CARTER TYPE WO

JEEP	Carter No.
1942-45 Ford & Willys	①539S

►FIELD & PRODUCTION CHANGES

►**Jeep 539S Carburetor Production Changes**—Early & late carburetors have different (non-interchangeable) parts as listed below, and first carburetors can be brought up to later standards as follows:

Early (first 4000) 539S Carburetors—May be identified by the mark 'K1' on brass inspection tag and can be brought up to latest specifications by installing the following parts (unit packages): No. 1-413U Body Flange Assembly, Metering Rod, & Tube Clamp Unit; or No. 3-466U Throttle Shaft Assembly, Metering Rod, & Tube Clamp Unit.

Later (after first 4000) 539S Carburetors—These carburetors have the following new parts (not interchangeable with parts on first 4000 carburetors): No. 1-412S Body Flange Assembly, No. 3-465S Throttle Shaft Assembly, No. 62-135S Choke Tube Bracket Assembly, No. 62-134 Tube Clamp Assembly, No. 105-13 Tube Clamp Screw. CAUTION—Make certain that correct parts used when servicing first 4000 carburetors (marked K1 on inspection tag), and later carburetors (with new parts as listed above). These parts not interchangeable

DESCRIPTION

DESCRIPTION: Single barrel, downdraft. Design same as WA-1 except as follows:

Idle System—Idle Orifice Tube (low speed jet) is located in idle well which is fed directly from float bowl (not main nozzle well as on other models) through a drilled passage in the body casting in which the Idle Well Jet is located. Idle well is vented to float bowl by drilled channel in carburetor body. Cross-channel at top of idle tube has two air bleed openings into mixing chamber above main venturi (upper air bleed hole is located ahead of economizer restriction in cross-channel (lower air bleed is beyond this point).

Venturi—Double venturi system used with small (primary) venturi located in main body casting above large (main) venturi which is integral with casting.

ADJUSTMENT & OVERHAUL

IDLE ADJUSTMENT: Adjust only with engine warmed up (choke valve open, fast idle inoperative). Idle adjusting screw controls fuel mixture and should be turned in for leaner mixture, out for richer mixture. Approximate settings below. See tune-up data on car model pages for complete tune-up data.

IDLE SETTING

Car Model	Carburetor	Idle Setting	Idle Speed
Jeep (Ford & Willys)	539-S	1-2 turns open	600 RPM., 8 MPH.

PERFORMANCE:—Should be satisfactory if Idling Adjustment and pump stroke setting correct. See Trouble Shooting.

ACCELERATING PUMP:—High pressure type (spring operated). Operated by throttle lever through spring connection between pump operating lever and pump arm (under dust cover on bowl cover). Fuel is drawn into pump cylinder through strainer and inlet ball check valve when throttle is closed and is discharged through outlet ball check valve and pump jet location in side of mixing chamber above main venturi when throttle is opened for acceleration. Pump is not adjustable for seasonal changes.

Pump Stroke Adjustment—To check pump plunger travel, remove dust cover on float bowl cover, install Universal Pump Stroke Gauge T109-117S on raised portion of bowl cover so that gauge is vertical and projecting ear rests on top surface of pump shaft. Back off throttle lever stopscrew so that throttle valve tightly closed, note gauge reading. Open throttle wide and again note gauge reading. Difference between two readings is pump stroke (in sixty-fourths of an inch) and should agree with table below. To adjust, use special bending tool T109-41 to bend throttle connector link at lower angle near throttle lever. CAUTION—Check metering rod setting (disturbed by this adjustment).

ACCELERATING PUMP SETTING

Car Model	Carburetor	Pump Stroke
Jeep (Ford & Willys)	539S	17/64"

METERING ROD (ECONOMIZER):—Metering rod and jet assembly meters fuel for main nozzle and rod is operated by throttle lever in same manner as on other Carter models. Metering rod mounting on pump operating lever is new and consists of a pin locked in place in a slotted hole in the pump arm by a nut.

METERING ROD SETTING

All Carburetors	Gauge T109-26 (2.718")

Metering Rod Adjustment—Disconnect choke linkage, take out air horn attaching screws, remove air horn and dust cover. Unhook metering rod spring, remove metering rod being careful not to lose disk on rod at bowl cover. Insert special gauge, T109-26 (2.718") in place of metering rod so that tapered end is seated in metering rod jet and gauge is vertical. Back off throttle lever stopscrew so that throttle valve closes tightly. Metering rod pin on pump operating rod should be even with shoulder of notch in gauge. To adjust, loosen pin nut, shift pin on arm, tighten nut securely (use special wrench T109-76).

►*CAUTION*—On 539S, 596S, 636S, 636SA, metering rod spring must be engaged in hole in metering rod and spring must exert slight downward pressure on rod so that rod seats in jet when throttle valve stopscrew set for normal idle speed. Bend lower end of spring, if necessary, to secure this setting.

FLOAT LEVEL:—To check, remove bowl cover and float assembly, invert cover, turn gasket so that machined surface of bowl cover is exposed, measure distance from this machined surface to top of float at free end (see Caution below). Adjust by bending lip of float lever at point where it contacts valve needle (do not bend float arm).

NOTE—When checking float level, use Gauge No. T109-80 (3/8"), T109-31 (1/4").

►*CAUTION*—Use great care not to compress spring in needle valve stem when checking float level (allow float to hang freely on inverted cover).

FLOAT LEVEL SETTING

Car Model	Carburetor	Float Level
Jeep (Ford & Willys)	539-S	3/8"

Float Travel—To check, hold bowl cover and float assembly in normal position. Free end of float should drop 1/2". Adjust by bending two small float stop lips at hinge end of float.

Needle Valve & Seat—Furnished in matched sets only as follows: Part No. 25-94S—Intake Hole #48 (444-S, 453-S, 468-S), Part No. 25-93S—Intake Hole #53 (450-S, 507-S, 539-S, 596-S, 636-S).

THROTTLE VALVE SETTING:—When installing valves, back off throttle lever stopscrew, see that trademark on valve is on idle port side, use new attaching screws and install screws loosely, tap valve lightly to centralize it in carburetor bore, tighten screws securely, check valve setting.

Setting—With stopscrew backed off and throttle valve tightly closed, idle port opening (above or below valve as noted) and height of vacuum spark port (above valve) should be correct as shown in table below. Shims furnished .002" thick (2-93), .005" thick (2-94) to correct throttle valve location.

THROTTLE VALVE SETTING

Car Model	Carburetor	Idle Port Opening	Vacuum Port Hgt.
Jeep (Ford & Willys)	539-S	.086-.090" (above valve)	

CHOKE:—Offset type valve with poppet type relief valve. Check choke linkage to see that choke valve closed when control button on instrument panel pulled out and fully open with control button pushed in (valve spring-loaded).

TROUBLE SHOOTING:—**Poor Idling Performance**—If motor stalls while idling, low speed performance is unsatisfactory, or if correct idling adjustment cannot be secured, remove idle well plug and gasket assembly and allow fuel to drain from bowl which will flush out idle well jet. Remove idle well jet and clean with compressed air, remove low speed jet and clean with air, see that jet seats gasoline tight at shoulder in casting when replaced. Check carburetor wall at throttle valve for carbon. Blow out idle passages with air.

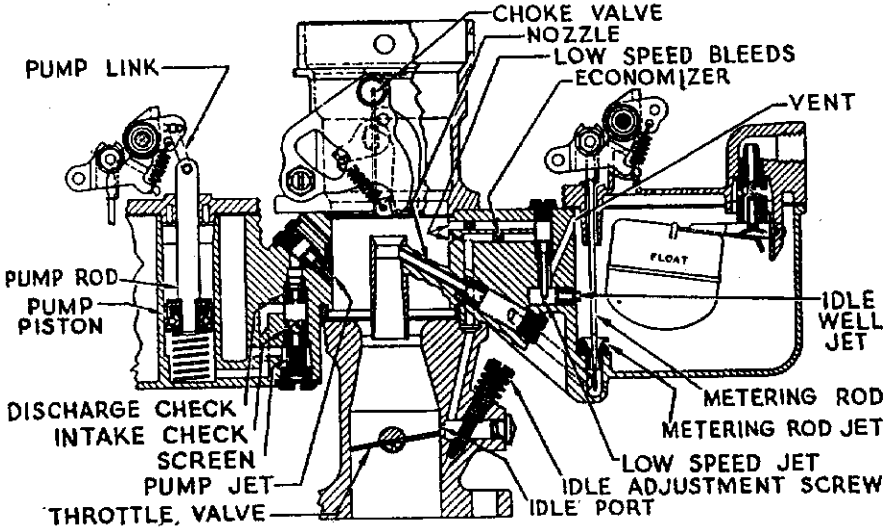
Poor Acceleration—Check pump stroke. Remove and clean or replace pump jet. Examine pump for damaged or worn plunger leather, loose plunger or bent pump arm, sediment or corrosion in pump cylinder, sticking or leaking ball check valves. If pump plunger removed from cylinder, use loading tool to install plunger to avoid damage to plunger leather.

CARTER TYPE WO (Continued)

Carburetor Loads up or Performance is Poor—Check float level, see that correct type metering rod installed and check metering rod setting.

DISASSEMBLY OF CARBURETOR: Remove the choke connector link, take out attaching screws and remove air horn assembly. Remove idle well plug and gasket assembly, remove idle well jet. Remove throttle shaft arm and connector rod. Take out screws and remove bowl cover assembly, disassemble parts on bowl cover. Remove low speed jet plug and gasket, low speed jet, idle adjusting screw and spring, metering rod jet and gasket assembly, nozzle passage plug and gasket, nozzle retainer plug, nozzle (use tool T109-55). Take out body casting flange attaching screws, remove flange casting and throttle valve assembly. Remove pump strainer plug and gasket, strainer, inlet ball check valve assembly, outlet ball check valve assembly. Remove pump jet passage plug and gasket, and pump jet. Remove idle port rivet plug. Take out throttle valve attaching screws, remove valve, withdraw shaft and lever assembly. Remove choke control bracket assembly from air horn, take out choke valve attaching screws, remove valve, withdraw choke valve shaft and lever assembly.

Servicing:—Clean body castings and all parts in gasoline, blow out all passages in castings and all jets with compressed air, dry all parts with air before reassembling. Check all parts for wear, see that they agree with specifications



REASSEMBLY OF CARBURETOR: Use new gaskets, soak metering jet and inlet gasket in 90 proof alcohol for 15 minutes, install on part and allow to dry before using). Reassemble by reversing disassembly directions above and note:

Nozzle Installation—Use new gasket. Use special tool T109-55 to install nozzle and make certain that flat side of nozzle is upward.

Low Speed Jet—Make certain that hole at lower end is open, work jet into seat by moving it back and forth, make certain that jet seats tightly in casting

SERVICE PARTS: Gasket Sets—No. 143A (444-S, 453-S, 468-S), No. 147 (450-S, SA; 507S, SA), No. 175A (539S, 596S, 636S, SA).

Repair Packages (with Std. Metering Jet)—No. 1066 (444-S, 453-S, 468-S), No. 1087 (450S, SA), No. 1304 (507S, SA), No. 1319A (539S), No. 1355A (596S, 636S, 636SA).

HOLLEY (FORD) SIX CYL. TYPE

FORD 6 CYLINDER	Ford No.
1941-42 Pass. Cars, Comm'l & Truck	1GA-9510-A
1946-47 Pass. Cars, Comm'l & Truck	5GA-9510-A
1947-48 Pass. Cars (With "H" Engine)	7HA-9510-A
1947 Comm'l & Truck (With "H" Engine)	7HT-9510
1948 Comm'l & Truck	7HT-9510-A
1949 8HA Passenger Cars	8HA-9510-A

DESCRIPTION: Single, plain tube, downdraft, with throttle operated accelerating pump and vacuum controlled economizer (power jet). Carburetor is similar to dual types used on Ford V8 models except for single barrel and new type economizer as described below.

►**1947-49 Type 7HT-9510, 7HT-9510-A, 8HA-9510-A Carburetor Vacuum Control for Distributor Advance**—Two ports in carburetor (one in venturi, one in carburetor throat above throttle edge) used to provide vacuum for operation of advance on new "Loadomatic Distributor."

See "Ford & Mercury Distributor" in Electrical Equipment Section for checking of these vacuum ports and passages.

Fuel System (Idling):—Fuel for idling taken from main jet well up through Idle Tube (which meters the fuel) to cross-passage in main nozzle bar where it is mixed with air admitted through Idle Air Bleed drilled passage in top of nozzle bar. Fuel mixture flows from this cross-passage down through channel to idle ports at throttle edge. For closed throttle idling, all fuel discharged through lower idle port (below throttle) and controlled by Idle Adjusting Needle. As soon as throttle is opened, additional fuel is discharged through upper idle port also.

Driving Range—At intermediate speeds, fuel metered by metering jet at lower end of main jet well flows through cross-passage in main nozzle bar to antechamber at center where it is mixed with air admitted through air bleed opening in side of cross-channel and through Nozzle Air Bleed Plug which is screwed in top of nozzle bar. Fuel mixture is then discharged through main nozzle opening below nozzle bar into throat of venturi.

High Speed & Wide Open Throttle Operation—At high speed or whenever throttle opened sufficiently so that vacuum decreases, economizer valve spring opens economizer valve allowing additional fuel to flow directly from float bowl to main jet well (by-passes metering jet). This fuel metered by economizer restriction which is small drilled passage at well end of economizer fuel channel.

IDLING ADJUSTMENT:—Idle adjusting needle or screw controls fuel discharge from lower (closed throttle) idle discharge port. Screw should be turned in for leaner mixture, out for richer mixture, and should be adjusted only with engine warmed up and choke valve wide open. Settings shown in table below. See car model page for complete tune-up instructions.

IDLE SETTING

Car Model	Idle Screw Setting	Idle Speed
Ford 6 Cyl. (All)	½-1¼ turns open	500 RPM

NOTE—Engine speed can be gauged when setting idle speed by marking a spot on the fan belt and noting the fan belt speed. The belt should make 25 revolutions in 10 seconds with engine speed of 500 RPM.

METERING JET:—Main metering jet is non-adjustable type located in float bowl and accessible by removing float bowl cover. Jet should be changed only to compensate for special operating conditions such as high altitudes. See Holley (Ford) Jet Specification Table.

ECONOMIZER:—Consists of a spring-loaded vacuum piston located in the air horn and float bowl cover casting with the piston stem extending down so as to contact the power jet valve located in the main body casting. Vacuum piston is normally held up at the top of its stroke by manifold vacuum (vacuum passage drilled in carburetor castings and opens into carburetor throat below throttle valve) so that power jet valve is held closed by the spring on the valve stem. When the manifold vacuum decreases to 8½-9" of HG., the spring on the vacuum piston stem forces the vacuum piston down and the piston stem opens the power jet valve. Fuel then flows from float bowl through valve to main jet well directly without passing through main metering jet.

Setting—Vacuum economizer opens power jet valve with manifold vacuum of 8½-9" of HG. No adjustment provided.

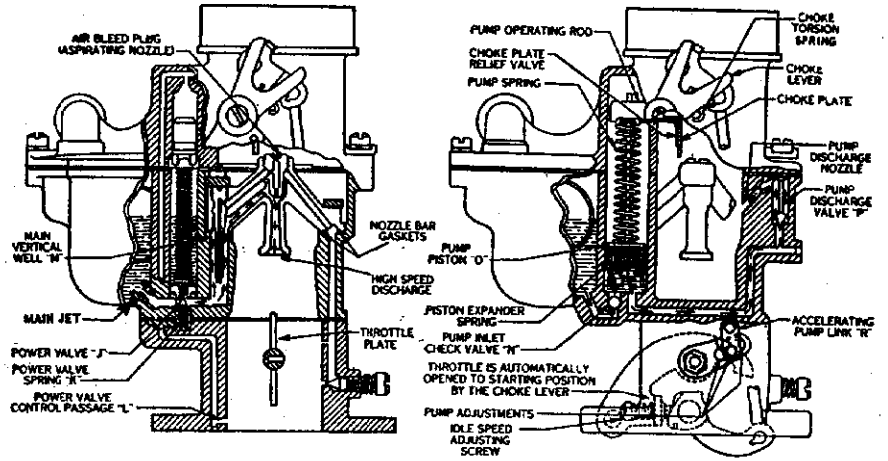
ACCELERATING PUMP:—Pump cylinder and piston located in float bowl, operated by inverted 'L' shaped pump rod linked to throttle lever. Fuel is drawn into pump cylinder through inlet ball check valve at lower end when throttle is

HOLLEY (FORD) 6 CYL. TYPE (Continued)

closed and is discharged through outlet check valve and pump discharge nozzle when throttle opened for accelerating (nozzle is located at upper edge of venturi). Pump piston connection to pump rod is through a driving spring on the piston stem which prevents loading up engine when throttle opened suddenly and also prolongs pump discharge (spring compressed at beginning of piston travel, expands at end of travel).

Adjustment—Three holes provided in throttle lever for pump link connection (these holes numbered 1-2-3 from throttle valve shaft outward). Inner (#1) hole provides minimum stroke, Center (#2) hole medium stroke, Outer (#3) hole maximum stroke. Recommended setting is No. 2 hole (medium temperatures), No. 1 hole (extremely hot weather), No. 3 hole (extremely cold weather). See car model page for recommended seasonal adjustment and other tune-up data.

NOTE—Pump link is locked in lower end of pump rod by a spring-loaded snap lock. To disengage lock, pull link shaft out of pump rod.



FLOAT LEVEL:—Use Ford No. 9550-A Float Position Gauge to check float level. With bowl cover and float assembly removed, remove gasket, invert cover so that float weight holds needle valve closed, place gauge on bowl cover with gauging arm extending over float (CAUTION—check both ends of float). "Go" end of gauge should clear float and "No Go" end should not clear (with "No Go" end of gauge resting on float, base of gauge should clear bowl cover at gauging arm end).

FLOAT LEVEL SETTING

Car Model	Checking Gauge	"Go"—Height—"No Go"
Ford 6 Cyl. (All)	9550-A	1.353"—1.322"

Adjustment—Use 9550-C bending tool to bend float arm using extreme care to keep float level (recheck float at both ends). Make certain that float has sufficient travel to drop to bottom of float chamber (travel controlled by stop on float arm.)

Fuel Level—With correct float adjustment, fuel level in bowl should be 11/16" plus or minus 1/32" below top edge of bowl with needle valve seated.

Float Needle Valve & Seat: Furnished only in matched sets as follows:
Part No. 78-9564—(1GA-9510-A & 5GA-9510-A Carburetors).
Part No. 7HA-9564—(7HA-9510-A, 7HT-9510, 7HT-9510-A, 8HA-9510-A Carbs.).

CHOKE:—Choke valve is offset type with poppet valve type relief valve to prevent over-choking.

THROTTLE-KICKER (STARTING):—Consists of a spring loaded lever pivoted on side of carburetor casting so as to contact cam on choke lever at upper end and throttle lever at lower end (through throttle stopscrew which is mounted on this starting lever). Lever is rotated by choke lever cam when choke valve closed for starting and opens throttle to starting position. No adjustment required.

DISASSEMBLY OF CARBURETOR: Remove choke lever screw, choke lever, plunger, and spring (disconnect lever from connector link). Take out throttle kicker screw and remove throttle kicker. Take out air horn screws and lift off air horn assembly being careful not to damage float or power jet (economizer) vacuum piston assembly. Disconnect accelerating pump link, lift out pump plunger and rod assembly. Remove main metering jet (use screwdriver with blade that fits jet snugly) and power jet from float bowl. Remove nozzle bar screws and clamps, remove Idle Tube and air bleed from nozzle bar, lift out nozzle bar gaskets. Remove check valve retainer from bottom of pump cylinder (use small rod with hooked end), invert main body casting and remove pump discharge needle and check ball (these parts will drop out). Remove throttle body attaching screws and washers, lift throttle body off. Remove idle adjusting screw and spring, take out float hinge pin and remove float assembly from air horn, remove fuel inlet needle valve and seat assembly and gasket.

Servicing—Clean all carburetor parts and make certain that all corrosion removed from float bowl. Examine all parts for wear and replace all worn or damaged parts. Use new gaskets when reassembling carburetor.

Accelerating Pump—When installing check ball in bottom of pump cylinder, seat the ball by tapping lightly with a brass drift rod, then install retainer using a wooden or fibre dowel to press retainer down in place. When installing pump discharge needle, tap needle lightly with a brass drift to insure that it seats properly. Check pump action when completely assembled, a good stream should be apparent at the pump discharge nozzle when throttle valve is opened (bowl must be filled with gasoline when making this test).

Float Inlet Valve & Seat—Keep needle valve and seat together as a set, rinse in cleaning solution and wipe off with clean cloth; if re-installed in carburetor, polish float lever end of needle valve with #320 'wet or dry' paper.

Choke Valve—Check valve tightness by holding air horn assembly against light and noting light around edge of valve. Check poppet relief valve and replace choke valve assembly if relief valve spring weak or broken. Check choke lever boss on air horn for wear using new choke lever, replace air horn if boss worn. Check choke lever for wear at ball end and in 'V' opening which engages choke shaft lever. Clean out choke lever pawl hole.

Float Assembly—See that float lever firmly soldered to float, examine float for leaks (immerse float in water heated just below boiling point, bubbles indicate that float leaks). Polish needle valve contact point on float arm with #320 'wet or dry' paper. Check float level and travel (use 9550-A gauge) as directed under Float Level (above) when float re-installed.

Throttle Valve Assembly—Check valves for tightness in same manner as choke valve (above). Replace complete assembly if valves worn, shaft worn or loose, throttle valve lever loose on shaft, or if pump link hole in throttle lever worn. If throttle valves replaced, stake attaching screws securely (use 9518-C anvil and 9518-D punch). Check throttle valve position using gauge (which gauges distance from valve to idle ports with valve closed).

Vacuum Economizer:—Vacuum piston is located in air horn and float bowl casting and will be removed when air horn is taken off. Power valve is screwed in place in main body casting and can be removed with air horn off and vacuum piston removed. When removing and installing jets, use screwdriver which just fits jet slots and take care not to damage jets and fuel orifices, see that gaskets are in good condition and in place when jets installed.

Pump Discharge Nozzle—Nozzle is a drilled passage in the main body casting and is not removable. A metering restriction is installed in the nozzle passage.

REASSEMBLY OF CARBURETOR: After cleaning and inspecting all parts for wear (see Servicing above), reassemble carburetor by reversing disassembling directions. Adjust carburetor after re-installation on engine.

TROUBLE SHOOTING:—Poor Idling Performance. Make certain that entire engine tuned up, check idle setting. If idle is lean, check for air leaks at manifold, check gaskets between carburetor throttle valve body and bowl casting. Remove idle adjusting needle and Idle Tubes, blow out channels with air, clean idle tube with air. If idle is rich, check Vacuum Economizer valve, see that valve is seating properly and not leaking. Check gasket between throttle valve body and bowl casting (vacuum chamber must be airtight).

Poor Running Performance. Check carburetor body gaskets, see that all carburetor body bolts are tight. Check metering jet for size. Blow out metering jet channel and main nozzle channel with compressed air. Check fuel level.

Poor Acceleration Performance. Check pump cylinder and channels for dirt which will prevent check-valves seating. See that piston leather is in good condition, check piston driving spring. To dismantle pump for cleaning (with

CONTINUED ON NEXT PAGE

HOLLEY (FORD) 6 CYL. TYPE (Continued)

air horn casting off carburetor), disconnect pump link, remove pump rod and piston assembly, inlet ball retaining spring and ball, and outlet check needle. Blow out all channels with compressed air. If pump is working properly, a fine, solid, steady stream should be discharged from each nozzle port at instant throttle is snapped open.

Poor High Speed Performance. Check engine compression, breaker contacts and gap, spark plug gaps first. Check vacuum economizer valve, remove economizer and blow out economizer channels and restrictions with compressed air. Check fuel level and float travel. Check fuel pump pressure.

Poor Economy or Gasoline Mileage. Check all parts of car which may cause this complaint (engine, valves, dragging brakes, etc.). Check fuel level and fuel pump pressure. Check metering jet for size. Manufacturer does not recommend use of leaner metering jets to secure fuel economy.

HOLLEY (FORD) V-8, MERCURY

FORD V-8	Ford No.
1939-40 "60" Cars & Trucks	922A-9510-A
1938-41 "85" & "90" Passenger Cars	①91A-9510-A
1938-41 "85", "90", "95", "100" Comm'l & Trucks	①91A-9510-A
1942 "90" Passenger Cars	21A-9510-A
1942-44 "90" & "100" Comm'l & Trucks	21A-9510-A
1945-47 "100" Comm'l & Trucks	59A-9510-A
1946-48 "100" Passenger Cars	59A-9510-A
1948 "100" Comm'l & Trucks	7RT-9510-A
MERCURY	
1939-41	①91A-9510-A
1942	21A-9510-A
1946-48	59A-9510-A

①—Marked "94".

►**FORD V8 & MERCURY CARBURETOR—POWER VALVE CHANGE (No. 78-9904 Carburetor Economizer or Poer Valve).** Diaphragm material changed from Neoprene to Fairprene to prolong life of this part. Parts may be identified by color of power valve cover as follows:

First Type (Neoprene Diaphragm)—Silver (cadmium plated).
Later Type (Fairprene Diaphragm)—Black (oxidized).

DESCRIPTION: Dual (double barrel), plain tube, downdraft types with throttle operated accelerating pump and vacuum controlled economizer (power jet). All models are similar except for following special features:

►**Ford & Mercury 1942 Carburetor**—No. 21A-9510 has new type bowl vent located at rear of carburetor to prevent surging of fuel in float bowl caused by air blast from 1942 type higher mounted cooling fan.
CAUTION—Previous type carburetors must not be used on 1942 engines with this new type higher mounted fan.

►**Ford 1948-49 7RT-9510-A & 8BA-9510-A Carburetor Vacuum Control for Distributor Advance**—Two ports in carburetor (one in venturi, one in carburetor throat above throttle edge) used to provide vacuum for operation of advance on new "Loadomatic Distributor."
See "Ford & Mercury Distributor" in Electrical Equipment Section for checking of these vacuum ports and passages.

