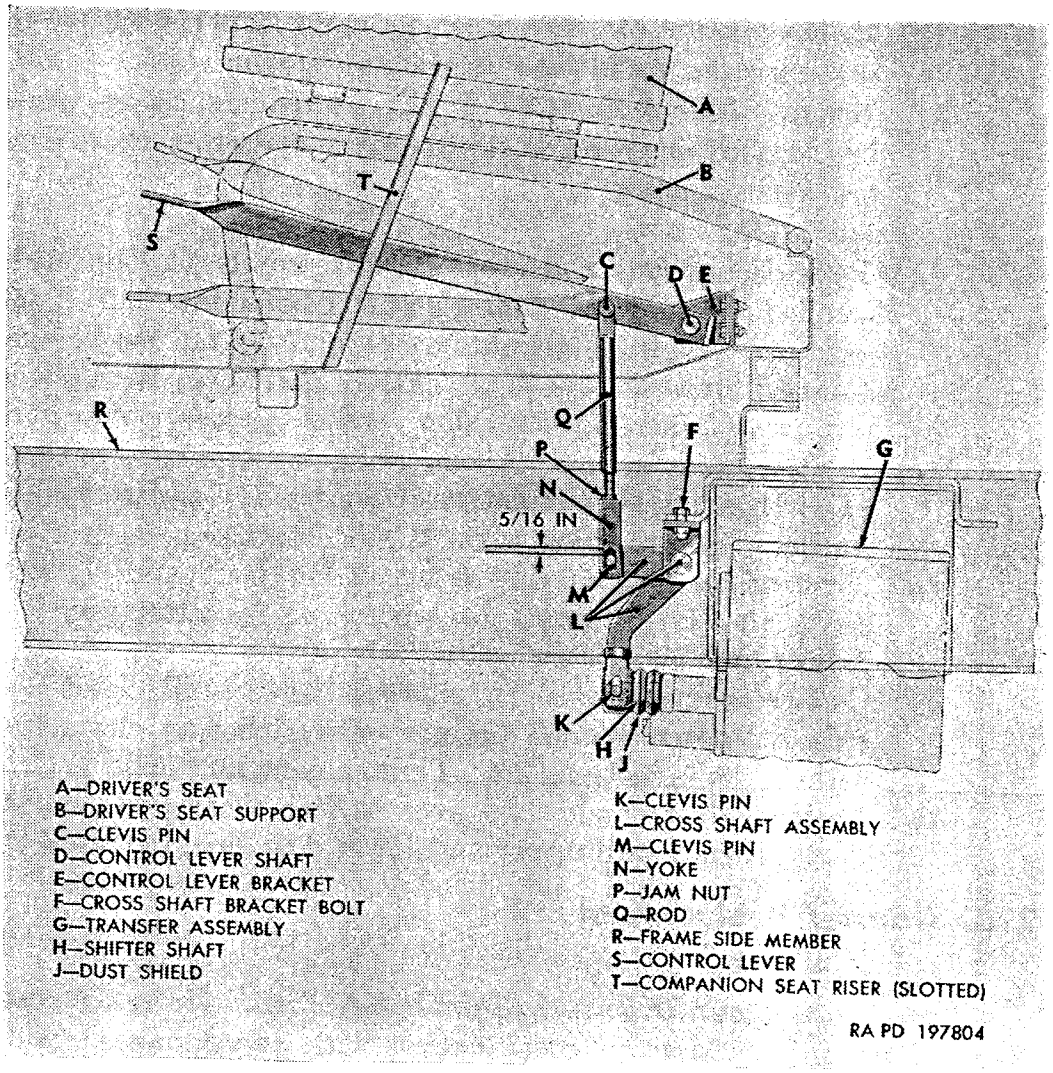

Figure 216. Transfer lever linkage.

(P), remove clevis pin (M); then adjust yoke (N) so that clevis pin (M) is five-sixteenths of an inch from top of elongated clevis pin holes in yoke (N). Tighten clevis jam nut (P). Install clevis pin (M) with two 3/8-inch plain washers; then secure clevis pin with 3/32 x 5/8 cotter pin.

c. Replacement.

(1) *Removal.*

(*a*) Remove cotter pin and clevis pin (C) from transfer control lever and lever-to-cross-shaft rod.

(*b*) Remove cotter pin, retaining washer, and shaft (D) which connect transfer control lever (S) to bracket (E); then remove lever.

(*c*) Remove cotter pin, two washers, and clevis pin (M) from lower end of lever-to-cross-shaft-rod yoke (N); then remove rod and clevis assembly.

(*d*) Remove upper and lower clamps from shifter shaft dust shield (J); then move dust shield back onto shifter shaft (H).

(*e*) Remove cotter pin, two washers, and clevis pin (K) connecting cross shaft lever to transfer shifter shaft.

(*f*) Remove four bolts (F) attaching transfer cross shaft brackets to cross member; then remove cross shaft and brackets assembly.

(2) *Installation.*

(*a*) Position brackets and cross shaft assembly (L) on cross member; then install four 3/8–24 x 1 bolts and four 3/8–24 locknuts. Tighten locknuts to 20 to 27 pound-feet torque.

(*b*) Connect cross shaft lever to shifter shaft (H) with clevis pin, two 3/8-inch plain washer, and a 3/32 x 5/8 cotter pin.

(*c*) Position transfer control lever (S) in control lever bracket (E); then install control lever shaft (D) and retaining wasner. Secure shaft with 1/8 x 1 cotter pin.

(*d*) Position rod (Q) on control lever (S); then install 3/8-inch clevis pin (C). Secure pin with 3/32 x 5/8 cotter pin.

(*e*) Adjust linkage as described in *b* above.

(*f*) Connect rod to cross shaft lever; then install clevis pin (M) with two 3/8-inch plain washers. Secure clevis pin with 3/32 x 5/8 cotter pin. Tighten jam nut (P).

(*g*) Position dust shield (J) over shifter shaft and end of clevis; then install upper and lower dust shield clamps.

210. Transfer Replacement

(fig. 217)

a. Coordination with Ordnance Maintenance Unit. Refer to paragraph 2 for information on coordination with an ordnance maintenace unit.

b. General. The transfer assembly, which includes parking brake and power-take-off (when used), is removed as an assembly. A suitable dolly jack is required to remove transfer assembly.

c. Removal.

(1) Remove filler and drain plugs (Q and R) and allow lubricant to drain. Install and tighten plugs when drainage is complete.

(2) Disconnect propeller shafts at transfer by removing bolts and nuts which attach propeller shaft flanges to transfer companion flanges (par. 229).

(3) Disconnect vent line (C) at tee on cross member and at transfer.

(4) Disconnect speedometer flexible shaft at transfer. Use pliers to unscrew knurled nut; then pull flexible shaft out of speedometer driven gear shaft.

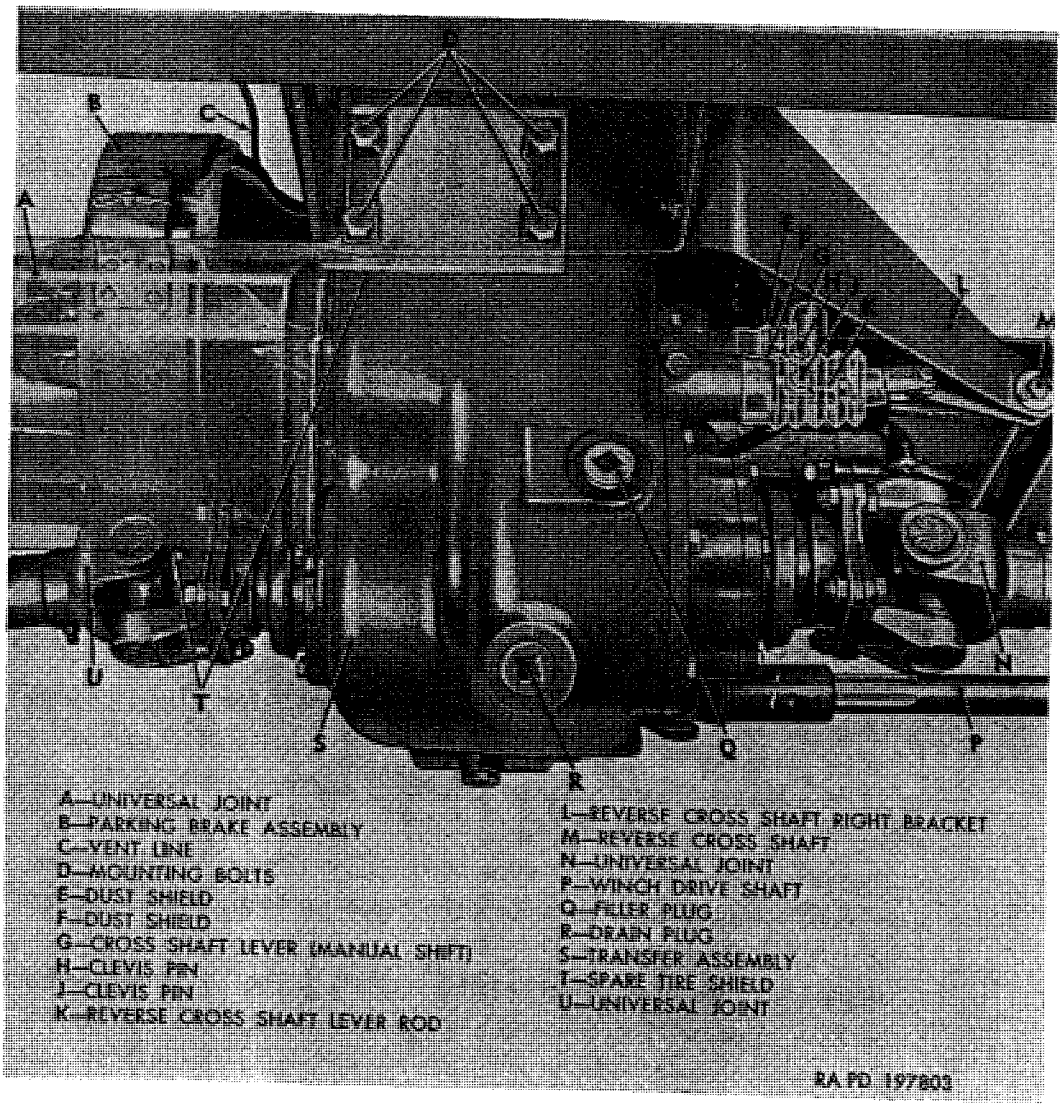

Figure 217. Transfer installed.

(5) When vehicle is equipped with power-take-off and winch, disconnect winch drive shaft (par. 319*b*), and winch control cable (par. 321*b*) at power-take-off.

(6) When vehicle is equipped with power-take-off and accessory drive assembly, remove cotter pin and clevis pin from shifting rod at accessor drive. Remove hex-socket setscrew from drive shaft universal joint yoke. Slide yoke toward end of accessory drive shaft as far as possible.

(7) Remove cotter pin and clevis pin attaching parking brake rod to brake cam levers.

(8) Remove upper and lower clamps from shifter shaft dust shield (F); then move dust shield back onto shifter shaft. Remove cotter pin, two washers, and clevis pin (H) connecting cross shaft lever (G) to transfer shifter shaft.

(9) Remove front and rear dust shield clamps from reverse shifter shaft dust shield (E); then slide dust shield forward. Remove cotter pin from reverse cross shaft lever rod clevis pin (J); then remove clevis pin.

(10) Position dolly jack under transfer and raise into position to support transfer.

(11) Bend bolt locks away from bolt heads; then remove four mounting bolts (D) and two bolt locks from each side. Remove spare tire shield (T). Lower transfer on jack and withdraw from under vehicle. When power-take-off accessory drive is used, the drive shaft yoke can be removed from accessory drive as transfer is lowered.

(12) Remove parking brake band from rear of transfer (par. 255*a*).

(13) Remove power-take-off assembly (when used) from side of transfer (par. 212).

d. Installation.

(1) Install power-take-off (when used) on side of transfer (par. 213).

(2) Install parking brake band on rear of transfer (par. 255*b*).

(3) Place transfer on dolly jack and roll into position under vehicle. Raise transfer into position between supports and aline holes in supports with threaded holes in case. If equipped with power-take-off accessory drive, guide accessory drive shaft into drive shaft yoke as transfer is raised into place. On left side, place two bolt locks over four $\frac{1}{2}$–13 x $1\frac{3}{16}$ mounting bolts; then install bolts. Tighten bolts to 60 to 85 pound-feet torque. Bend corners of bolt locks up against bolt heads. On right side, position spare tire shield (T) on transfer support. Place two bolt locks over four $\frac{1}{2}$–13 x $1\frac{11}{16}$ mounting bolts; then install bolts (D) and

tighten to 60 to 85 pound-feet torque. Bend corners of bolt locks up against bolt heads.

(4) Adjust forward and reverse shift linkage (par. 202*c*). Position reverse shifter shaft rod clevis on transfer shifter shaft; then install 3/8-inch clevis pin (J). Secure clevis pin with 3/32 x 5/8 cotter pin. Position reverse shifter shaft dust shield (E), then install and tighten front and rear dust shield clamps.

(5) Adjust manual shift linkage (par. 209). Connect cross shaft lever (G) to shifter shaft with clevis pin (H), two 3/8-inch plain washers, and a 3/32 x 5/8 cotter pin. Position shifter shaft dust shield (F) over shifter shaft and end of clevis; then install upper and lower dust shield clamps.

(6) Attach parking brake rod to parking brake cam lever with a 3/8 x 15/16 clevis pin. Secure clevis pin with a 3/32 x 5/8 cotter pin.

(7) If vehicle is equipped with winch, connect winch drive shaft (par. 319*d*) and winch control cable (par. 321*c*) to power-take-off.

(8) If vehicle is equipped with power-take-off accessory drive, connect shifting rod to accessory drive with clevis pin. Secure clevis pin with 1/8 x 7/8 cotter pin. Install and tighten setscrew in drive shaft yoke.

(9) Connect speedometer flexible shaft to transfer. Make sure that tongue on cable meshes with speedometer gear shaft. Tighten knurled nut with pliers.

(10) Connect vent line (C) at line tee on cross member and at transfer. Tighten tubing nut.

(11) Connect propeller shafts to transfer (par. 230).

(12) Examine condition of drain and filler plugs and gaskets and replace if necessary. Refer to lubrication chart (par. 69) for type of lubricant. Fill as described in paragraph 207.

e. Record of Replacement. Record the replacement on DA Form 478.

Section XIX. POWER-TAKE-OFF AND ACCESSORY DRIVE

211. Description and Data

a. Description. Power-take-off assembly, installed at left side of transfer, provides power for operation of winch only, winch and dump body hoist pump, and pump used with gasoline and water tanks. Power-take-off assemblies are single-speed-type and can be operated either with vehicle standing or moving. Some applications require an accessory drive, which is mounted on top of power-take-off.

(1) *Power-take-off (winch only).* Power-take-off used on vehicles equipped with winch only is illustrated in figure 218. This unit has a single output shaft at forward side of power-take-off. Control cable is also attached at forward side.

(2) *Power-take-off (winch and dump body hoist).* Power-take-off used on vehicles equipped with dump body and winch is illustrated in figure 219. This unit is equipped with an accessory drive, mounted at top of power-take-off, and provides means for driving dump body hoist pump. Accessory drive output shaft and control shaft are toward rear.

(3) *Power-take-off (tank body pump).* Power-take-off used on vehicles equipped with tank bodies is illustrated in figure 220. This unit is equipped with an accessory drive, mounted at top of power-take-off, and provides means for driving tank body pump. Accessory drive output shaft is toward rear and controls are toward front.

b. Data.

Make	Chelsea
Type	reversible
Speed	single
Power take-off model:	
Winch only	87C1
Winch and dump body hoist	87C1
Tank body pump	88C
Accessory drive model:	
Dump body	82C
Tank body	81C

212. Power-Take-Off Removal

a. General. The arrangement of power-take-off and accessory drive assemblies are similar in their mounting and controls as illustrated in figures 221, 222, and 223. Removal procedures for each type are described in *b*, *c*, and *d* below.

b. Removal of Winch Power-Take-Off (fig. 221).

(1) Remove plug from bottom of power-take-off to drain lubricant.

(2) Loosen setscrew securing universal joint yoke to power-take-off shaft; then slide yoke forward to remove from power-take-off shaft.

(3) Remove control cable from power-take-off (par. 321*b*).

(4) Remove six cap screws and lockwashers, and two stud nuts attaching power-take-off to transfer. Remove power-take-off assembly from transfer. Remove and discard gasket.

c. Removal of Dump Body Hoist Power-Take-Off (fig. 222).

(1) Remove plug from bottom of power-take-off to drain lubricant.

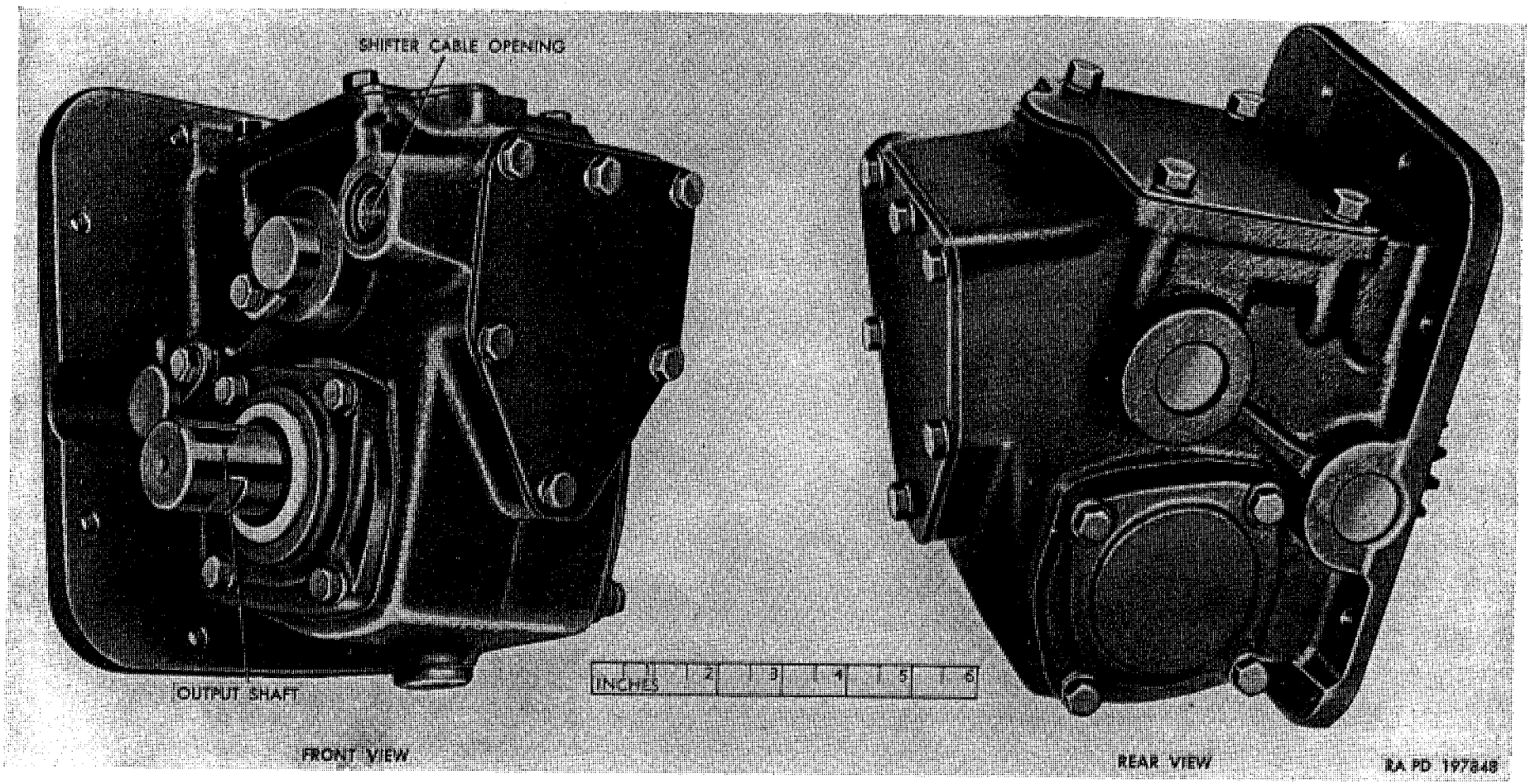

Figure 218. Front and rear views of winch power-take-off assembly.