Fuel System (Idling):—Fuel for idling taken from main jet well up through Idle Tube (which meters the fuel) to cross-passage in main nozzle bar where it is mixed with air admitted through Idle Air Bleed drilled passage in top of nozzle bar. Fuel mixture flows from this cross-passage down through channel to idle ports at throttle edge. For closed throttle idling, all fuel discharged through lower idle port (below throttle) and controlled by Idle Adjusting Needle. As soon as throttle is opened, additional fuel is discharged through upper idle port also. Independent idle system used for each carburetor barrel.

Driving Range—At intermediate speeds, fuel metered by metering jet at lower end of main jet well flows through cross-passage in main nozzle bar to antechamber at center where it is mixed with air admitted through air bleed opening in side of cross-channel and through Nozzle Air Bleed Plug which is screwed in top of nozzle bar. Fuel mixture is then discharged through main nozzle opening below nozzle bar into throat of venturi.

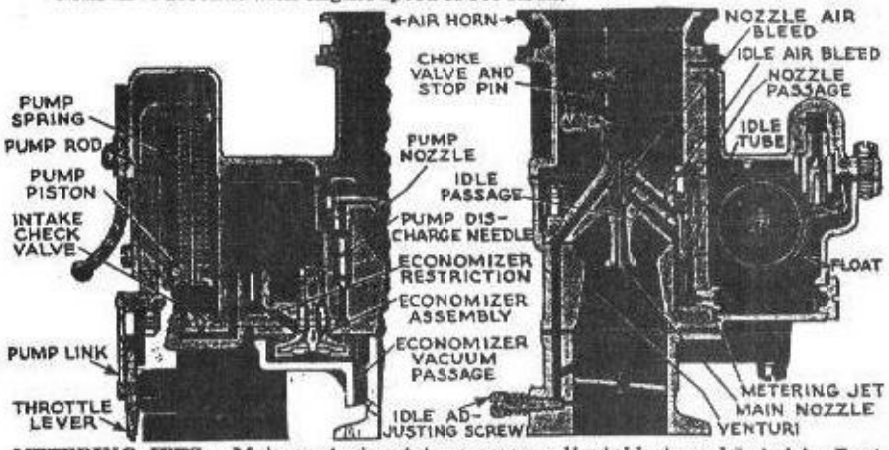
High Speed & Wide Open Throttle Operation—At high speed or whenever throttle opened sufficiently so that vacuum decreases, economizer valve spring opens economizer valve allowing additional fuel to flow directly from float bowl to main jet well (by-passes metering jet). This fuel metered by economizer restriction which is small drilled passage at well end of economizer fuel channel.

IDLE ADJUSTMENT:—Idle adjusting needle or screw for each carburetor barrel controls fuel discharge from lower idling port. Screws should be turned in for leaner mixture or out for richer mixture and should be adjusted equally. Setting is shown in table below. See car model page for complete instructions on each car model.

IDLE SETTING

Car Model	Idle Screw Setting	Idle Speed
Ford V8 (All)	½-1¼ turns open	500 RPM
Lincoln & Mercury (Synchro-mesh)	½-1¼ turns open	500 RPM
Lincoln & Mercury (Liquamatic)	½-1¼ turns open	350 RPM

NOTE—Engine speed can be gauged when setting idle speed by marking a spot on the fan belt and noting the fan belt speed. The belt should make 25 revolutions in 10 seconds with engine speed of 500 RPM.



METERING JETS:—Main metering jets are non-adjustable type located in float bowl and accessible by removing plug on side of float bowl opposite each jet. Jets should be changed only to compensate for special operating conditions such as high altitude. See Holley (Ford) Jet Specification Table.

ECONOMIZER:—Consists of a spring-loaded, vacuum diaphragm controlled, by-pass valve assembly screwed in lower face of main body casting so that valve extends into float bowl (diaphragm assembly fits in recess in throttle valve body casting and vacuum passage in casting connects diaphragm chamber with carburetor barrel below throttle valve). Vacuum economizer set at factory to open when vacuum decreases to 8½-9" of HG. (corresponding to engine speed of 3800 R.P.M.). No adjustment provided.

ACCELERATING PUMP:—Pump cylinder and piston located in float bowl, operated by inverted 'L' shaped pump rod linked to throttle lever. Fuel is drawn into pump cylinder through inlet ball check valve at lower end when throttle is closed and is discharged through outlet check valve and pump discharge nozzle when throttle opened for acceleration (nozzle is located at upper edge of venturis and has two discharge holes so that fuel is discharged equally into each carburetor barrel). Pump piston connection to pump rod is through a driving spring on the piston stem which prevents loading up engine when throttle opened suddenly and also prolongs pump discharge (spring compressed at beginning of piston travel, expands at end of travel).

Capacity—As shown in table below in cc. per 10 strokes. Throttle lever stop-screw must be backed off to allow throttle to close completely and pump link must be connected in center hole.

CONTINUED ON NEXT PAGE

Car Model	Pump Capacity
Ford & Mercury	9-13 cc.

Adjustment—Three holes provided in throttle lever for pump link connection. Upper hole (short radius) provides minimum stroke, lower hole (long radius) maximum stroke. Center hole is normal setting. See tune up data on car model page for recommended settings.

NOTE—Pump link locked in lower end of pump rod by spring-loaded snap lock. Pull link shaft out of pump rod to disengage lock.

FLOAT LEVEL: Fuel Level—Fuel level in bowl should be 11/16"±1/32" (All Ford V8 and Mercury),

below top edge of bowl with engine idling (3 lbs. pressure).

NOTE—If glass tube or sight level indicator used to check fuel level, use extreme care to eliminate error caused by capillary action of fuel in sight tube.

Float Level—With bowl cover and float assembly removed, remove gasket, invert cover so that float weight holds needle valve closed, check float with special "Go" and "No Go" gauge (see table below). Place gauge on bowl cover with gauging arm extending over float (CAUTION—check both ends of float). "Go" end of gauge should clear float and "No Go" end should not clear (with "No Go" end of gauge resting on float, base of gauge should clear bowl cover at gauging arm end).

FLOAT LEVEL SETTING

Car Model	Checking Gauge	"Go"—Height—"No Go"
Ford & Mercury	9550-A	1.353" ..... 1.322"

Adjustment—Use 9550-C bending tool to bend float arm. Use extreme care to keep float even (check both ends of float). Make certain that float has sufficient travel to drop to bottom of float bowl (controlled by stop on float arm.

Float Needle Valve & Seat—Furnished only in matched sets as follows: Part No. 78-9564 (922A-, 91A-, 21A-, 59A-, 96H-, 06H-, 16H-, 26H- Carbs.). Part No. 7HA-9564 (7RT- and 8BA-9510-A Carburetors).

CHOKE:—Offset type with poppet type relief valve to prevent over-choking.

Lincoln Automatic Choke—Refer to Sisson Automatic Choke article in Carburetion Equipment Section for adjustment instructions.

THROTTLE-KICKER (STARTING):—Consists of a spring loaded lever pivoted on side of carburetor casting so as to contact cam on choke lever at upper end and throttle lever at lower end (through throttle stopscrew which is mounted on this starting lever). Lever is rotated by choke lever cam when choke valve closed for starting and opens throttle to starting position. No adjustment required.

DISASSEMBLY OF CARBURETOR: Remove choke lever screw, choke lever, pawl, and spring. Take out throttle kicker screw, remove throttle kicker and spring. Take out five air horn screws, remove air horn assembly, use care not to bend float. Remove accelerator pump link (pry upper end of link out), remove pump plunger and rod assembly. Remove drain plugs and gaskets, remove main metering jets (use tool 9510-A, remove front nozzle bar screws and clamp, remove idle tubes and brass air bleeds from nozzle bar, then remove rear nozzle bar screws and clamp, remove nozzle bars, pump discharge nozzle and gasket, and nozzle bar gasket. Remove check valve retainer from bottom of pump cylinder (use small rod with hooked end), invert main body casting and catch pump discharge brass needle and check ball which will drop out. Remove throttle body attaching screws and lockwashers, lift throttle body off. Use wrench 9904-A to remove economizer valve assembly and gasket. Remove throttle valve loose lever collar, loose lever and spring, idle adjusting screws and springs. Take out float hinge pin and remove float assembly from air horn, remove fuel inlet needle valve and seat assembly and gasket (use wrench 9510-A).

Servicing—Clean all carburetor parts and make certain that all corrosion removed from float bowl. Examine all parts for wear as directed below and replace all worn or damaged parts (renew all following parts when carburetor overhauled: Accelerator pump rod felt and brass rod retainer, pump check valve retainer, accelerator pump piston, economizer (power) valve assembly), and all gaskets.

Float Inlet Valve & Seat—Keep needle valve and seat together as a set, rinse in cleaning solution and wipe off with clean cloth; if re-installed in carburetor, polish float lever end of needle valve with #320 'wet or dry' paper.

Choke Valve—Check valve tightness by holding air horn assembly against light and noting light around edge of valve. Check poppet relief valve and replace choke valve assembly if relief valve spring weak or broken. Check choke lever boss on air horn for wear using new choke lever, replace air horn if boss worn. Check choke lever for wear at ball end and in 'V' opening which engages choke shaft lever. Clean out choke lever pawl hole (use reamer 9537-A).

Float Assembly—See that float lever firmly soldered to float, examine float for leaks (immerse float in water heated just below boiling point, bubbles indicate that float leaks). Polish needle valve contact point on float arm with #320 'wet or dry' paper. Check float level and travel (use 9550-A gauge) as directed under Float Level (above) when float re-installed.

Throttle Valve Assembly—Check valves for tightness in same manner as choke valve (above). Replace complete assembly if valves worn, shaft worn or loose, throttle valve lever loose on shaft, or if pump link hole in throttle lever worn. If throttle valves replaced, stake attaching screws securely (use 9518-C anvil and 9518-D punch). Check throttle valve position using gauge 9518-A (which gauges distance from valve to idle ports with valve closed), replace throttle body and valve assembly if distances not within gauging limits.

Accelerating Pump—Remove brass retainer and pump rod felt from main body before cleaning casting in cleaning solution (solution will damage felt). If main body has shoulder around accelerating pump rod hole, remove this shoulder with a file (shoulder limits pump stroke) and if no vent provided between float bowl and pump head clearance chamber (larger section at top of pump cylinder), provide a vent by cutting a slot with a hacksaw or small file. Use driver 9513-C to install felt and brass retainer in pump rod hole. Seat check ball in bottom of pump cylinder by tapping lightly with a brass drift rod, then use ⅝" wood or fibre dowel to press retainer down in place. When installing brass pump discharge needle, tap needle lightly with brass drift to insure that it seats properly. When installing pump plunger and rod assembly, make certain that correct link used (Ford '85' & Mercury marked 'C', Ford '60' and Lincoln marked '6'—use marked links). Check pump action when completely assembled, a good stream should be apparent at each pump jet when throttle opened several times (fill bowl with fuel to make this test).

Economizer Power Jet Assembly—When installing valve assembly, use new gasket and tighten securely to 15 lb. ft. torque.

Carburetor Body Castings—Clean castings thoroughly in cleaning solution, clean ports and channels with correct drill in hand chuck 9518-E as follows: Lower Idle Port (nearest throttle valve)—9518-H (.037") drill, Upper Idle Port—9518-E (.0395") drill, Idle Adjustment Screw Holes—9518-F (.046") drill, Idle Adjustment Screw Threads—9541-A Tap (use care not to remove any metal or enlarge holes), Idle Adjusting Needle Seat—9541-C refacer and 9541-D guide bushing, Accelerating Pump Rod Hole—9513-B reamer, also clean out felt retainer groove.

REASSEMBLY OF CARBURETOR: After cleaning and inspecting all parts for wear (see Servicing above), reassemble carburetor by reversing disassembling directions. Adjust carburetor after re-installation on engine.

TROUBLE SHOOTING:—Poor Idling Performance. Make certain that entire engine tuned up, check idle setting. If idle is lean, check for air leaks at manifold, check gaskets between carburetor throttle valve body and bowl casting. Remove idle adjusting needle and Idle Tubes, blow out channels with air, clean idle tubes with air. If idle is rich, check Vacuum Economizer valve, see that valve is seating properly, and that diaphragm is not leaking. Check gasket between throttle valve body and bowl casting (vacuum chamber must be airtight).

Poor Running Performance. Check carburetor body gaskets, see that all carburetor body bolts are tight. Check metering jets for size. Blow out metering jet channel and main nozzle channels with compressed air. Check fuel level.

Poor Acceleration Performance. Check pump cylinder and channels for dirt which will prevent check-valves seating. See that piston leather is in good condition, check piston driving spring. To dismantle pump for cleaning (with air horn casting off carburetor), disconnect pump link, remove pump rod and piston assembly, inlet ball retaining spring and ball, discharge nozzle, and outlet check needle. Blow out all channels with compressed air. If pump is working properly, a fine, solid, steady stream should be discharged from each nozzle port at instant throttle is snapped open.

Poor High Speed Performance. Check engine compression, breaker contacts and gap, spark plug gaps first. Check vacuum economizer valve, remove economizer and blow out economizer channels and restrictions with compressed air. Check fuel level and float travel. Check fuel pump pressure.

Poor Economy or Gasoline Mileage. Check all parts of car which may cause this complaint (engine, valves, dragging brakes, etc.). Check fuel level and fuel pump pressure. Check metering jets for size. Manufacturer does not recommend use of leaner metering jets to secure fuel economy.

MARVEL-SCHEBLER (FORD) MODEL TSX

FORD NO. ONY-9510

FORD 4 CYLINDER, ALL COMMERCIAL & TRUCK MODELS (1941-42)

TYPE:—Plain tube updraft type with low speed (idle) and high speed (power) adjustments. Float bowl is concentric type with double 'saddle' type float and is vented through air horn. Fuel for idling is taken from main nozzle well up through passage in carburetor body and air horn castings to idle discharge ports at the throttle edge and is metered by Idle Jet installed in lower end of passage in air horn and bowl cover casting. Idle adjusting screw controls air bleed in idle passage. Fuel for main nozzle is metered by power adjusting needle which controls fuel flow from bowl to main nozzle well and a Maximum Fuel Limiting Jet is located at the bottom of the main nozzle well for additional control. There is also an Economizer Jet located in a channel in the carburetor casting. Main nozzle is air bled through passage opening into top of float bowl chamber in bowl cover casting behind venturi. This passage has an Air Vent Cup pressed in the upper end at the bowl cover casting gasket opening.

CAUTION—If Air Vent Cup removed, new cup must be installed and reamed after assembly to specified size of .035" as directed in Servicing section below.

ADJUSTMENT:—Adjust carburetor only after engine warmed up and with choke valve wide open. Then adjust low speed (idling) and high speed (power) adjustments as follows:

Low Speed Idling Adjustment—Set throttle stopscrew for correct 5-7 MPH. idle speed. Turn idle adjusting screw in until engine begins to roll (mixture too rich), then turn screw out slowly until engine idles smoothly. Recheck idle speed. NOTE—This method of adjustment will give a setting which is slightly on the rich side which is preferable to a too lean setting.

High Speed Power Adjustment—Open throttle approximately ⅓. Turn power adjusting needle (on bowl cover beside fuel inlet connection) in or clockwise slowly until engine begins to lose power and speed drops off, then turn needle out or counter-clockwise until speed picks up and engine runs smoothly. Check performance and if engine tends to backfire or falter in picking up load, turn power adjusting needle out or counter-clockwise one notch at a time until acceleration is satisfactory. NOTE—This setting will give most economical performance and Economizer Jet will provide proper fuel mixture for full throttle operation. Power adjusting needle should be approximately 1 turn out from inner seated position.

FLOAT LEVEL:—Float is double type and both floats should be set exactly alike. To check float level, remove bowl cover and float assembly, invert cover, measure from gasket surface on cover to nearest edge of floats. Distance should be 9/32". To adjust float level, use bending tool M-8 and bend float lever at narrow section midway between valve and floats. Adjust both floats exactly alike.

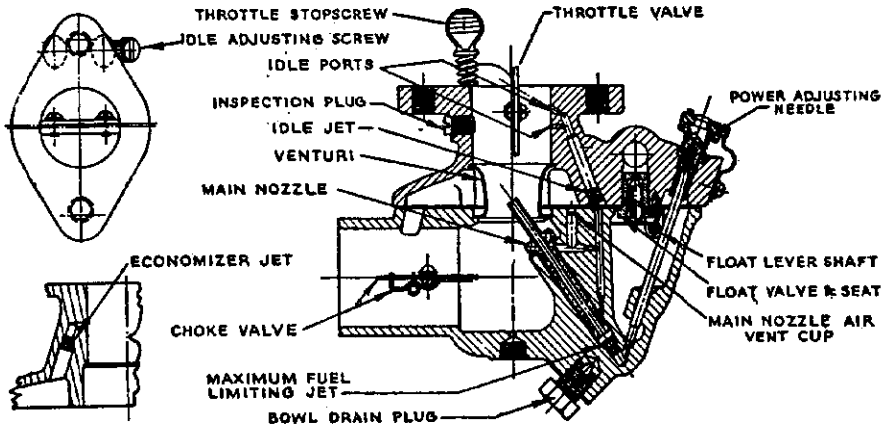
Needle Valve & Seat—Furnished as matched sets only. Ford No. 9N-9564.

CHOKE:—Choke valve is butterfly type with spring-loaded flapper type relief valve. Check choke linkage and adjust so that choke valve fully closed when choke control button pulled out, and wide open when control button pushed in.

SERVICING:—Disassembly—Back out and remove power adjusting needle, spring, and gasket (CAUTION—Power adjusting needle must be removed before any attempt made to remove bowl cover and air horn casting). Remove four bowl cover attaching screws, remove bowl cover and air horn assembly. Take out float lever shaft, remove float and lever assembly, float valve, float valve seat and gasket, bowl cover gasket, venturi, Economizer Jet (use long, slender screwdriver), Idle Jet, idle adjusting screw and spring, fuel intake elbow and strainer screen, throttle valve screws and lockwashers, and throttle valve. Examine throttle valve shaft for wear (use new shaft when reassembling if wear evident), remove throttle shaft and lever, and packing at lever end of shaft. Remove idle port inspection plug. Remove main nozzle and nozzle gasket (use tool M-78), remove Maximum Fuel Limiting Jet from bottom of nozzle well. If necessary to remove Air Vent Cup from top of main nozzle air bleed passage, insert sharp pointed tool in cup and pry cup out (CAUTION—New cup must be installed when carburetor reassembled and then reamed to specified size—see Reassembly data below). Remove float bowl drain plug, remove dust strainer at bottom of carburetor (if strainer cannot be cleaned without removal). Remove choke valve screws, choke valve, shaft and lever assembly, and shaft packing.

Servicing—Clean out all passages and channels in carburetor castings, blow out jets with air, examine all parts for wear. NOTE—When overhauling carburetor after normal service, following parts only should require replacement: Throttle shaft and lever assembly, Float valve and seat (furnished as matched set), float lever shaft, power adjusting needle, felt packing on throttle valve and choke shafts.

Reassembly—Use new gaskets, install all parts in reverse order to disassembly directions above. Note following special directions and cautions: When installing choke valve and throttle valve, hold valves in closed position (throttle valve stopscrew must be backed off to allow valve to close completely) while tightening attaching screws, then check valves to make certain that they operate freely



without binding. When installing idle adjusting screw and power adjusting needle use care not to tighten these screws excessively which will groove needle point and prevent satisfactory adjustment (turn screws in until lightly seated, then back idle adjusting screw off 2 turns, power adjusting needle 1 turn which is approximate setting and will allow engine to be warmed up so that accurate adjustment can be made). Adjust float level.

Air Vent Cap Servicing Note—If cap removed, press new cap in place in main body casting, then ream hole in cap to finished size of .035".

Part	Jet Specifications	Ford Part No.
Idle Jet		9N-9596
Maximum Fuel Limiting Jet		9N-9533
Main Nozzle		9N-9530
Power Adjusting Needle		9N-9565A
Venturi		9N-9586A
Float Valve & Seat (Matched Set)		9N-9564

STROMBERG MODELS EE-7/8

MODEL EE-7/8

FORD "60", ALL MODELS (1937-38-39)—SEE NOTE

1938-39 Ford—Holley (Chandler-Groves) carburetors also used. See Holley Chandler-Groves (Ford) Carburetor article for data on these models.

TYPE:—Duplex or dual barrel, plain tube, downdraft type. Similar in design to other 'E' type carburetors except that each carburetor barrel has independent main discharge jets, main metering jets, throttle valves and idling adjustments. Throttle valves are mounted on the same shaft and do not require synchronization. Accelerating pump is positively operated by the throttle lever through a 'walking beam' linkage on the carburetor body casting. Idling adjustment and accelerating pump adjustment (some models only) are the only points requiring attention.

IDLING ADJUSTMENT:—Needle valve type controlling fuel mixture. Adjusting screws control discharge through lower or closed throttle discharge ports below throttle valves (upper ports also discharge fuel when throttle is opened slightly) and should be turned in for leaner mixture or out for richer mixture. Engine must be warmed up when adjustments are made. With engine warm and idling with closed throttle (adjust throttle stopscrew, if necessary so that idle speed is approximately 5-7 MPH), adjust each idle adjusting screw in turn by turning screw in until engine begins to hesitate or miss, and out until engine begins to roll, and then turning screw in slowly until engine fires smoothly. Final setting should be approximately midway between the missing (lean) and rolling (rich) positions. After adjusting both screws, recheck idling speed. See car model pages for complete tune-up data. Nash Note—On these models, set idle speed not lower than 7 MPH, and if engine tends to stall when coasting (when cruising gear used continuously), speed can be advanced up to 9 MPH.

If correct idling adjustment cannot be secured, take out idling adjusting screws and upper idling port plugs and clean out idling ports with compressed air. The idling tubes located in the upper carburetor body can also be taken out and cleaned with compressed air.

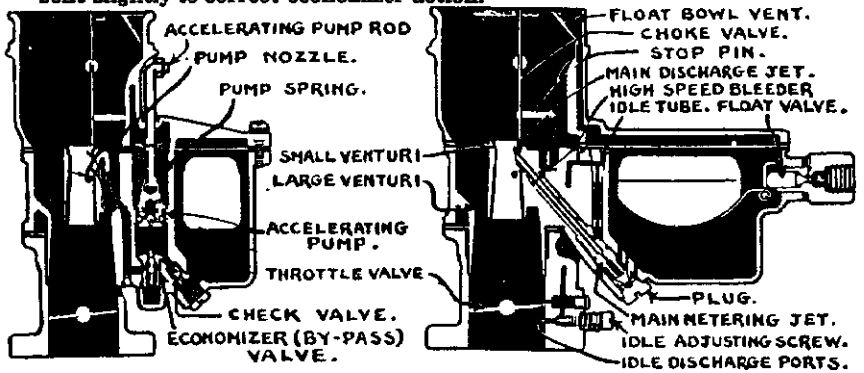
METERING JETS:—Main metering jets (2 used) are non-adjustable fixed type and should be changed only for special operating conditions such as high altitudes. See Notes above for special recommendations and Stromberg Jet Specification Table for standard jets. Both main metering jets must be same size.

ECONOMIZER:—Built in lower end of the accelerating pump and is operated by the pump piston. At speeds above 65 M.P.H. or with wide open throttle, economizer needle valve is forced down, opening the economizer valve so that additional fuel flows through this valve and is discharged through the pump discharge nozzle. Economizer should not require attention but setting can be checked by noting throttle opening when pump piston contacts by-pass valve seat (economizer). Throttle valve opening at this point as checked by drill passed between throttle valve edge and carburetor wall is shown in table below.

ECONOMIZER SETTING

Car Model	Economizer Setting
Ford (all models) EE-7/8 Carb.	9/32"

Adjustment—No adjustment provided but pump arm (walking beam) may be bent slightly to correct economizer action.



ACCELERATING PUMP:—Accelerating pump is operated through a walking beam linkage by the throttle valve lever. Pump chamber is filled with fuel (flowing through check-valve) when throttle is closed. When the throttle is opened, this fuel is discharged through the pump discharge nozzle in each carburetor barrel. The check-valve prevents the fuel flowing back into the float bowl. When the throttle is held open, the pump piston opens the economizer by-pass valve so that fuel flows straight through the pump chamber to discharge nozzles. Pump capacity in cc. per 10 strokes (operated slowly) is shown in table below. Pump setting must be as indicated.

ACCELERATING PUMP SETTING

Car Model	Pump Capacity	Pump Setting
Ford '60' EE-7/8	9-13 c.c.	Max.

Adjustment:—Two holes (ball studs on Ford and Lincoln Zephyr) provided on throttle lever for pump rod connection. Inner hole (short radius) provides minimum stroke, outer hole (long radius) maximum stroke. See tune up data on car model page for recommended setting and seasonal changes.

FLOAT LEVEL:—Fuel level in float bowl set at 15/32" below top edge or gasket surface of bowl with 3 lbs. pressure (engine idling) for all models except as noted below. Float height can be changed to correct fuel level by bending float lever at the point where it is attached to the float.

FLOAT LEVEL SETTING

Car Model	Carburetor	Fuel Level
Ford (all models)	EE-7/8, EE-1	15/32"

FLOAT INLET VALVE

Needle Valve & Seat Assembly—Furnished only in matched sets as follows:

Car Model	Part No.	Size
Ford (all Carb.)	P-20287	.098"

CHOKE:—Choke valves offset type. Check hand choke controls to see that choke valve is fully closed when dash control button pulled and is wide open when control button pushed all the way in.

THROTTLE VALVE SETTING:—Throttle valves for all models are 5° type and should be set so that upper lip of valve is .030" plus or minus .004" below lower edge of upper idle port with throttle valve closed

SERVICE PARTS:—Gasket Sets—Part No. J-4790-G

Repair Kits (including Gaskets)—Part No. RK-66

AC FUEL PUMP TESTING & TROUBLE SHOOTING

NOTE:—Manufacturer recommends that Fuel Pump Analyzer No. 1521551 be used in making these tests. All tests should be made with the fuel pump in place on the engine and the engine running to drive the pump. Engine speed should be 30-35 MPH (for capacity test), lowest possible idling speed (pressure test).

TESTING:—Test equipment should be connected at pump outlet. Disconnect fuel line from pump to carburetor at pump, use special fitting and connect "T" connection, use rubber tubing to join gasoline line to end of "T", connect test equipment (bleeder line, pressure gauge and shut-off valve to open and close bleeder line) to side opening of "T" connection. Operate engine and make Capacity Test and Pressure Test as described below. Capacity and Pressure Specifications on each type pump listed in tables below. If pumps do not test to these specifications, manufacturer recommends that pump be replaced with a replacement exchange pump. Refer to individual article for each pump type on following pages for description and operation.

FUEL PUMP UNIT

TROUBLE SHOOTING:—If the pump action is not satisfactory, check in accordance with the following table:

No Fuel or Insufficient Fuel at Carburetor:

(1) Gasoline tank empty.
(2) Bent, kinked, leaky tubing or connections. Tighten all connections. Check condition of tubing. Replace if necessary.
(3) Dirty filter screen or loose sediment bowl. Take off glass sediment bowl, clean filter screen. Examine cork gasket and replace if necessary. Tighten bowl thumbnut securely.
(4) Loose valve plugs or caps. Examine gasket under head of plug, replace if necessary. Tighten plugs securely.
(5) Dirty or warped valves. Loose valve seat. Remove valve plugs and take out valves. Wash valves in gasoline. If warped or gummed, replace. Examine valve seat for smooth surface and see that seat is tight in pump body. Replace valves and assemble valve springs and plugs.
(6) Worn linkage, weak driving spring. Check for excessive play in linkage or worn rocker arm pin which will shorten pump stroke. Check driving spring (under diaphragm).
(7) Insufficient pump capacity. Check capacity (above).

Fuel Leakage through Vent in Pump Body:

(1) Worn or punctured diaphragm. Replace diaphragm.
(2) Loose diaphragm nut or defective gasket. See that nut on upper end of pull rod is tight and that gasket under nut is in good condition.

Fuel Leakage at edge of Diaphragm:

(1) Loose cover screws. Tighten cover screws securely (alternately around pump body).

Carburetor Flooding:

(1) Carburetor needle valve not seating. Check for worn valve or seat, sediment or other obstruction preventing seating of valve. Check float level.
(2) Excessive pump pressure. Check pressure (above).

VACUUM PUMP UNIT

TROUBLE SHOOTING:—If vacuum pump performance is not satisfactory as evidenced by faulty windshield wiper action, check as directed in following table:

Windshield Wiper operations slow at high speeds or when accelerating. Indicates that vacuum pump is not operating. Check windshield wiper lines and fittings. If no leaks are found, disassemble and inspect vacuum pump.

Oil Smoke in Engine Exhaust. Indicates punctured diaphragm. To check before disassembling pump, disconnect line between pump and manifold, operate pump, hold a piece of paper over pump outlet. Oil spray in exhaust from pump indicates a punctured diaphragm (if no oil spray noted at this point, oil smoke may indicate defective piston rings, etc.

PUMP SPECIFICATIONS (ALL TYPES)

Type	Minimum Capacity	Maximum Pressure
G	1 Pint in 45 Seconds	3½ lbs.
N, R	1 Pint in 1 Minute	3½ lbs.

REPLACEMENT PUMPS

Pump No.	Static Pressure (Lbs.) Min.	Max.
406, 409	1½	3
432, 433	1½	2¾
541, 543	1½	2¾

AC TYPE R

Ford V8 "60", All Models (1937 to 1940)
Ford V8, "85", "90", "100" Models (1936 to 1949)
Ford 6 Cyl., All Models (1941 to 1949)
Ford 4 Cyl. Comm'l & Truck Models (1941-42)
Mercury, All Models (1939 to 1949)

FORD, LINCOLN, MERCURY FUEL PUMP NOTE: AC and Ford Part Numbers for pumps used on these models are listed below. NOTE—Pump Nos. 433 and 541 are interchangeable but No. 433 has smaller sediment chamber and will require servicing at more frequent intervals.

FORD, LINCOLN, MERCURY FUEL PUMPS

Ford No.	AC No.	Pump Type	Exch. Pump No.
B-9350	856253	G	406
18-9350	1521134	N	409
52-9350 HA	1521459	R	433
52-9350-B	1523257	R	432
40-9350	1533138	R	433
40-9350-B	1531764	R	433
68-9350	1523307	R	433
11A-9350	1537383	R	541
1GA-9350	1538529	R	543
26H-9350-A	1537709	R	

NOTE:—Type R is similar in design to Type T. See following article on Type T for complete description and servicing data for Type R pumps without oil seal. Data on pumps with oil seals are given below.

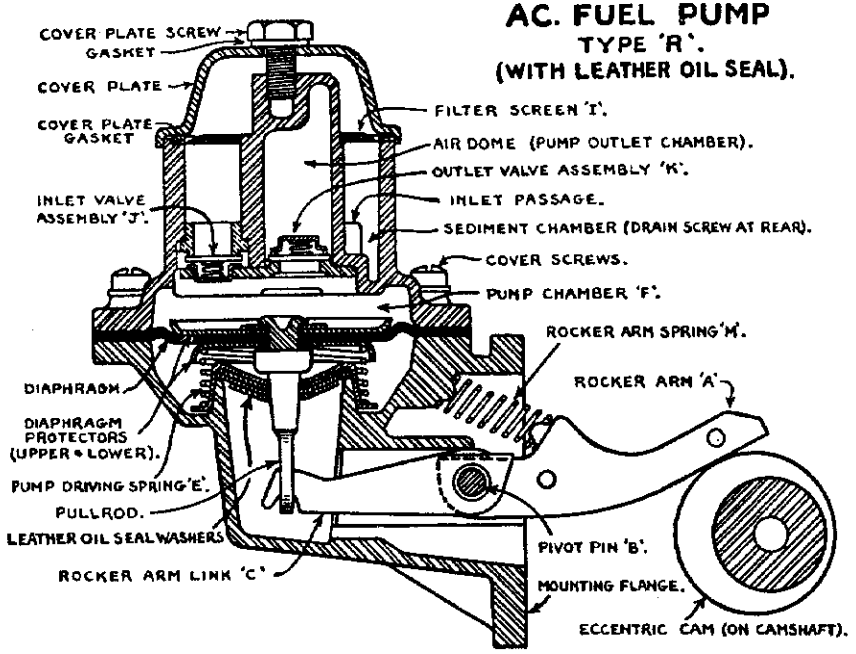
OIL SEAL NOTE:—Pump differs from other Type R pumps only in that an Oil Seal is assembled on the lower end of the pull rod below the diaphragm. The Oil Seal assembly consists of an upper retainer (with a flange at its lower end serving as lower seat for the driving spring), two leather oil seal washers, and a lower retainer. The entire assembly is locked in place on the pull rod stem by the shoulder on the lower end of the pull rod and rests on the pump boss in the pump body (see illustration). The operation of the pump is entirely similar to other Type R pumps.

SERVICING:—Trouble Shooting and servicing for this pump are the same as for other Type R pumps except for the special directions given below for the removal of the diaphragm assembly, assembling of oil seal on the pull rod, and replacing of diaphragm assembly in the pump.

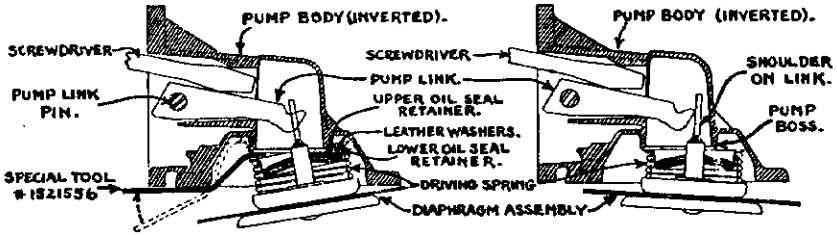
To Remove Diaphragm Assembly from Pump:—Use special tool #1521556, which is designed to free lower retainer from boss on pump body (if this tool is not used, it will be necessary to remove rocker arm pin in order to free pull rod from rocker arm linkage). To remove diaphragm assembly (with pump cover or upper body removed), invert pump body, force edge of special tool under edge or flange of upper oil seal retainer, pry on tool to move flange on retainer up onto top edge of pump boss. Hold pump link against upper stop by wedging a screwdriver between the link and the bottom of the pump body, push down on diaphragm and away from end of

link. This will unhook the pull rod from the link and diaphragm assembly can then be removed. Diaphragm assembly should be replaced as a unit (see directions below for assembly of oil seal on pull rod).

To Assemble Oil Seal on Diaphragm Assembly:—Place driving spring (E) in position on pull rod against lower diaphragm protector, place upper oil seal retainer in position on lower end of driving spring with cupped portion within spring, compress spring by pressing on oil seal retainer until retainer is below shoulder on pull rod, then rotate retainer ¼ turn so that it is locked in place. Force two leather oil seal washers down on pull rod stem



REMOVING DIAPHRAGM ASSEMBLY. INSTALLING DIAPHRAGM ASSEMBLY.



until they rest against upper retainer, assemble lower retainer below washers and lock in place by rotating ¼ turn. The complete assembly is then ready to be installed in the pump.

To Install Diaphragm Assembly in Pump:—Invert the pump body, hold link against upper stop by wedging screwdriver between link and bottom of pump body, insert diaphragm assembly in pump body, tilting assembly so that flange on upper oil seal retainer rests on top edge of pump boss and pull rod clears end of link (see illustration). Press down on diaphragm assembly and hook pull rod over end of link, then push diaphragm back into vertical position and center in pump body so that oil seal retainer snaps into place around pump boss. The upper pump body can then be put in place and the screws installed.

TROUBLE SHOOTING:—See article on Fuel Pump Trouble Shooting. Use Fuel Pump Analyser to check pump performance before removing pump from car.

AC AUTHORIZED

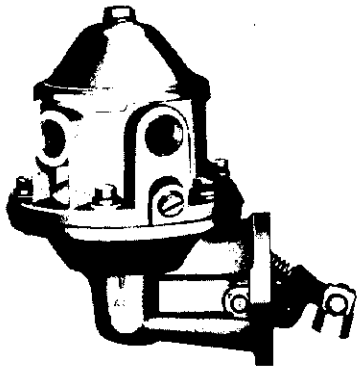
FACTORY REBUILT FUEL PUMPS

Make, Year and Model	† Factory Pump No.	Series	Rebuilt Pump Type
Ford			
Eng. 6-90			
1941-47, Models 1GA, 2GA, 6GA	8529	R	543X
1947-50, All 6 Cyl. Vac. Cont. Dist.	9287	CC	592X
Eng. V8-80, 85, 90, 95, 100:			
1938-39, Models 81A, 91A,	3307	R	591X
99A	7383	R	541X
1940, Models 01A, 09A	7383	R	541X
1941-42-46, Models 11A, 19A, 21A, 29A, 69A,	7383	R	541X
69M	9047	BR	571X
1947-48, Model 51A, Ford 8, 51C Com.	9047	BR	571X
Ford Truck			
Eng., 6-90			
1941-47, Models Ser. 1G, 2G, 6G, 7GA	8529	R	543X
1947-49 Models, All 6 Cyl. Vac. Cont. Distr.	9287	CC	592X
Eng. V8-60 Small			
1937-40, Models 73-75	3257	R	432X
Eng. V8-80, 85, 90, 95, 100			
1938-39 Models, Ser. 81, 811, 817; Ser. 91, 911,	3307	R	591X
917; Ser. 99, 991, 997	7383	R	541X
1940 Models, Ser. 01, 011, 018; Ser. 09, 091, 098	7383	R	541X
1941-46 Models, Ser. 11, 111, 114, 118; Ser. 19, 191, 198; Ser. 21, 211, 214, 218; Ser. 29, 298;			
Ser. 59, 598; Ser. 69,	7383	R	541X
691, 698	9047	BR	571X
1946-47, 100 H.P., 8 Cyl.			
Models 51A, 59A, 51c,	9047	BR	571X
51T	7774	AU	563X

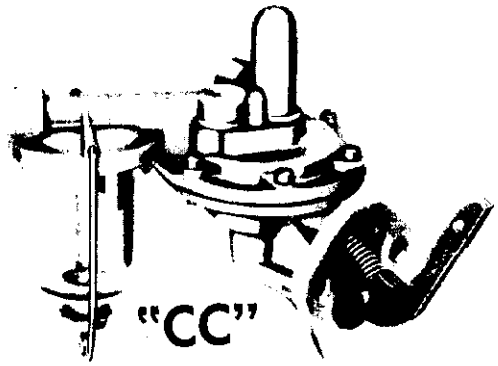
CONTINUED ON NEXT PAGE

Make, Year and Model	† Factory Pump No.	Series	Re-built Pump Type
Ford Truck			
1948-50, All 8 Cyl., 100 H.P.	9119 9139	BX BY	578X 586X
1948-50, All 8 Cyl., 145 H.P.	9206	CA	9206X
Mercury			
1939-40 Models 99A, 09A	7383	R	541X
1941 thru 1946	3307 7383 9047	R R BR	591X 541X 571X
1947	9047	BR	571X
1948-49-50	9119	BX	578X

†When more than four digits appear on pump mounting flange, the last four digits provide positive identification



"R"



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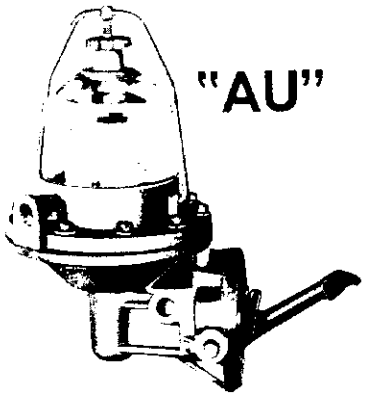
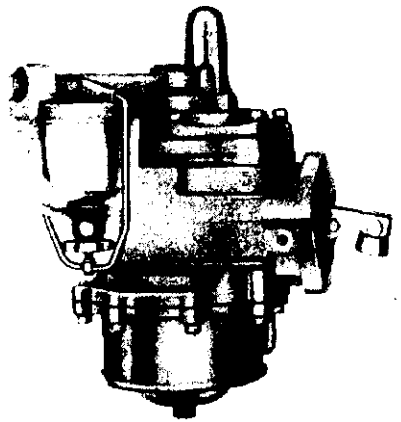


"AU"



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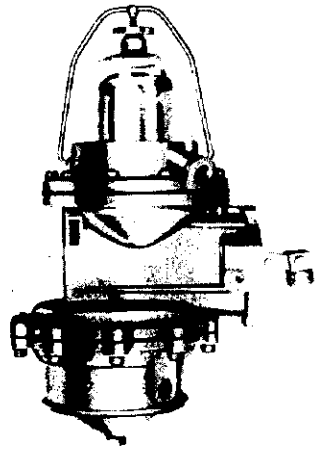

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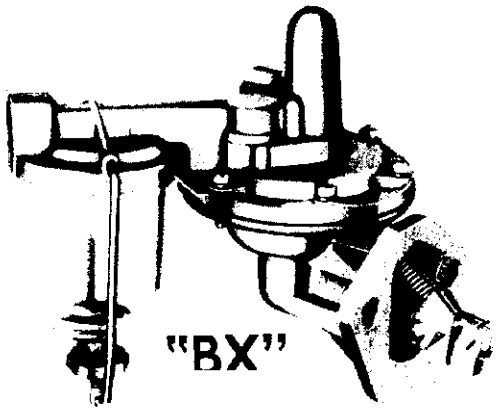

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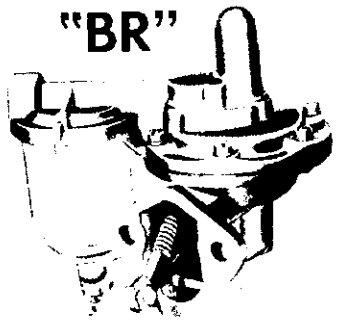

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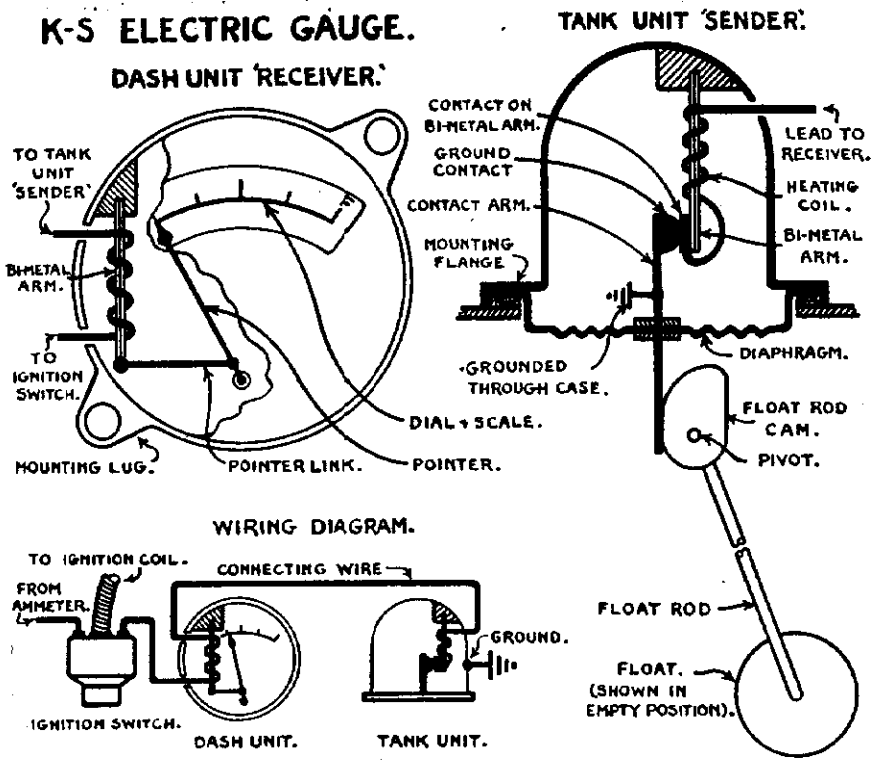
TYPICAL SERIES ILLUSTRATIONS – ACTUAL PUMPS IN EACH SERIES MAY VARY SLIGHTLY IN APPEARANCE FOR ACCURATE IDENTIFICATION, CHECK FOR FACTORY NUMBER STAMPED ON PUMP.

KING-SEELEY GASOLINE GAUGE

K-S ELECTRIC GAUGE.



DESCRIPTION:—This is an electric type gauge of a new type using bi-metal arms on which heating coils are wound in both the tank or engine unit 'Sender' and the dash unit 'Receiver'. The two heating coils are connected in series and the gauge circuit is completed to ground through a set of contacts in the Sender unit (one of which is mounted on the bi-metal arm). The feed wire on the Receiver unit is connected to the accessory terminal of the ignition switch so that the gauge registers only with the ignition on.

Gasoline, Oil, Water Level—For this purpose the ground contact in the Sender is mounted on a movable arm (arm mounted through diaphragm forming lower cover of Sender unit and flexes diaphragm as it is moved). The lower end of the ground contact arm is actuated by a cam on the upper end of the float rod pivot. When the float moves up to follow the gasoline, oil, or water level, the cam moves the arm so that contact pressure and length of time contacts remain closed is increased.

OPERATION:—When the Sender contacts are closed a current flows through the heating coils of both the Sender and Receiver units. This causes the bi-metal arm in the Receiver to bend, moving the pointer, and indicating a reading on the gauge dial. At the same time the heating coil in the Sender unit causes its bi-metal arm to bend, opening the contacts and interrupting the current flow. When this occurs the heating action stops and the cooling of the bi-metal arm causes it to flex in the opposite direction and again close the contacts. In operation, this cycle takes place very rapidly (approximately once each second for the gasoline gauge with tank empty), and a steady reading is obtained on the Receiver dial.

TROUBLE SHOOTING:—**Gasoline, Oil, Water Level Gauges**—Manufacturer recommends use of extra or test Sender and Receiver to check operation of units which do not perform satisfactorily. Make tests as directed below:

Testing Sender:—Disconnect lead of Sender unit on car, connect this lead to test Sender and ground this Sender to the car frame. Turn on ignition, move Sender float up to 'full' position and note reading on Receiver. Receiver should read full or 'F' after 10-15 seconds time. If Receiver reading is correct, check following points before replacing Sender unit.

1. Ground. Sender is grounded through case| See that all paint and grease are removed under flange and both surfaces make good contact.

2. Radio By-pass Condenser Shorted. If by-pass condenser is connected at Sender on cars with radio, test for short-circuit by disconnecting condenser and noting gauge operation. If gauge is satisfactory, replace condenser. Use only condenser of .05 microfarad capacity (manufacturer recommends Cornell Dubilier Corp. Condenser No. 22-259).

If reading is secured with test Sender is same as that with Sender on car, check wire connecting Sender and Receiver and replace if found to be open-circuited or grounded.

Testing Receiver—Disconnect wires on Receiver on car and connect to same terminals on test Receiver. Turn on ignition switch and note reading on gauge. If test Receiver reading is correct, replace Receiver on car. If test Receiver reading is same as car Receiver, repeat tests on Sender and wiring.

SERVICING:—No service operations are required other than to see that wires are properly connected and terminals are tight. No repair operations are possible and defective Senders and Receivers should be replaced.

FORD BATTERY INDICATOR

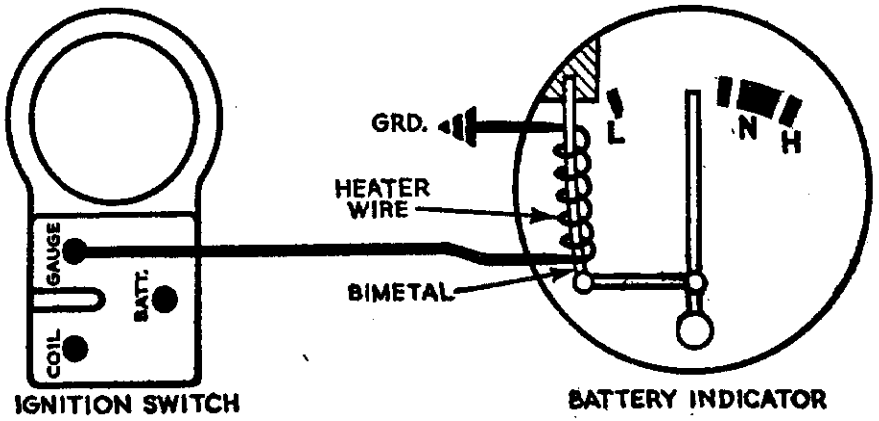
1939-40 FORD, MERCURY BATTERY INDICATOR

FORD MODELS

"85" Deluxe 91A (1939)	91A-10844B
Other Models (1940)	01A-10844A
Cars, 2-Brush Gen. ('39)	91A-10844A
"85" Deluxe 01A (1940)	01A-10844A

MERCURY MODELS

Model 99A (1939)	99A-10844
Model 09A (1940)	09A-10844



DESCRIPTION:—This gauge is a 'hot wire' type voltmeter calibrated to show battery voltage ranges rather than actual volts. It consists of a simple bimetal arm linked to the gauge pointer and wound with a heater wire. The heater wire circuit is controlled by the ignition switch.

OPERATION:—When the ignition switch is turned on, a current flows through the heater wire on the bimetal arm (approximately 1/10 ampere—heater wire resistance is 60 ohms), heating the arm and causing it to bend so that a reading is indicated on the gauge. Gauge reading indicates line voltage.

READING THE GAUGE:—See illustration for gauge dial markings. This marking should be interpreted as follows: **Left hand Line Marked 'L'—2 volts. Unmarked line to left of 'N' range—6 volts.** If pointer drops below this mark, battery, starter, wiring, and generator should be checked (Performance Test). If pointer is above this 6 volt mark, but below the 'N' range, battery load is greater than generator charging rate and electrical system and generator should be checked. **'N' Range**—This segment indicates the normal line voltage range from 6.75 volts (left hand end) to 8.25 volts (right hand end) and indicates that generator charging rate is in excess of the load. **Right Hand Line Marked 'H'—9 volts.**

This voltage is too high and unsafe for lamp bulbs and wiring. Check wiring and generator and correct conditions causing this high voltage.

TESTING & SERVICING:—To check gauge accuracy, connect test voltmeter in parallel with Battery Indicator (connect one test voltmeter lead to battery indicator terminal, ground other voltmeter lead), turn on ignition switch and note if both gauge readings agree (see 'Reading the Gauge' section above for meaning of battery indicator dial markings). Replace defective units

DIRECTION SIGNALS

MERCURY, ALL MODELS (1942 to 1948)

DESCRIPTION: Direction Signals use a special 21 cp. filament combined with the parking lamps in the front Fender Lamp (21-3 cp. bulb) at the front of the car, 21 cp. filament combined with tail lamps in the Rear Lamp Assembly (21-3 cp. bulb) at the rear of the car (Stop lamp is separate 21 cp. bulb in assembly with Rear License lamp at center of body in rear), and pilot indicator lamps on instrument panel.

Flasher unit is mounted on Ignition Resistor and Lighting Circuit Breaker unit in back of instrument panel with fuse in connector in line between flasher and feed terminal of ignition resistor unit.

Control Switch—Built in housing on steering column below steering wheel with switch lever extending out toward left side. Switch has automatic turn-off mechanism by which switch is returned to off position when steering wheel rotated back to straight ahead position after a turn has been completed.

Wiring Diagram—See wiring diagram on car model page for complete Direction Signal circuit and fuse data

OPERATION:—Switch must be operated manually to indicate a turn but is turned off automatically when steering wheel straightened out after turn has been completed. Switch handle should be moved in same direction steering wheel is rotated to make a desired turn (up for right turn, down for left turn). Operating the switch completes the circuit through the flasher to the right or left Front Direction Signal, Rear Signal, and Pilot Indicator on instrument panel

SERVICING:—If pilot indicator does not flash when switch operated to indicate a turn, check for burned out bulbs, defective flasher, or blown fuse. For access to switch, remove steering wheel.