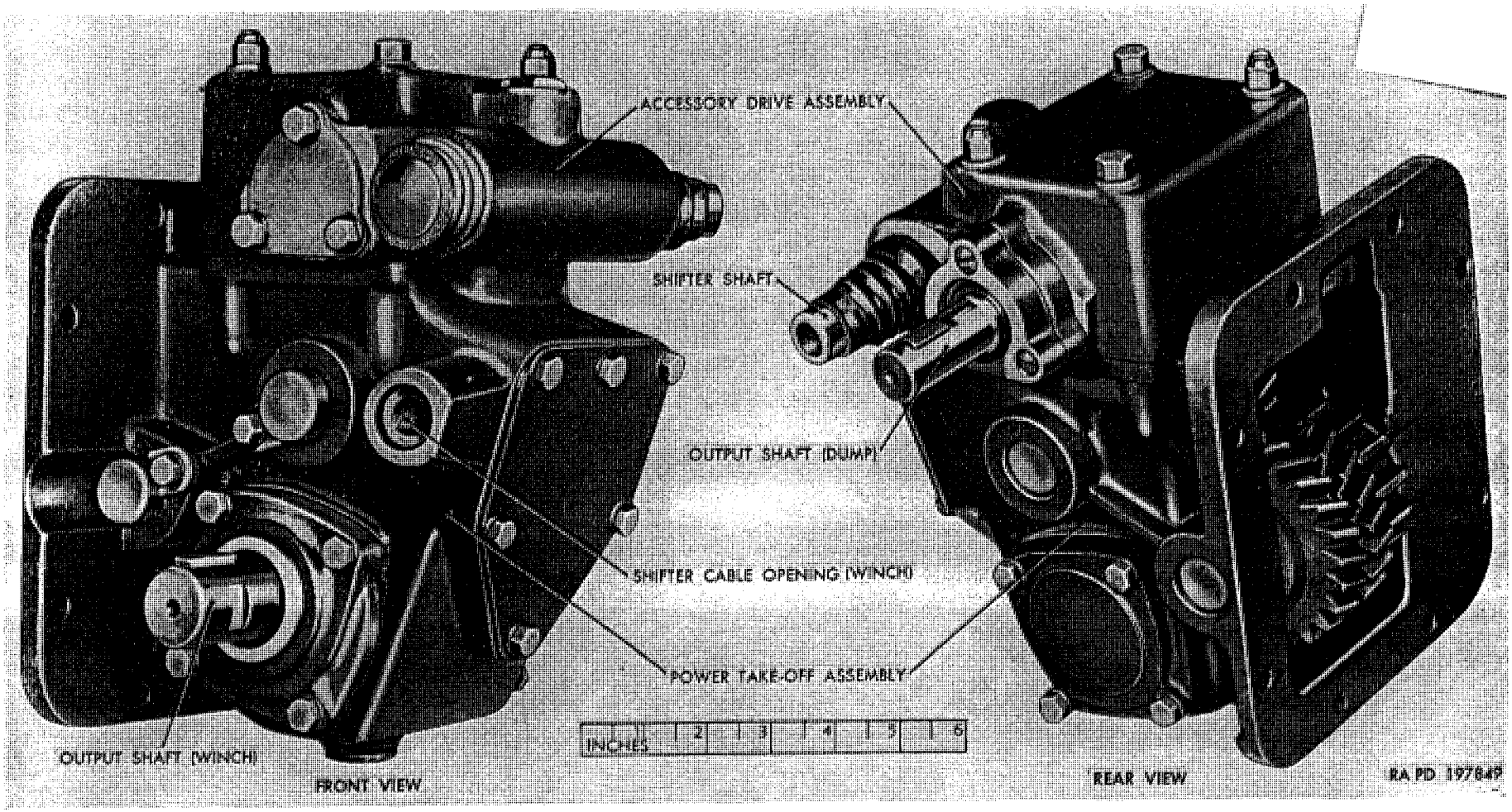

Figure 219. Front and rear views of dump body hoist and winch power-take-off and accessory drive assemblies.

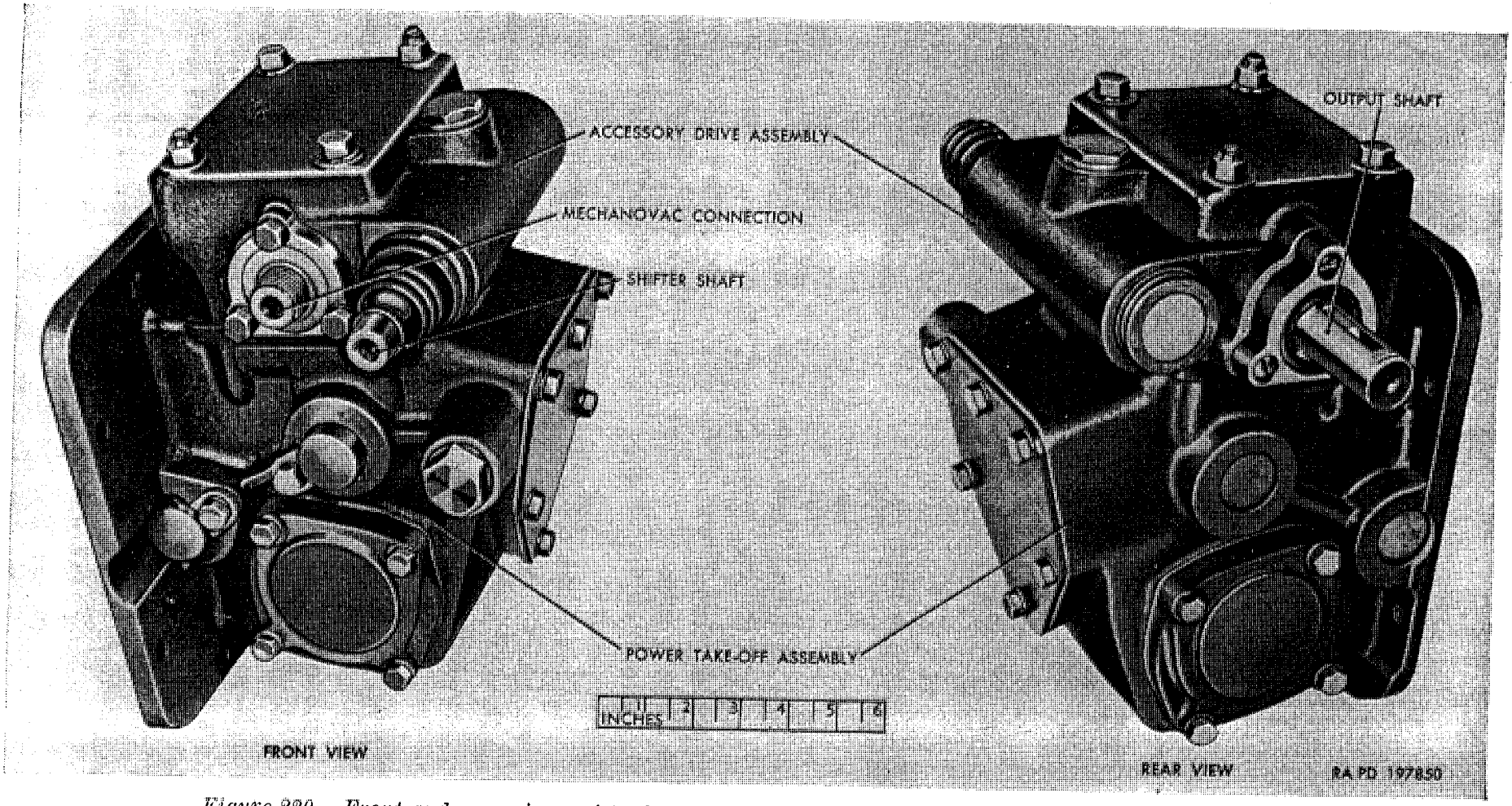

Figure 220. Front and rear views of tank body pump power-take-off and accessory drive assemblies.

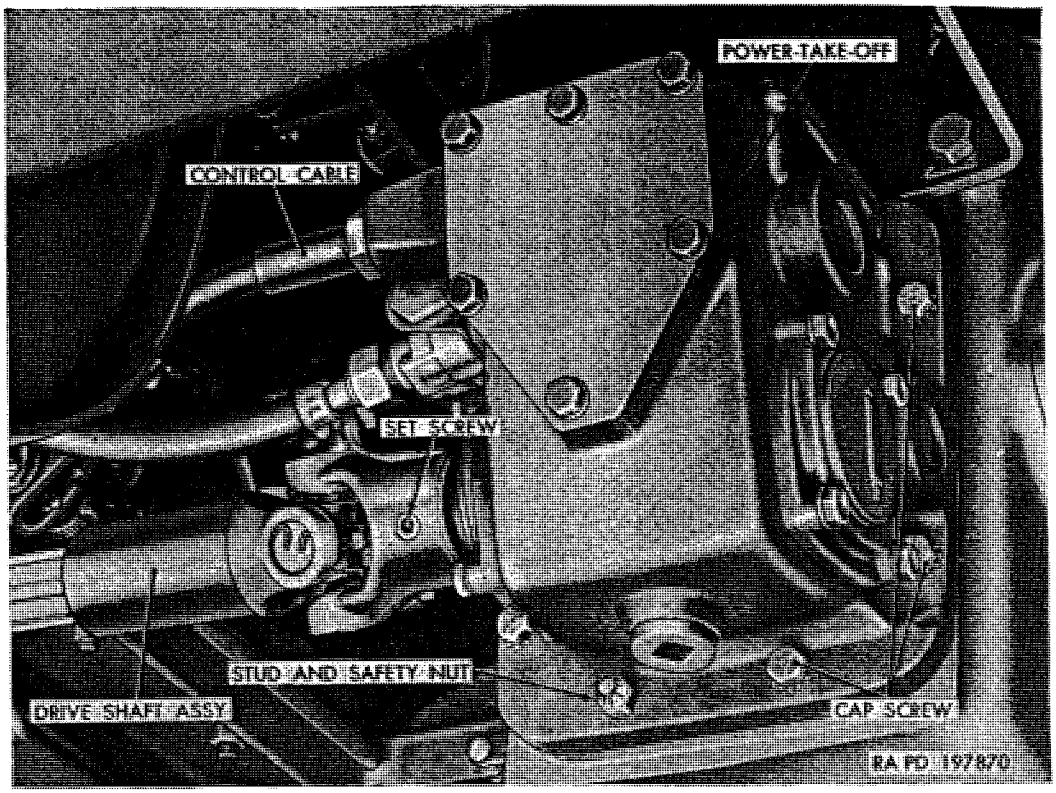

Figure 221. Power-take-off installed (winch only).

(2) On vehicles equipped with winch, disconnect drive shaft universal joint yoke (*b*(2) above). Remove control cable from power-take-off (par. 321*b*).

(3) Remove setscrew securing hoist pump drive shaft yoke to accessory drive assembly; then slide yoke rearward to remove from shaft.

(4) Remove cotter pin and clevis pin attaching shifting rod to accessory drive shifter shaft.

(5) Remove six cap screws and lockwashers, and two stud nuts attaching power-take-off to transfer. Remove power-take-off from transfer. Remove and discard gasket.

d. Removal of Tank Body Pump Power-Take-Off (fig. 223).

(1) Remove plug from bottom of power-take-off to drain lubricant.

(2) Remove pump front propeller shaft (par. 345*b*).

(3) Remove cotter pin and clevis pin; then remove shift rod at accessory drive shift shaft.

(4) Remove nut attaching Mechanovac governor control cable to accessory drive assembly; then remove cable.

(5) Remove six cap screws and lockwashers, and two stud nuts attaching power-take-off to transfer. Remove power-take-off from transfer. Remove and discard gasket.

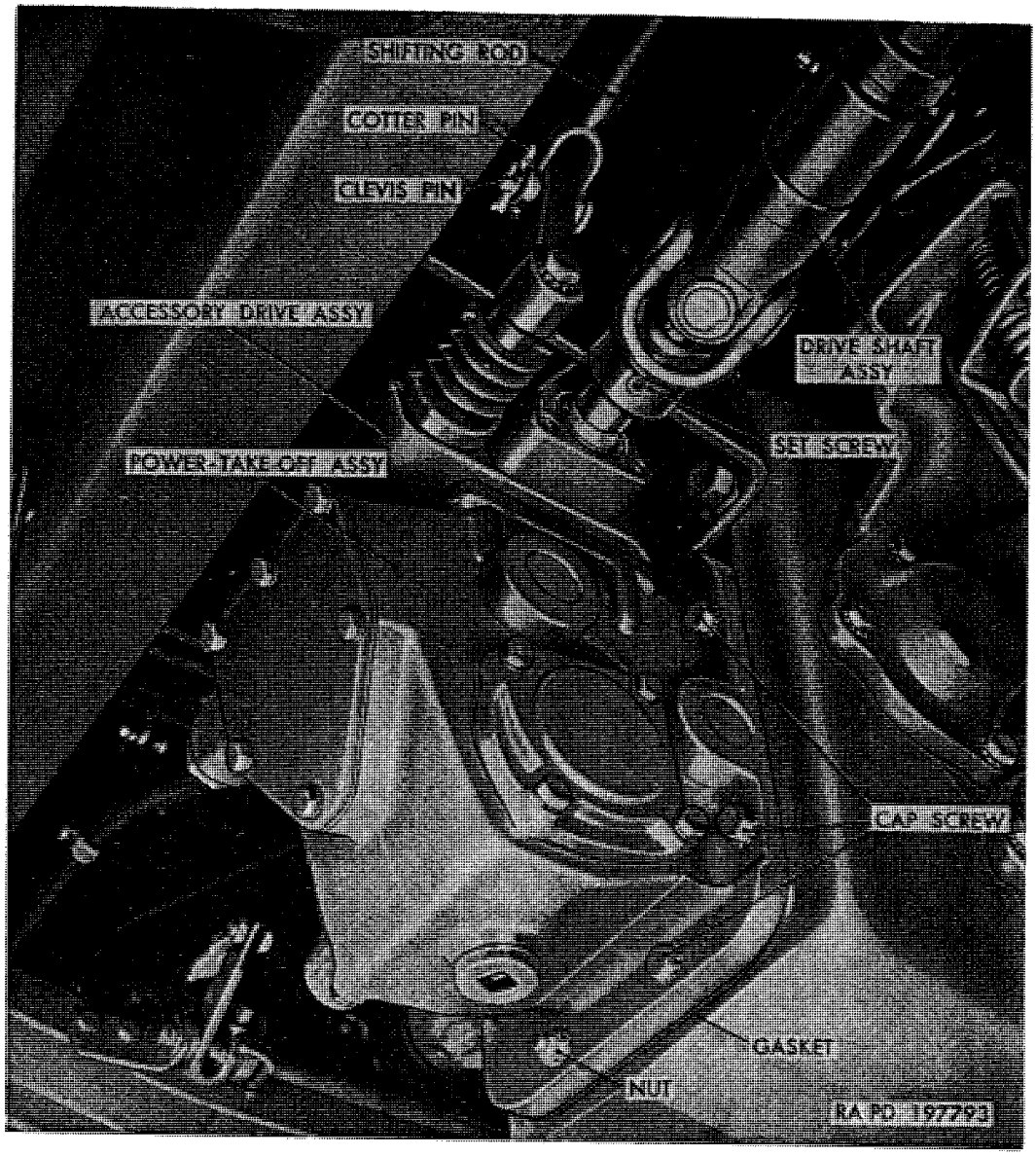

Figure 222. Power-take-off installed (dump body hoist).

213. Power-Take-Off Installation

a. General. Procedures for installation of each type are described in *b*, *c*, and *d* below.

b. Installation of Winch Power-Take-Off (fig. 221).

(1) Position two new gaskets over studs and against transfer. Position power-take-off over two studs and against transfer. Install one 3/8–24 nut on each of the two studs. Install six 3/8–16 x 1 1/8 cap screws and 3/8-inch lockwashers. Tighten stud nuts and cap screws evenly and alternately.

(2) Fill transfer with lubricant as directed in paragraph 207*c*.

(3) Install control cable (par. 321*c*).

(4) Install 1/4 x 1 woodruff key in power-take-off shaft keyway. Install rear universal joint on splined rear shaft; then slide joint rearward and onto power-take-off shaft, alining keyway

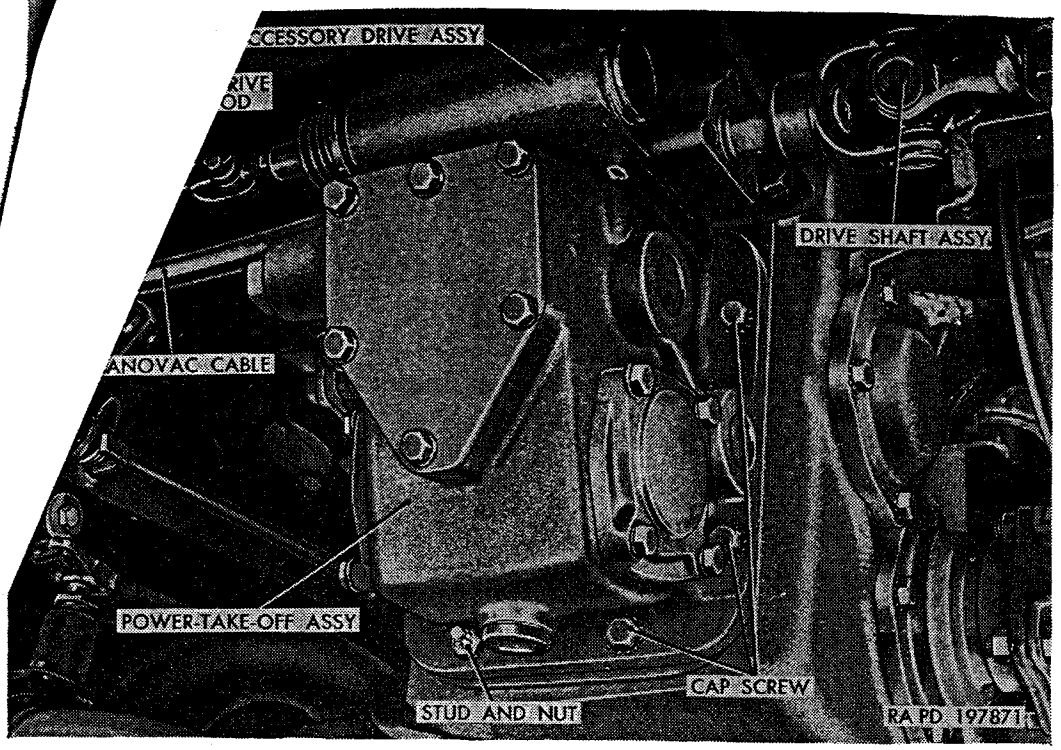

Figure 223. Power-take-off installed (gasoline and water tank pump).

and key. Install and tighten ½–13 x ½ setscrew securing yoke to drive shaft.

c. Installation of Dump Body Hoist Power-Take-Off (fig. 222).