DIRECTION SIGNAL LAMPS & FUSE: See car model page for complete data.

FORD REGULATORS

FORD TWO-UNIT VOLTAGE-CURRENT REGULATORS

Car Model	Generator	Regulator Model
Ford '60' 922A, C, 92Y, ('39)	82-A-10000-D, E	91-A-10505-A
Ford '85' 91A,C,Y (1939)	81-A-10000-D, E	91-A-10505-A
Ford '85' 91A Deluxe ('39)	91-A-10000	91-A-10505-A
Ford '85' & '95' Trks. ('39)	81-T-10000-A, B	91-A-10505-A
Ford '95' 99C (1939)	81-A-10000-D, E	91-A-10505-A
Ford '60' 022A, 022C ('40)	01-A-10000	01-A-10505-A
Ford '85' 01A, 01C ('40)	01-A-10000	01-A-10505-A
Ford Trucks exc. C-O-E ('40)	01-A-10000	01-A-10505-A
Ford C-O-E Trucks ('40)	81-T-10000-A, B	01-A-10505-A
Mercury 99A (1939)	91-A-10000	91-A-10505-A
Mercury 09A (1940)	01-A-10000	01-A-10505-A

REPLACEMENT REGULATOR NOTE:—New type three-unit Voltage-Current Regulator used on late 1940 cars and trucks and furnished for replacement on above models. See following article for service data on this new type.

SERVICE NOTE:—Regulator covers are sealed and should not be removed. No adjustments are possible and units which are defective as determined by tests given below should be replaced.

Bench Test Caution—Ford Generator and Regulator circuits and wiring not same as units used on other cars and these units must always be tested together. Do not operate generator or regulator with regulator or generator of other make on test sets.

TYPE:—Regulator consists of a vibrating type combination voltage-current regulator and a cutout relay in a single case designed to be mounted on the dash and used in conjunction with a two-brush shunt wound generator (see illustration).

OPERATION:—Voltage Regulation. Regulator voltage winding is connected across the generator main brushes. When the generator voltage reaches the value for which the regulator is set, regulator contacts vibrate (cutting the resistance in and out of the field circuit) so that the voltage is held constant (winding actually connected in two sections, one of which is short-circuited by the contacts when they are closed but is energized when the contacts open—see illustration).

Current Regulation. Current coil on regulator is connected in series in charging circuit so that the entire generator output flows through this winding. When the current reaches the maximum for which the regulator is set, the regulator contacts vibrate and the output is held from exceeding this figure.

CHECKING & ADJUSTING:—When checking regulator on the car, test Battery, Charging Circuit, and Regulator in order as described below. Regulator should be at normal operating temperature (operate car for approximately 5 minutes).

Battery:—Check battery with 'BRS' attachment and Ford Test Set. If battery tests less than 70%, recharge battery or install fully charged battery.

Charging Circuit:—Check entire circuit for high resistance as follows: Operate engine at 1250 RPM. with generator charging battery (use HI-TAC tachometer and Ford Test Set to set engine speed. Turn on Headlamp Country Beams. Use 3-volt voltmeter test leads, connect one lead to positive post of battery, other lead to generator frame or positive (grounded) main brush. Voltmeter reading must not exceed .1 volt (Ford Test Set 'B' scale reading of 4). Then check resistance between generator and regulator by connecting one voltmeter lead to generator 'A' terminal, other lead to regulator 'A' terminal (armature terminal). Note voltmeter reading (or 'B' scale reading on Ford Test Set), then shift voltmeter lead from regulator 'A' terminal to regulator 'B' terminal (battery terminal) without disturbing lead at generator 'A' terminal. Voltmeter or Ford Test Set 'B' scale reading must not be more than 6 times previous reading (from generator to regulator 'A' terminals). Then shift voltmeter lead to negative post of battery (without disturbing lead on generator 'A' terminal), voltmeter or Ford Test Set 'B' scale reading must not be more than 6½ times first reading (from generator to regulator 'A' terminals). If voltmeter readings too high (indicating high resistance in charging circuit), correct this condition by cleaning and tightening terminals or replacing wiring before checking and adjusting regulator.

Regulator:—Voltage regulator should be tested with a resistance of ¾ ohm (two 32 cp. headlamp bulbs) in generator circuit instead of battery to eliminate differences caused by battery being more or less charged. Regulator temperature should be carefully gauged with thermometer in contact with regulator case (performance varies with temperature).

Relay Cut-in Voltage—Connect 15 volt voltmeter between generator 'A' terminal and ground. Start engine and slowly increase speed until cutout relay contacts close (pointer will drop back slightly). Note voltmeter reading at instant contacts close. Cut-in voltage should be 5.8-6.3 volts. NOTE—This test should not be repeated unless necessary since residual magnetism of cutout relay will cause successive cut-in voltage figures to be slightly lower.

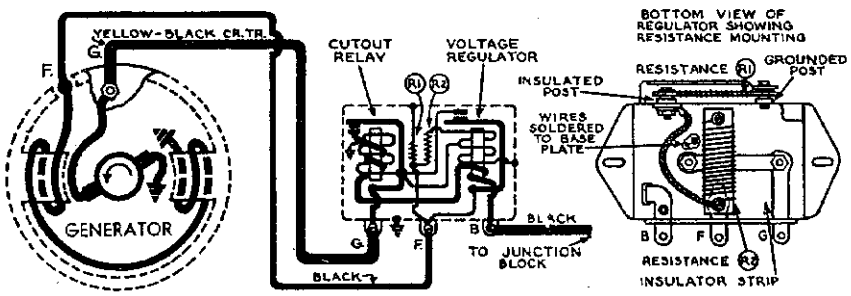
Voltage Setting Test—Disconnect lead at regulator 'B' terminal, connect special ¾ ohm resistor (Heyer No. DABAE) or two 32 cp. headlamp bulbs in series between this terminal and ground (so generator output flows through both bulbs in series), connect voltmeter between 'B' terminal and

CONTINUED ON NEXT PAGE

ground. Operate generator at speed of exactly 2300 RPM. and note voltmeter reading. If voltage is within range given in table below, regulator is OK. If voltage is below minimum or above maximum figure, replace regulator.

NOTE—With this ¾ ohm resistor connected between regulator terminal and ground, generator output will be approximately 10 amperes.

Ford Test Set 'B' Scale Maximum	Minimum	Voltage Setting Temperature	Equivalent Volts Maximum	Minimum
51	43	60°	7.65	7.20
50	47¼	80°	7.50	7.0875
49½	46¾	100°	7.425	7.0125
49	46¼	120°	7.35	6.9375
48¾	45¾	140°	7.3125	6.8625
48¼	45½	160°	7.2375	6.825
48¼	45½	180°	7.2375	6.825



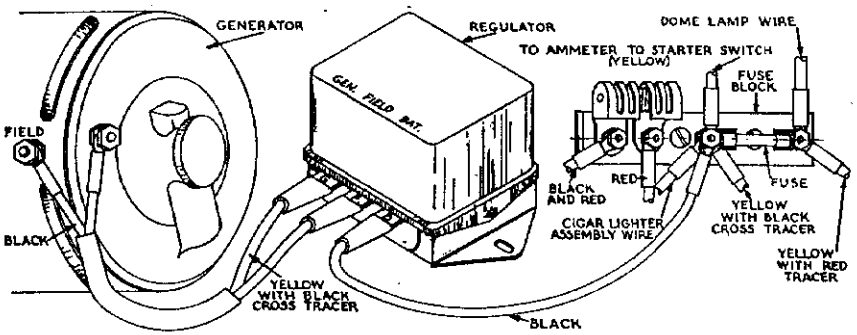
FORD TWO-UNIT VOLTAGE-CURRENT REGULATOR CIRCUIT

Current Setting Test—Use 'BRS' test set attachment to discharge battery until voltage drops to 5¾ volts. Connect ammeter in charging line at regulator 'B' terminal. Operate engine at speed at which maximum output produced (see car model pages for generator data). Note the ammeter reading. Current should be 30-33 amperes and if in excess of this figure the regulator should be replaced.

Cutout Relay Reverse Current—After checking Current Regulator (above) and without disturbing test connections, slowly decrease generator speed until ammeter indicates discharge "reverse" current through cutout relay (on Ford Test Set, meter plug should be reversed in socket when charging current drops to approximately 5 amperes so that discharge current can be read on dial). Note ammeter reading at instant contacts open (ammeter pointer will drop to zero when contacts open). Reverse current varies with temperature but must not exceed 8 amperes.

INSTALLING NEW GENERATORS & REGULATORS:—Disconnect battery ground strap. Disconnect yellow wire with black tracer (old generator lead) from fuse block, draw this two-wire cable (contains also black wire not used with three-brush generator) back through rubber grommet in dash. Mount regulator securely on dash on bosses provided (near bottom on first cars, on inclined surface to left of center on later cars—avoids interference with oil-bath air cleaner and the oil filter when installed). Connect regulator ground lead to the dash (scrape paint from dash and tighten ground lead screw securely for good ground connection). Insert special black wire through the dash grommet, connect one end to fuse block, opposite end to regulator 'B' terminal. Disconnect wire on old generator, replace with new generator (do not install belt). Connect wires in two-wire cable to regulator as follows: Yellow-with-black tracer wire to regulator 'G' terminal, Black wire to 'F' terminal. Connect black wire (field lead) to other (field) terminal on the generator. Connect battery ground strap, touch yellow-with-black tracer wire to 'G' terminal on generator commutator endplate. No spark should be evident and generator should not motor or show other reaction (see Note below). If O.K., connect wire permanently, install fan belt. NOTE—The generator output may be as low as 6-7 amperes with ignition load only, or as high as 30-35 amperes with low battery and maximum load.

NOTE—If spark noted or if generator tends to rotate when wire touched to generator terminal in test (above), regulator is defective or other wires have been connected incorrectly.



FORD TWO-UNIT VOLTAGE-CURRENT REGULATOR

FORD THREE-UNIT VOLTAGE-CURRENT REGULATORS

Model	Generator	Regulator
Ford, 4 Cyl. Trucks ('41-42)	1NC-10000	01A-10505-C
Ford, 6 Cyl. "G" Cars & Trucks ('41)	1GA-10000-B	01A-10505-C
Ford, 6 Cyl. "G" Cars & Trucks ('42-47)	2GA-10000-A	01A-10505-C
Ford, 6 Cyl. "H" Cars ('47-48)	7HA-10001-B	01A-10505-C
Ford, 6 Cyl. "H" Cars ('49)	8BA-10002-A	51A-10505-C or E
Ford, 6 Cyl. "H" Trucks ('47)	7HA-10001-B	01A-10505-C
Ford, 6 Cyl. "H" Trucks ('48)	8BA-10002-A	51A-10505-C or E
Ford, V8 Cars ('41)	01A-10000-B	01A-10505-C
Ford, V8 Cars ('42-48)	21A-10000	01A-10505-C
Ford, V8 Trucks ('41)	01A-10000-B	01A-10505-C
Ford, V8 Trucks ('42-47)	21A-10000	01A-10505-C
Ford, V8 Trucks ('48)	8BA-10002-A	51A-10505-C or E
Mercury, Model 19A ('41)	01A-10000-B	01A-10505-C
Mercury, All Models ('42-48)	21A-10000	01A-10505-C

►NOTES, CAUTIONS, & CHANGES

PRODUCTION CHANGE NOTE: Regulators with several minor differences will be found in service as follows:

Regulator Ground Lead—On some regulators, ground lead consists of a braided pigtail connected to a lug on the regulator case by which the regulator is grounded directly to the engine dash. The regulator case ground lug is attached to the regulator case by the cover rivet and this ground connection is disturbed by removal of the regulator cover. On other regulators, the ground connection consists of a separate wire which is connected to the regulator case and grounded to a terminal screw on the generator frame. CAUTION—Ground lead must be in place when regulators are tested. If ground disturbed by removal of regulator cover, re-install ground lead before making regulator tests.

Regulator Wiring Color Code—On some regulators, wire colors are marked on regulator cover adjacent to terminals. See individual car wiring diagrams in car model section for wire colors and regulator connections.

1940 PRODUCTION NOTE:—These new 3-unit Regulators were used on late 1940 Ford, Lincoln, and Mercury (after July) and are also furnished as Service Replacement for the earlier 2-unit type regulator. All data given below applies to 1940 and earlier cars with this new 3-unit regulator.

►**REGULATOR CONTACT DESIGN CHANGES:** Contacts on early regulators can be replaced with later design contacts listed below.

Current Regulator Later Design Contacts: Following parts required:
No. 01A-10551-A—Armature with silver contact.
No. 01A-10653-A—Contact screw with silver contact (screw .41" long).
No. 01A-10568-A—Spacer (additional spacer installed bet. armature & frame).

CONTINUED ON NEXT PAGE

Voltage Regulator Later Design Contacts: Following parts required:
No. 01A-10551-B—Armature with tungsten contact (brass rivet under arm).
No. 01A-10653-B1 or B2—Contact screw with platinum contact.
No. 01A-10568-B—Spacer (replaces original spacer on box type shunt regulators, or used together with old spacer on old type voltage regulators).

See "CONTACT REPLACEMENT" following for installation of these parts.

►**GROUND CAUTION:** Make certain regulator and generator ground in place when these units operating. See car page wiring diagram for ground locations.

DESCRIPTION

DESCRIPTION: 3 unit (Cutout Relay, Voltage Regulator, Current Regulator) regulator with separate voltage and current regulator units (these units were combined on previous 2-unit regulators). Regulators are vibrating type and charging rate is normally controlled by Voltage Regulator. Current Regulator operates when current reaches value in excess of rated capacity and limits current to this figure. Both regulators operate in the same manner by cutting the resistance in and out of the field circuit and control the generator output by regulating the field current. Cutout Relay is compensated for temperature by means of a bi-metal clip on the armature spring so that the cut-in voltage is held constant throughout the normal temperature range.

►*CAUTION*—Ford Generators and Ford Regulators are not wired in the same manner as units of other makes and cannot be operated in conjunction with units of other makes. Always operate Ford Generators & Regulators together.

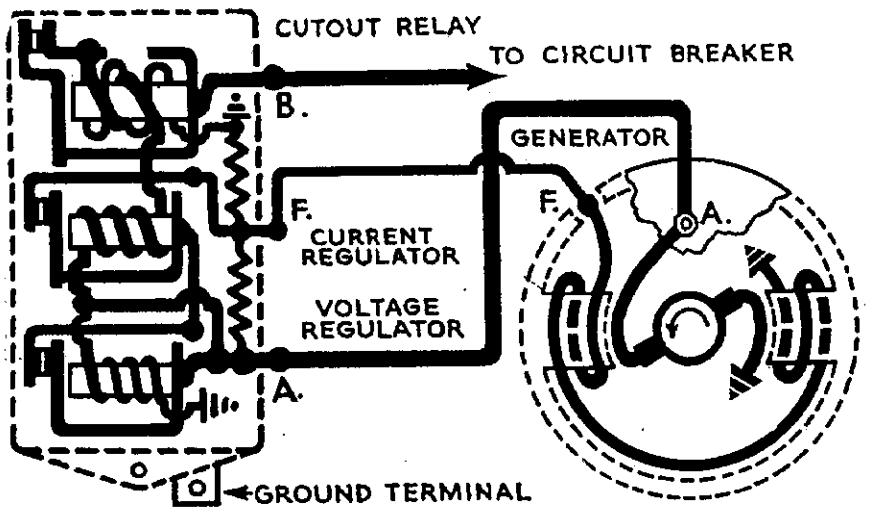
CHECKING GENERATING CIRCUIT

CHECKING GENERATING CIRCUIT: Preliminary check of Battery, Charging Circuit Resistance, and Generator Output should be made to locate trouble if generating circuit faulty.

Battery: If specific gravity below 1.250, recharge battery or install fully charged battery.

Charging Circuit: Check entire circuit for high resistance as follows:

1)—**Generator to Battery Resistance**—Connect voltmeter negative lead to generator "A" terminal. Connect ammeter in series at regulator "B" terminal. Set engine speed to charge more than 5 amperes. Connect voltmeter positive lead to "A" terminal of regulator and check this original voltmeter reading. Touch regulator "B" terminal with voltmeter positive lead and check reading. Reading must not be more than 6 times original reading above (if more than 6 times, loose or faulty connections or excessive resistance in cutout points indicated). Then check reading secured by touching voltmeter lead to negative battery post. Reading must not be more than 6½ times original reading above (if reading too high, loose or faulty connections indicated).



FORD THREE-UNIT VOLTAGE-CURRENT REGULATOR CIRCUIT

2)—**Ground Circuit Resistance**—With 20 ampere or more charging rate, connect voltmeter positive lead to positive battery terminal, negative lead to generator frame. Reading should not be in excess of 0.1 volt (if reading high, faulty ground indicated at ground straps or at generator bracket).

Generator Output: Connect jumper between "A" and "F" generator terminals. Disconnect wire at regulator "A" terminal. With engine running at approx. 1500 RPM., connect ammeter negative lead to generator "A" terminal and positive lead to battery negative terminal. Turn on cars lights and press starter button (or if Ford Test Set used cut in load). Ammeter reading should be at least 30 amperes (40 amperes on '49 Lincoln). If reading too low, repair or replace generator.

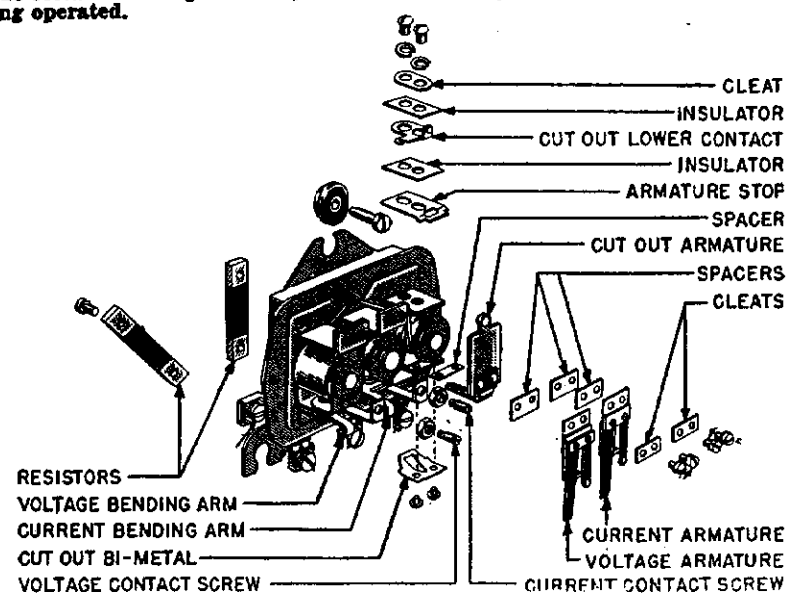
►*CAUTION—After Generator Output Test completed, disconnect ammeter before stopping engine. Disconnect jumper on generator after engine stopped. Engine should be stopped as soon as possible to prevent overheating generator.*

CHECKING & ADJUSTING REGULATOR

CHECKING & ADJUSTMENT OF REGULATOR: Use "fixed resistance" method, requires a special ¾ ohm fixed resistance capable of carrying 10 amperes and which does not change in value due to temperature changes. A special Heyer 'DABAE' ¾ ohm resistance unit available for this purpose. To install resistor, disconnect charging line at regulator 'B' terminal (leave this lead disconnected while tests being made), connect ¾ ohm resistor to regulator 'B' terminal and ground opposite end of resistor. Then check and adjust regulator as directed below. NOTE—With this ¾ ohm resistor connected between regulator and ground, generator output is approximately 10 amperes.

►*NOTE*—Regulator should be at normal operating temperature when checking regulator settings.

►*CAUTION*—Ground connection must be in place when generator and regulator are operated. If ground wire disturbed by removal of regulator cover, make certain that regulator is grounded whenever generator and regulator are being operated.



FORD THREE-UNIT VOLTAGE-CURRENT REGULATOR

Relay Cut-in Voltage—6.1-6.3 volts (6.4-6.9 volts starting 1949) at operating temperature. To check, connect 10 volt voltmeter between generator "A" terminal and ground. Start engine and slowly increase speed until cut-out relay contacts close (pointer will drop back slightly). Cut-in voltage should be within limits listed above. To adjust, remove regulator cover, bend bi-metal at lower end of cutout relay armature spring in to increase tension and raise cut-in voltage, bend out to decrease tension and lower cut-in voltage.
CAUTION—Cut-in voltage reading should be noted on first test and test should not be repeated as residual magnetism of the relay will cause subsequent cut-in voltage figures to be slightly lower.

►*IDLE SPEED NOTE*—If higher than cut-in point, it will be necessary to back **off throttle stopscrew and lower idling speed below cut-in point before the above test can be made. If idling speed changed in this manner, make certain that speed is reset at 500 Eng. RPM. (5-7 MPH.) after tests completed.**

Voltage Regulator Setting—7.0-7.3 volts (7.0-7.5 starting 1949) at operating temperature. After checking Relay Cut-in Voltage (above), re-install regulator cover if removed. Disconnect ¾ ohm resistance used above. Connect ammeter in series at regulator "B" terminal. Obtain 10 ampere reading by turning on headlights and accessories if required. Note voltmeter reading when engine speed increased to approx. 1500 RPM. (should be within limits listed above). To adjust, remove regulator cover, bend spring adjustment (bending arm)—see illustration—upward to increase tension and raise voltage setting, bend down to decrease tension and lower voltage setting. Re-install cover and repeat test, re-adjusting setting if required.

Current Regulator Setting—30 amperes (40 amperes for 1949 Lincoln) at operating temperature. After checking Voltage Regulator Setting (above), re-install regulator cover if removed. Proceed as for Voltage Regulator check with engine speed approx. 1500 RPM., press starter button (to increase load). Note ammeter reading (should agree with setting given above). To adjust, remove regulator cover, bend spring adjustment (bending arm) for current regulator—see illustration—upward to increase tension and raise current setting, bend down to decrease tension and lower current setting.

Cutout Relay Reverse Current—8 amperes maximum reverse current. After checking Current Regulator (above), reduce engine speed to obtain approx. 5 ampere reading, then reduce engine speed until negative reading secured (just before cut-out points open). Negative reading should be within limits listed above.

►*CAUTION*—After testing completed, remove meters, connect charging line to regulator "B" terminal.

CONTACT REPLACEMENT

CONTACT REPLACEMENT: Cutout Relay and Voltage and Current Regulator Contacts can be replaced as follows:

Cutout Relay: *CAUTION*—Lower cutout contacts replaceable only on regulators where contact mounting secured by screws (if contact secured by rivets, regulator must be replaced if contacts damaged).

Removal of Cutout Relay Contacts—Remove cover. Take out cutout armature, bi-metal, and spacer by removing 2 screws directly above "B" terminal. Disconnect two cutout winding wires from lower contact by softening solder. Remove cleat, insulator, lower contact, and armature stop by taking out 2 screws in lower contact.

Installation of Cutout Relay Contacts—Assemble in following: Install armature stop, insulator, lower cutout contact, insulator, and cleat, and hold in place with 2 screws (do not tighten). Solder 2 cutout winding wires to lower contact. Install armature with spacer under hinge and bi-metal outside hinge, and secure with 2 screws. Set Air Gap, and Contact Gap, and align contacts as described below.

Cutout Relay Contact Gap—.010" with armature against stop.

Cutout Relay Air Gap—.017" between armature and core with contacts open.

Setting Contact Gap and Air Gap—Insert .017" feeler between armature and core. Then set contact gap to .010" using a feeler gauge, by lowering armature stop and raising the lower contact, tighten 2 lower contact screws.

Aligning Cutout Relay Contacts—Contacts must make and break squarely. If adjustment necessary, bend lower contact up or down, then check Air Gap and Contact Gap (may be disturbed by movement of lower contact).

Voltage and Current Regulator: Remove and install contacts as follows:

Removal of Regulator Contacts—With cover removed, remove cleat, armature, and spacer by taking out 2 screws in armature. Loosen contact screw locknut and remove contact screw.

Installation of Regulator Contacts—*CAUTION—Where Later Design Contacts being installed, see parts list at beginning for necessary replacements or additions required.* Install parts on regulator frame in following order: Spacer, armature, and cleat, tighten 2 screws, align contacts if necessary by bending upper contact arm.

Regulator Air Gap—.035" between armature & core with contacts just closed.

Setting Air Gap—Bend the spring adjustment (bending arm)—see illustration—to clear armature spring. Insert .035" gauge (round stock) between armature and core *(CAUTION*—On voltage regulator make certain gauge does not contact rivet on underside of armature). Press armature down, turn contact screw down to just touch armature contact, set contact screw with locknut. Realign contacts if required.

Regulator Contact Spring Tension—5 ozs. minimum with contacts just opening.

Checking Contact Spring Tension—Use a spring scale to measure tension just as contacts open. Adjust upper contact screw after loosening locknut if pressure below limits listed above.

►*Check Relay and Regulator Settings after completing above adjustments.*

FORD B&S STARTER DRIVE

FORD 6 CYL., ALL MODELS (1941-42)
FORD & MERCURY V8, ALL MODELS (1940-41-42)

SPECIAL SERVICE NOTE:—This Starter Drive serviced as an assembly and should not be disassembled. Servicing is limited to cleaning and lubricating the screw threads as directed below. Service Parts furnished as follows: 91A-11350—complete Drive, 91A-11377—Attaching Bolt, 91A-11379 Tang Washer (for bolt).

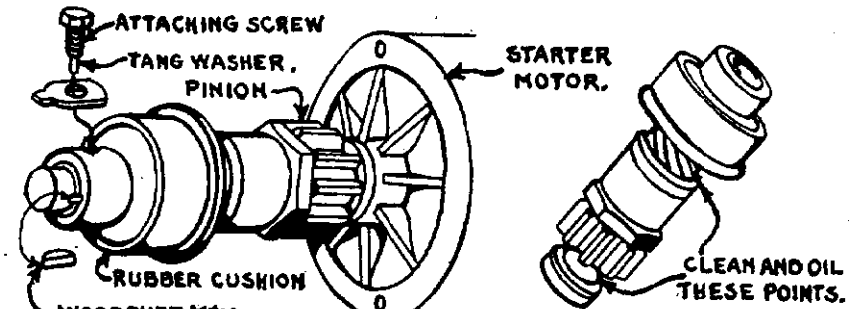
DESCRIPTION:—This drive consists of a rubber-cushioned pinion assembly which threads in on spiral thread on mounting sleeve on starter armature shaft to engage flywheel teeth. Pinion drives through this resilient rubber cushion which absorbs shocks and starting noises. A pin and spring ring assembled in the pinion sleeve prevents pinion engaging with flywheel teeth when engine is running. CAUTION—No attempt should be made to remove or adjust this pin and spring ring.

SERVICING:—Limited to cleaning and lubricating screw threads on mounting sleeve. Parts not furnished separately and drive is serviced by replacement. CAUTION—Do not immerse drive in oil, gasoline, or any type of cleaning fluid which will damage the rubber cushion.

Removal—With starter off engine, straighten tang of locking washer on attaching bolt at outer end of armature shaft, remove bolt. Push drive assembly toward starter to expose woodruff key in outer end of armature shaft, remove key, pull drive assembly off shaft.

Cleaning & Lubricating Drive—Hold drive vertical with pinion end down, move pinion forward to expose threads, squirt kerosene on threads and tube at base of threads move pinion back and forth 5-6 times to distribute the kerosene over the threaded surfaces. Run pinion down and blow excess kerosene off threads, run pinion up and wipe excess kerosene off tube. Apply 10W oil on threads and on tube and washer at base of threads, move pinion back and forth to distribute oil over threaded surfaces. Re-install drive.

NOTE—Drive is lubricated in production with special M-4648-B zinc oxide containing thin grease but 10W oil can be used for lubrication in the field.



FORD B & S STARTER DRIVE

FORD DISTRIBUTOR

Car Model	Distributor①
Ford 6 Cyl., Cars & Trucks (1947-49)②	7HA-12127
Ford V8, Truck Models (1948)	7RA-12127-C

①—Distributor less Terminal Housing & Rotor.
②—All models with "H" Engine.

►NOTES, CAUTIONS, & CHANGES

►**Contact Installation Caution**—Paper tape on underside of stationary contact assembly (part no. marking) must be removed when contacts are installed. If tape left on, good ground between contact plate and breaker plate cannot be secured, primary resistance will be increased, and ignition will not be satisfactory.

►**Excessive Pinging Correction**—May be caused by obstructions in vacuum passages in carburetor interfering with correct operation of distributor advance mechanism. Correct by disconnecting vacuum line and cleaning out all passages. *See "Checking Distributor Spark Advance" data below.*

►**Mercury Distributor Timing Caution**—Clearance between distributor vacuum diaphragm housing and water pump outlet or fan belt on engine should be ¼" to preclude interference in service. Distributors with less clearances should be replaced.

CAUTION—When timing engine, initial timing should be set as near as possible to specified setting (see car model page for instructions) but at least ⅛" CLEARANCE must be maintained between vacuum diaphragm and outlet or fan belt.

►**Retarded Spark Complaints on First Mercury Cars**—On cars before Engine No. 9CM-826, with first type timing gears, excessive backlash in gears may cause retarding of ignition timing. Check for this complaint as follows:

Checking for Retarded Spark—Disconnect distributor vacuum line (to prevent automatic advance functioning). Idle engine, direct neon timing light on timing mark at front of engine, increase engine speed and note if definite retarding of spark occurs (timing button width is 2.2 engine degrees and can be used to estimate amount of retarding action). Correct by advancing initial timing to compensate for this retarding action.

►***CAUTION—Timing must not be advanced so far as to cause excessive pinging.***

DESCRIPTION: This "Loadomatic" or Pressure Type distributor is a full-automatic advance type in which the entire advance is provided by action of the vacuum diaphragm unit linked to the breaker plate (no centrifugal weights used). This advance action is controlled by the two diaphragm springs on the breaker plate which oppose diaphragm movement. Springs are of unequal weight, but act together to produce the desired advance curve.

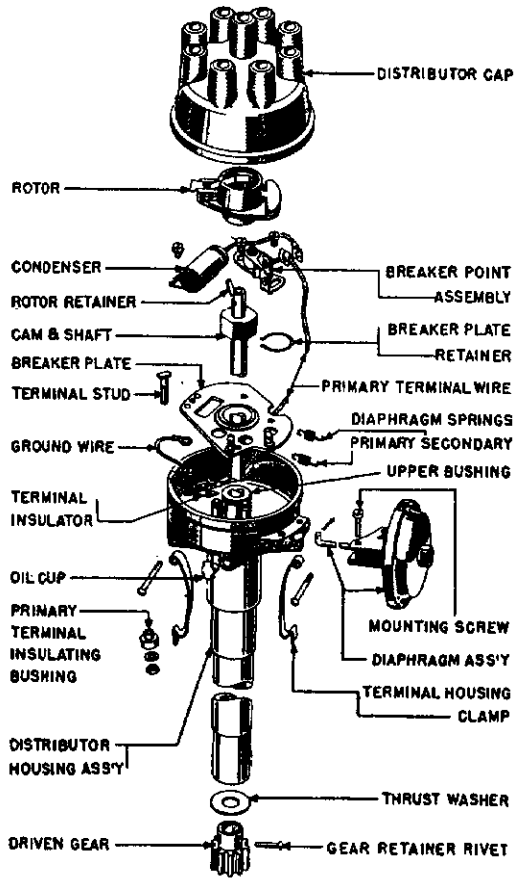
NOTE—Distributors used on 6 Cyl. and V8 engines are same design and differ only in minor details (number of cam lobes, location of primary terminal, type of mounting, etc.).

OPERATION: The diaphragm vacuum line is connected to the carburetor and terminates in two separate ports: 1) Upper Port in carburetor venturi tube, 2) Lower Port in carburetor throat just above throttle valve edge. Vacuum at these ports, and consequent suction in line, varies in accordance with engine operating conditions to provide correct advance as follows:

Idling Speed (Closed Throttle)—Vacuum is at minimum at both carburetor ports (lower port above throttle valve) and breaker plate is retarded by springs. Spark occurs at the initial timing point with no automatic advance.

Normal Driving (Part Throttle)—Vacuum is high at both carburetor ports and vacuum diaphragm unit advances timing progressively until maximum advance point is reached at 18-35 MPH.

Acceleration—Vacuum at upper (venturi) port is high but vacuum at lower (carburetor throat) port decreases under these conditions. This results in a lower vacuum at the diaphragm unit and timing is retarded by breaker plate springs from the normal road load point.



FORD V8 DISTRIBUTOR
(FORD 6 CYL. SIMILAR)

ADJUSTMENT: Distributor Breaker Gap & Contact Dwell, Spring Tension, Ignition Timing—*See individual car model pages in Car Model Section.*

Automatic Advance: Adjustment of breaker plate spring tension requires use of special Stroboscope to check performance. Spring tension is set at factory for desired advance performance and should not be disturbed unless this special equipment available.

►***CAUTION—Do not disturb spring tension adjustment (slotted eccentric spring posts on breaker plate) unless Stroboscope used to check advance performance.***

CHECKING SPARK ADVANCE (to detect restrictions in Carburetor vacuum passages resulting in incorrect advance & unsatisfactory engine performance): Use a vacuum gauge and tachometer and proceed as follows:

1) Set ignition timing using a Timing Light.

2) Disconnect vacuum line at carburetor. Use ⅜"x24 adapter fitting to connect vacuum gauge at carburetor.

3) Connect Tachometer to engine.

4) Run engine and measure vacuum at indicated engine speeds. Vacuum (in " of HG) should be as follows:

	Vacuum at Carburetor①	
Engine Speed	8HA (6 Cyl.)	8BA (V8)
800 RPM.	0.6"	2.5"
1000 RPM.	1.4"	4.15"

①—These figures are plus or minus 15%.

►*NOTE*—If gauge indicates full manifold vacuum, venturi passage is plugged. If gauge readings are low, throttle body passage is defective.

5) Increase engine speed and measure vacuum at following speeds:

	Vacuum at Carburetor①	
Engine Speed	8HA (6 Cyl.)	8BA (V8)
2200 RPM.	5.7"	5.55"
2400 RPM.	5.8"	5.40"

①—These figures are plus or minus 15%.

►*NOTE*—If vacuum gauge reading drops to less than 2", lower vacuum passage is plugged.

LUBRICATION: ***CAUTION—Oil or grease on contacts usually caused by use of wrong type or excessive amount of lubricant (see Distributor Upper Bushing Note below).***

Ford Distributors—Few drops engine oil in oiler every 1000 miles. Light film of M-4601 distributor grease on face of cam every 5000 miles or when contacts serviced.

Mercury Distributor—Few drops engine oil in oiler and light film of 8L-19575 grease on face of cam every 5000 miles.

►**Ford Distributor Upper Bushing Note**—Upper bushing is sintered (powder metal) type and upper surface is ordinarily finished smooth or becomes burnished in service which prevents excessive oil seepage through bushing (seepage at this point will cause oil to be thrown off in distributor by breaker cam). If this condition not corrected by wearing in (burnishing) of bushing and **if excessive oil seepage continues, replace bushing** (using bushing which has machined upper surface).

BRAKES

FORD-LOCKHEED HYDRAULIC
FORD & MERCURY

Ford 6 & V8 Pass. Car Models (1939-48)—See Note
Ford Comm'l & Truck, All Models (1939-48)
Mercury, All Models (1939-48)—See Note

NOTE: Ford & Mercury (1946-48) Pass. Cars & Ford Light Duty Trucks—Brakes on these models are "self-centering" type and do not have adjustable anchor pins. These brakes are adjusted in the same manner as on other models except that Anchor Pin Adjustment (Major Adjustment) is not necessary and these instructions should be disregarded.

DESCRIPTION & OPERATION:—Lockheed two-shoe, double anchor type. Two shoes per wheel, each mounted on individual eccentric anchor pin at lower or 'heel' end and bearing directly against opposed pistons of stationary wheel cylinder at upper or 'toe' end. Shoes are held against eccentric adjusting cams (wear adjustment) in 'off' position by a single retracting spring hooked between the two shoes at the toe end.

Anchor Pins (Ford & Mercury 1946-48 Self-centering type Brakes). On these models, anchor pins are fixed on backing plate and have special elongated washers which engage elongated holes in brake shoe web. With this mounting, shoes tend to "center" themselves in drum when brakes are applied.

Wheel Cylinders:—Rigid type mounted on backing plate with opposed pistons which bear directly against toes of brake shoes. Pistons are sealed by rubber cups held against piston heads by central spring and dirt is excluded from cylinder by rubber boot fitting over end of cylinder and brake shoe.

Passenger Car & 1 Ton Truck—Cylinders are stepped or two-stage bore type with larger end of cylinder toward front and actuating forward shoe. Front wheel cylinders larger than rear wheel.

Truck Models. Cylinders not stepped (both ends same size). Larger cylinders used on rear wheels.

NOTE—Wheel cylinder not interchangeable from right to left sides of car or from front to rear wheels.

Master Cylinder:—Compensating type with integral supply tank. Similar in design to type used on other Lockheed Hydraulic Brake applications.

Parking (Hand) Brake:—On Pass. Cars, ¾ Ton&1 Ton models, hand lever applies rear service brakes through cables connected to a strut and lever linkage on the brake shoes. On other truck models, hand lever applies an independent internal-expanding brake band in the rear wheel brake drums (1939), independent brake band on brake drum on propeller shaft at rear of transmission (1940 and later models).

SERVICING:—Bleeding Brake Lines. Fill master cylinder supply tank with genuine Ford Brake Fluid (keep tank filled during bleeding operation, bleeding must be repeated if fluid level low enough so that air enters cylinder and lines). Remove dustscrew on bleeder valve at wheel cylinder, install rubber tubing in bleeder valve and immerse other end of tubing in brake fluid in a container. Open bleeder valve and pump brake pedal with slow even strokes until only clean fluid flows from wheel cylinder (no trace of air or bubbles) being careful that fluid level maintained in master cylinder supply tank. Close bleeder valve, remove tubing, replace dustscrew. Bleed other wheels in same manner.

ADJUSTMENT:—Before adjusting, jack up all four wheels, remove one front wheel and inspect lining (to determine if new linings required), re-install wheel. Check front wheel bearing adjustment, spring shackles, shock absorber links, and radius rod mountings, tighten steering connections. Place hand lever in released position. Adjust each wheel as follows:

MINOR (WORN LINING) ADJUSTMENT

Minor Adjustment (For Wear):—Install wrench on eccentric adjusting cam on backing plate with wrench handle upward, turn cam by moving wrench handle out toward wheel rim until shoe is tight in drum, then turn cam back until wheel just turns freely without drag (do not turn cam back more than enough to free wheel, desired setting is with least possible amount of clearance). After adjusting forward shoe, repeat adjustment on rear shoe, then adjust all other wheels in same manner. Check pedal reserve, if reserve less than half total travel, repeat adjustment (if pedal is 'spongy', bleed lines). Check brake pedal clearance and adjust hand brake

►*CAUTION—Clearance between shoes and drum should be least amount possible without drag (no specific clearance specified).*

MAJOR (NEW LINING) ADJUSTMENT

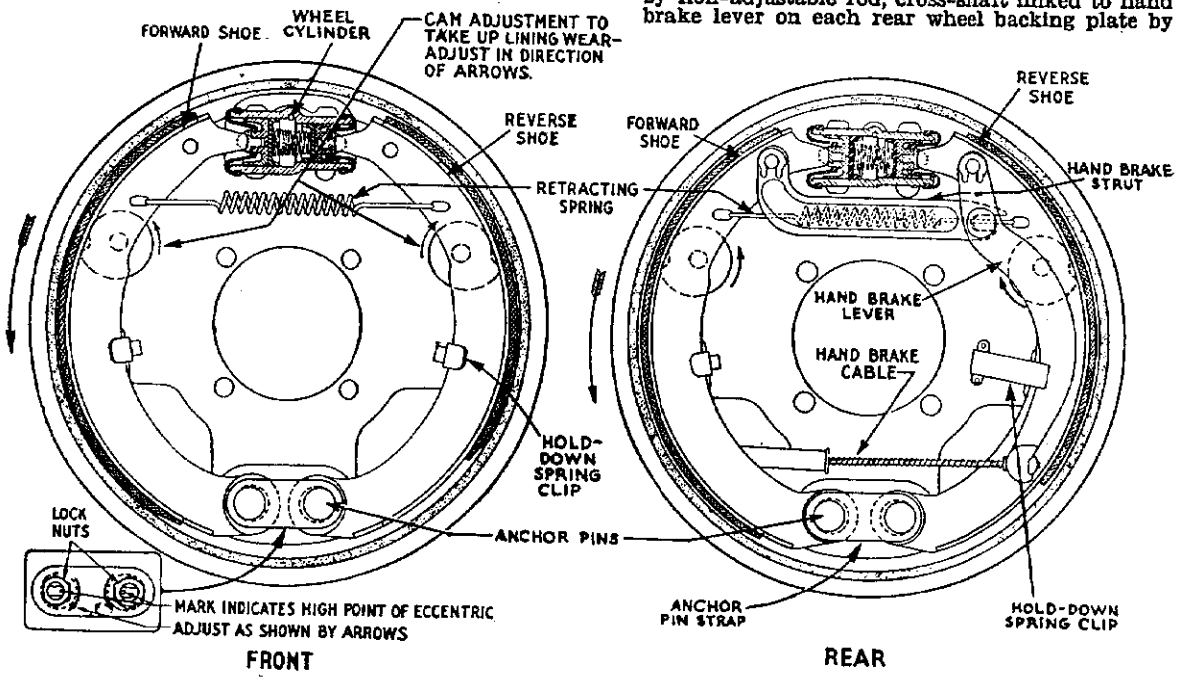
Major Adjustment (For relined brakes, etc.):—NOTE This adjustment not required on 1946-48 Pass. Cars and Light Trucks with "self-centering" type brakes Before installing brake drums, loosen eccentric anchor pin locknuts and turn each anchor pin so that marks on flatted ends of pins are together (marks indicate 'high' side of eccentric and in this minimum position will allow drums to be installed over new linings), turn eccentric adjusting cam for each shoe to minimum position. With drums installed, turn eccentric anchor pin toward adjacent anchor pin (wrench handle upward) until brake shoe is tight against drum, then back anchor pin off slightly until wheel turns freely without any drag. Hold anchor pin from turning and tighten locknut securely. Then adjust eccentric adjusting cam (see Minor Adjustment above) for correct toe clearance of the brake shoe. Adjust both shoes in each wheel in this manner, then adjust hand brake.

Brake Pedal Adjustment:—Brake pedal must have ¼" free movement (measured at pedal pad), to insure master cylinder piston being against its stop for correct compensating action when brakes released. To adjust, loosen locknut on pedal rod, turn rear section of rod (integral with large adjusting nut—not necessary to disconnect clevis pins), tighten locknut.

HAND BRAKE ADJUSTMENT

Passenger Cars (& 1939 1 Ton)—Place hand lever in fully released position. Depress the brake pedal until rear brake shoes applied firmly against drums, leave pedal in this position while adjustment being made. Pull forward on cables to remove all slack, adjust clevis on end of hand brake cable so that, with foot brake applied as above, end of hand lever has ½" travel before slack in cables is taken up. Release foot brake pedal. With hand lever in released position, check that rear wheels are free of any brake drag.

Trucks (1939)—Hand lever linked to cross-shaft by non-adjustable rod, cross-shaft linked to hand brake lever on each rear wheel backing plate by



FORD-LOCKHEED BRAKE ASSY.

FORD-LOCKHEED HYDRAULIC (Cont.)

adjustable rods. To adjust, remove clevis pin in forward end of each rod at cross-shaft, loosen locknut, turn clevis on rod.

¾ & 1 Ton Truck (1940-48)—Place the hand brake lever in fully released position. Use pedal jack to depress brake pedal until rear brake shoes are applied firmly. Adjust each wheel cable at equalizer lever on frame cross-member by taking out clevis pin, loosening locknut, and turning clevis on cable end fitting until all slack is removed from cables and mounting bolt is centered in slot in equalizer plate. Adjust hand lever cable by taking out clevis pin, loosening locknut, and turning clevis on cable end fitting until hand lever has approximately ½" movement (with brake shoes applied as above). Release pedal, make certain rear wheels free of drag.

Trucks exc. ¾ & 1 Ton (1940-48)—Release hand brake lever. See that flat of cam rests on brake band ear (if not, remove clevis pin from rod above cam and adjust clevis as necessary so that flat of cam rests on ear of band, install clevis pin. Remove lockwire and turn anchor screw (on bracket on left side) in until clearance between lining and drum is .010" at this point, replace lockwire. Loosen locknut and turn bracket adjusting screw nut (on right side, adjusting screw head on bracket is slotted) until clearance between lining on lower half of band and drum is .010", tighten locknut. Then tighten nut on lower end of band adjusting rod (below ear on lower end of band) until clearance between lining on upper half of band and drum is likewise .010". Recheck rod linking cam and brake lever.

OVERHAUL:—Note—Factory recommends installation of factory reconditioned brake shoes (with new lining installed) whenever lining worn so that replacement required. Before removing brake shoes, install clamp on wheel cylinders (to retain wheel cylinder pistons) and be careful not to depress brake pedal with shoes off. This will eliminate necessity of bleeding lines when shoes installed.

Brake Shoe Installation:—Assemble retracting spring to shoes (and hand brake lever and link parts for rear wheels). Turn eccentric adjusting cams to minimum position. Hold shoes so that anchor pin ends overlap and upper ends spread sufficiently to enter wheel cylinder pistons, engage shoes in piston slots, spread lower ends of shoes until they are engaged under flat lip of hold-down springs. Install anchor pins making certain that eccentric is in place in hole in brake shoe and that anchor pin engages eccentric. Turn anchor pins so that notch in flatted end of each pin is lined up with notch in opposite pin, install anchor pin locknuts, connect hand brake cable to lever. Adjust shoes as directed in Major Adjustment above.

Master Cylinder & Wheel Cylinder Disassembly and Overhaul:—All service operations same as on other Lockheed Brakes. See article on Lockheed Double Anchor Hydraulic Brakes and separate article on Hydraulic Brake Servicing for complete data.

FORD-BENDIX HYDRAULIC

Ford Half-Ton Truck, Series F-1 (1948)

DESCRIPTION

DESCRIPTION: Brakes used on these models are Bendix Hydraulic, Single Anchor (Without Eccentric adjustment of same design as used on other car models.

ADJUSTMENT NOTE: Adjustments are made differently for wear (Minor Adjustment) and for new lining or shoe assemblies (Major Adjustment). Major adjustment should also be made whenever a minor adjustment does not give satisfactory brake performance. Perform all following operations before adjusting brakes:

Preliminary Brake Adjustment Operations: Check master cylinder fluid level and fill to within ½" of top of filler neck, Check brake pedal free travel and adjust (see Brake Pedal Adjustment below) if not within limits of ¼-½". Check pedal reserve (distance from pedal pad to floor with brakes applied—brakes require adjustment if this distance less than ½ total pedal travel). Jack up all four wheels. Place hand lever in fully released position and make certain that cable slack is sufficient so that rear wheel brake shoes fully released.

►*CAUTION—Correct brake adjustment cannot be secured if hand brake cables so tight that brake shoes are held away from anchor pin.*

MINOR ADJUSTMENT (For Wear): First perform all preliminary operations under "Adjustment Note" above. At each wheel, make certain that anchor pin nut is tight (check with 16" wrench), remove adjusting hole cover on backing plate, insert adjusting tool or screwdriver in hole and engage notched adjusting screw, turn screw to expand shoes by moving tool handle in toward axle until brake drum can just be turned by hand, then back off adjusting screw approximately 14 notches until shoes are just free and drum turns without drag. Adjust parking (hand) brake cables (below).

Brake Pedal Adjustment: Pedal must have more than ¼", but less than ½", free travel measured at pedal pad before master cylinder piston begins to move. Adjust as follows:

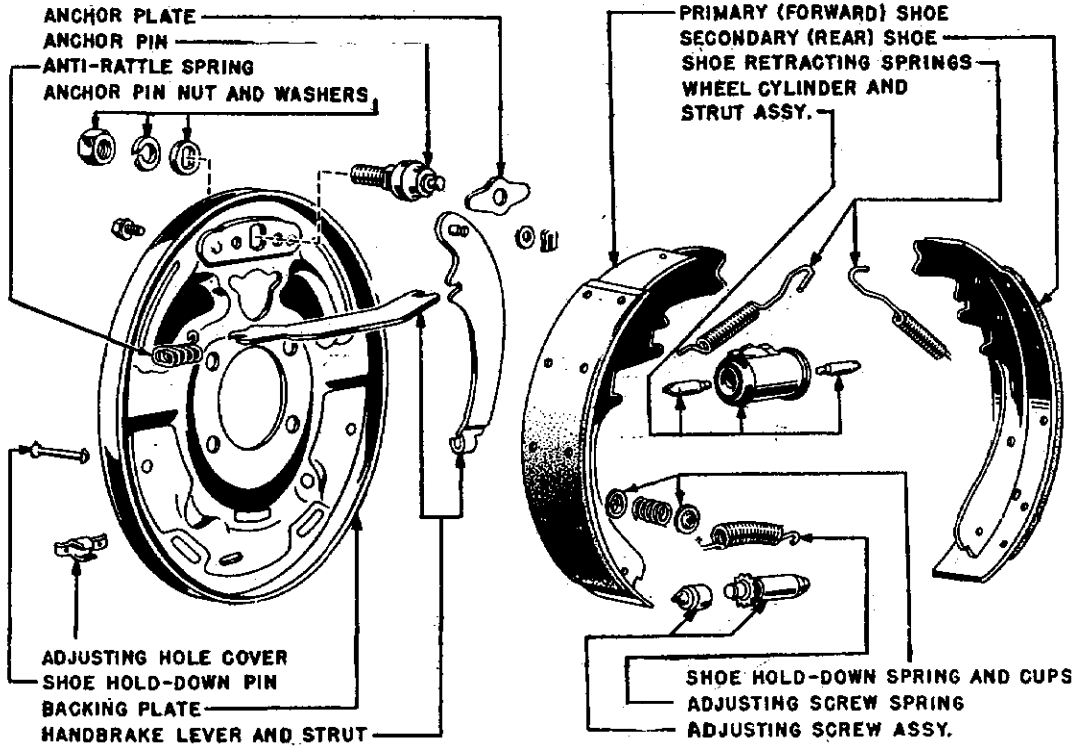
Ford—Loosen locknut and turn eccentric bolt linking brake pedal to master cylinder piston rod.

Parking (Hand) Brake Adjustment: After adjusting service brakes, adjust parking brakes as follows:

►*CAUTION—Do not over-tighten cables which will hold brakes away from anchor pin and cause brake drag.*

Ford (Truck Series F-1)—Brake cable linkage and adjustment same as for Ford Series F-2 & F-3 Trucks. *See "Ford-Lockheed Hydraulic" Brakes for complete instructions.*

MAJOR ADJUSTMENT (For New or Relined Shoes): Perform all preliminary operations under "Adjustment Note" above. Turn brake drum so that inspection slot in web is at lower end of rear (secondary)



FORD-BENDIX HYDRAULIC (Cont.)

shoe, insert .010" feeler between shoe and drum, move feeler up along shoe so that entire shoe assembly is wedged forward with primary (forward) shoe against drum. Insert screwdriver or adjusting tool through the adjusting slot on backing plate to engage notched adjusting screw, turn screw by moving tool handle inward toward axle (to move shoes out toward drum), or outward away from axle (to move shoes in away from drum), until .010" feeler is snug between secondary shoe and drum at point 1½" from adjusting screw end of shoe. Check clearance 1½" from opposite (anchor pin) end of this same shoe. If clearance not .010" loosen anchor pin locknut, tap anchor pin out toward drum (to decrease clearance), or inward away from drum (to increase clearance). Tighten anchor pin locknut securely with 16" wrench. Recheck clearance at both ends of secondary shoe and repeat adjustments if required. Adjust all four wheels in this manner. Then adjust parking (hand) brake cables (above).