(1) Install power-take-off (*b*(1) above); then fill transfer with lubricant as directed in paragraph 207*c*.

(2) On vehicles equipped with winch, connect drive shaft universal joint to power-take-off (*b*(4) above). Connect control cable (par. 321*c*).

(3) Connect shifting rod to accessory drive shift shaft, using ½ x 1 13/64 clevis pin and ⅛ x ⅞ cotter pin.

(4) Install one ¼ x ⅞ woodruff key in accessory drive shaft. Aline drive shaft yoke keyway with drive shaft key; then tap yoke with soft hammer until in position on shaft. Install and tighten a ⅜–16 x ½ socket-head setscrew which attaches yoke to shaft. Prick punch head of setscrew to prevent loosening.

d. Installation of Tank Body Pump Power-Take-Off (fig. 223).

(1) Install power-take-off (*b*(1) above); then fill transfer with lubricant (par. 207*c*).

(2) Connect shifting rod to accessory drive shift shaft eye, using ⅜ x 15/16 clevis pin and 3/32 x ⅝ cotter pin.

(3) Insert end of Mechanovac governor control cable into opening in accessory drive; then tighten retaining nut.

(4) Install pump front propeller shaft as directed in paragraph 345*c*.

214. Accessory Drive Replacement

a. Removal. Remove power-take-off and accessory drive assembly from transfer (par. 212). Remove two cap screws and lockwashers, also two stud nuts which attach accessory drive to power-take-off. Remove accessory drive assembly from power-take-off. Remove and discard gasket.

b. Installation. Install new gasket over studs on power-take-off. Position accessory drive assembly over studs on power-take-off. Install two 3/8–24 stud nuts, and two 3/8–16 x 3¾ cap screws with 3/8-inch lockwashers. Tighten stud nuts and cap screws evenly and alternately. Install power-take-off and accessory drive assembly to transfer (par. 213).

Section XX. FRONT AXLE

215. Description and Data

a. Description.

(1) *General.* Front axle assembly (fig. 224) is a hypoid, single-reduction-type axle consisting of a housing, differential and carrier assembly, axle shaft and universal joint assemblies, and steering knuckle support assemblies. Power is transmitted from transfer to drive pinion through a tubular propeller shaft. Power is transmitted from drive pinion to drive gear and differential assembly, then to the wheels through axle shaft and universal joint assemblies. Action of universal joints permits delivery of power to the wheels when they are turned from straightahead position. Front axle is automatically engaged and disengaged by action of a jaw-type clutch located in transfer unit. Front axle is disengaged, except when tractive effort is required.

(2) *Axle housing.* The axle housing is of the conventional one-piece banjo-type with carrier assembly and cover openings near center of housing. The spherical shaped housing outer ends, torque rod brackets, spring seats, and steering knuckle stops are welded to the axle housing. Oil seals are used at outer ends of housing to prevent lubricant loss. External surface of housing outer ends are machined and polished to provide smooth surface for housing outer end oil and dust seals.

(3) *Axle shaft and universal joint assemblies.* The axle shafts are full-floating-type with constant-velocity universal joints at steering knuckles. Each assembly consists of inner and outer shafts with integral yokes which form a universal joint around five steel balls. Outer shafts are the same for right and left sides and are splined at outer ends to engage drive

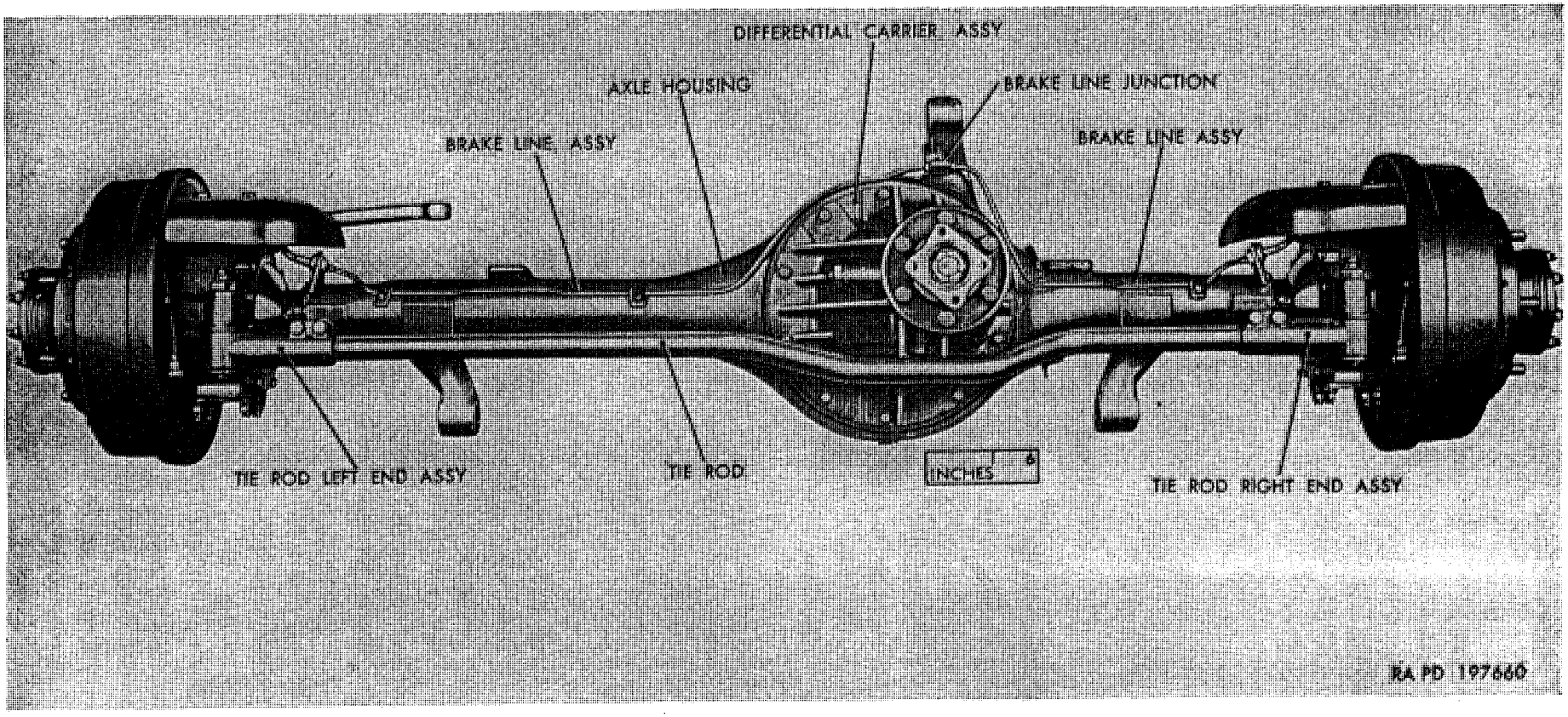

Figure 224. Front axle assembly removed.

flange. Inner shafts are of different lengths and are splined at inner ends to engage side gears at differential. Universal joint assemblies are completely inclosed within the steering knuckle supports.

(4) *Steering knuckle supports.* Steering knuckle supports are supported at outer ends of housing by tapered roller bearings. Supports are held in position on the bearings by steering knuckle trunnions, which permit steering knuckle supports to turn as front wheels are turned to right or left. Steering arms, to which tie rod ends attach, are integral with steering knuckle supports. Housing outer end oil and dust seals are attached to inner side of steering knuckle supports and are held in place by suitable retainers.

(5) *Steering knuckles.* Steering knuckles are attached to steering knuckle supports by bolts and lockwashers, which also serve to attach brake backing plate and brake anchor blocks. Steering knuckles act as spindles for mounting wheel hubs and bearings. A brake oil shield is installed at outer side of steering knuckle flange which prevents any escaping lubricant reaching brake linings.

(6) *Tie rod assembly.* The tie rod is a solid rod, threaded at each end, and double offset to clear the differential carrier assembly. Rod has finer threads (16 per in.) on the left end than on the right end (12 per in.) to permit a finer degree of toe-in adjustment (par. 220). The tie rod is attached to integral arm on each steering knuckle support by a tapered stud installed in each tie rod end. Tie rod is threaded into tie rod ends and held by clamp bolts (and a lock at left end). In addition to controlling toe-in, tie rod also transmits the turning force from the left steering knuckle support to the right steering knuckle support.

b. Data.

Type	hypoid, single-reduction
Ratio	6.17:1
Universal joints	Bendix-Weiss

216. Front Axle Alinement

a. General. Front axle alinement factors, such as camber, caster, turning angle, and toe-in have a major effect on steering from the standpoint of control, ease of steering, and safety. Front axle misalinement is a major cause of premature and uneven tire wear.

b. Caster. Front axle caster (L, fig. 225) is the inclination of the centerline through the upper and lower steering knuckle support trunnion bearings toward the rear of the vehicle. Caster is established by design; therefore no adjustment can be made. The axle is given

this caster angle to provide a castering action at the front wheels when the vehicle is in motion. When the front axle has proper caster, the wheels will tend to point straightahead as long as the vehicle is in motion. Caster angle is affected by a twisted axle housing, loose spring U-bolts, or sagging springs. Insufficient caster will permit front wheels to wander out of straightahead position. Excessive caster will cause hard steering when turning.

c. Camber. Camber is the sidewise inclination of the front wheels. Positive camber is the outward inclination of the wheels as viewed from the front of the vehicle; that is, the wheels are farther apart at the top than at the bottom (H—G, fig. 225). Camber is established by design; therefore no adjustment can be made. A bent axle housing, bent steering knuckle, loose steering knuckle support trunnion bearings, or loose wheel bearings will affect camber. Unequal camber will cause vehicle to pull toward side having most camber. Camber may be measured with a square and rule in manner illustrated in figure 225. Camber dimensions given in *f* below are for straightahead position only and must be checked with axle installed on vehicle.

d. Toe-in. Toe-in is the amount which the front wheels are closer together at the front than at the rear (A—B, fig. 225). An adjustable tie rod, connecting the two steering knuckle supports, is used to adjust toe-in. Camber causes both wheels to tend to turn outward from the vehicle; however, by adjusting tie rod to give wheels proper toe-in, the tendency to turn outward is counteracted and the wheels roll straightahead with no scuffing action on tires. Toe-in is affected by loose wheel bearings, bent axle housing, bent steering knuckle, loose steering knuckle support trunnion bearings, or a bent or improperly adjusted tie rod. Improper toe-in causes excessive tire wear or scuffing. Unequal toe-in may cause the vehicle to pull toward the side having the least toe-in. When wheels are turned from straightahead to either right or left, toe-in changes, until at extreme right or left positions they are farther apart at the front than at the rear. This condition is termed toe-out. Always measure toe-in with wheels in straightahead position, by actually measuring A—B as shown in figure 225 and described in paragraph 220. Toe-in dimensions are given in *f* below.

e. Turning Angle. The turning angle is the maximum angle through which the front wheels may be turned to right or left from the straightahead position. This angle is greater for the inside wheel than the outside wheel on a turn. The turning angle for the inside wheel is shown as C, figure 225, and the turning angle for the outside wheel is shown as D, figure 225. Stop plugs, threaded and welded in housing, are provided to limit the angle through which the inside wheel can turn. Refer replacement and adjustment of stop plugs to ordnance maintenance personnel.

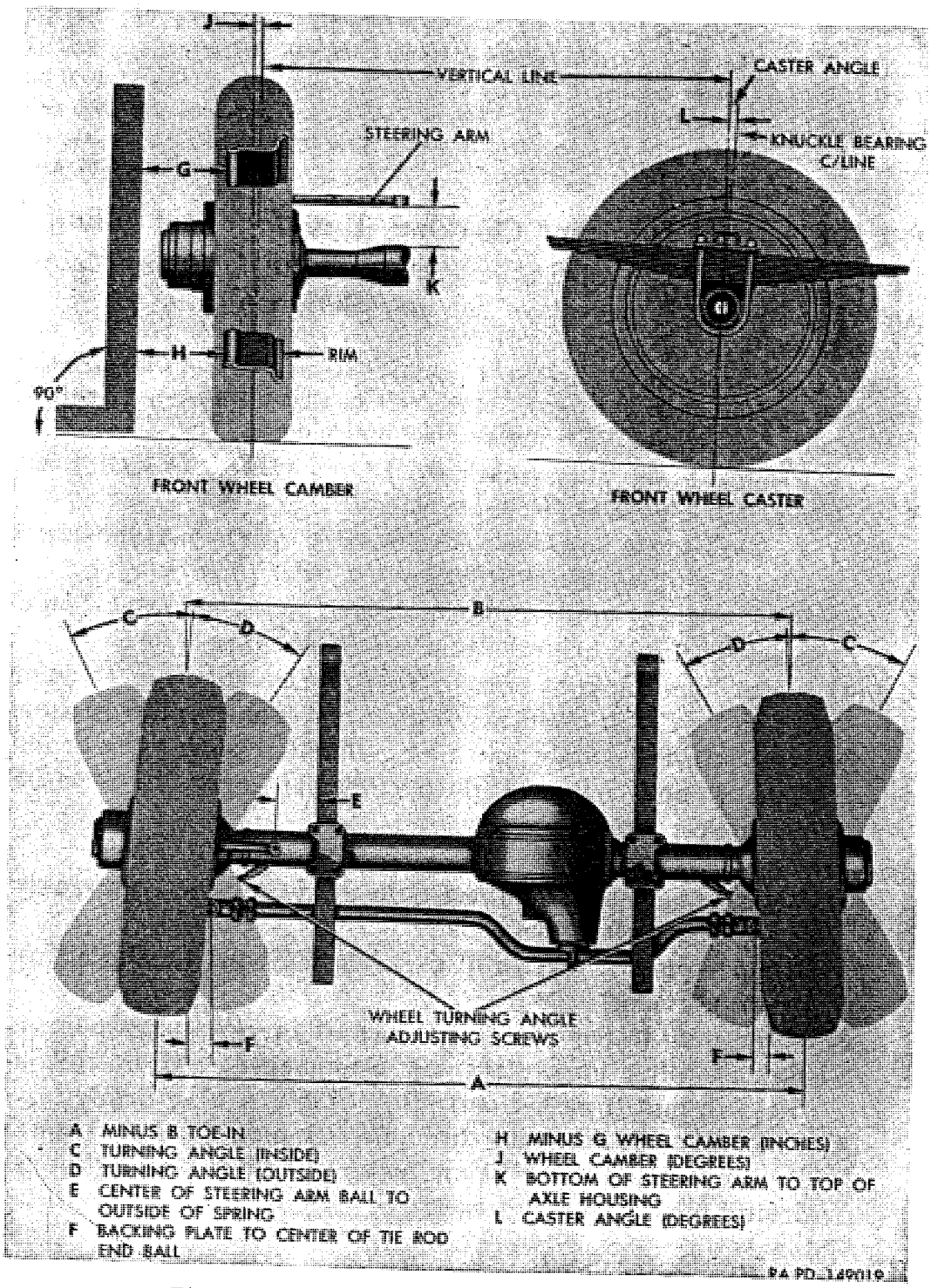

Figure 225. Front wheel and axle alinement chart.

ment Data.

____	toe-in (at hub C/L)	5/32 to 7/32 in.
_____	turning angle—inside	28 deg+1 deg—0 deg
_____	turning angle—outside	26 deg
_____	centerline of steering arm ball to outside of spring	3¼ in.
_____	backing plate to center of tie rod end pin	3¼ in.
H—G_____	wheel camber	27/64 in. to 0 in.
J_____	wheel camber	¾ deg to 0 deg
K_____	bottom of steering arm to top of axle housing	3½ in.
L_____	caster angle	1 deg 45 min.

217. Differential Lubricant Checking, Draining, and Filling

a. General. Refer to lubrication chart (par. 69) for type of lubricant, capacities, and intervals of checking and draining.

b. Checking Level.

Note. Axle housing covers used on front and rear axles are the same; however, they are installed differently. Make certain that oil filler hole marked FRONT OIL LEVEL (fig. 82) is upright—not upside down.

(1) Remove lower plug (marked FRONT OIL LEVEL) from axle housing cover (R, fig. 82).

(2) If lubricant is hot (immediately after operation), lubricant level should be even with bottom of filler plug opening.

(3) If lubricant is cold (before operation), lubricant level should be one-half inch below bottom of plug opening.

(4) Clean filler plug to remove all particles adhering to plug magnet. Check condition of plug gasket and replace if damaged. Install gasket and plug. Tighten plug. Check for leaks around cover. Tighten cover cap screws to 45 to 55 pound-feet torque.

c. Draining and Filling.

(1) Lubricant should be drained while lubricant is hot, preferably immediately after operation.

(2) Remove plug at bottom of axle housing bowl (S, fig. 82) to drain lubricant.

(3) Clean plug to remove all particles adhering to plug magnet. Replace plug gasket if part is damaged. After unit is drained, install gasket and plug. Tighten plug firmly.

(4) Fill unit with lubricant through filler plug (*b* above) until level is one-half inch below bottom of filler plug opening. Install filler plug and gasket.