BLEEDING BRAKE SYSTEM: *See complete "Hydraulic Brake Servicing" for bleeding instructions.*

BRAKE DRUM REPLACEMENT: Brake drums are "demountable" type (removable without disturbing wheel hub) on all models except Ford Pass. Car & Station Wagon **front wheels.** To remove brake drums after wheel has been removed, take off three speed nut (Ford Pass. Car Rear Wheels), or remove three capscrews (Ford Truck, Lincoln, Mercury), retaining drum on wheel hub or axle shaft flange.

Drum Regrinding Note—When refinishing drums, diameter must not be increased more than .030".

BRAKE SHOE REPLACEMENT: With wheels and brake drums removed, brake shoes are removed and replaced as follows:

Brake Shoe Removal—Disconnect return springs at anchor pin, remove hold-down cup, spring, and pin on each shoe. Disconnect hand brake cable at lever on rear wheel brake rear shoe. Pull shoes out at top to free wheel cylinder piston links, lift shoe assembly out, lift out hand brake strut and anti-rattle spring on rear wheel brakes. Disassemble shoes by removing adjusting screw spring (free spring by moving anchor pin end of shoes together) and lifting off adjusting screw assembly.

HYDRAULIC BRAKE TROUBLE SHOOTING

TROUBLE SHOOTING:—Brake Pedal goes down to floor.

1—Excessive shoe clearance due to wear—Adjust brakes. If adjusting screw must be turned up more than 50 clicks or notches, examine lining for replacement.

2—Leaks in system. Minor leaks evident by gradual slacking off of brakes when applied with pedal depressor. Examine lines and wheel cylinders. When caused by contraction of piston cups due to extreme cold, correct by installing special expanders (between cup and spring) and special springs (shorter than standard).

3—Air in Brake System—when present in considerable quantity (smaller amount evidenced as 'springy' pedal). Bleed system.

4—No fluid in supply tank. Lines must be bled if supply tank allowed to become empty.

Brakes drag at all wheels:—

1—Mineral oil in system—causes rubber piston cups to expand. Wash out master cylinder, lines and wheel cylinders with alcohol, replace rubber piston cups, refill with genuine brake fluid.

2—By-Pass port in master cylinder clogged or covered by piston. See that port is uncovered with piston in extreme off or outer position to allow fluid return to supply tank (see brake pedal adjustment directions in each brake article.

Brakes drag at one wheel:—

1—Weak or broken return spring. Replace springs. See that stronger spring is attached to secondary shoe.

2—Improper adjustment (shoe clearance too small).

3—Cylinder cups distorted or incorrectly installed. Lip of cup must point in.

4—Loose front wheel bearings.

Car pulls to one side:—

1—Oily linings. Replace shoes or reline.
2—Improper adjustment (shoe clearance too small).
3—Loose backing plate, loose front spring U bolts.
4—Incorrect lining type or length. See specifications in Car articles.
5—Incorrect or uneven tire inflation pressures.
6—Brake drums out-of-round or scored.
7—Brake lines kinked, hose plugged.

Brake Pedal Springy:—

1—Air in system. Bleed lines.

2—Brakes shoes incorrectly adjusted.

Brake Pedal 'Hard':—

1—Improper adjustment.
2—Incorrect lining type.
3—Oily linings—replace or install new shoes.
4—Partial contact—high spots. Linings should be ground concentrically.

Brake Pedal 'Soft':—

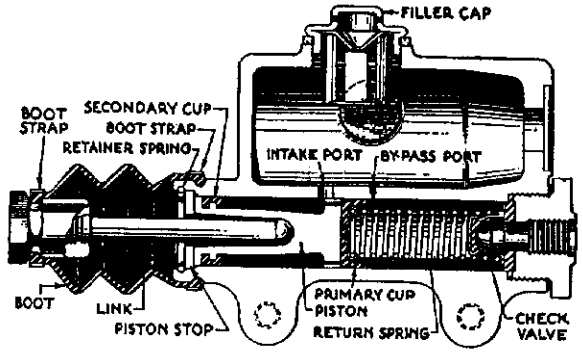
1—Improper adjustment.
2—Dust shield or backing plate loose.
3—Oily linings.

SERVICING NOTE:—See following article for directions for bleeding lines and servicing of master and wheel cylinders. See separate brake articles for brake shoe and brake pedal adjustment directions.

HYDRAULIC BRAKE SERVICING

BLEEDING BRAKE LINES:—Remove master cylinder supply tank filler cap, fill tank with genuine brake fluid, keep tank filled with fluid during entire bleeding operation (air will be drawn into brake lines if tank allowed to become dry). Remove screw in bleeder valve on wheel backing plate, install special fitting and hose connection. Submerge free end of hose in brake fluid in clean glass container. Unscrew bleeder valve ½-¾ turn, press brake pedal down by hand approximately half of travel, allow pedal to return slowly. Repeat operation until fluid flow from tube is completely free from any air bubbles, then close bleeder valve, remove hose connection and replace dustscrew. Bleed lines at each wheel in same manner.

CAUTION—Use extreme care not to allow supply tank to become dry during bleeding operation. If automatic refiller unit not used, supply tank should be filled after every 6-10 strokes of the brake pedal (automatic refiller will maintain level in supply tank without attention during bleeding operation).



BRAKE MASTER CYLINDER

Two Cylinder (Chrysler Front Wheel Brake Type). When bleeding these brakes, first attach bleeder line to **upper** cylinder bleeder connection, bleed this cylinder and the brake line as directed above. Then connect bleeder line to lower cylinder bleeder connection and bleed this cylinder and the line between the cylinders as directed above. Both cylinders must be bled in this manner to remove all air from the brake system.

SERVICING:—Wheel Cylinders—To disassemble wheel cylinders, remove brake shoes, take out wheel cylinder mounting screws, withdraw cylinder through backing plate. Disconnect brake line, remove piston boots, withdraw pistons. Examine cylinder bore. If corroded or scored, cylinders can be lapped or honed and oversize pistons fitted. Piston clearance (metal piston) in cylinder should be .001-.003" and must never exceed .005". In assembling wheel cylinder, wash all parts in alcohol, dip rubber piston cups in Brake Fluid, and insert ahead of piston with lip in. Central return spring in stepped cylinders is tapered and should be installed with small end toward piston in smaller bore. Reconditioned cylinders should be tested for leakage in fixture under alcohol with 8 lbs. and 80 lbs. air pressure. Wheel must be bled when wheel cylinder reinstalled.

Piston Cup Expanders—Can be used with special return spring in wheel cylinders to correct leakage caused by piston cup contraction in extreme cold temperatures. Expander should have .005" clearance in cylinder and should fit into open end of piston cup with slight clearance. Install expanders with cupped face in and use special return spring which is ½ turn shorter than standard spring.

Master Cylinder:—To disassemble master cylinder, remove rubber boot and push rod or link, take out retainer spring and piston stop, withdraw piston. Examine cylinder. If corroded or scored, cylinder can be lapped or honed and oversize piston fitted. Clearance should be .001-.003". In reassembling, wash all parts in alcohol, dip in Brake Fluid, see that check valve is installed correctly and that thin washer is in place between piston and primary piston cup. Insert piston with lips on both primary and secondary cups in. Test for leaks in same manner as for wheel cylinders and bleed entire system when installed on car.

HYDRAULIC BRAKE SERVICING

By-pass Port Note—By-pass or compensating port connecting supply tank and master cylinder must be uncovered with the master cylinder piston against its stop. When installing master cylinder piston assembly, hold piston against stop and make certain that this port is not covered by lip of primary cup.

CAUTION—When master cylinder installed on car, brake pedal must be adjusted for correct pedal clearance or free-travel to insure this by-pass port being uncovered with pedal released and master cylinder piston against its stop. Brakes will drag if this port is not open.

CLUTCHES

LONG MODELS 8½CB

MODEL 8½CB-CS6

Cover Assy. No. — Used On:

BL-1449—Ford V8, "60" Pass. Cars (1937-38-39)

NOTE:—Manufacturer recommends use of Borg-Warner UF-300 fixture for servicing clutch. Fixture consists of surface plate, which duplicates driving surface of flywheel, clamp screws to clamp cover against plate, arbor press to compress springs in dismantling clutch, and gauge standard for use in setting up release levers.

DESCRIPTION:—Single plate, dry disc type. Release levers pivoted on studs in outer rim of pressure plate with edge of cover at lever holes serving as fulcrum to actuate clutch. Servicing directions below apply to Pressure Plate and Cover Assembly

SERVICING:—Mark all parts before disassembling (reassemble in same positions to preserve balance). Replace grooved, warped, or cracked pressure plates, replace springs if pressure plate discolored from excessive heating.

Dismantling:—Free release lever stud nut locks by running hacksaw blade through slots. Place assembly on fixture or in arbor press, compress cover slightly, remove lever stud nuts, release pressure slowly, lift off cover plate and lever assembly. Free release lever tension springs, lift out levers. Lever studs are pressed in pressure plate and pinned in place (need not be removed unless pressure plate or studs being replaced—see servicing directions

Release Lever Studs:—Replacement studs furnished without drilled hole for lock pin. To install studs, start stud in pressure plate hole, use vise jaws as press to force studs in until end of stud is 13/16" plus or minus 1/32" above finished surface of pressure plate, drill studs through pressure plate hole (use No. 22 drill), drive lockpins in from inside (rounded end first).

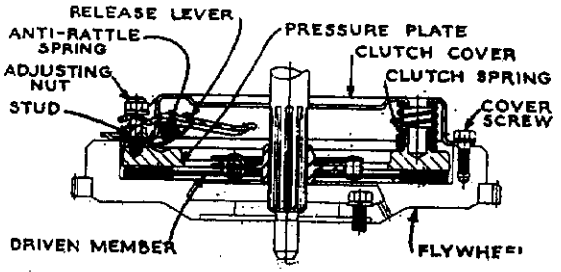
Clutch Springs:—Replace springs if weak or burnt, or if pressure plate indicates clutch has heated excessively.

Model 8½CB Springs

Spring No.	Pressure & Length	Color
C-287 (Ford)	130-140 lbs. @ 1 9/32"	Blue

Release Lever Assembly:—Invert cover, insert levers through slots in cover from inside, hook tension springs over levers and in spring holes in cover below lever slots. Cover is then ready to install on pressure plate.

Pressure Plate Assembly:—Place pressure plate and stud assembly on fixture (see release lever stud servicing above), install springs on spring bosses on pressure plate, place cover in position on springs, compress cover until it is tight against #2 (8½CB), #8 (11CB) height sleeves placed under cover edge at clamps, guide lever studs through holes at outer ends of levers, install lockwashers and tighten lever nuts flush with ends of studs. Use clamps at height sleeves to hold cover, compress and release clutch several times (use weight on levers) to seat all parts, adjust lever heights.



Release Lever Adjustment (On Fixture):—Use lever adjusting arm and sleeve, setting lower face of lever exactly 1¼" (8½CB—Ford 60), 1 7/16" (8½CB Overland—with "3J" lands under pressure plate), 1 23/32" (11CB—Packard) above the bottom of the sleeve, tighten thumbnut. Swing arm over each release lever in turn, turn release lever nut until lever tip just contacts arm. Lock adjustment by peening nut into stud slot, recheck lever setting.

Release Lever Adjustment (Dial Indicator):—If dial indicator used, install indicator plate on lever tips, set indicator bracket at 1¾" (8½CB), 1 23/32" (11CB), set all levers for zero reading on dial indicator.

DRIVEN MEMBER:—Manufacturer recommends installation of replacement driven member (clutch disc) with new facings installed. See car model page for facing specifications.

CLUTCH INSTALLATION:—Manufacturer recommends that cover be compressed on clutch fixture or in arbor press and ¼" tapered wooden blocks be installed between inside edge of cover and levers to hold levers in released position while installing clutch on flywheel. This will prevent cover distortion when cover bolts are tightened (remove blocks after clutch installed).

LONG 9CF, 9½CF, 10CF, 11CF

	Clutch Model	Cover Assy. No.
FORD		
V8 '85' Pass. Cars ('35-40)	9CF-CS	BL-1441
V8 '60' Pass. Cars (1940)	9CF-CS	BL-1441
V8 '90' Pass. Cars (1941-42)	9CF-CS	BL-5102
6 Cyl. Pass. Cars (1941-48)	10CF-TI	BL-5222
V8 '100' Pass. Cars (1941-48)	10CF-TI	BL-5222
6 Cyl. Pass. Cars (1949)	9½CF-TS	263594
V8 '100' Pass. Cars (1949)	9½CF-TS	263594
V8 '85' Comm'l (1935-40)	9CF-CS	BL-1441
V8 '60' Comm'l (1937-40)	9CF-CS	BL-1441
4 Cyl. Comm'l (1941-42)	9CF-CS	BL-5102
V8 '90' Comm'l (1941-42)	9CF-CS	BL-5102
V8 '100' Comm'l (1941-48)	10CF-TI	BL-5222
6 Cyl. Comm'l (1941-48)	10CF-TI	BL-5222
V8 '60' ¾ & 1 Ton ('37-40) ④	9CF-CS	BL-1441
4 Cyl. Truck Models (1941-42)	9CF-CS	BL-5102
V8 '85' ¾ & 1 Ton ('35-40) ④	11CF-CI	BL-1440
V8 All ¾ & 1 Ton ('41-42) ④	10CF-TI	BL-5122
6 Cyl. ¾ & 1 Ton ('41-42) ④	11CF-CI	BL-1440
V8 All 1½ Ton (1935-40)	11CF-CI	BL-1440
6 Cyl. & V8 1½ Ton ('41-42)	11CF-CI	BL-1440
6 Cyl. & V8 ¾ Ton ('44-47) ④	10CF-TI	BL-5222
6 Cyl. & V8 1½ Ton ('44-47)	11CF-CI	BL-1440
6 Cyl. & V8 2 Ton ('44-47)	11CF-CI	BL-1478
6 Cyl. & V8 Trks. (1948)	11CF-CI	⑥
Bus Models (1936-48)	11CF-CI	BL-1478
MERCURY		
All Models (1939-40)	9CF-CS	BL-5102
All Models (1941-42)	10CF-TI	BL-5222
Cars with Liquamatic Dr. ('42)	9CF-CS	BL-5448
All Models (1946-48)	10CF-TI	BL-5222

④3-Speed Trans. (BL-1440 with 4-Speed Trans.).

⑥—BL-1440 Std., BL-1478 Optl.

►NOTES, CAUTIONS, & CHANGES

►**Clutch Assembly Number Note:** This number is the Cover Assembly which includes all clutch parts except driven member. Clutch Model Number (9CF-CI, 9CF-CS, etc.) indicates also the type of driven member used on each car model.

►**Optional Replacement Clutch Assemblies:** The manufacturer lists following optional cover assemblies which can be used where complete assemblies to be replaced.

Optional Replacement Cover Assemblies

Clutch Model	Original Equipment	Optl. Replacement Assembly
9CF	BL-1441①	BL-5102
9½CF	BL-4114	BL-5385
9½CF	BL-5385	BL-4114
10CF	BL-3555	BL-5389
10CF	BL-3731	BL-5389
10CF	BL-4395	BL-5392
10CF	BL-4671	BL-5034
10CF	BL-5389	BL-3555
10CF	BL-5392	BL-4395
11CF	BL-5004	BL-5167
11CF	BL-5013	BL-5152
11CF	BL-5152	BL-5013
11CF	BL-5167	BL-5004
11CF	BL-5300	BL-4928② or BL-5391
11CF	BL-5305	BL-4721② or BL-5393
11CF	BL-5391	BL-4928② or BL-5300
11CF	BL-5393	BL-5305

①—Not made. For complete replacem't use BL-5102.

②—Riveted Assembly (Model 11CFS Special Type).

►**Long Driven Members (for other cars):** "CF" type driven members used on cars with other clutch models as shown in table below. Driven member data as shown below applies to these car models

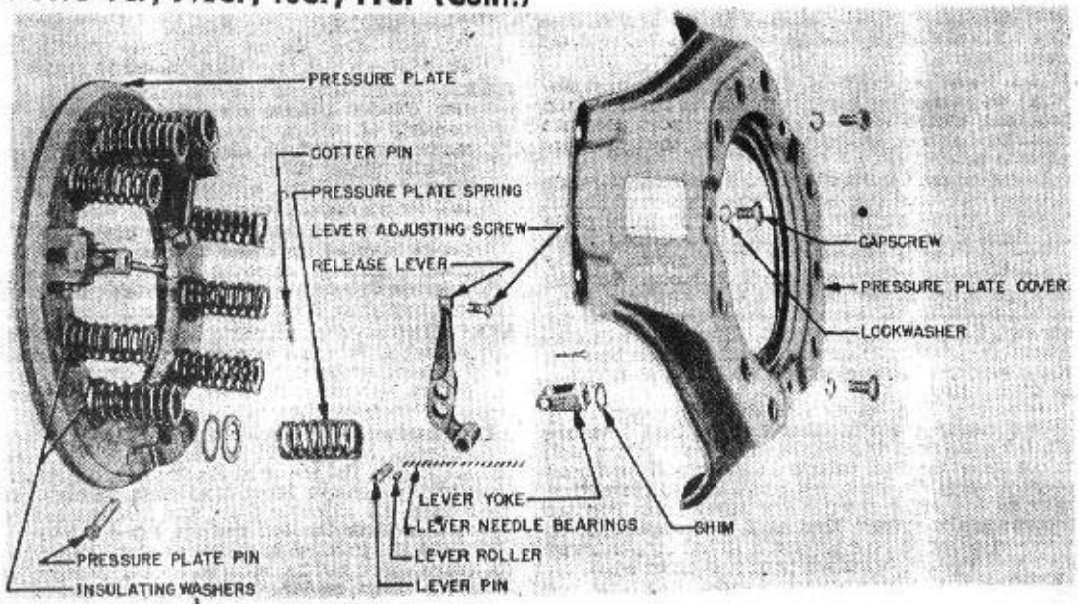
Mercury 1942 Models (With Liquamatic Drive)—Smaller clutch (9" instead of 10") used on these cars.

DESCRIPTION:—Single plate, dry disc type. Release levers formed with weight on outer end which increase pressure on driven member as engine speed increases. Levers pivoted on pressure plate on needle bearings with fulcrum located in yoke support on cover plate. Hardened-steel screw contact provided on lever tips. These screws staked in place and should be disturbed only when release lever adjustment (for new or relined driven plate) is to be made. Servicing directions below apply to pressure plate assembly. See Driven Member Section below if pressure plate not to be dismantled and rebuilt.

REMOVAL OF CLUTCH: *See "Clutch" on car model page.*

SERVICING:—Mark all parts before dismantling and reassemble in same position. Replace grooved, warped, or checked pressure plates. Replace springs when pressure plate discolored from heat (see Spring Testing below).

LONG 9CF, 9½CF, 10CF, 11CF (Cont.)



Clutch Fixture Note:—Manufacturer recommends use of Borg-Warner Universal Clutch Fixture UF-300 for all servicing and rebuilding operations.

DISASSEMBLY

Disassembly: Place clutch on fixture (supporting pressure plate on special lands under lugs) or arbor press. Compress cover plate slightly, take out assembly screws (lever yoke mounting screws) on cover, release pressure on cover plate slowly, lift off plate. Note whether washers used on yokes under assembly screws (these washers must be reinstalled if old pressure plate used again). See special directions below on removing and reinstalling release levers. Remove and test clutch springs.

Pressure Plate:—Pressure plate refacing by grinding or turning down on lathe will throw release levers out of adjustment. If pressure plate being refinished, remove .020" from face and install spacer washer .015" thick on release lever yoke under cover. NOTE—If washers are found on release lever yokes under cover when clutch disassembled, replace these washers (if old pressure plate used) or discard washers (if new pressure plate installed).

Clutch Springs:—Pressure springs should check with table below. Replace springs if weak or burned or if clutch has been subjected to excessive heat. Six springs used in 9CF, nine springs on 10CF, 11CF.

Spring Specifications

Spring Number	Pressure at 1 9/16"	No. of Coils	Color Mark
C-1965	90-100 lbs.	8¾	Lt. Green
C-2045	110-120 lbs.	8.8	Gray
C-2096	125-130 lbs.	8¾	Red
C-2141	130-140 lbs.	8½	Black
C-2686	145-150 lbs.	8¾	Yellow
C-2717	100-110 lbs.	8¾	Drk. Green
C-3431	150-160 lbs.	8½	Pink
C-3529	130-140 lbs.	8¾	None
C-4188	170-180 lbs.	7.4	Pl. or Orange
C-4873	145-153 lbs.	8¼	Brown
C-4905	158-168 lbs.	8¼	Tan
C-5333	125-135 lbs.	8¾	Blue

Release Lever Assembly:—Mount lever yoke on release lever, fasten by inserting flat-sided lever pin (flat side out or toward cover) and roller (place roller on flat side of pin). Insert lever in pressure plate lug, use roller pin sawed off to length of lever width as a guide and insert needle bearings, insert roller pin, pushing guide pin out, lock both lever pins with cotter pins. Thread release lever adjusting screws in ends of levers, turning screws down completely.

REASSEMBLY

Assembling:—Place pressure plate on fixture or arbor press. Assemble pressure springs, locator washers or insulator washers on plate, place washers on lever yokes (if washers used previously and old pressure plate being used). Place cover plate in position (lining up marks made before dismantling), compress cover slowly guiding lever weights through holes in cover and lining up yokes under cover plate holes. See that pressure springs are seated, insert cover screws in yokes, using lockwasher under screw head, tighten screws down securely. Compress and release clutch several times (using weight on release levers) to seat all parts. Then adjust release lever heights.

Release Lever Settings

9CF TYPES

Clutch No.	Lever Height
BL-1441, 3538, 4235, 5102	2 3/32"
①BL-5448	1 15/16"

9½CF TYPES

②BL-4114, 4328, 4442, 5385	2"

10CF TYPES

BL-3555, 3731, 3817, 4395, 4671	2⅛"
BL-4898, 5078	2"
BL-5034	1 15/16"
BL-5222, 5470	1¾"
BL-5148, 5389, 5392	2⅛"

11CF TYPES

BL-1440, 1478, 3607, 3800, 4525	2 7/32"
BL-3890	2 3/16"
BL-5004, 5013, 5152, 5167	1⅞"
BL-5143	1 15/16"
BL-5300, 5305, 5391, 5393	2 7/32"

①—Lever setting 2 7/16" if dial indicator (and special gauge plate) used. See data below.

②—Lever setting 2½" if dial indicator (and special gauge plate) used. See data below.

RELEASE LEVER ADJUSTMENT

Release Lever Adjustment (on Fixture):—Place special lands on fixture under pressure plate lugs, assemble lever adjusting arm and sleeve setting bottom of adjusting arm correct distance as showr in table above (all figures plus or minus 1/32") above bottom of sleeve and lock the adjusting arm with the thumbscrew. Swing arm over each release lever in turn, back off adjusting screw on tip of lever until rounded screw head just contacts arm, lock screws by inverting clutch so that screw head is supported and stake or peen lever into adjusting screw slot. Do not disturb lever yoke screws when making this adjustment.

Release Lever Adjustment (without Fixture):—Assemble the special lever setting disc or gauge on the flywheel in place of driven member, placing gauge so that lugs are under release levers and gauge is centered in clutch. Tighten all clutch cover bolts evenly. Place short straightedge on edge on top of gauge shoulder, turn adjusting screws at tips of release levers up or down until they contact straightedge, lock screws by peening metal of lever into screw slot. Lever heights must be equal within .005".

Release Lever Adjustment (Dial Indicator):—When using dial indicator to set release levers on Model 9CF (BL-5448 only), all 9½ CF, special indicating plate must be installed on levers and lever setting with this plate in place should be 2 7/16" 9CF (BL-5448 only), 2½" 9½CF, plus or minus 1/32", and lever heights equal within .005". This indicating plate is not used on other models.

►**Ford Release Lever Adjustment Note:** The release levers can be adjusted by assembling a gauge plate of the proper thickness (see table) between pressure plate and flywheel in place of regular driven member (use a spare flywheel and install clutch in usual manner on this flywheel), place a straightedge across top of clutch cover directly above release lever, measure from lower edge of straightedge to top of lever adjusting screw and set the adjusting screws so that these distances are correct and equal as follows:

Ford Clutch Lever Settings

Clutch Diameter	Gauge Thickness	Lever Height
9" Clutches	.340"	11/16"
10" Clutches	.295"	15/16"
11" Clutches	.365"	7/8"

DRIVEN MEMBER

NOTE: Clutch manufacturer recommends installation of new driven member with new clutch facings rather than relining clutch. Driven plate hub (Spring dampener) cannot be serviced in the field. Cushioning springs used under facing on pressure plate side of disc only.

LONG 9CF, 9½CF, 10CF, 11CF (Cont.)

To Remove Facings:—Drill out 12 iron rivets mounting cushion springs on plate (two rivets radially at center of each spring), remove spring and facing assembly, drill out rivets to remove springs from facing (replace springs as complete sets). Then drill out rivets mounting other facing on plate. Do not punch out rivets.

To Install Facings:—Install facings on flywheel side inserting brass rivets with heads in countersunk holes in facing and roll rivets on plate side (rivets staggered in inner and outer holes alternately around facing or placed two in a row radially). Place cushion springs on second facing with clearance at center between spring and facing, insert brass rivets with head in countersunk holes in facing and roll on spring side. Rivet layout same as for first facing except that rivets staggered in opposite direction or radial rows offset from rivets for first facing. Brass rivets must not project more than 1/32" when rolled (plate and spring cutaway to provide clearance). Place cushion spring and facing assembly on plate, insert iron rivets through holes in plate and spring, roll rivets (work through holes in facing). Driven member should be balanced after new facings installed.

Installing Driven Member:—Install with hub nuts on flywheel side and cushioned facing toward transmission (plate on Cadillac V12 is solid hub type with no dampening device).