218. Housing Outer Seals

(fig. 226)

a. General. Axle housing outer seals are installed on inner side of each steering knuckle support around spherical surface of axle housing outer end. Each assembly consists of a gasket (G), oil seal outer retainer (F), felt oil seal (E), dust seal spring (D), dust seal (C),

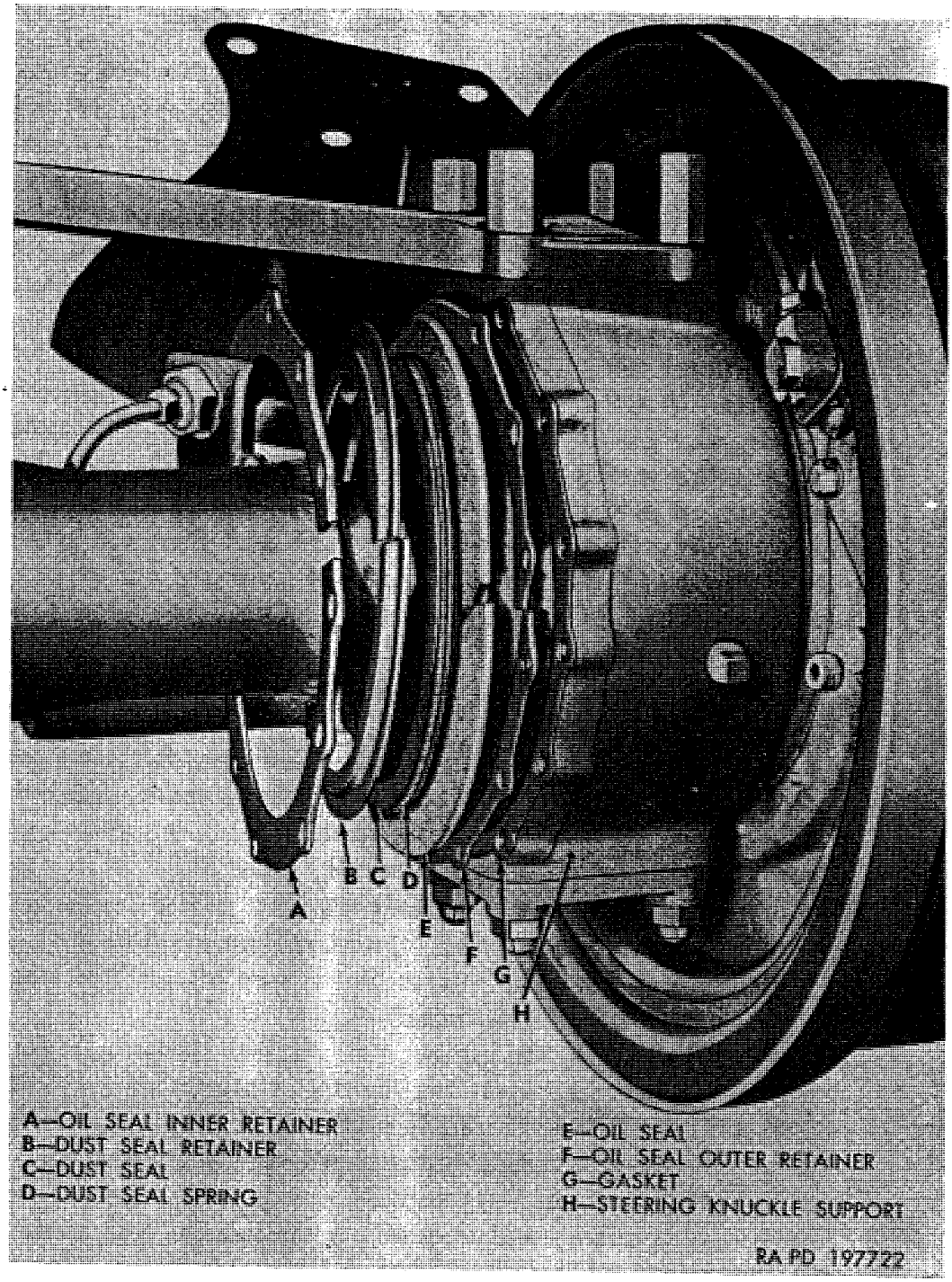

Figure 226. Housing outer seal components.

dust seal retainer (B), and oil seal inner retainers (A). The oil seal (E) is composition of felt and neoprene to prevent leakage of lubricant. The dust seal (C) is spring-loaded and bears tightly against spherical surface. When seals are in good condition and properly installed, lubricant leakage is prevented and entrance of dirt, water, or other contaminants is prevented. The dust seal (C) and dust seal spring (D) cannot be replaced without partial disassembly of axle; however the oil seal (E) and retainers are split and can be replaced with axle installed.

inner retainers. Remove 12 cap screws and lock- attaching two oil seal inner retainers (A), dust seal (B), and oil seal outer retainer (F) and gasket (G) g knuckle support (H). Discard gasket.

il seal. Felt oil seal (E) is split and can be replaced part. Dust seal (neoprene) (C) and dust seal) are not split and cannot be replaced at this time. Report worn or damaged dust seal and spring to ordnance maintenance personnel.

c. Cleaning and Inspection.

(1) *Cleaning.* Clean steering knuckle support (H) and oil seal outer retainer (F) to remove all gasket material. Clean axle housing spherical surface and retainers, using dry-cleaning solvent or volatile mineral spirits. Clean spherical surface with fine crocus cloth if surface is slightly pitted or rusty.

(2) *Inspection.* Inspect dust seal (C) to determine if continued use is advisable. Report all worn or damaged conditions to ordnance maintenance personnel.

d. Installation.

(1) Install new gasket (G) to steering knuckle support (H), using small quantity of plastic-type gasket cement on both sides of gasket; then position gasket on steering knuckle support with split in gasket toward front.

(2) Apply a film of automotive and artillery grease (GAA) to spherical surface of housing, oil seal, and dust seal to provide initial lubrication when unit is first placed into service; also as a preservative after installation.

(3) Position oil seal outer retainer (F) against steering knuckle support with split in retainer at top. Position oil seal (E) into retainer (F) with split in seal at right angles to split in retainer, and felt side of seal toward spherical ball.

(4) Fit dust seal spring (D) into groove in edge of dust seal (C); then position seal and spring against oil seal as dust seal retainer (B) is positioned to retain seals. While holding dust seal retainer against seals, install two oil seal inner retainers (A) with splits on a horizontal line.

splits in the gasket (G), oil seal outer retainer (F), l retainer (B), and oil seal inner retainer (A) n assembled.

18 x 5/8 cap screws and 5/16-inch lockwashers. ws just tight enough to hold parts in place tainers are in proper position as explained above; then make final tightening of cap

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219. Tie Rod

a. Removal.

(1) Place vehicle on a level surface and apply parking brake. Place a jack under front axle and raise enough to take weight of vehicle off front wheels.

(2) Loosen two tie rod end clamp screw nuts at each end of tie rod; then remove inner clamp screws and nuts; also lock (fig. 227) at tie rod left end. Remove tie rod end stud nut at each end of tie rod. Tap steering knuckle support arm a sharp blow with hammer as downward pressure is applied to tie rod end with pinch bar. Move each tie rod end down, and at same time twist forward until free from steering

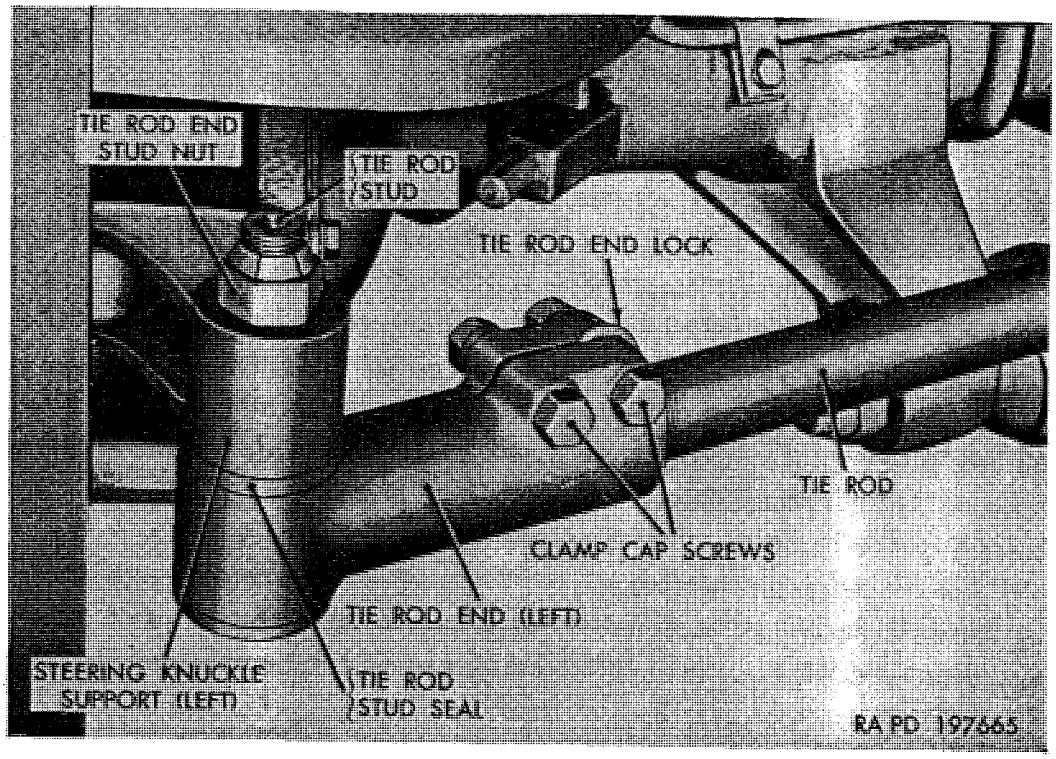


Figure 227. Tie rod installed (left side shown).

knuckle support arm. Remove tie rod ends when both ends are free. Remove and discard tie rod stud seals if deteriorated or damaged.

b. Installation.

(1) Thread tie rod ends onto tie rod an equal distance. Each tie rod end will engage tie rod a distance of 3 inches when in approximately correct location.

(2) Carefully measure distance between centerline of tie rod end studs; then thread tie rod ends on or off until dimension is $62\frac{17}{32}$ inches. This dimension will approximate correct toe-in after tie rod is installed.

(3) Install two ½–20 x 2½ cap screws and ½–20 nuts used to clamp tie rod ends to tie rod. Also install tie rod lock at tie rod end (left) (fig. 227). Do not final tighten cap screw nuts until toe-in check is made.

(4) Place tie rod stud seal (fig. 227) over each tie rod stud. Position tie rod assembly with end having coarse threads to right, and end with lock to the left. Insert tie rod end studs into tapered holes in support arms. Install ⅞–14 safety nut on each tie rod end stud. Do not final tighten nuts.

(5) Check and adjust toe-in (par. 220).

(6) After toe-in adjustment has been made, final tighten tie rod end clamp screw nuts to 48 to 64 pound-feet torque. Final tighten tie rod end stud nuts to 85 to 125 pound-feet torque.

220. Toe-In Adjustment

a. Toe-In Check (fig. 228). Inflate tires to correct pressure (par. 258*b*) and check for proper wheel bearing adjustment (par. 265*a*); then position vehicle with the wheels in straightahead position. Place a toe-in wheel alinement gage between the wheels ahead of the axle at hub height with the ends of the gage bearing against the tire side walls and with ends of both pendant chains an equal distance from ground. Set gage so pointer registers zero. Remove gage and place at same relative position at rear of tire and with ends of pendant chains same distance from ground as at front. The pointer will indicate the amount of toe-in or toe-out. Correct toe-in is 5/32 to 7/32 inch.

b. Toe-In Adjustment (fig. 227). Loose wheel bearings, worn steering knuckle bushings, loose steering knuckle support trunnion bearings, damaged wheels, and bent steering knuckle, housing, and tie-rod

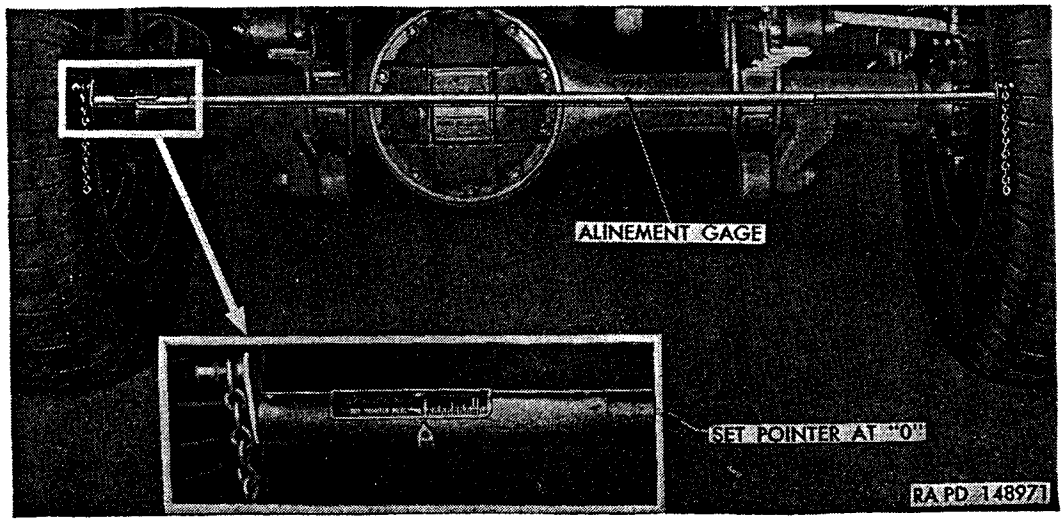


Figure 228. Checking toe-in.

will affect toe-in. Replace damaged parts and adjust wheel bearings (par. 265*b*) before adjusting the tie rod to correct toe-in.

(1) *Remove tie-rod.* Position vehicle with wheels in straight-ahead position. Remove tie rod (par. 219*a*).

(2) *Adjust tie-rod.* Loosen tie rod end clamp screw nuts at each end of tie rod. Remove inner clamp screws and tie rod end lock at left side. Screw tie rod ends onto or off tie rod to obtain correct toe-in.

Note. Tie rod right end has coarse threads, while tie rod left end has fine threads. This construction permits finer adjustment than would be possible if both ends were the same. Toe-in will be changed about one-eighth inch by each revolution of right (coarse thread) end, and slightly less by turning left (fine thread) end. In some instances, it may be necessary to adjust both ends to obtain correct toe-in.

(3) *Check adjustment.* Temporarily install ends on steering knuckle supports. Measure toe-in (*a* above). Readjust if necessary. Install tie rod (par. 219*b*).

221. Axle Shaft and Universal Joint Assembly Replacement

a. Coordination with Ordnance Maintenance Unit. Refer to paragraph 2 for information on coordination with an ordnance maintenance unit.

b. Removal.

(1) *Remove wheel.* Jack up axle; then remove wheel stud nuts, and remove tire and wheel assembly.

(2) *Removed drive flange.* Remove eight stud nuts attaching drive flange to hub. Strike hub a sharp blow with a soft hammer to loosen tapered split dowels; then remove dowels from studs. Thread two ½–20 cap screws into the tapped holes in drive flange. Turn screws in evenly and alternately until flange is removed. Remove and discard flange to hub gasket.

(3) *Remove hub and drum.* Remove wheel hub and brake drum assembly (par. 266*a*).

(4) *Loosen brake hose shield.* Remove three cap screws and lockwashers attaching brake hose shield to top of steering knuckle support to permit utilizing full length of brake flexible hose when brake backing plate and shoe assembly is removed.

(5) *Remove brake backing plate and shoe assemly.* Remove 12 retaining screws and lockwashers attaching brake backing plate (fig. 229) to steering knuckle. Observe installed position of backing plate so that it can be reinstalled in its original location. Mark backing plate. Remove backing plate and shoe assembly from steering knuckle and swing over end of steering knuckle (fig. 230).

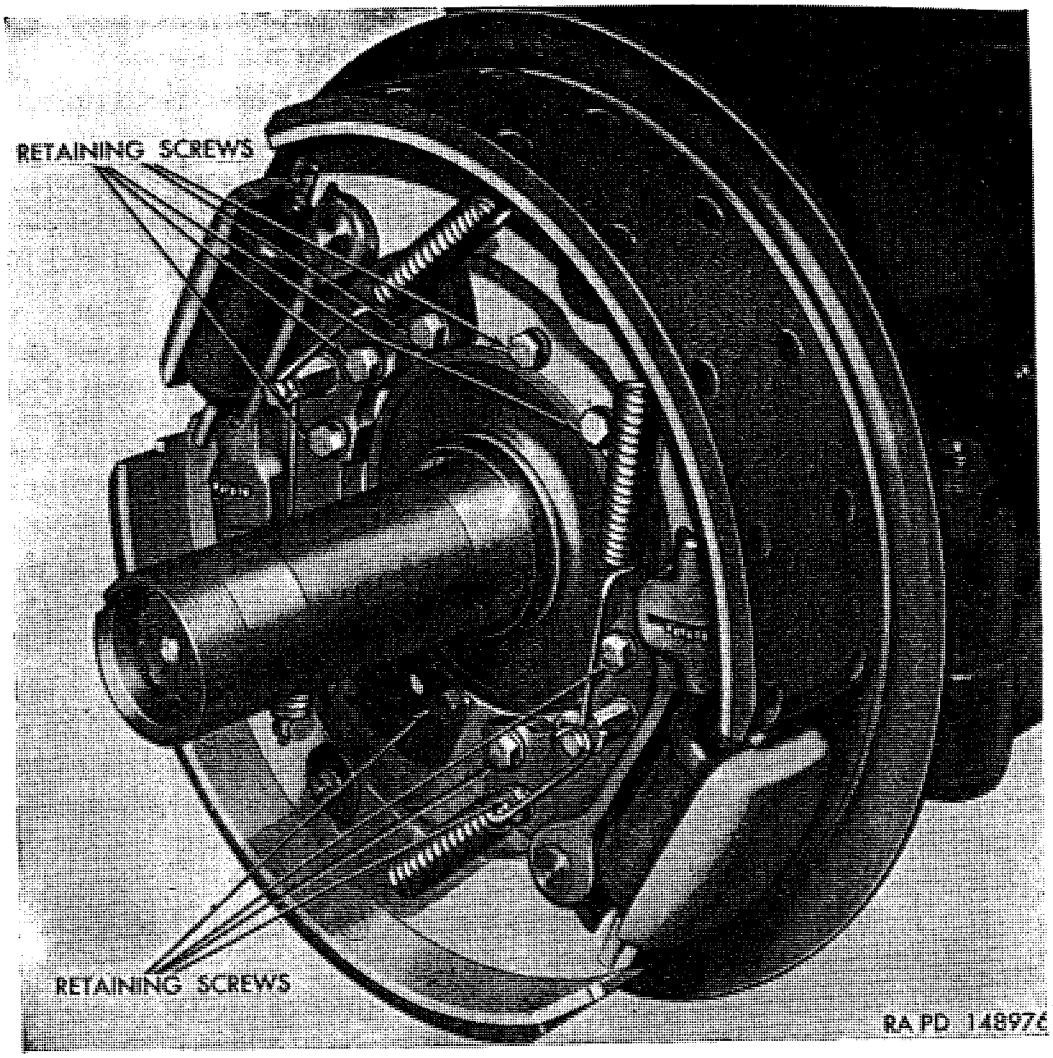


Figure 229. Brake backing plate and shoe assembly installed.