REAR AXLES

COLUMBIA TWO-SPEED

Optional Equipment On::
FORD '35', PASS. CAR MODELS (1938-39-40-41)
MERCURY, 99A ('39), 09A ('40), 19A ('41)

NOTE:—This axle provides low axle ratio for power and acceleration (with planetary gears locked out) and a higher ratio to reduce engine R.P.M. at high speeds (with planetary gears operating). Do not confuse this type with the Ford Two-Speed Truck Axle which operates differently.

Model Changes—Two-speed axle used on all models is same design and operates in same manner. Minor differences in control units and installation procedure will be found on the various car models listed above.

Lincoln 1941 Overdrive—Warner Type R10 Overdrive unit (mounted on rear of transmission) also available for 1941 Lincoln models (both Overdrive Transmission and two-speed axle may be found on some cars). Refer to Warner Overdrive article for data on Overdrives.

TYPE:—Consists of a planetary gear reduction unit built in a special differential assembly case which is installed in place of the regular Ford or Lincoln-Zephyr differential (furnished with new right hand axle housing which replaces original housing). A vacuum cylinder mounted on the axle housing operates the planetary gear clutch and is controlled by a valve assembly linked to the clutch pedal and to a control button on the instrument board. An adapter (two-speed gear box) is provided for connection in the speedometer drive cable and is linked to the control button so that the speedometer drive ratio is changed for overdrive operation to insure speedometer reading accurately at all times. NOTE—Some 1939 cars have a speedometer drive gear on the right hand axle shaft and a driven gear assembly mounted on the axle housing. These cars do not require a separate adapter.

OPERATION:—With the dash control button pushed in (for direct drive), the sliding clutch in the rear axle locks the sun gear and the differential case (in which planetary pinions are mounted) so that the entire planetary gear system (sun gear, pinions, and outer internal gear) rotate as a unit and the ring gear drives the rear wheels directly. When the clutch is released and the control pulled out to the overdrive position, the vacuum cylinder pulls the sliding clutch out so that the differential case is free and engages the stationary clutch plate so that the sun gear is prevented from rotating. The ring gear then drives the differential case and pinions, and the rotation of the pinions (on the stationary sun gear) causes the internal gear and the axle shafts to revolve at a faster 'overdrive' speed.

INSTALLATION:—When Overdrive axle is installed, the regular Ford or Lincoln-Zephyr axle should be dismantled (center pinion mounting housing need not be removed but torque tube should be blocked up so that it does not hang on the universal joint ball housing). Right hand axle housing, differential case (right and left halves and bearing on right half), differential pinion spider, and ring gear bolts and nuts should be discarded (replaced by overdrive axle parts). Overdrive axle assembly should be assembled on pinion housing using original capscrews except for top front hole (special long capscrew and copper washer furnished wired to hole in which it should be installed). Original right hand axle shaft should be filed smooth for distance 8" back from side gear to remove all scale and high spots, thoroughly cleaned, and dipped in regular axle lubricant (5" at side gear end), then insert shaft through overdrive unit (these instructions for shafts without speedometer drive gear only). Original differential pinions should be assembled on new spider, bronze thrust washer installed on spider in back of each pinion (lubricate washers with axle lubricant before installing), and inserted in overdrive differential case so that spider engaged in slots in internal gear case and pinions properly meshed with side gear. Original left hand axle shaft should be threaded through new yellow bronze side gear thrust washer and original ring gear, washer tongues entered in slots in differential case through which differential spider was assembled, and ring gear bolted to face of differential case with new capscrews. Left hand axle housing can then be assembled. **Important**—See that ring gear and differential clean and free from all nicks to insure gear running true, tighten mounting screws evenly and securely and lock screws with lockwire. Make certain that side gear thrust washer tongues do not slip out of slots in case while gear is being installed.

Control and Speedometer Adapter (Ford):—Control valve is mounted on bracket bolted to top of left hand frame side rail ahead of steering gear (bracket center hole engages rivet head, other holes must be drilled for bolts). Special clip should be bolted to lower end of clutch pedal and connected to bellcrank on control valve by rod (see adjustment below). Forward vacuum tube connection on valve should be connected to manifold spacer installed between carburetor and manifold (manifold studs must be replaced with new longer studs when spacer installed). Vacuum connections at rear of valve should be connected to vacuum cylinder by rubber tubing and copper tubing running along left hand frame side rail (connect 'low' top connection on valve to right hand end of cylinder, 'high' bottom connection to left hand end of cylinder). Control button is installed in drilled hole in instrument panel (2½" up from starter button, 1⅝" to left of instrument cluster), and control cable taken through drilled hole in dash (3½" in from left edge). Connect cable wire to lever on top of valve, see that lever is in forward detent position and that control button in forward position against instrument panel, then tighten cable clamp on valve.

Speedometer Adapter—Adapter screws directly on speedometer head (install square key furnished for connection between adapter and speedometer bfore mounting) with regular speedometer cable connected to adapter and short control cable (from control button connected to adapter lever.

CAUTION—Control cables, speedometer cables and vacuum tubes must not be kinked or bent in short radius which will interfere with correct operation.

Speedometer Adapter—Adapter should be mounted on left front side of dash and connected to speedometer by special short length of cable taken through 15/16" hole drilled in center of dash. Regular speedometer cable should be looped up on left side of engine compartment and connected to adapter.

ADJUSTMENT:—Control Valve Clutch Connection—Adjust clevis on valve operating rod at control valve end so that valve plunger is depressed ⅛" minimum, ¼" maximum with clutch pedal depressed to floor. Valve travel must not exceed ¼".

Control Button—Cable conduit should be positioned in clamp on valve body so that valve lever is in forward position (stopped by detent) with control button pushed in toward dash and fastened in this position by tightening clampscrew.

SERVICING:—Axle Lubrication—When first installed, axle should be filled with 4½ pints (Ford), 6 pints (Lincoln-Zephyr) recommended axle lubricant and car should be run with rear wheels jacked up (transmission in high, overdrive in low) for 5 minutes to circulate oil through overdrive unit. Axle should then be refilled to level of filler plug in overdrive case. **Always fill to level of overdrive filler plug, do not use regular axle filler plug for this purpose.**

Vacuum Cylinder Lubrication—At 10000 mile intervals, remove vacuum cylinder, lubricate leather piston cups thoroughly with Houghtons Cosmolubric #1000 hydraulic oil or equivalent.

Speedometer Adapter Lubrication—At 10000 miles, or sooner if noise develops, remove adapter, take out small plug on side and repack case with Alemite lubricant by hand—**do not use pressure.**

TROUBLE SHOOTING:—If overdrive axle does not shift properly, check all vacuum lines and connections for leaks, check tubes for kinks, sharp bends, or flattened spots, make certain that rubber tubing not cut or torn so as to obstruct opening at valve and copper tubing connections. Check valve settings (see adjustment section above).

OVERHAUL:—See Ford and Lincoln-Zephyr Rear Axle articles for axle servicing data.

REAR AXLES

FORD MODELS

V8 '60', Pass. Car & Comm'l (1937 to 1940)
V8, '85', '90', '100' Pass. Car & Comm'l (1936 to 1948)
6 Cyl., Pass. Car & Comm'l Models (1941 to 1948)
4 Cyl., Comm'l Models (1941-42)

MERCURY MODELS

V8, All Models (1939 to 1948)

►**COMM'L AXLE NOTE (1942 & Later):** The rear axles on these models are similar to passenger car axles, except that Hotchkiss Drive is used. Pinion assembly is retained by a Pinion Bearing Retainer and Pinion Grease Retainer Support bolted on front face of pinion housing (in place of torque tube) and a rear universal joint yoke is bolted directly on the end of the pinion shaft. These axles serviced in same manner as passenger car types except that data on torque tube should be disregarded.

DESCRIPTION: Spiral bevel gear, ¾ floating type with torque tube drive & straddle mounted pinion. Pinion mounted on double roller bearing (straddle mounted with additional roller bearing behind pinion). Pinion shaft splined and pinned to tubular propeller shaft. Differential assembly is mounted on roller bearings directly in axle housing (right and left hand housings bolted directly to pinion housing).

REMOVAL OF AXLE: *See "Rear Axle" on car model page.*

AXLE SHAFT REPLACEMENT: Remove axle shaft from inner end after axle dismantled and differential case bolts removed (side gears integral with shafts). When installing axles see that free travel or play at wheel keyway does not exceed .010" or endplay exceed .015". If play excessive, check differential gears for wear (pinion clearance .005" maximum).

PROPELLER SHAFT: Propeller shaft is part of rear axle assembly (pinned to pinion shaft). See overhaul data below. Propeller shaft bearings in torque tube are serviced as follows:

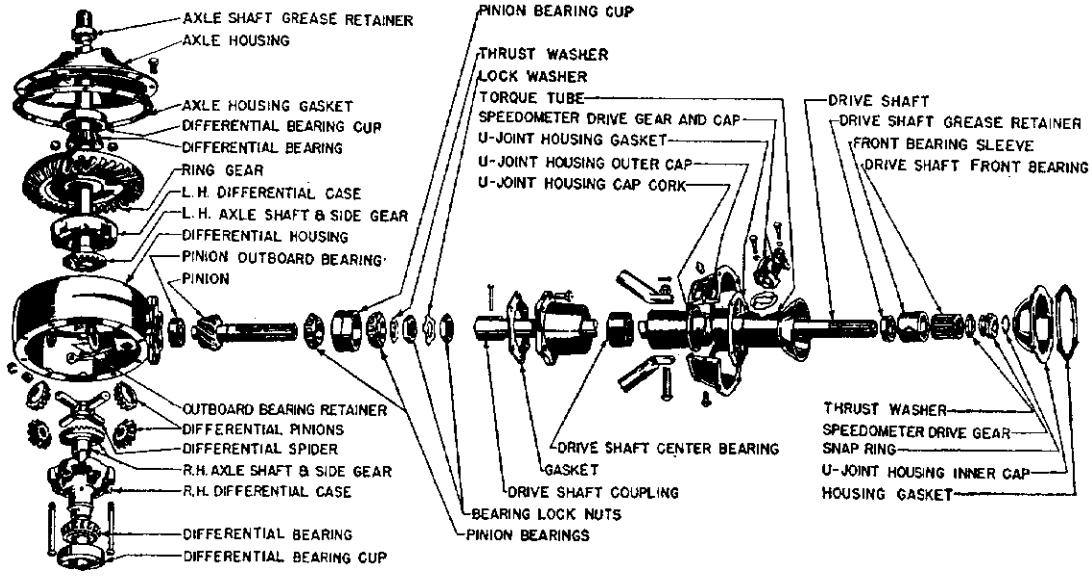
Propeller Shaft Forward Bearing:—In forward end of torque tube behind speedometer drive gear. Two types used (use B-4645-A roller assembly with split sleeve, 68-4645 with small rollers with solid sleeve). Use special puller SV-245 to remove solid sleeve from torque tube. Install new grease retainer (use tool A-310) with sharp edge of leather toward universal joint.

Propeller Shaft Center Bearing:—In torque tube at center. On types with solid propeller shaft, front bearing sleeve must be removed before center bearing can be removed with SV-186 tool (see above).

OVERHAUL: Disassembly. Remove speedometer driven gear assembly. Remove snap ring on forward end of propeller shaft, withdraw speedometer drive gear and thrust washer. Take out flange mounting screws at rear of torque tube, withdraw propeller shaft from tube toward rear. Drive out rivet in coupling, disconnect propeller shaft from pinion. Use AATA-1 driver to remove pinion assembly from housing, BV-92 puller to remove bearings.

Pinion Bearing Assembly:—Assemble bearings on pinion shaft (see Note below), tighten bearing locknuts so that bearing cup turns on cones with heavy drag. Heat housing (use approved heater or immerse housing neck in boiling water or hot oil for 1-2 minutes), install outboard bearing (use BV-94 driver), then with housing still hot install pinion assembly making certain that bearing cup is against shoulder in housing. Check pinion bearing adjustment only after installed in housing.

NOTE—Only bearings marked 'P' on end of cone should be used next to the pinion (install with 'P' marked end next to pinion).



FORD, MERCURY (PASS. CAR) SPIRAL BEVEL GEAR AXLE

Pinion Bearing Adjustment:—Use approved gauge ABV-129 to check bearing adjustment. The setting (torque required to turn pinion) should be 12-17 in.lbs. To adjust, tighten pinion bearing nut until correct gauge reading secured (check only after pinion assembly installed in axle housing), then tighten locknut securely and turn lockwasher ears over on nuts to prevent nuts loosening in service.

Differential Bearing Adjustment:—Assemble axle housings with gasket thickness of .008-.010" between right and left hand axle housing and pinion housing. Check bearing adjustment by rotating both axle shafts simultaneously (rotating one shaft will not turn differential assembly). Differential assembly should turn with a heavy drag. If clearance too great, replace gasket between right hand axle housing and pinion housing with one thinner gasket (B-4035-B) .004" thick. Check backlash.

Ring & Pinion Gear Backlash: Use a dial indicator to show pinion gear shaft movement with ring gear stationary. Backlash .006-.010" (Ford 1935-36), .012" max. (Ford '37 on), .010" (Mercury & Lin.-Zephyr) maximum. Adjust by increasing or decreasing thickness of gasket between left hand axle housing and pinion housing. Total gasket thickness must not be changed in order not to disturb bearing adjustment (increase or decrease right hand gasket thickness equally).

REAR AXLES

Ford Half-Ton Truck, Series F-1 (1948)

DESCRIPTION: Semi-floating, hypoid gear, Hotchkiss drive type. This axle does not have a separate Differential Carrier Assembly. Ring gear and differential assembly is mounted on taper roller bearings seated directly in housing under bearing caps with shim adjustment for gear backlash and bearing pre-load. Pinion is mounted on taper roller bearings in housing with pinion setting shims in housing (behind rear bearing cup) and pinion bearing adjusting shims on shaft (between front bearing cone and shoulder on shaft). Axle shafts have integral flange at outer end for wheel mounting (no separate wheel hub) and wheel bearings are sealed, pre-lubricated, ball bearing type. Bearings are press fit on shaft and are retained by ring pressed on shaft behind bearing (remove bearings only for replacement).

AXLE SHAFT REPLACEMENT: Same as for Ford (see preceding data) except that special tools required: Axle Shaft Puller #4235, Bearing Remover and Replacer #4234, Bearing & Oil Seal Replacer #4245B.

REMOVAL OF AXLE: *See "Rear Axle" on car model page.*

REAR AXLE DISASSEMBLY & OVERHAUL: Remove axle shafts (see Axle Shaft data), remove cover assembly and gasket, install special Spreader Tool No. 4000-A on housing and **spread housing not more than .015"**. Remove bearing cap screws, mark bearing caps and posts to insure correct reassembly, lift caps out, lift out differential assembly. To remove drive pinion, take off nut on pinion shaft at universal joint flange, pull flange (Tool No. 4858 for Lincoln & Mercury), withdraw pinion through rear of housing. Do not lose shims on pinion shaft next to front bearing cone (these shims control pinion bearing pre-load and **must be re-installed**). Remove oil seal at forward end of pinion housing, lift out front bearing cone and roller assembly. To remove bearing cups, use Tool No. 4628-B (front bearing on

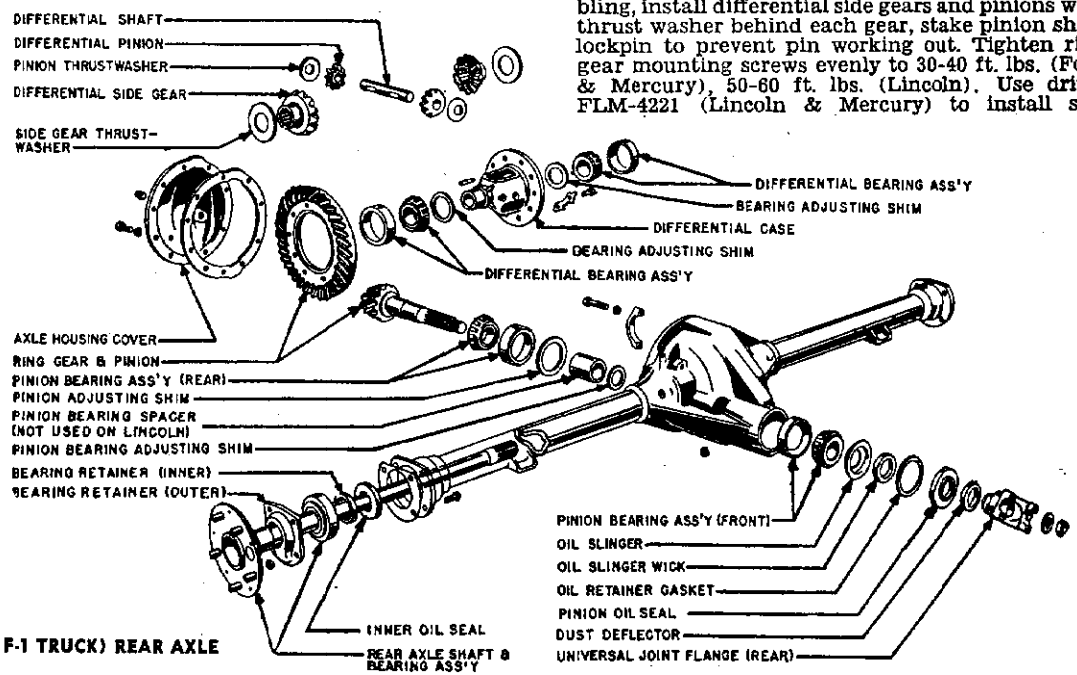
REAR AXLES (Continued)

Lincoln & Mercury), 4628-D (rear bearing on Lincoln & Mercury). CAUTION—Save and re-install shims located in housing behind rear bearing cup—these shims control pinion setting. Overhaul and assemble all sub-assemblies as follows:

Pinion Bearing Assembly: Lubricate all bearings and thrust washers with hypoid gear oil before installation. Install front and rear bearing cups in housing using Replacer No. 4616 (Lincoln & Mercury) for front bearing cup, No. 4628-A (Lincoln & Mercury) for rear bearing cup (CAUTION—re-install shims in housing behind rear bearing cup—these shims control pinion setting). Install rear bearing cone and roller assembly on pinion shaft using Replacer No. 4621-A (Lincoln & Mercury), place bearing spacer on shaft (spacer not used on Lincoln), install assembly in housing. Re-install shims on pinion shaft (same shim thickness as removed from shaft unless new pinion being installed—see Pinion Bearing Adjustment below), install front bearing cone and roller assembly, oil slinger, oil seal assembly, dust deflector, universal joint flange, washer and nut. Adjust pinion bearings and check pinion setting (gear mesh) as follows:

Pinion Bearing Adjustment: 8-12 in. lbs. pre-load (Ford models & Mercury). To check (with nut on end of pinion shaft tight), measure torque required to turn shaft. To adjust, add or remove shims (furnished .003", .005", .010", .030" thick) on shaft behind front bearing cone.

►***CAUTION—Bearing adjustment will be affected by pinion setting adjustment (change of shim thickness in housing under rear bearing cup).***



F-1 TRUCK) REAR AXLE

Pinion Setting: Pinion position must be checked when new parts installed or when same number and thickness of shims, as removed from behind rear bearing cup, not re-installed. Check pinion position by using Pinion Depth Gauge No. 4020-A (Lincoln & Mercury) or by noting marking on end of pinion (stamped figures ranging from "—5" to "+10"). Adjust pinion by adding or removing shims in housing behind rear bearing cup and make final check of gear mesh by painting gear teeth after axle re-assembled.

Pinion Marking Note—Standard pinions are marked "0". When installing a "—" pinion, **add** shims equal in thousandths to the figure following this minus sign on the pinion; for "+" pinions, **subtract** shims similarly from the standard shim thickness (for pinions marked "0"). These shims furnished in thicknesses of .003", .005", .010" (Ford & Mercury), .0025-.0035", .0045-.0055", .009-.011" (Lincoln).

►***CAUTION—Changing shim thickness to adjust pinion position will disturb bearing adjustment unless same shim thickness is added or removed from shaft at front bearing cone (add or remove shims equally at both points).***

Differential Assembly: If assembly being dismantled, remove ring gear mounting capscrews, tap ring gear off case with a brass hammer, drive differential pinion shaft lockpin out from ring gear side of case, slide shaft out, remove side gears, pinions, and thrust washers. Use puller No. 4221-C (Lincoln & Mercury) to remove side bearing cone and roller assemblies. Note number and thickness of shims behind each bearing cup and **re-install same thickness at each point when axle reassembled** unless new parts being installed in which case shims should be omitted until differential bearing and ring gear backlash is adjusted (see below). When reassembling, install differential side gears and pinions with thrust washer behind each gear, stake pinion shaft lockpin to prevent pin working out. Tighten ring gear mounting screws evenly to 30-40 ft. lbs. (Ford & Mercury), 50-60 ft. lbs. (Lincoln). Use driver FLM-4221 (Lincoln & Mercury) to install side bearing cone and roller assemblies **with same shim thickness as removed behind each bearing cone unless new parts being installed** in which case install bearings without shims and then adjust bearings and ring gear backlash as follows:

Differential Bearing & Ring Gear Backlash Adjustment: Bearing adjustment and backlash should be correct if no new parts installed. If new parts used (and side bearings installed without shims as directed above), install assembly in axle housing with pinion out, use dial indicator to measure **total end-play** of assembly and note this figure. **Select shims** (furnished .003", .005", .010", .030" thick for Ford & Mercury; .0025-.0035", .0045-.0055", .009-.011", .027-.033" thick for Lincoln) equal to this amount **plus shims equal to bearing pre-load** (.005-.009" for Ford) which is correct TOTAL SHIM PACK for the axle (total for installation on both sides of case). After pinion installed in housing, re-install carrier assembly **without shims** and measure endplay from point where ring gear and pinion backlash is zero to point where differential assembly is solidly against left hand bearing (mount dial indicator at back face of ring gear, slide carrier back and forth). Select shims equal to this indicator reading **less** .005" for desired backlash from the total shim pack (above), install these shims on carrier behind **left hand** bearing cone, install remaining shims of total shim pack on carrier behind **right hand** bearing cone. Place carrier in housing, install bearing caps (note markings), tighten bearing cap screws to 60-70 ft. lbs. torque. Recheck ring gear backlash and gear mesh as follows:

Ring Gear Backlash & Gear Mesh: Measure backlash with a dial indicator. If not within limits of .003-.006" (Ford Truck), .003-.008" (Others), adjust by shifting shims behind side bearing cups from one side of the carrier to the other but **do not change total shim thickness** which would affect bearing pre-load (above). After all adjustments completed, paint gear teeth with red lead and rotate gears in both directions under load to check tooth contact.

FORD TRUCK FULL-FLOATING (TORQUE TUBE DRIVE)

V8 Trucks, All '60', '85', '95' Models (1936 to 1939)

DESCRIPTION: Spiral bevel gear, full-floating type with torque tube drive (all models). Pinion and shaft are straddle mounted on double taper roller bearings (front), plain roller bearing (rear). **Front bearings mounted in sleeve in pinion housing (sleeve flange clamped between flanges on torque tube and pinion housing which is integral with right section of axle housing). Pinion shaft splined in rear end of tubular propeller shaft. Differential assembly mounted on taper roller bearings seated directly in recesses in axle halves.**

REMOVAL OF AXLE: *See "Rear Axle" on car model page.*

AXLE SHAFT REPLACEMENT & WHEEL BEARING ADJUSTMENT: Axle shafts can be removed without disturbing wheel bearing adjustment but must be removed to adjust the bearings.
See Hotchkiss type axle (following) for Axle Shaft Removal and Wheel Bearing Adjustment.

PROPELLER SHAFT: Propeller shaft is part of rear axle assembly (see Overhaul data below). Front bearing in torque tube is serviced as follows:

CONTINUED ON NEXT PAGE

Propeller Shaft Front Bearing:—In forward end of torque tube behind speedometer drive gear. Consists of two plain roller bearings side by side on shaft within split sleeve in torque tube. Use tool BB-309 to remove or install bearing sleeve, BB-140 to install new grease retainer in tube behind bearing sleeve.

OVERHAUL: Disassembly. Propeller shaft is removed from torque tube in same manner as passenger car model (see preceding article). Pinion bearing sleeve or cup clamped between torque tube flange and axle housing flange, use AAT13 tool to remove and install assembly after torque tube removed. Use BB-143 tool to remove bearing cups, BB-144 to install. Use tool BB-142 to remove and install pinion bearing roller and cone.

Pinion Bearing Assembly & Adjustment:—Tighten pinion nut (on pinion shaft in front of forward bearing) until force required to turn shaft is 12-16 in. lbs. Use ABV-129 gauge to check setting (gauge reads in. lbs. directly which is force in lbs. times distance out from center of shaft at which force is applied in inches). Tighten locknut securely and see that lockwasher ears turned over against both nuts

Ring & Pinion Gear Backlash: .008-.020" (1936), .004-.016" (1937-39). No adjustment.

Pinion Setting:—Not adjustable. Replace worn parts.

Differential Bearing Adjustment:—Not adjustable.

FORD TRUCK FULL-FLOATING (HOTCHKISS DRIVE)

V8 '60', All Truck Models (1940)
V8 '90' & '100' Trucks exc. ½ Ton (1940 to 1948)
4 Cyl., Truck Models (1941-42)
6 Cyl. Truck Models exc. ½ Ton (1941 to 1948)

DESCRIPTION: Spiral bevel gear, full-floating type with Hotchkiss drive. Similar to axle on previous truck models except that no torque tube is used.

¾ & 1 Ton Truck—Axle used on these models same as on other trucks except that pinion bearing sleeve (double bearing cup) is not flanged and is retained in housing by separate bearing retainer which is bolted on front end of housing with separate grease retainer assembly.

REMOVAL OF AXLE: *See "Rear Axle" on car model page.*

AXLE SHAFT REPLACEMENT & WHEEL BEARING ADJUSTMENT: This work can be done without disturbing wheels and hubs as follows:

Axle Shafts—Shafts can be removed without disturbing wheels and hubs as follows: Take out two screws in hub cap, remove cap. Remove nuts on 8 studs on axle shaft flange, turn two bolts (located between studs) in evenly to loosen axle shaft flange from hub. Then back off these two bolts, strike sharp blow on center of axle shaft flange to loosen locking cones on studs. Remove locking cones, pull shaft out. When installing shaft, see that new gasket in place under axle shaft flange, back off loosening bolts sufficiently to allow axle shaft to seat on hub, install locking cones on studs, tighten stud nuts evenly, then tighten two loosening bolts.