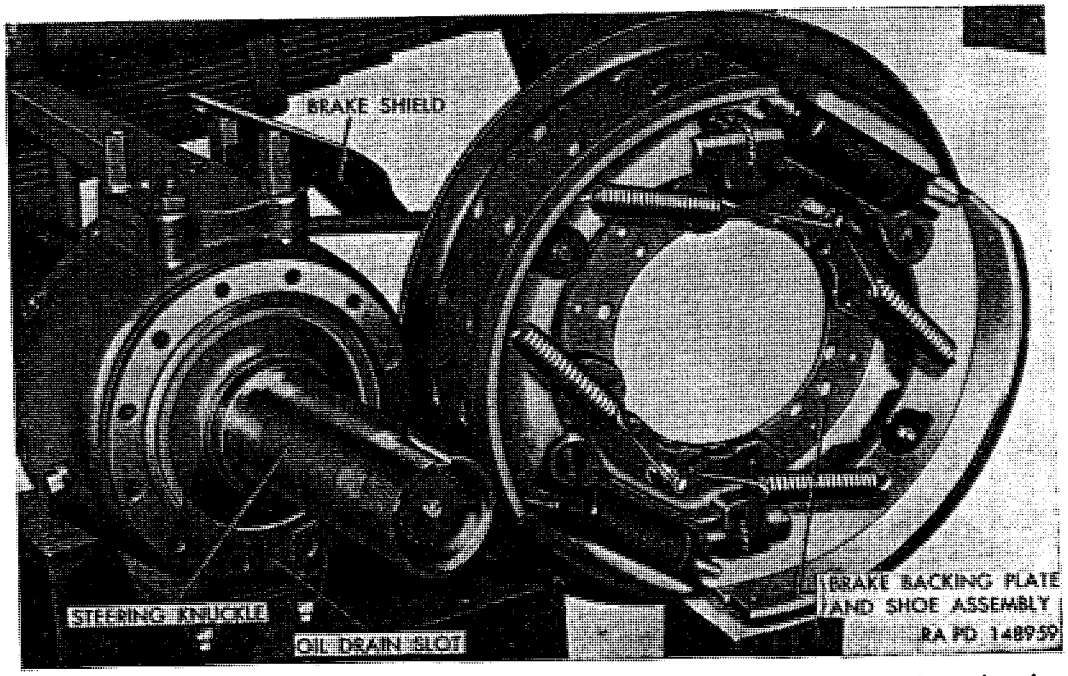


Figure 230. Brake backing plate and shoe assembly removed showing steering knuckle.

(6) *Remove steering knuckle.* Tap steering knuckle with soft hammer as shown in figure 231 to loosen from steering knuckle support; then remove steering knuckle. Remove old gasket from steering knuckle and knuckle support.

(7) *Remove axle shaft and universal joint.* Pull assembly straight out (fig. 232) as assembly is supported to avoid damage to axle shaft oil seal in housing.

c. Cleaning, Inspection, and Lubrication.

(1) *Cleaning.* Thoroughly wash axle shaft and universal joint in dry-cleaning solvent or volatile mineral spirits to remove all old lubricant; also wash inside of steering knuckle support, steering knuckle, and housing outer end.

(2) *Inspection.* Inspect balls and ball races for grooved, scratched, or pitted condition. To determine if excessive play or backlash exist in the universal joint, place the assembly in a vise having soft jaws, in a vertical position with the outer (short) shaft up, and with vise jaws gripping the inner shaft below the universal joint. Firmly push down on outer shaft so that it rests on center ball, and at the same time attempt to twist the joint in both directions. If any play or

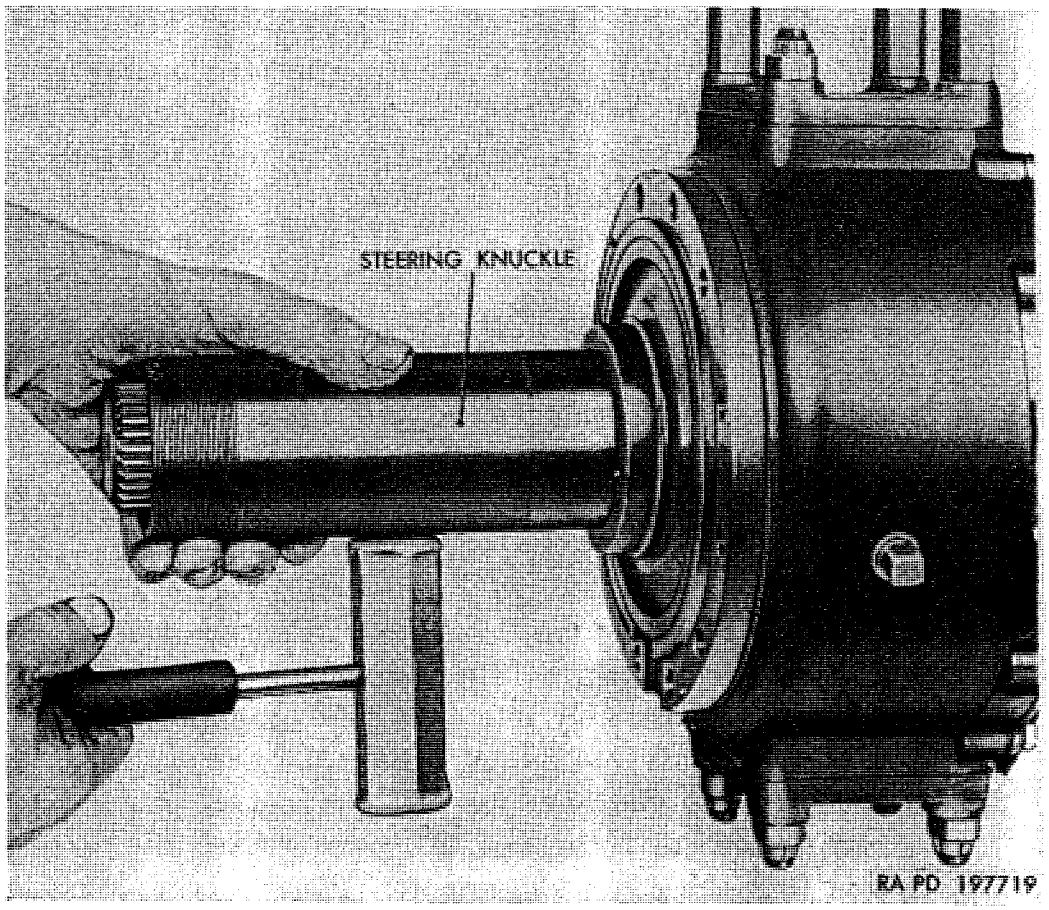


Figure 231. Removing steering knuckle.

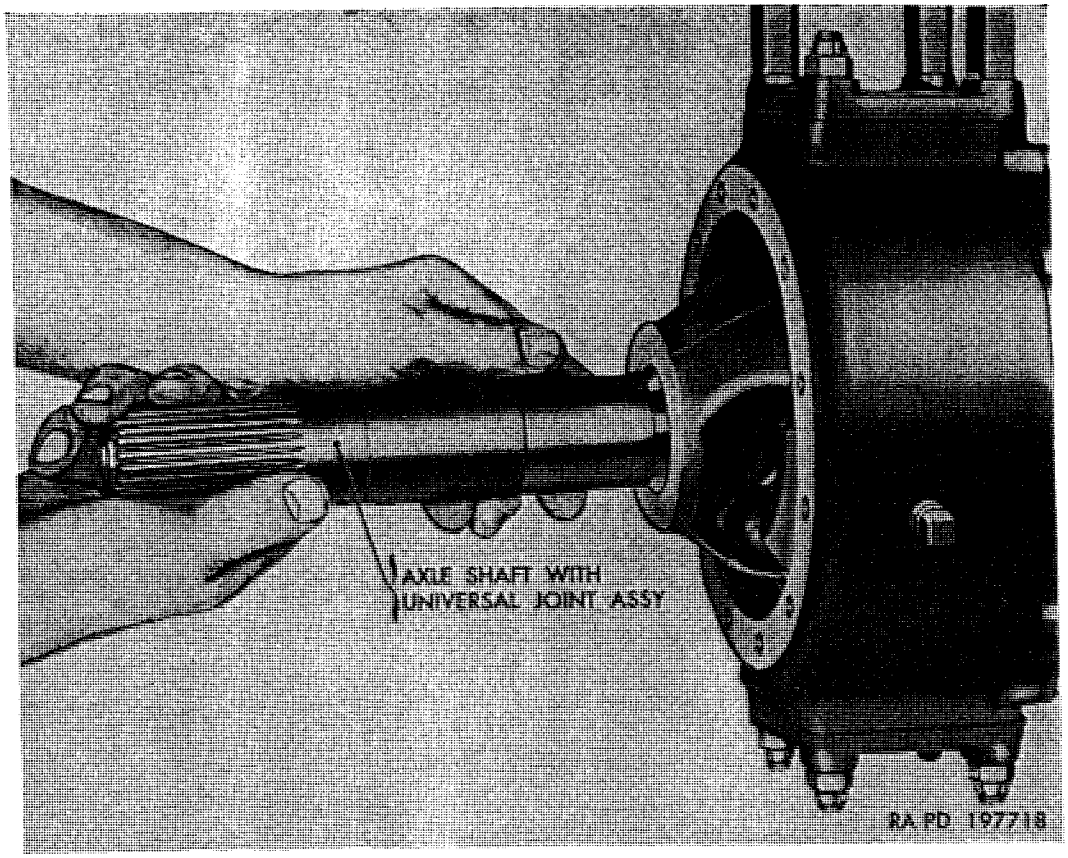


Figure 232. Removing or installing axle shaft and universal joint assembly.

backlash is evident, report to ordnance maintenance personnel. Inspect axle shaft thrust washers in steering knuckle and axle housing for excessive wear or damage. Examine axle shaft splines for nicks, cracks, or other damage. Inspect oil seal in axle housing for wear or cuts in lip of seal. Report all worn or damaged conditions to ordnance maintenance personnel.

(3) *Lubrication.* Using universal gear lubricant (GO), pack new lubricant well into universal joint and around balls until it fills all space between balls and universal joint yokes. Also spread lubricant on surfaces which contact thrust washers and bushing in steering knuckle.

d. Installation.

(1) *Install axle shaft and universal joint.* Use care not to damage axle shaft seal in housing, and insert axle shaft and universal joint assembly into axle housing, guiding splined end of inner shaft into splined differential side gear.

(2) *Install steering knuckle.* Apply light coat of plastic-type gasket cement to both sides of gasket. Carefully install gasket to steering knuckle support. Place steering knuckle

over outer end of axle shaft and position against steering knuckle support with bolt holes in alinement.

Note. Milled oil drain slot (fig. 230) in steering knuckle flange must be at the bottom as shown.

(3) *Install brake backing plate and shoe assembly.* Swing backing plate and shoe assembly over end of steering knuckle (fig. 230) and into place against steering knuckle, being sure plate is properly located as noted at time of removal. Aline bolt holes in plate with those in steering knuckle. Apply liquid-type gasket cement to female threads of steering knuckle and to threads of retaining bolts to insure a leakproof fit. Install four 3/8–16 x 1 5/16 bolts and 3/8-inch lockwashers through brake backing plate and steering knuckle flange. Install eight 3/8–16 x 1 11/16 bolts and 3/8-inch lockwashers through anchor block, backing plate, and steering knuckle flange. Tighten all 12 bolts to 27 to 30 pound-feet torque. Install brake flexible hose shield at top of steering knuckle arm studs, using three cap screws and lockwashers. Tighten cap screws.

(4) *Install hub and drum.* Install wheel hub and brake drum assembly (par. 266*g*) and adjust hub bearings (par. 265*b*).

(5) *Install drive flange.* Install drive flange over splined outer end of axle shaft, using a new gasket between flange and hub. Aline holes in flange with hub studs; then push flange in against hub. Install eight split tapered dowels and 1/2–20 safety nuts on studs and tighten nuts to 55 to 65 pound-feet torque. When nuts have been tightened, inspect for slight clearance (approx. 1/16 in) between nut and flange. If no clearance exists, it indicates that dowels, tapered holes in flange, or studs are worn excessively and must be replaced with new parts.

(6) *Install wheel.* Install wheel and tire on hub (par. 259*c*).

e. Record of Replacement. Record the replacement on DA Form 478.

222. Front Axle Assembly Replacement

(figs. 224 and 233)

a. Coordination with Ordnance Maintenance Unit. Refer to paragraph 2 for information on coordination with an ordnance maintenace unit.

b. General. Front axle assembly includes front axle housing, differential and carrier assembly, axle shaft and universal joint assemblies, steering knuckle support assemblies, hub and drum assemblies, tie rod with ends assembly, and brake line assemblies.

c. Removal.

(1) *Position vehicle.* Place vehicle in a level surface and apply parking brake, or place blocks on each side of rear wheels to prevent vehicle rolling. Place a jack under front axle and raise front end of vehicle high enough to permit withdrawing axle. Place blocks under frame side members at rear of front spring hanger brackets. Lower jack until entire front end weight rests on blocks.

(2) *Remove wheels.* Remove wheel stud nuts, and remove wheel and tire from each side.

(3) *Disconnect propeller shaft.* Remove four bolts and nuts attaching propeller shaft universal joint flange to differential pinion flange. Tie propeller shaft up to prevent universal joint becoming damaged or filled with dirt.

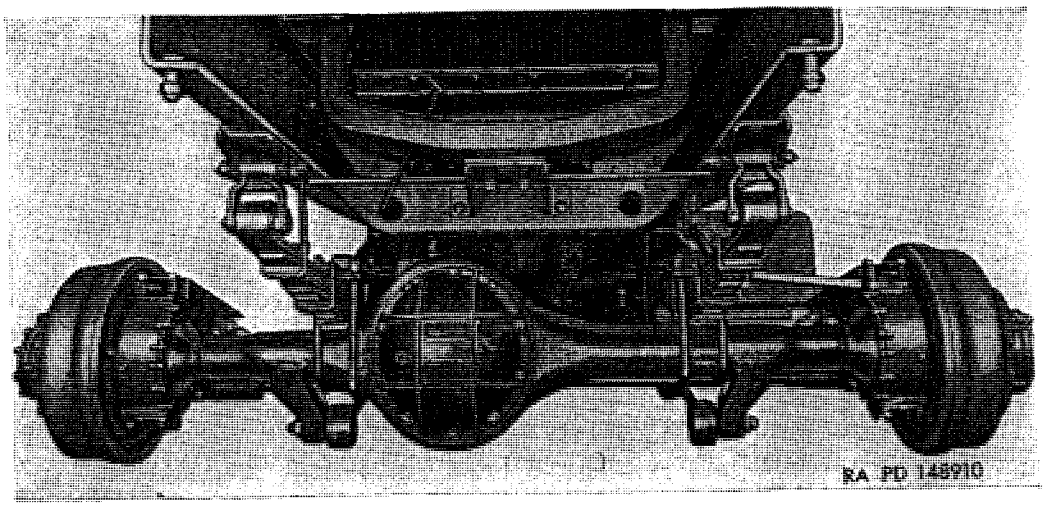


Figure 233. Front axle assembly installed.

(4) *Disconnect drag link.* Remove nut at steering arm end of drag link. Use pry bar between steering arm and drag link; then strike arm a sharp blow with hammer to loosen tapered pin from arm.

(5) *Disconnect lower torque rods.* Remove nuts and washers from torque rod end pins; then use soft metal hammer to drive pins from axle brackets.

(6) *Disconnect shock absorber links.* Remove nut and disconnect shock absorber link from spring bumper block at each side of vehicle.

(7) *Remove spring* U*-bolts.* Remove nuts from two spring U-bolts at each side of vehicle; then remove U-bolts.

(8) *Disconnect flexible hose.* Lower jack under axle for better accessibility; then disconnect hydraulic brake and axle vent flexible hose at junction block on top of axle housing.

(9) *Disconnect upper torque rod.* Remove nut and washer from torque rod end pin; then use soft metal hammer to drive pin from axle bracket.

Caution: Be sure axle is safely supported to prevent rolling off jack and resulting in injury to personnel.

(10) *Remove axle assembly.* Lower jack until axle assembly clears under side of chassis and withdraw from under vehicle.

d. Installation.

(1) *Position axle assembly.* Place axle assembly on dolly jack and move into position under vehicle.

(2) *Connect upper torque rod.* Insert upper torque rod tapered pin into axle bracket and install nut and washer. Do not tighten nut.

(3) *Connect flexible hose.* Connect hydraulic brake and axle vent flexible hose at junction on top of axle housing with two connector bolts and four new copper washers. Use one washer on each side of connector. Tighten connector bolts to 20 to 30 pound-feet torque.

(4) *Connect axle to springs.* Lift axle until spring center bolt is located in hole of spring seat on top of axle. Install U-bolts and spring bumper block with shock absorber link eye at front. Install U-bolt nuts and tighten nuts to 170 to 200 pound-feet torque.

(5) *Connect shock absorber links.* Install shock absorber link stud in spring bumper block and install nut. Tighten nut to 48 to 64 pound-feet torque.

(6) *Connect lower torque rods.* Insert lower torque rod end pins into axle brackets and install washers and nuts. Tighten nuts on upper and lower torque rod end pins to 350 to 400 pound-feet torque.

(7) *Connect drag link.* Install drag link tapered stud in steering arm and install nut. Tighten stud nut to 75 to 100 pound-feet torque. Install $\frac{1}{8}$ x $1\frac{3}{8}$ cotter pin.

(8) *Connect propeller shaft.* Position propeller shaft joint flange to differential pinion flange and install four bolts and four $\frac{7}{16}$–20 safety nuts attaching these two flanges. Tighten nuts to 33 to 43 pound-feet torque.

(9) *Install wheels.* Install wheels on hub (par. 259*c*).

(10) *Bleed brakes.* Perform brake bleeding operation (par. 237).

(11) *Lubricate.* Check lubricant level in axle differential and universal joints at outer end of housing. Check for lubricant leaks around housing cover. Tighten cover stud nuts to 45 to 55 pound-feet torque.

(12) *Remove blocks and jack.* Raise front of vehicle with jack sufficiently to permit removal of blocks from under frame side

mbers. Lower jack and withdraw from under vehicle. Re-
spring U-bolt nuts for 170 to 200 pound-feet torque with
weight of vehicle resting on springs.
ord of Replacement. Record the replacement on DA Form

Section XXI. REAR AXLE

223. Description and Data
(fig. 234)

a. Description.

(1) *General.* Both rear axles are hypoid, single-reduction-type, consisting of a housing, differential and carrier assembly, and axle shafts. Forward rear axle and rear rear axle are mounted in tandem with upper and lower torque rods connecting each axle to vehicle frame. The two rear axles are similar in design and construction; the major difference between the two is that the opening for the differential carrier in the forward rear axle is off-center. Power is transmitted from the transfer by two propeller shafts, one to each of the rear axles. Forward rear axle is driven direct from transfer by a single shaft, while drive to rear rear axle is through two propeller shafts and a pillow block mounted on a bracket attached to forward rear axle housing.

(2) *Axle housing.* Axle housings are conventional one-piece banjo-type. The carrier assembly and rear cover openings are in center of housing on rear rear axle, while the openings are offset near left side on forward rear axle. Ribbed cast rear covers provide maximum strength and accessibility to differential. Flanges which support brake assemblies are welded to outer ends of housings. External surfaces of housing outer ends are machined to provide accurate surfaces for mounting hub bearings. Spring pads and torque rod brackets are welded to axle housings; in addition, forward rear axle has a welded flange which supports pillow block.

(3) *Mounting.* Driving force is transmitted from axles to vehicle frame by six torque rods. Three torque rods are attached to each axle and take all driving and braking load at rear axles. Vehicle's load is transmitted to axles through main and secondary springs which are anchored to vehicle frame, with the spring ends riding on slipper-type brackets welded on axle housings.

b. Data.

Type of differential	hypoid, single-reduction
Ratio	6.17 : 1
Type of axle shafts	full-floating

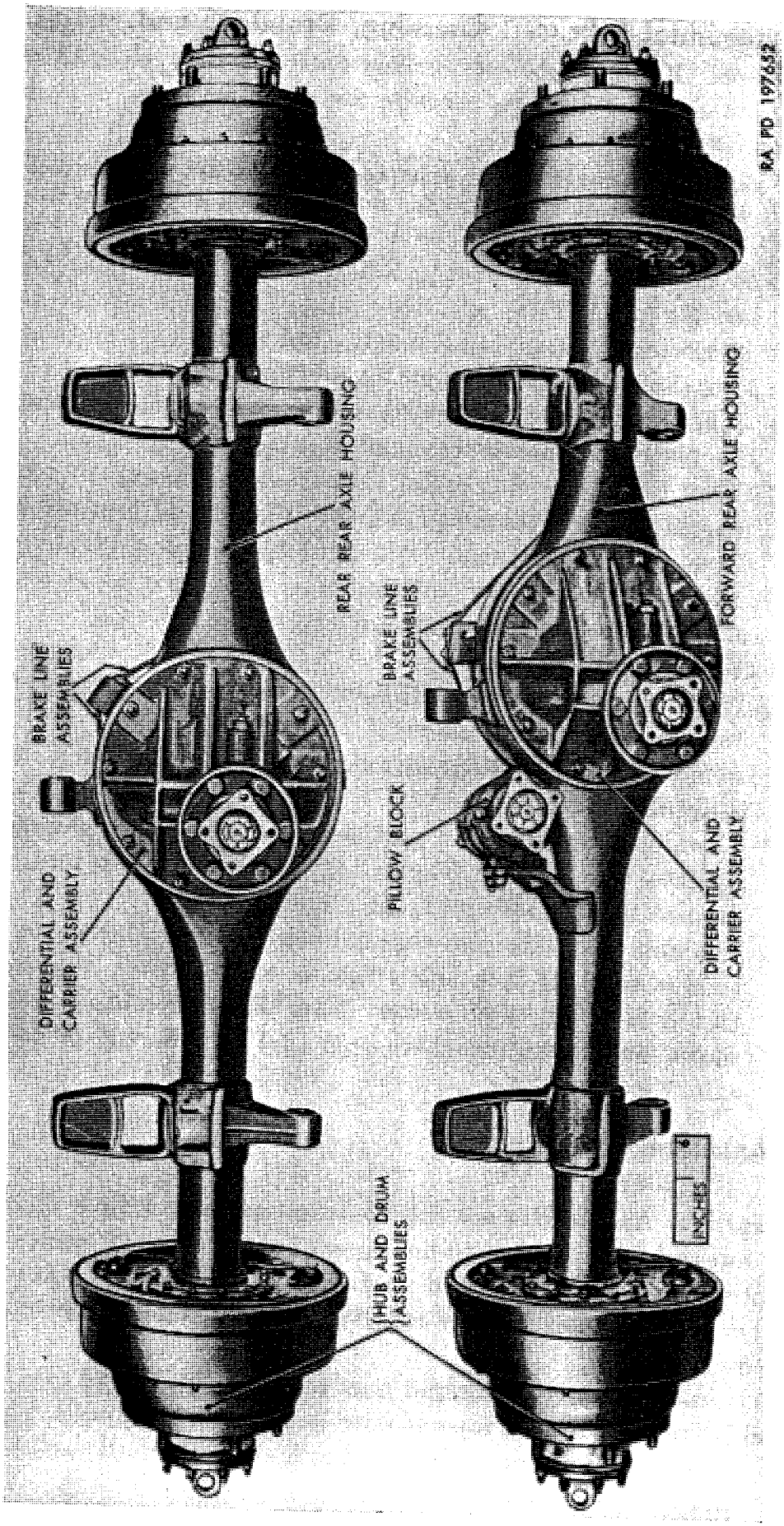
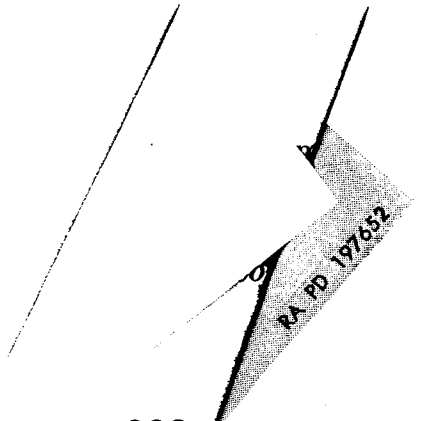


Figure 234. Forward and rear rear axle assemblies removed.



Checking, Draining, and Filling

...on chart (par. 69) for type of lubri-...king and draining.

...and rear axles are the same; how-...e certain that oil filler hole marked ..., not upside down.

223. ...rked REAR OIL LEVEL from axle ...82).

...c (immediately after operation), lubricant ... even with bottom of plug opening.

...s cold (before operation), lubricant level should ...f inch below bottom of plug opening.

...iller plug to remove all particles adhering to plug ...et. Check condition of plug gasket. If crushed or ...maged, replace gasket. Install gasket and plug. Tighten plug. Check for leaks around cover. Tighten cover stud nuts to 45 to 55 pound-feet torque.

. *Draining and Filling.*

(1) Unit should be drained while lubricant is hot, preferably immediately after operation.

(2) Remove plug at bottom of axle housing bowl (U, fig. 82) to drain lubricant.

(3) Clean plug to remove all particles adhering to plug magnet. Replace plug gasket if part is damaged. After unit is drained, install gasket and plug. Tighten plug.

(4) Fill unit with lubricant through filler plug (*b* above) until level is one-half inch below bottom of filler plug opening. Install filler plug and gasket. Note that lubricant capacity shown on lubrication chart (par. 69) is different in each axle.

225. Axle Shafts

(fig. 235)

a. General. Axle shafts are full-floating-type with forged flange having integral lifting-and-hold-down eye at outer end, and splines at differential end. Flanged end of shaft is attached to hub by studs, tapered dowels, and nuts. Inner end of shaft is splined to differential side gear.

b. Removal. Remove eight stud nuts at hub. Strike end of axle shaft with hammer to loosen tapered dowels; then remove dowels. Insert small steel bar through eye in end of axle shaft and pull shaft out of axle. Remove and discard gasket.

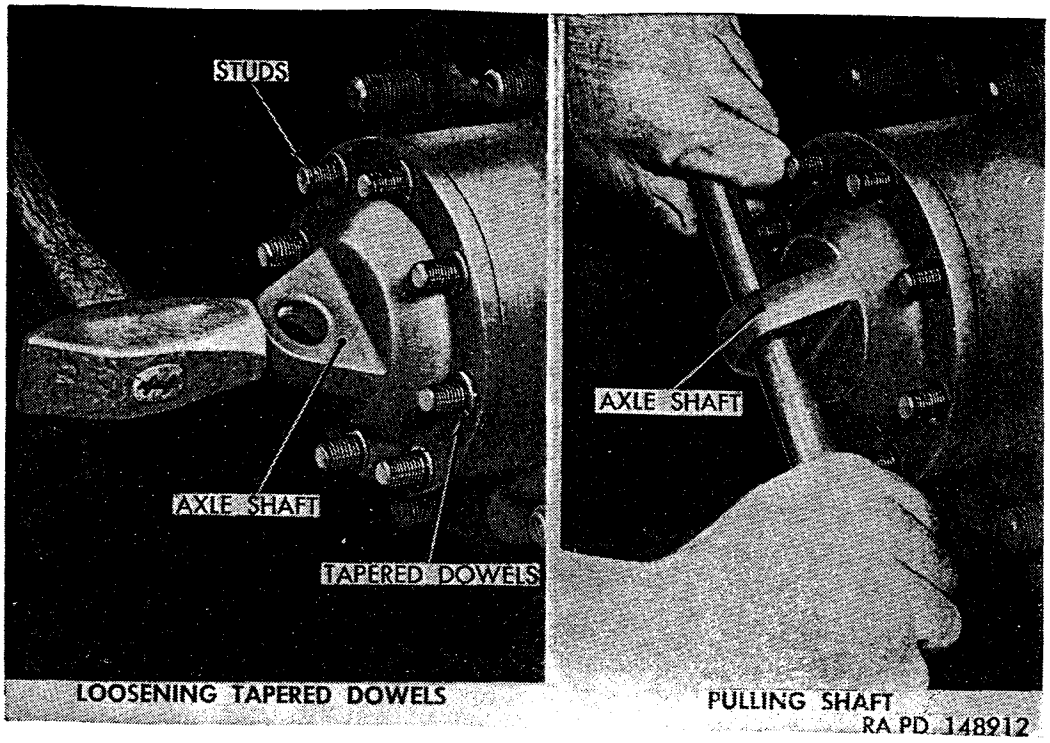


Figure 235. Removing axle shaft.

c. Cleaning and Inspection.

(1) *Cleaning.* Clean axle shafts of all accumulated grease and dirt. Be sure splines are cleaned thoroughly. Remove all gasket particles from inside of flange.

(2) *Inspection.* Inspect axle shafts for twisted, worn, or damaged splines. Inspect tapered dowel holes in flange of axle shaft for evidence of excessive wear by fitting new dowel in each hole.

d. Installation. Install new paper gasket over studs on hubs. Dip splined end of axle shaft in axle lubricant. Insert splined end into hub, guiding splines into differential side gear. Rotate shaft or wheel hub as necessary to aline hub studs with holes in shaft flange; then press shaft into place. Install split tapered dowel and ½–20 safety nut on each stud and tighten nuts to 55 to 65 pound-feet torque. There should be slight clearance (approx. 1/16 in.) between nut and shaft flange. If no clearance exists, or if studs, dowels, or holes in flange are worn excessively, new parts must be installed.

226. Forward Rear Axle Replacement

a. Coordination with Ordnance Maintenance Unit. Refer to paragraph 2 for information on coordination with an ordnance maintenance unit.

b. General. Forward rear axle assembly includes axle housing, differential and carrier, axle shafts, hub and drum assemblies, and brake line assemblies. Pillow block is also removed and installed with the axle assembly (fig. 234).

c. Removal (fig. 236).

(1) *Position vehicle.* Place vehicle on a level surface and block front wheels to prevent vehicle rolling. Place a jack under axle and raise vehicle until tires are off the ground.

(2) *Remove wheels.* Remove wheels and tires from each side (par. 259*b*).

(3) *Block vehicle.* Place blocks under torque rod support bracket at spring seat on each side to support vehicle after axle is removed.

(4) *Disconnect flexible hose.* Disconnect hydraulic brake and axle vent flexible hose at junction block on top of axle housing.

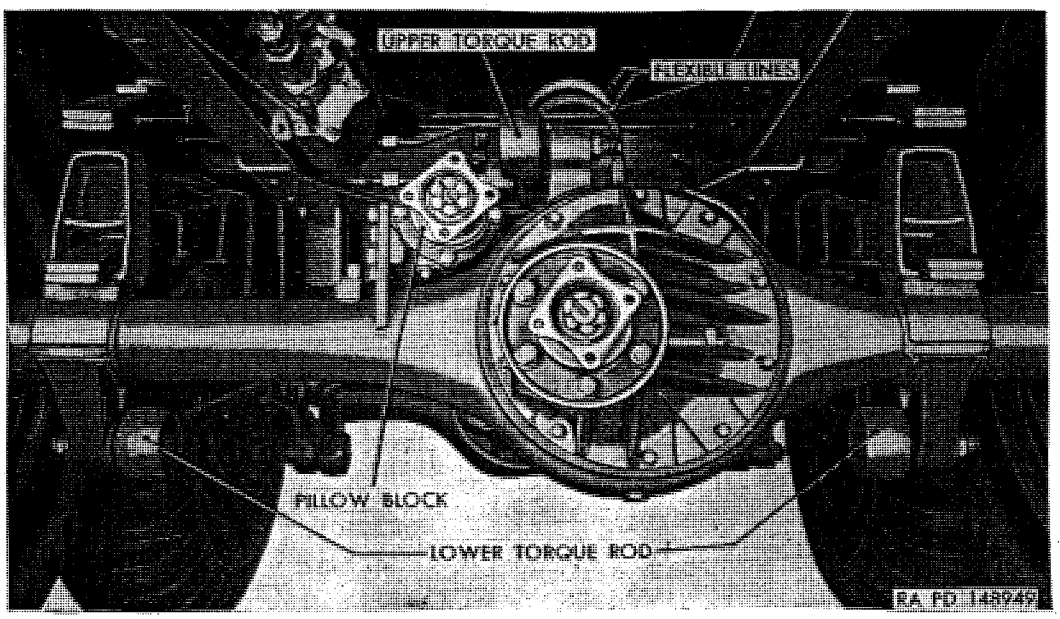


Figure 236. Forward rear axle installed.

(5) *Disconnect propeller shafts.* Remove four bolts and nuts attaching propeller shaft universal joint flange to differential pinion flange. Remove bolts and nuts attaching propeller shafts to each end of propeller shaft pillow block on top of axle housing.

(6) *Loosen torque rods.* Remove nuts and washers from three torque rod end pins; then use soft metal hammer to loosen torque rod end pins in axle brackets.

(7) *Disconnect torque rods.* Remove torque rod end pins from each axle bracket.

Caution: Be sure axle is safely supported to prevent rolling off jack and resulting in injury to personnel.

(8) *Remove axle.* Lower axle with jack and pull forward as necessary to disengage main spring ends from axle brackets; then completely remove axle assembly from under vehicle.

(9) *Remove pillow block.* Remove pillow block from axle (par. 233*b*).

Note. If same axle assembly is to be installed, it is not necessary to remove pillow block assembly.

d. Installation (fig. 236).

(1) *Install pillow block.* Install pillow block on axle (par. 233*c*).

(2) *Position axle.* Move axle into position under vehicle and engage main spring ends in openings in brackets at each end of axle housing.

(3) *Connect torque rods.* Attach three torque rods to axle brackets by installing torque rod end pins in axle brackets. Install washer and 1–14 safety nut on each pin and tighten to 350 to 400 pound-feet torque.

(4) *Connect flexible hose.* Connect hydraulic brake and axle vent flexible hose at junction on top of axle housing with two connector bolts and four new copper washers. Use one washer on each side of connector. Tighten connector bolts to 20 to 30 pound-feet torque.

(5) *Connect propeller shafts.* Position respective propeller shafts to differential pinion flange and to each end of pillow block assembly, with lubrication fittings in same plane as other shafts; then install four bolts and $\frac{7}{16}$–20 safety nuts at each location. Tighten nuts to 33 to 43 pound-feet torque.

(6) *Install wheels.* Install wheels on hubs (par. 259*c*).

(7) *Remove blocks and jack.* Raise vehicle with jack as necessary to remove block from under each torque rod support bracket at spring seat. Lower jack and withdraw from under vehicle.

(8) *Bleed brakes.* Perform brake bleeding operation (par. 237).

(9) *Lubricate.* Check lubricant level in axle differential (par. 224*b*). Lubricate propeller shaft universal joints and pillow block as directed on lubrication chart (par. 69).

(10) *Check for lubricant leaks.* Check for lubricant leaks around housing cover. Tighten cover stud nuts to 45 to 55 pound-feet torque.

e. Record of Replacement. Record the replacement on DA Form 478.

227. Rear Rear Axle Replacement

a. Coordination with Ordnance Maintenance Unit. Refer to paragraph 2 for information on coordination with an ordnance maintenance unit.

b. General. Rear rear axle assembly includes axle housing, differential and carrier, axle shafts, hub and drum assemblies, and brake line assemblies (fig. 234).

c. Removal (fig. 237).

(1) *Position vehicle.* Place vehicle on a level surface and block front wheels to prevent vehicle rolling. Place a jack under axle and raise vehicle until tires are off the ground.

(2) *Remove wheels.* Remove wheels and tires from each side (par. 259*b*).

(3) *Block vehicle.* Place blocks under torque rod support bracket at spring seat at each side to support vehicle after axle is removed.

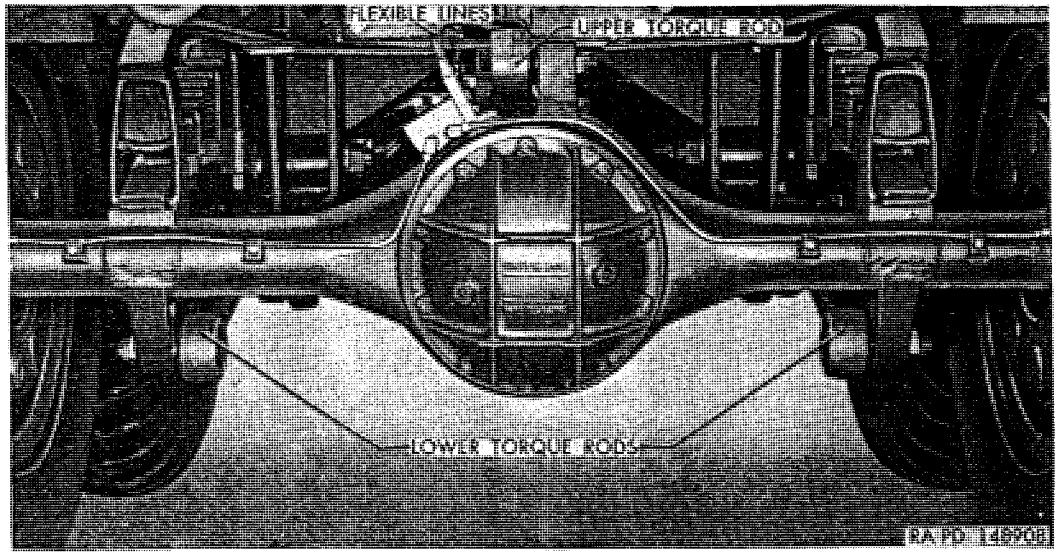


Figure 237. Rear rear axle assembly installed.

(4) *Disconnect flexible hose.* Disconnect hydraulic brake and axle vent flexible hose at junction block on top of axle housing.

(5) *Disconnect propeller shafts.* Remove four bolts and nuts attaching propeller shaft universal joint flange to differential pinion flange.

(6) *Loosen torque rods.* Remove nuts and washers from three torque rod end pins. Use a soft metal hammer to loosen torque rod end pins in axle brackets.

(7) *Disconnect torque rods.* Remove torque rod end pins from each axle bracket.

Caution: Be sure axle is safely supported to prevent rolling off jack and resulting in injury to personnel.

(8) *Remove axle.* Lower axle with jack and pull assembly rearward as necessary to disengage main spring ends from axle brackets; then completely remove axle assembly.

d. Installation (fig. 237).

(1) *Position axle.* Move axle into position under vehicle and engage main spring ends with openings in bracket at each end of axle housing.

(2) *Connect torque rods.* Attach three torque rods to axle brackets by installing torque rod end pins in axle brackets. Install washer and 1–14 safety nut on each pin. Tighten nuts to 350 to 400 pound-feet torque.

(3) *Connect flexible hose.* Connect hydraulic brake and axle vent flexible hose at junction on top of axle housing with two connector bolts and four new copper washers. Use one washer on each side of connector. Tighten connector bolts to 20 to 30 pound-feet torque.

(4) *Connect propeller shaft.* Position propeller shaft joint flange to differential pinion flange, with lubrication fittings in same plane as other shafts; then install four bolts and 7/16–20 safety nuts. Tighten nuts to 33 to 43 pound-feet torque.

(5) *Install wheels.* Install wheels on hub (par. 259*c*).

(6) *Remove blocks and jack.* Raise vehicle with jack as necessary to remove block from under each torque rod bracket; then lower jack and withdraw from under vehicle.

(7) *Bleed brakes.* Perform brake bleeding operation (par. 237).

(8) *Lubricate.* Check lubricant level in axle differential (par. 224*b*). Lubricate propeller shaft universal joints as directed on lubrication chart (par. 69).

(9) *Check for lubricant leaks.* Check for lubricant leaks around housing cover. Tighten cover stud nuts to 45 to 55 pound-feet torque.

e. Record of Replacement. Record the replacement on DA Form 478.

Section XXII. AXLE PROPELLER SHAFTS AND UNIVERSAL JOINTS

228. Description

a. General. This section includes replacement of axle drive propeller shafts and universal joints, pillow block, and repair of universal joint assemblies. Arrangement of axle drive propeller shafts is shown in figure 238.

b. Axle Propeller Shafts. Each of the four tubular propeller shafts has a universal joint at each end of shaft. In addition, each shaft has a slip joint at one end. The slip joint on the front-axle-to-transfer propeller shaft is at the rear of vehicle while on all other shafts the slip joint is toward front of vehicle. The purpose of the slip joint is to permit telescopic action of shaft during operation. One half

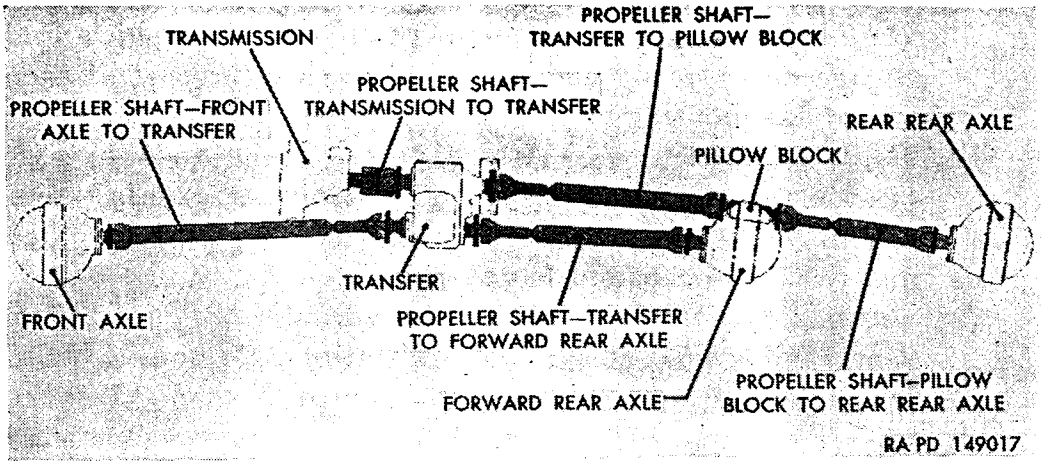


Figure 238. Propeller shafts and universal joint arrangement.

of slip joint is a splined solid stub shaft, having one blank spline for alinement at assembly, and is welded to tubular shaft, while opposite half is incorporated in universal joint yoke.

c. Transmission-to-Transfer Propeller Shaft (fig. 240). Power from transmission to transfer is through two universal joint assemblies which are bolted together, thus eliminating shaft usually used. Slip joint between transmission and transfer is through splined yoke which engages transmission output shaft.

d. Universal Joints. Universal joints permit angular movement of shaft during rotation. Movement between the shaft yoke and flange yoke is through bearings over each arm of a journal or cross. Seal at each journal arm prevents loss of lubricant or entry of dirt, water, or other foreign matter.

e. Pillow Block (fig. 243). Pillow block assembly, mounted on top of forward rear axle, connects and supports the two propeller shafts required to transmit power from transfer to rear rear axle.

229. Propeller Shaft and Universal Joint Removal

a. General. Propeller shafts used between transfer and respective drive units can be completely removed by disconnecting both ends; however, when service requirements permit, only one end can be disconnected from its respective unit.

b. Axle Propeller Shaft Removal. Remove four bolts and nuts at each end of shaft attaching universal joint flange to drive or driven unit flange; then remove complete shaft assembly (C, D, E, or F, fig. 239).

c. Transmission-to-Transfer Propeller Shaft Removal. Remove four bolts and nuts attaching two universal joints (fig. 240) together; also remove four bolts and nuts attaching rear universal joint flange to transfer flange. Remove rear universal joint. Slide front universal joint toward rear and off transmission output shaft.

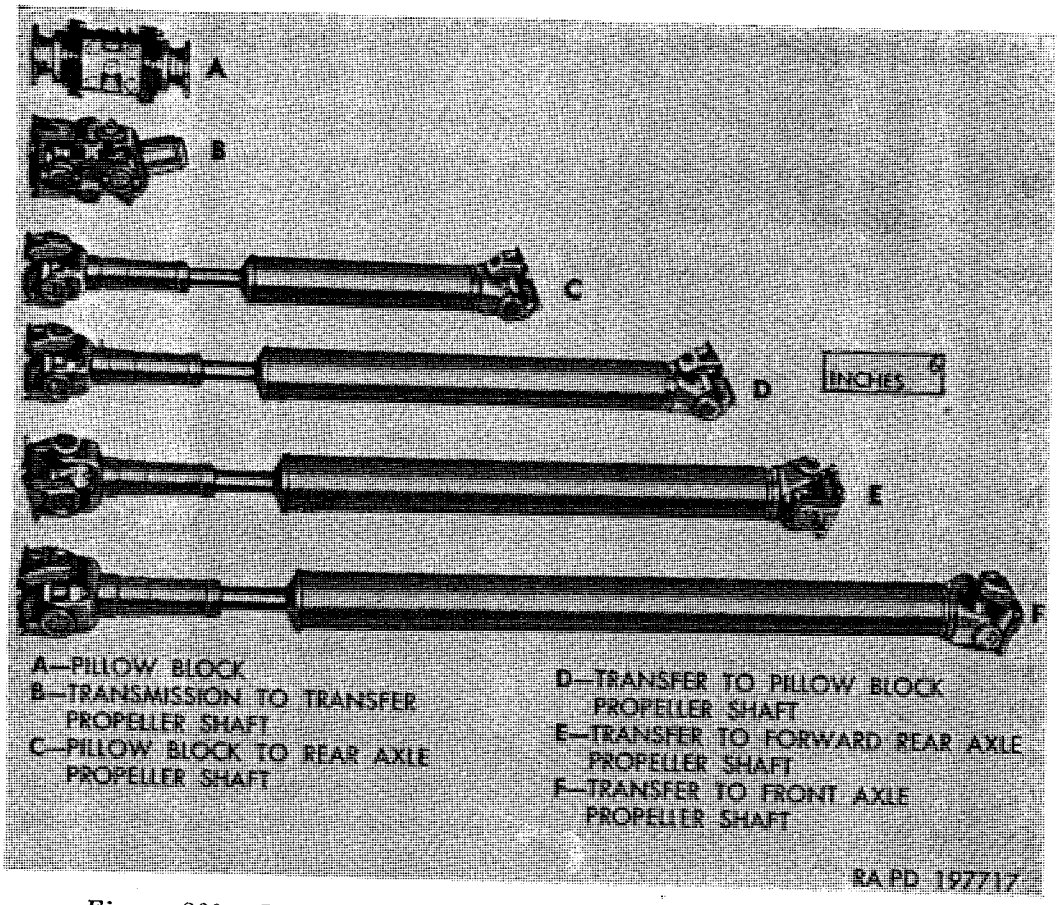


Figure 239. Pillow block and propeller shaft assemblies removed.

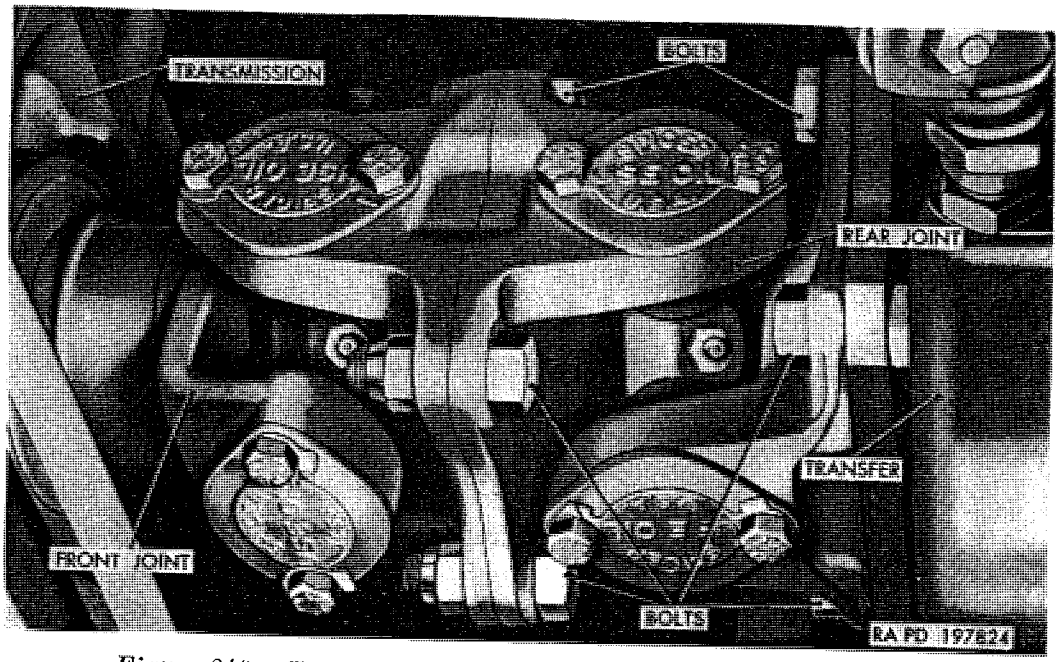


Figure 240. Transmission-to-transfer propeller shaft installed.

d. Slip Joint Removal. Slip joint removal can be accomplished while complete shaft is removed; also when only slip joint end of shaft is disconnected from its respective unit flange. Unscrew knurled cap from slip joint sleeve yoke; then slide sleeve yoke and universal joint from splined stub shaft.

230. Propeller Shaft and Universal Joint Installation

a. Slip Joint Installation. Clean splines on stub shaft and apply automotive and artillery grease (GAA) to splines. Position dust cap over stub shaft; then install dust cap steel washer and a new dust cap cork washer on stub shaft. Slide slip joint sleeve yoke onto stub shaft splines, matching blank spline in sleeve yoke and blank spline in stub shaft. Thread dust cap onto sleeve yoke and tighten fingertight.

b. Axle Propeller Shaft Installation. Position shaft between flanges of connecting units with lubrications fittings in same plane with other shafts; then install four 7/16–20 x 1 3/16 bolts and 7/16–20 nuts at each end. Tighten nuts to 33 to 43 pound-feet torque.

Note. Propeller shafts (fig. 238) are installed with slip joint toward front of vehicle, except shaft used between front axle and transfer, which is installed with slip joint toward rear of vehicle.

c. Transmission-to-Transfer Propeller Shaft Installation (fig. 240). Apply automotive and artillery grease (GAA) to sleeve yoke sleeve; then slide sleeve yoke over transmission output shaft, being careful that transmission rear seal is not damaged during installation. Move joint toward transmission to provide sufficient space to install rear universal joint. Locate rear joint between front joint and transfer flange with lubrication fittings in alinement; then install four 1/2–20 x 1 3/8 bolts and 1/2–20 nuts attaching two universal joints together. Install four 1/2–20 x 1 3/8 bolts and 1/2–20 nuts attaching rear joint to transfer flange. Tighten the eight nuts to 48 to 64 pound-feet torque.

231. Axle Propeller Shaft Universal Joint Assembly

Note. The key letters noted in parentheses are in figure 241, except where otherwise indicated.

a. General. The four axle propeller shaft assemblies (C, D, E, and F, fig. 239) are identical in construction except lengths of tubular shaft and stub shaft assemblies. Each shaft has a slip joint at one end to permit telescopic action of shaft during operation. One half of the slip joint is a splined solid stub shaft welded to tubular shaft. The slip joint sleeve yoke assembly (G) fits over the stub shaft splines, thus forming the slip joint. Universal joints should be repaired whenever excessive wear is indicated by looseness in bearing

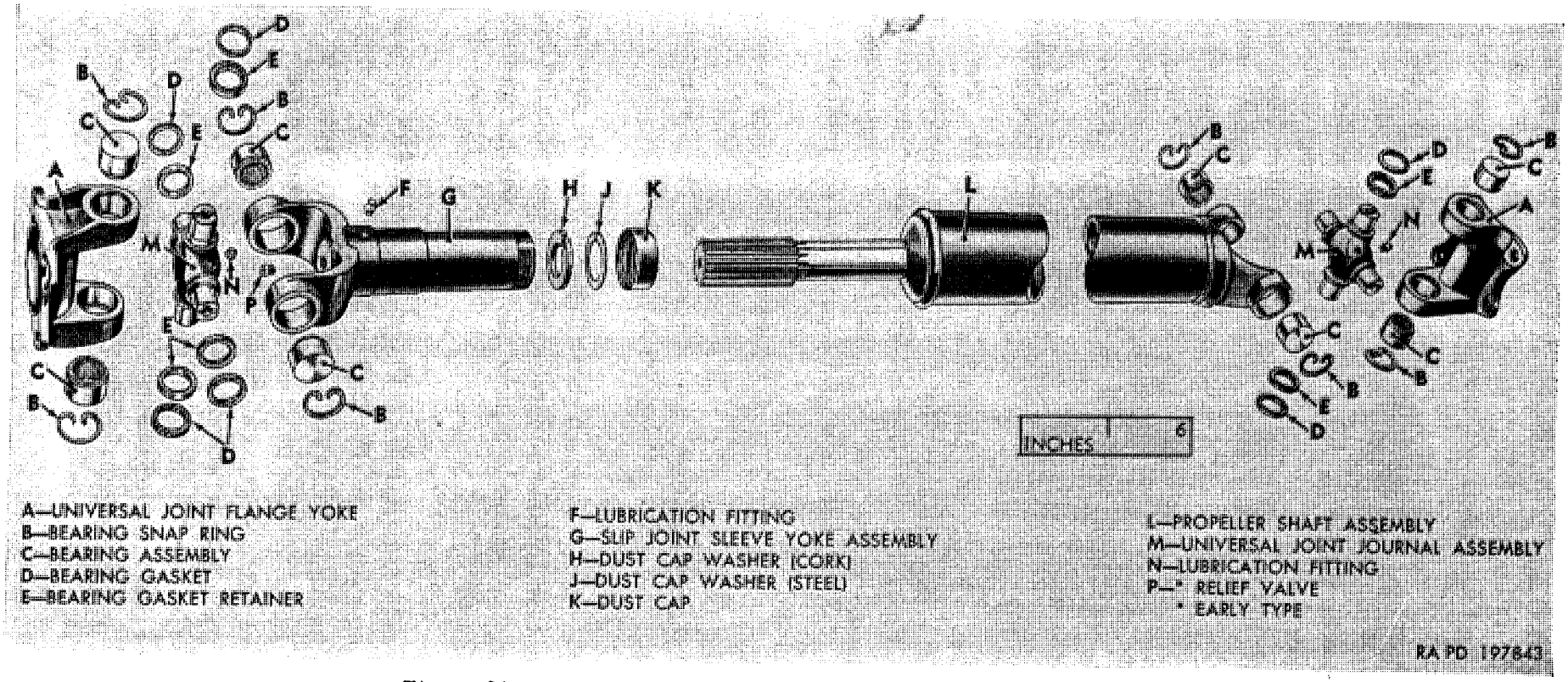


Figure 241. Axle propeller shaft and universal joint components.

between journal and yoke flange. A kit used for repair of axle propeller shaft universal joints consists of one journal assembly, four snap rings, and four bearing assemblies; the journal assembly includes gaskets and retainers.

b. Disassembly. Disassembly procedures for all axle propeller shaft assemblies are identical.

(1) Loosen dust cap (K) which is threaded onto slip joint sleeve yoke assembly (G). Slide sleeve yoke from stub shaft.

(2) Slide dust cap from stub shaft and remove steel washer (J) and cork washer (H) from dust cap. Discard cork washer.

(3) Pinch ends of bearing snap rings (B) together; then remove four snap rings from each universal joint.

(4) Strike the yokes sharply with lead hammer to force one roller bearing assembly (C) from yoke far enough to permit removal.

Note. The roller bearings are loose in the bearing retainer and may fall out when bearing assembly is removed.

(5) Remove opposite roller bearing from yoke. Push universal joint journal assembly (M) to one side as far as possible. Tilt slip joint sleeve yoke (G) and remove journal from yoke. Repeat procedures on opposite yoke. Remove and discard bearing gaskets (D) and bearing gasket retainers (E) from journal.

(6) Remove relief valve (P) (when used) and lubrication fitting (F).

(7) Opposite universal joint assembly can be disassembled as explained in (3) through (6) above.

c. Cleaning and Inspection.

(1) *Cleaning.* Clean all parts thoroughly with dry-cleaning solvent or volatile mineral spirits. Upon installation, use new bearing gasket retainers (E) and bearing gaskets (D) on journal.

(2) *Inspection.*

(*a*) *Shaft assemblies.* The shaft assemblies with stub shaft and yoke are of different lengths (fig. 239), depending on location. Examine shaft assembly for bent condition. Each shaft is balanced and no attempt should be made to repair a shaft. If shaft is bent, or if yoke or splines are damaged, replace shaft.

(*b*) *Universal joint flange yokes.* Inspect universal joint flange yokes (A) for damage. Replace yokes if damaged. Do not attempt to repair yokes.

(*c*) *Slip joint sleeve yoke.* Thoroughly clean out interior of slip joint sleeve yoke assembly (G). Inspect yoke for dam-

age. Replace if yoke is distorted or damaged in any manner.

(*d*) *Universal joint journal assemblies.* Inspect bearing surfaces on universal joint journal assemblies (M) for roughness or scoring. Make certain that lubricant passages in journals are clean and free. Make certain that journal lubrication fittings (N) are clean and in good usable condition.

(*e*) *Bearing assemblies.* Examine bearings for bent condition; check for bent or missing rollers. There are 34 rollers mounted in retainer. If rollers are missing or retainer is bent, replace with new bearing assembly. If bearing snap rings (B) have been damaged or stretched at time of disassembly, replace rings.

d. Assembly. Procedures in (1) through (5) below apply to universal joint at both ends of shaft; procedure in (6) through (9) below apply only to slip joint end.

(1) All parts should be thoroughly lubricated during assembly with automotive and artillery grease (GAA).

(2) Install a new bearing gasket retainer (E) and a new bearing gasket (D) on each end of the universal joint journal assembly (M). Position journal in place in universal joint flange yoke (A).

(3) Install 34 rollers in bearing retainer. Apply small quantity of grease to hold rollers in place. Install bearing assembly (C) into yoke over each end of journal.

(4) Install relief valve (P) (when used) into end of slip joint sleeve yoke assembly (G). Position journal in place in yoke of slip joint sleeve yoke or shaft yoke. Install bearing assembly into yoke over each end of journal.

(5) Install bearing snap ring (B) at each bearing, making certain snap rings engage grooves in yokes.

(6) One splined tooth in slip joint sleeve yoke assembly (G) is blank. This blank spline must match with a similar blank spline on stub shaft of propeller shaft to assure proper universal joint alinement.

(7) Position dust cap (K) over stub shaft; then install dust cap washer (steel) (J) and new dust cap washer (cork) (H). Insert slip joint sleeve yoke assembly (G) over stub shaft splines, matching blank spline of yoke with blank spline of shaft.

(8) Thread dust cap (K) onto sleeve yoke. Do not use a wrench. Tighten with fingers.

(9) Install lubrication fitting (F) in slip joint sleeve yoke, and install journal lubrication fittings (N) in universal joint journal assembly (M). Thoroughly lubricate universal joints with automotive and artillery grease (GAA).

232. Transmission-To-Transfer Propeller Shaft Assembly

Note. The key letters noted in parentheses are in figure 242, except where otherwise indicated.

a. Description. The propeller shaft assembly between transmission and transfer (B, fig. 239) consists of two universal joint assemblies bolted together to form a propeller shaft assembly. The sleeve yoke assembly (R) fits on splined output shaft of transmission to form a slip joint. The flange yoke (Q) bolts to a companion flange on transfer input shaft. Needle-type roller bearing assemblies are used at each universal joint. Universal joints should be repaired whenever excessive wear is indicated by looseness in bearings. A kit for repair of universal joints consists of one journal assembly, four bearing assemblies, four bearing caps (when used), two lubrication fittings, eight cap screws, and four lock straps; the journal assembly includes gaskets and retainers.

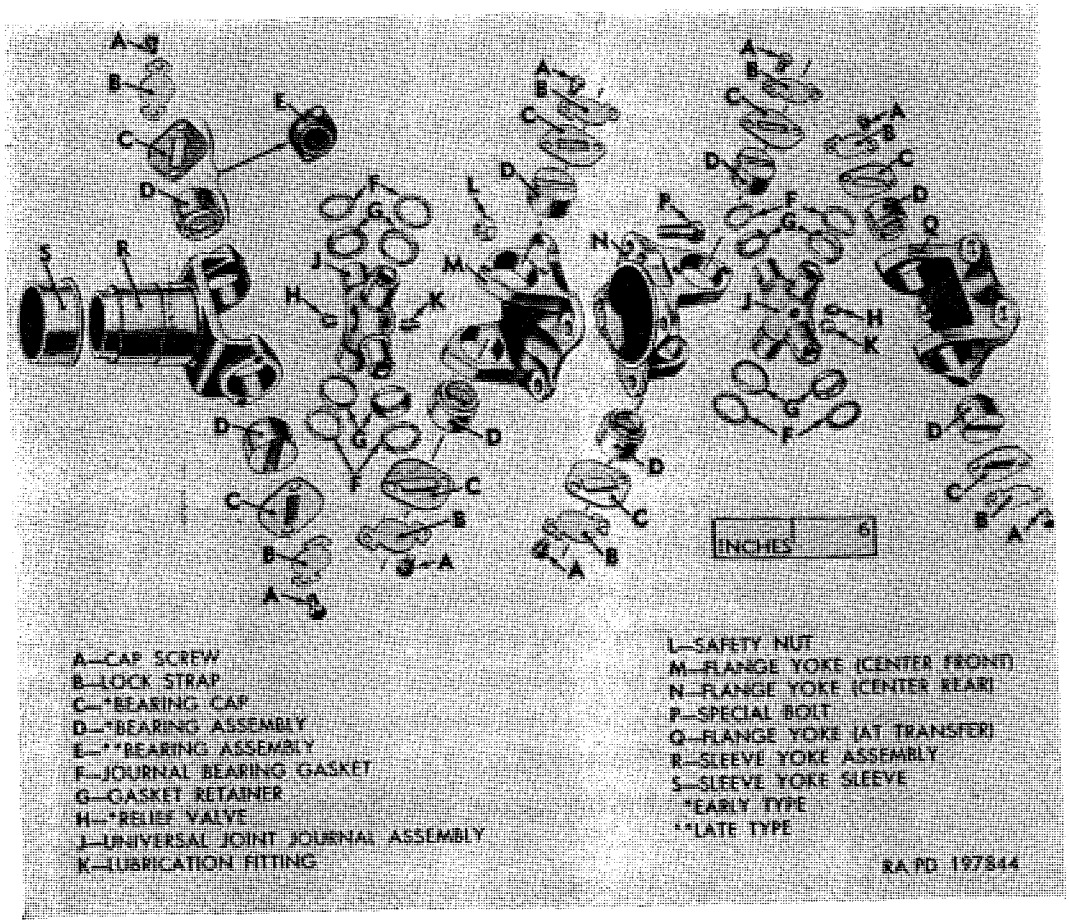


Figure 242. Transmission-to-transfer propeller shaft universal joint components.

b. Disassembly.

(1) Remove four safety nuts (L) from special bolts (P). Separate flange yokes (M and N).

(2) Remove lubrication fitting (K) from universal joint journal assembly (J) at the sleeve yoke.

(3) Straighten lugs on lock straps (B). Remove two cap screws (A) from each journal bearing cap. On late type, the bearing cap is integral with the bearing assembly. Remove lock straps (B), and, on early type, remove journal bearing caps (C).

(4) Strike either the flange yoke or sleeve yoke sharply with lead hammer to force a journal bearing assembly (D or E) out of yoke far enough to permit removal. Remove opposite bearing assembly from yoke.

(5) Push universal joint journal assembly (J) to one side as far as possible. Tilt yoke and remove yoke from journal. Repeat procedures on opposite yoke. Remove and discard journal bearing gaskets (F) and gasket retainers (G) from journal.

(6) Remove relief valve (H) (when used) from universal joint journal assembly (J).

(7) Opposite universal joint assembly can be disassembled as explained in (2) through (6) above.

c. Cleaning and Inspection.

(1) *Cleaning.* Thoroughly clean all parts with dry-cleaning solvent or volatile mineral spirits.

(2) *Inspection.*

(*a*) *Flange yokes.* Inspect flange yokes (M, N, and Q) for distortion, damage, or stripped threads. Replace yokes if these conditions exist.

(*b*) *Sleeve yoke assembly.* Inspect splines of sleeve yoke assembly (R) for distortion, chipped condition, or excessively worn condition. If these conditions exist, replace sleeve yoke assembly. Examine sleeve yoke sleeve (S) for scoring, checking, or looseness. If sleeve is damaged, replace sleeve yoke assembly.

(*c*) *Journal bearing assemblies.* Examine bearing assemblies (D or E) for bent condition or missing rollers. There are 28 rollers for each bearing. Bearing rollers are held in place with a retainer. If retainer or rollers are damaged, replace bearing assembly.

(*d*) *Universal joint journal assemblies.* Inspect bearing surfaces on journal for roughness or scoring. Make certain that lubricant passages in journal are clean and free.

(e) *Journal bearing caps and lock straps.* Journal bearing caps (C) (when used) should be inspected for damage. As a general rule, lock straps (B) should be replaced at assembly; however, straps can be reused if one lug at each end has not been bent.

d. Assembly.

(1) Thoroughly lubricate all parts with automotive and artillery grease (GAA).

(2) Install relief valve (H) (when used) and lubrication fitting (K) in universal joint journal assembly (J).

(3) Install new gasket retainer (G) and journal bearing gasket (F) on each end of journal.

(4) Assemble front universal joint first. Place universal joint journal assembly (J) in sleeve yoke assembly (R).

(5) Install a journal bearing assembly (D or E) into sleeve yoke over each end of journal cross.

(6) Insert journal into center front flange yoke; then install journal bearing assembly (D or E) into flange yoke over each end of journal cross.

(7) Install journal bearing cap (C) (when used) over journal bearing, making sure that lug on cap fits in slot in bearing retainer.

(8) Position lock strap (B) over each cap. Install two $\frac{5}{16}$–24 x $\frac{1}{2}$ cap screws (A) and tighten. Bend one lug of lock strap against face of cap screw.

(9) Assemble opposite universal joint in the same manner ((1) through (8) above).

(10) Bolt center front and center rear flange yokes (M and N) together, using four $\frac{1}{2}$–20 x $1\frac{3}{8}$ special bolts (P) and $\frac{1}{2}$–20 safety nuts (L). Tighten nuts to 48 to 64 pound-feet torque.

Note. The front and rear universal joint assemblies must be in same plane when bolted together.

233. Pillow Block

a. Description. Pillow block consists of a shaft supported by two ball bearings mounted in a housing. Pillow block is installed on forward rear axle housing as shown in figure 243. Double lip oil seals, supported in retainer, are used at each end to prevent loss of lubricant and entry of dirt, water, and other foreign matter.

b. Removal. Drain pillow block by removing bottom plug; then disconnect propeller shafts at front and rear of pillow block by removing four bolts and nuts at each end. Remove four mounting stud nuts and split tapered dowel wedges attaching pillow block to mounting bracket; then remove pillow block.

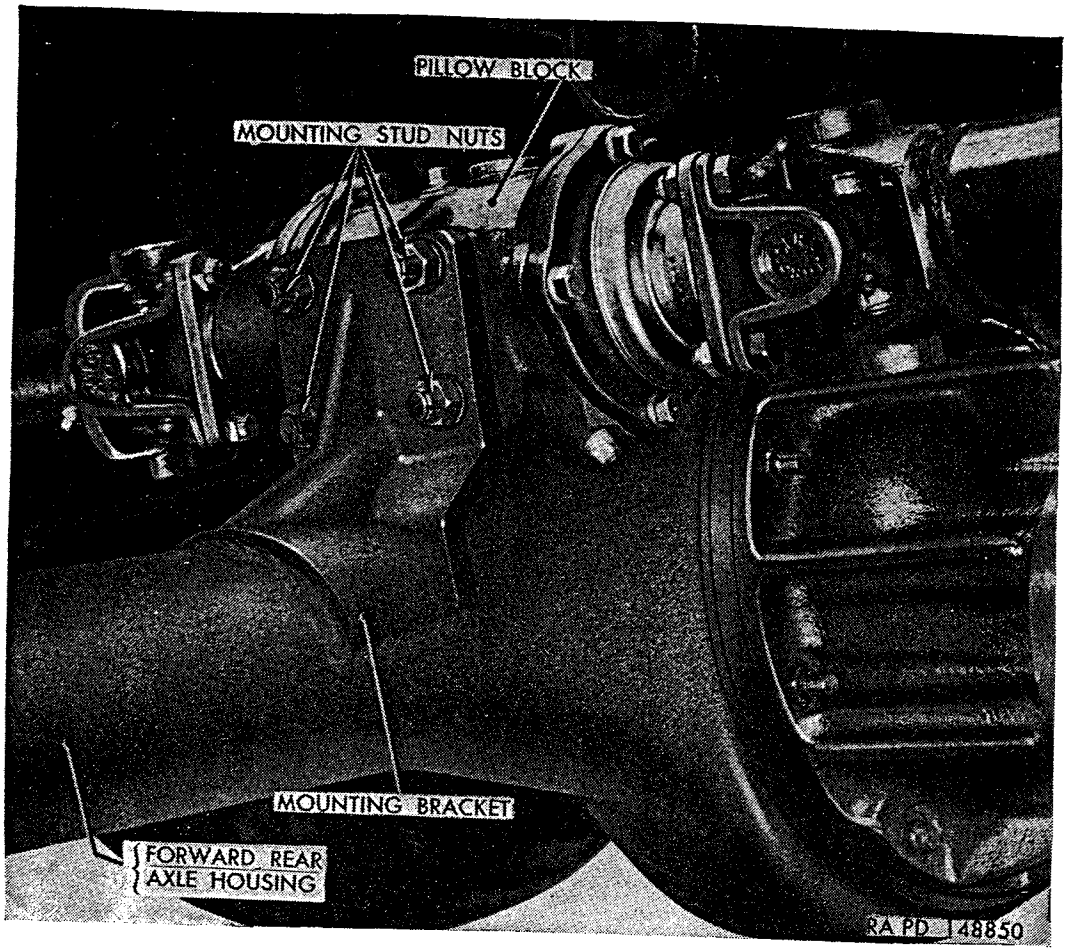


Figure 243. Pillow block installed.

c. Installation. Position pillow block assembly on inside (differential side) of mounting bracket, with drain plug toward front. Install four split tapered dowel wedges and ½–20 safety nuts on mounting studs. Tighten nuts to 48 to 64 pound-feet torque. Connect propeller shafts (par. 230*b*). Lubricate pillow block and propeller shaft universal joints as instructed on lubrication chart (par. 69).

d. Filling. Remove plug at side of housing near lubrication fitting (KK, fig. 84); then apply lubricant through fitting until level with plug opening.

Section XXIII. SERVICE BRAKE SYSTEM

234. Description and Operation

a. Description. The combined air-hydraulic brake system consists primarily of a pedal, interconnected to a hydraulic master cylinder to build up the initial hydraulic pressure; and air-hydraulic power cylinder to increase the hydraulic pressure; hydraulic wheel cylinders to transmit the hydraulic pressure to the brake assembly at each wheel; compressed air system which maintains a supply of compressed air for

operation of the air-hydraulic power cylinder; and interconnecting lines, fittings, and linkage.

b. Operation.

(1) *Application.* When brake pedal is depressed, hydraulic brake fluid is displaced from the master cylinder into the air-hydraulic cylinder, and through the air-hydraulic cylinder slave cylinder into the lines leading to the wheel cylinders. When hydraulic pressure against the air-hydraulic cylinder control valve hydraulic piston reaches a certain point, control valve functions to admit compressed air into the air-hydraulic cylinder behind the cylinder air piston, causing the piston to move forward in the cylinder. Forward movement of air piston forces slave cylinder piston forward in slave cylinder, displacing hydraulic brake fluid under high pressure into the lines leading to the wheel cylinders. Hydraulic brake fluid entering the wheel cylinders forces wheel cylinder pistons apart; outward movement of wheel cylinder pistons is transmitted to the brake shoes through push rods, forcing brake shoes into contact with brake drums.

(2) *Release.* When brake pedal is released, hydraulic pressure is removed from air-hydraulic cylinder control valve hydraulic piston; with pressure removed from control valve hydraulic piston, control valve functions to exhaust air pressure from power cylinder into the engine air cleaner manifold. With air pressure removed from behind air-hydraulic cylinder air piston, piston return spring forces air piston to rear of cylinder, at the same time pulling slave cylinder piston to rear of slave cylinder, removing pressure from hydraulic brake fluid in wheel cylinders. With hydraulic pressure removed from wheel cylinder pistons, brake shoe return springs pull brake shoes away from brake drums, forcing wheel cylinder pistons together. Hydraulic brake fluid is displaced from wheel cylinders and returns to the master cylinder via the air-hydraulic cylinder slave cylinder.

235. Service Brake System Data

a. Air Compressor.

Make	Midland Steel Products Co
Model	N4119W
Ordnance number	7350423
Capacity	7¼ cu. ft. per min. at 1,250 rpm
Governor cutout pressure	100 psi
Governor cut-in pressure	75 to 80 psi

b. Master Cylinder.

Ordnance number	7410830
Cylinder bore	1¾ in.
Piston stroke	1 7/16 in.

c. Air-Hydraulic Cylinder.

Make	Bendix Products Division
Model	A35–15–154
Tag number:	
Early M135	375817
Late M135 and all other models	376440
Ordnance number	7410860
Cylinder shell diameter	4¼ in.
Air piston stroke	3⅞ in.
Slave cylinder bore	1⅛ in.
Slave cylinder piston stroke	3¾ in.
Control valve piston bore:	
Early M135	1 1/16 in.
Late M135 and all other models	29/32 in.

d. Wheel Cylinders.

Ordnance number	7412065
Bore diameter	1¼ in.

e. Brake Drums.

Inside diameter	15 in.

f. Brake Shoe Lining.

Width	3 in.
Thickness	⅜ in.

236. Brake System Tests

a. Performance Tests.

(1) *Road test.* Road-test brakes by making a brake application at about 20 mph to determine if vehicle stops evenly and quickly. If pedal has a spongy feel when applying brakes, air is present in hydraulic system. Brake system must be bled to expel air (par. 237).

(2) *Check pedal free-travel.* Press brake pedal down with hand until resistance other than that of the pedal pull-back spring is felt. Pedal movement should not be less than one-fourth inch or more than one-half inch before master cylinder piston cup covers bypass port in cylinder and power stroke commences. If free travel is not within one-fourth to one-half inch, pedal or master cylinder piston is not returning to fully released position, or the master cylinder piston cup is defective. Adjust brake pedal linkage (par. 241*b*) or replace master cylinder (par. 242).

(3) *Operating test.*

(*a*) Build up air pressure in system to normal operating pressure (100 psi); then stop engine.

(*b*) Apply brakes; then listen for sound of exhausting air pressure as brakes are released. Rapid release of air pressure indicates that air-hydraulic cylinder control valve is operating.

(*c*) Depress brake pedal and hold pressure on pedal. If pedal gradually falls away under pressure, leakage in hydraulic system is indicated. Make hydraulic pressure tests (*c* below).

(*d*) If stop washer on pedal shaft goes to within 2 inches of the toe pan when brakes are applied, brake shoes require adjustment (par. 238) or replacing (par. 239).

b. Air Pressure Tests.

(1) Remove lubrication pipe plug from rear end of air-hydraulic cylinder and connect an air pressure test gage at this point. Build up air pressure in system to normal operating pressure (100 psi) as registered on air pressure gage in instrument cluster; then shut off engine.

(2) Coat all air line connections with a solution of soap and water to check for leakage. Leakage can sometimes be corrected by tightening the connection. If this fails to correct leakage, air line or fittings must be replaced (par. 245*b*).

(3) Disconnect air exhaust line from air-hydraulic cylinder exhaust port. Connect a flexible hose or a bent tube to exhaust port; hose or tube must be long enough to hang down over side of air-hydraulic cylinder. Hold a jar of water up under exhaust tube so that end of tube is immersed in water. Watch for bubbles to appear in water. The appearance of bubbles indicates a leaking control valve poppet air inlet seal, requiring replacement of the air-hydraulic cylinder (par. 243).

(4) Apply brakes and hold pressure on pedal, observing action of air pressure test gage at rear of air-hydraulic cylinder. Air-hydraulic cylinder should hold maximum pressure registered on test gage without noticeable loss until the brake pedal is released. Loss of air pressure indicates a leaking control valve poppet exhaust seal, or leakage past the air-hydraulic cylinder air piston. Replace air-hydraulic cylinder (par. 243).

(5) Depress and momentarily hold brake pedal to several positions between fully released and fully applied positions. Pressure registered on test air pressure gage should increase gradually according to brake pedal depression. Failure to