Wheel Bearing Adjustment—Remove axle shaft (above), remove outer locknut, lockplate, and grease retainer (except on ¾ and 1 Ton). Turn inner bearing adjusting nut up tight, then back nut off ⅛ turn, install lockplate being certain that locking pin in nut engages notch in lockplate (except ¾ & 1 Ton), bend lockplate tang against nut (¾ & 1 Ton). Install outer locknut and tighten securely. Rotate wheel by hand and see that it turns freely. Re-install axle shafts.

Wheel Bearing Assembly—To disassemble wheel bearings, remove axle shafts, remove outer locknut, grease retainer, lockplate and inner adjusting nut, remove wheel hub. Remove snap ring in inner end of hub. Use brass drift to tap inner bearing out until grease retainer comes out of hub, lift out bearing cone and roller assembly. Use puller 1239-Q to remove bearing cups from hub. Re-install parts in same manner using replacer 1239-P to install bearing cups and grease retainer in hub. Make certain that grease retainer snap ring installed, adjust wheel bearings after hub installed on axle (above).

RING GEAR BACKLASH: .004-.018". No adjustment.

OVERHAUL: Disassembly—Remove axle shafts and wheel hubs, take out capscrews holding left hand axle housing on right hand housing, remove left hand housing using care not to lose thrust pin and plate. Withdraw ring gear and differential assembly from housing (differential side bearing roller and cone assembly will come out on differential case hubs, bearing cones will remain in housing halves). Remove and service pinion assembly and differential assembly as directed below.

Pinion Bearing Assembly (Except ¾ & 1 Ton): To disassemble, take out screws mounting grease retainer and pinion sleeve flange on forward end of axle housing, lift off oil seal retainer. Remove pinion assembly using puller 4609-P and adapter 4609-P-4 (screw adapter on end of pinion shaft, mount puller on axle housing with mounting bolts passing through holes in pinion sleeve flange). Clamp pinion assembly in vise, remove locknut, lockwasher, adjusting nut, and thrust washer, lift pinion sleeve off (rear roller bearing roller and cone assembly will remain on shaft). Use puller 4221-A to remove and install this rear roller bearing on pinion shaft. To replace pinion shaft rear (pilot) bearing, remove inner race from end of pinion shaft by removing lock ring. Remove outer race and roller assembly from housing with replacer 4625-P, install new bearing with same tool and spacer 4625-P-7. To remove bearing cups from pinion bearing sleeve, use puller 4616-P. Install bearing cups with replacer 4616-Q and make certain that cups are flush with shoulder in sleeve. When assembling pinion, lubricate bearings with thin film of grease, insert pinion shaft and inner roller bearing in sleeve, install outer roller bearing, thrust washer, and adjusting nut. Tighten adjusting nut until force required to turn pinion shaft is 12-16 in.lbs. which is correct bearing pre-load. Install lockwasher and locknut, bend lockwasher ears over both nuts with locknut tight.

Pinion Bearing Assembly Installation—Make certain that axle housing face and pinion sleeve flange are clean and smooth, align dowel pin in sleeve flange and hole in housing, press pinion assembly into housing until flange seats solidly, install new cork gasket in groove in sleeve flange, install oil seal retainer (see oil seal data below), install six capscrews and tighten screws securely.

Pinion Oil Seal—To replace oil seal, press old seal out of retainer using driver 4674-P-2 with adapter 4674-P-1. Install new seal with same tools. Make certain that sharp edge of seal leather faces toward inner end of retainer.

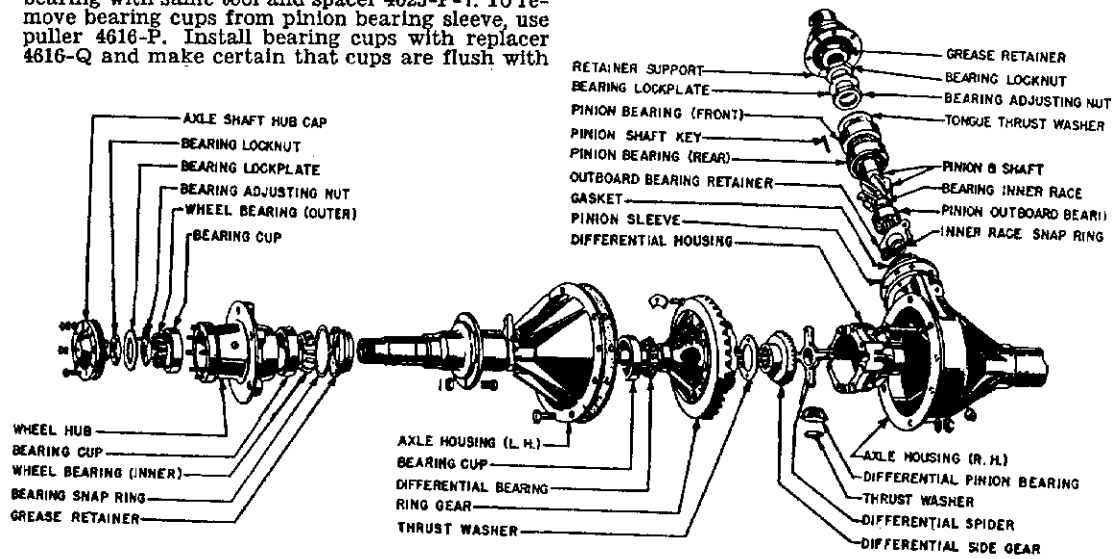
Pinion Bearing Assembly (¾ & 1 Ton): Pinion bearing sleeve is not flanged (sleeve forms pinion bearing cups) and is retained in axle housing by separate pinion bearing retainer. Pinion bearing assembly is serviced in exactly same manner as other trucks and requires same special tools (above) except that special adapter 4609-T-1 should be screwed on pinion shaft when pulling assembly out of housing. When assembling pinion, tighten adjusting nut until force required to turn pinion shaft is 12-16 in. lbs. which is correct bearing pre-load.

Pinion Bearing Assembly Installation—Same as for other trucks (above) except that oil return hole in pinion bearing retainer must be aligned with oil hole in housing.

Pinion Oil Seal—Same as given above.

Pinion Setting:—Pinion position not adjustable. If pinion mesh with ring gear not correct, replace all worn parts.

Differential Assembly:—To disassemble take out capscrews holding right hand half of differential case



FORD TRUCK SPIRAL BEVEL GEAR, FULL-FLOATING AXLE (HOTCHKISS DRIVE)

FORD TRUCK FULL-FLOATING HOTCHKISS DRIVE (Cont.)

on left hand half, remove right half of case and lift out differential gears, pinions and pinion shaft. To remove differential bearing rollers and cones from differential case hubs, use special puller 4221-A with 4221-A-5 adapter. Replace these bearings with driver 4221-T (¾ & 1 Ton), 4221-P (Other Trucks). Use puller 4616-P (¾ & 1 Ton), 1239-Q (Other Trucks) to remove bearing cups from axle housings, replacer 4222-P to install these bearing cups. Ring gear is serviced as a unit with differential case and should not be removed. Replace differential spider if worn to diameter less than .745" (¾ & 1 Ton), .868" (Other Trucks), at gear bearing surfaces, replace spider gears if inside diameter worn to more than .758" (¾ & 1 Ton), .881" (Other Trucks). Replace side gears if splines worn so that backlash of new axle shaft in gear is more than .004". Replace spider gear thrust washers if worn to thickness of less than .025" (all models), side gear thrust washers if thickness less than .057" (¾ & 1 Ton), .055" (Other Trucks). Differential bearings are not adjustable and use of additional gaskets between axle housing halves for bearing adjustment not recommended.

Ring & Pinion Gear Backlash: .004-.018". No adjustment provided.

Assembly Note:—When reassembling axle, see that thrust block and thrust pin not worn and properly installed in left hand axle housing, use one 61-4035 gasket (¾ & 1 Ton), BB-4035 gasket (Others) between axle housing halves.

Ring Gear Thrust Block: Thrust block can be removed by driving out retaining pin using a long nosed drift to drive pin out of left hand axle housing. Install new thrust block in same manner making certain that pin is seated firmly in housing.

FORD TRUCK TWO-SPEED

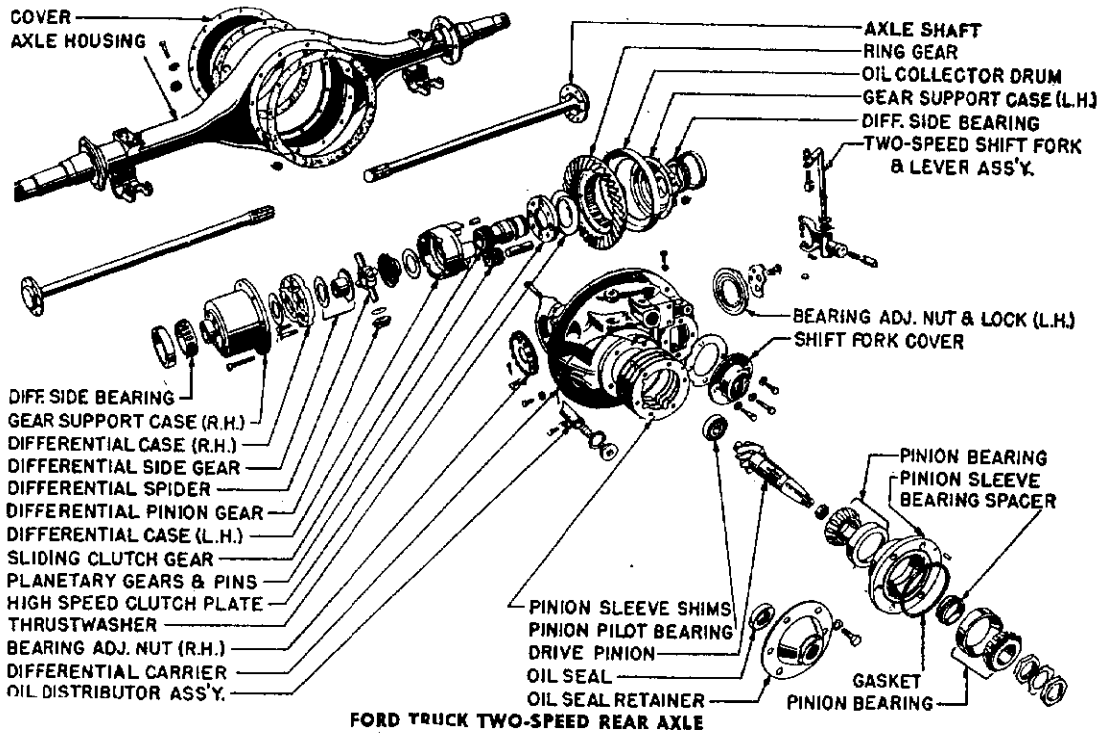
Optional Equipment On:
All 1½ & 2 Ton Truck Models (1939 to 1948)

►**NOTE:** This axle provides ratio of 5.83-1 for speed with reduced engine R.P.M. (planetary gears locked out) and a ratio of 8.11-1 for power (with planetary gears operating—these gears provide a supplementary reduction of 1.39-1). Do not confuse this type with the Ford Overdrive Axle used on passenger car models which operates differently.

DESCRIPTION: Spiral bevel gear, full-floating type with torque tube drive (1939), Hotchkiss Drive (1940 & later trucks). The pinion shaft is straddle mounted on two taper roller bearings (front), plain roller bearing (rear). Pinion shaft is splined and pinned to propeller shaft within torque tube housing. Differential assembly mounted on taper roller bearings with bearing adjusting nut under bearing cap at outer end of each bearing.

Two-Speed (Planetary) Gears. Two speed design consists of a set of four planetary pinions mounted on hardened bronze pins in the differential case and meshing with an internal gear cut on the inner rim of the ring gear. A sliding gear clutch on the left side of the differential assembly (operated by a shift lever extending through the axle housing) controls the planetary system.

Lubrication System. Special lubricating system consists of a drum on the ring gear which picks up lubricant and a scraper tube which is held against the drum by light spring pressure so as to collect this lubricant. Scraper tube is divided by partition so that lubricant directed to front pinion bearings through one channel and to right differential bearing through second channel in housing.



FORD TRUCK TWO-SPEED REAR AXLE

REMOVAL OF AXLE: *See "Rear Axle" on car model page.*

AXLE SHAFT REPLACEMENT & WHEEL BEARING ADJUSTMENT: Same as for full-floating truck axle. *See "Ford Truck Full-floating" Rear Axle.*

OVERHAUL: With differential carrier assembly removed, disassemble carrier as follows:

Disassembly: Remove oil distributor locating screw and lockwasher from top of carrier (to left of oil filler plug), remove oil distributor plug and gasket, pull oil distributor and spring out of housing. Take out four capscrews and lockwashers retaining shift fork cover (CAUTION—Note location of the one longer capscrew and re-install this in same hole when reassembling axle), remove cover and gasket, remove plunger and spring from shift fork, pull shift lever out of shift fork (do not remove felt washer and retainer unless worn and require replacing), slide shift fork from housing, pull sliding clutch gear out. Mark right and left hand bearing adjusters and bearing caps to insure correct reassembly, remove lock wires, take out bearing cap bolts, remove bearing caps, adjusting nuts, and locks. Lift differential assembly out of carrier. Remove lock wire and bolts from ring gear, remove right hand gear support case by tapping gear with a brass hammer, remove left hand gear support case, high speed clutch plate thrust washer, and oil collector drum. Slide ring gear off differential and planetary gear case. To disassemble differential and planetary gear assembly, remove high speed clutch plate by tapping with a soft hammer (strike alternately and evenly on each side). Remove planetary gears and planetary gear bronze pins. Take out 12 capscrews in differential case, separate right and left halves of case, lift out differential side gear and thrust washers, pinions and thrust washers, and spider. To remove drive pinion assembly, remove cotter pin and nut on end of shaft, pull or drive universal shaft flange off end of shaft, take out six capscrews in pinion retainer. Drive pinion assembly out of housing using a soft brass drift to drive on inner end of shaft.

Pinion Bearing Assembly: To disassemble, clamp assembly in a vise, bend lockwasher ears away from pinion bearing nuts, remove nuts and lockwasher. Lift pinion sleeve (including bearing cup and spacer) off shaft. To replace pinion bearings, use puller to remove bearing cups from pinion sleeve or insert bar 3 7/16" long through hole in side of sleeve so that it rests on inner end of one bearing cup and press cup out in an arbor press, remove second cup similarly. Remove bearing roller and cone assemblies from pinion shaft with a puller. To remove rear (pilot) bearing, remove lockring on pinion end of bearing using a sharp screwdriver blade, slide outer race off, remove bearing rollers, press inner race off end of shaft. Press new rear bearing on shaft and stake bearing at four points (place a steel ball on end of shaft at inner race, strike ball with a hammer). Press bearing cups in pinion sleeve until they seat solidly against shoulder, press one roller and cone assembly on pinion shaft, insert pinion shaft in sleeve, place bearing adjustment spacer on shaft (see Pinion Bearing Adjustment below), install second roller and cone assembly, install bearing nut, lockwasher, locknut (bend lockwasher ears over nuts after bearing adjustment checked).

FORD TRUCK TWO-SPEED (Continued)

Pinion Bearing Adjustment—With pinion nut tight, force required to turn pinion shaft should be. 12-16 in. lbs. If bearing adjustment not correct, install spacer of different thickness on pinion shaft between bearing cones. This spacer furnished in 12 different thicknesses from .513"/.514" thick (min.) to .543"/.544" thick (max.) for bearing adjustment.

Pinion Oil Seal—To replace oil seal, drive old seal out with a small punch, install new seal with Driver 4674-P-2 and Adapter 4674-P-1. Seal must be installed with sharp edge of leather facing inner end of retainer.

Pinion Setting: Pinion position controlled by shims installed between pinion sleeve flange and mating face of carrier. When installing pinion assembly, make certain that these faces are clean and smooth, install same thickness of shims between carrier face and pinion sleeve flange as removed when axle disassembled, line up dowel pin in sleeve with hole in carrier, drive assembly in until it seats solidly. Install new cork gasket in pinion sleeve groove, install oil seal retainer taking care that seal leather not damaged by keyway in shaft. Install and tighten six capscrews and lockwashers. After completely assembling axle, check ring and pinion gear mesh. Pinion position can be adjusted by changing shim thickness under sleeve flange. These shims furnished in four thicknesses from .00975"/.01025" (min.) to .028"/.032" (max.) for this adjustment.

Differential Gear & Bearing Assembly: To remove differential side bearings, tap old bearing roller and cone assemblies off drive gear case hubs using a drift inserted through holes in case back of each bearing (drive alternately and evenly through both holes). Press new bearings on hubs. Replace differential spider if worn to diameter of less than .934" at gear bearing surfaces, replace spider gears if inside diameter worn to more than .944". Replace side gears if splines worn so that backlash of new axle shaft in gear is more than .004". Replace spider gear thrust washers if thickness less than .025", side gear thrust washers if thickness less than .058". When reassembling unit, lubricate gears and thrust washers, make certain that long and short bolts installed in proper holes (8 long, 4 short), lock bolts with lockwire after properly tightened. Install planetary gear pins in holes in differential case, install gears, install high speed clutch plate on planetary gear pins with **chamfered teeth in toward planetary gears**, tap plate in place with a brass hammer. Place right hand gear support case on bench with open end up, lubricate and install thrust washer in case, install differential assembly with planetary gears upward, install ring gear with teeth facing downward and mesh internal gear teeth with planetary gears, line up bolt holes in gear with bolt holes in case. Place oil collector drum on ring gear with open side toward gear and engage tongues on drum in gear recesses. Lubricate high speed clutch plate thrust washer and install it on high speed clutch plate. Install left hand gear support case, install six bolts with heads against flange of right hand gear support case, tighten all bolt nuts securely and secure nuts with lockwire.

Differential Bearing Adjustment—When installing differential assembly in carrier, lubricate bearings with thin film of grease, install bearing cups and adjusters, hold adjuster away from threads in carrier until bearing cap bolts are started, then lower cap and adjuster into mesh with carrier threads. Make certain that adjuster properly meshed in both cap and carrier before tightening cap bolts. Turn left hand adjuster up until ring and pinion gears mesh loosely, tighten right hand adjuster up as tightly as possible, then back off adjuster one notch. This setting will give correct bearing pre-load. After checking ring and pinion gear backlash, tighten both bearing cap bolts very tight, secure bolts with lockwire, install adjuster locks.

Ring Gear Backlash Adjustment: Back off the right hand differential bearing adjusting nut and turn up left hand nut until backlash between gears is .004-.018" (measured at gear teeth). Paint gears to check mesh, adjust ring gear position for correct lengthwise contact, adjust pinion position for correct contact on tooth (contact depth on face of tooth). After correct gear mesh and backlash secured, adjust differential bearings (above).

►*CAUTION*—When making this adjustment, back off one adjuster, and tighten opposite adjuster **exactly same number of notches** to avoid disturbing differential bearing adjustment.

SHOCK ABSORBERS

HOUDE (HOUDAILLE) ROTARY TYPE

1939 CAR MODELS

Car Models.	Houde Model No. Front.	Rear.
Ford, All Models (1939)	BBDK	BBDW
Mercury Model 99A (1939)	BBDK	BBDW

1940 CAR MODELS

Ford All '60' & '85' ('40)	BBDM	BBDX
Mercury 09A (1940)	BBDM	BBDX

1941 CAR MODELS

Ford Pass. Car Models (41)	BBCN	BBCZ
Ford Comm'l. (1941)	BBCME	BBCZ
Ford Truck (1941)	BBCME	BBG
Mercury Model 19A (1941)	BBCN	BBCZ

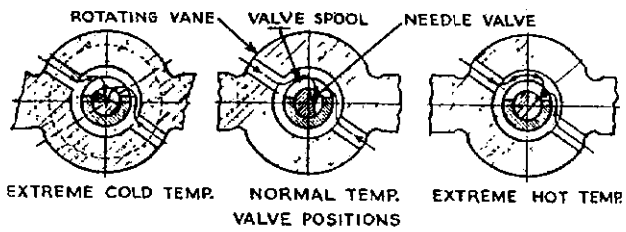
1942 CAR MODELS

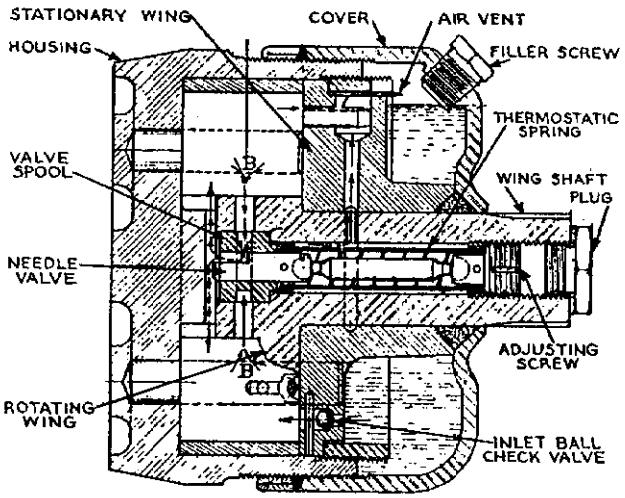
Ford Pass. & Comm'l ('42)	BBCN	BBCZ
Ford Truck Models (1942)	BBCME	BBG
	BBCHMS	BBCLL
		BBCLT
Mercury, Model 29A (1942)	BBCN	BBCZ

1946-48 CAR MODELS

Ford, All Models ('46-48)	BBCN-3	BBCZ-3
Mercury, All Models ('46-48)	BBCN-3	BBCZ-3

Production Change Note—First type shock absorber with domed filler plug (using #1402 fluid) should be replaced by later thermostatic control type exchange shock absorbers with flat filler plug (use #800 fluid).





Ford, Mercury (1939-48); . A new spring-loaded automatic type packing gland is used which does not require attention in service. With this type construction, packing is installed within the housing end cover and uniform pressure is maintained on the packing by a spiral spring.

NOTE—These shock absorbers can be identified by three drill spots on raised lugs on cover.

New Houdaille L-1404 Fluid (1946-48)—This is the only type fluid to be used in 1946-48 Houde shock absorber with round top filler plugs, **do not use earlier type fluid.** This is a new castor oil base fluid which gives improved cold weather performance. This fluid can be used in earlier type shock absorbers.

DESCRIPTION & OPERATION:—Double vane, hydraulic type. Case is divided into two semi-circular chambers by stationary wing or partition. Rotating wing is integral with shaft to which shock absorber arm is attached and moves backward and forward in the chamber displacing the fluid from the compression space (in front of the moving vane) to the non-compression space behind it. Fluid escape from compression chamber is regulated by valves in the movable wingshaft as detailed below for each type. In addition, on the compression stroke (when car springs compressed by road shock) fluid is allowed to flow through ball check valves in the stationary wing into the opposite non-compression chamber which lessens the shock absorbing action. On the rebound these check valves close and all fluid flow is regulated by the movable wingshaft valves.

HOUDE (HOUDAILLE) Cont.

Adjustable Orifice Type. By-pass in rotating wing-shaft controlled by needle valve which is adjustable by turning handle at end of shaft within shock absorber lever or by removing plug on end of shaft and turning valve stem with special adjusting tool.

ADJUSTMENT:—Adjustment provided for both Adjustable Orifice type and Automatic Thermostatic Control type so that softer or firmer shock absorber action can be secured for particular operating conditions. Adjustments are sensitive and screw should not be turned more than 1/32" at a time (road test car to check performance).

Adjustable Orifice Type — On these models adjusting handle or pointer located on end of shaft within lever. Original standard setting indicated by one or two chisel marks on shaft (center pointer on single mark or between double marks), turn handle clockwise to increase, or counter-clockwise to decrease shock absorber action. Stops provided to limit motion in each direction. Do not force adjusting handle beyond stops.

SERVICING:—Fluid Level. Inspect at 5000 mile intervals and fill with genuine Houdaille fluid, even with bottom of filler plug hole (unit must be in normal mounting position). Work arm up and down several times to expel all air bubbles.

Fluid Recommendations—Ford, Lincoln, Mercury Models—Ford Shock Absorber Fluid.

CAUTION—All 1946-48 Houde Shock Absorbers with **round top filler plug** designed for use with L-1404 fluid only (new castor oil base fluid which gives improved cold weather performance). Do not use earlier type fluid in these units.

HOUDE (HOUDAILLE) DIRECT ACTING

Car Model	Front	Rear
Ford F1, F2, F3 Truck ('48)	H-160	H-170

TYPE:—Direct Acting, piston type. Shock Absorber is permanently sealed and cannot be dismantled or refilled.

SERVICING:—Serviced by replacement (permanently sealed and cannot be refilled or repaired).

STEERING GEARS

GEMMER WORM-AND-ROLLER (WITH PUSH-PULL ADJUSTMENT) TYPES 305, 335

Car Model	Gemmer Model
Ford V8, All Pass. Car Models (1937-40)	305
Ford 6 Cyl. & V8, All Pass. Cars (1941-48)	②
Ford Truck, All Models (1938-42)	335
Ford Truck, ½ & ¾ Ton (1944-48)	②
Ford Truck, Others (1944-48)	③
Mercury, All Models (1939-42)	305
Mercury, All Models (1946-48)	②

②—Own Make but similar to Gemmer Model 305.
③—Own Make but similar to Gemmer Model 335.

NOTE:—Steering Column Gear Shifts—For Adjustment, Servicing, and Removal of steering column mounted gear shifts, see "Transmission Controls."

DESCRIPTION:—These models are similar in design to other Gemmer Worm and Roller types except that washer on adjusting screw head engages slot in end of roller shaft so that shaft is prevented from moving in either direction (push-pull adjustment).

ADJUSTMENT:—Before making adjustments, disconnect drag link at steering arm and jack up front wheels. Wheels should turn freely in both directions with not more than 10 lbs. pull on drag link

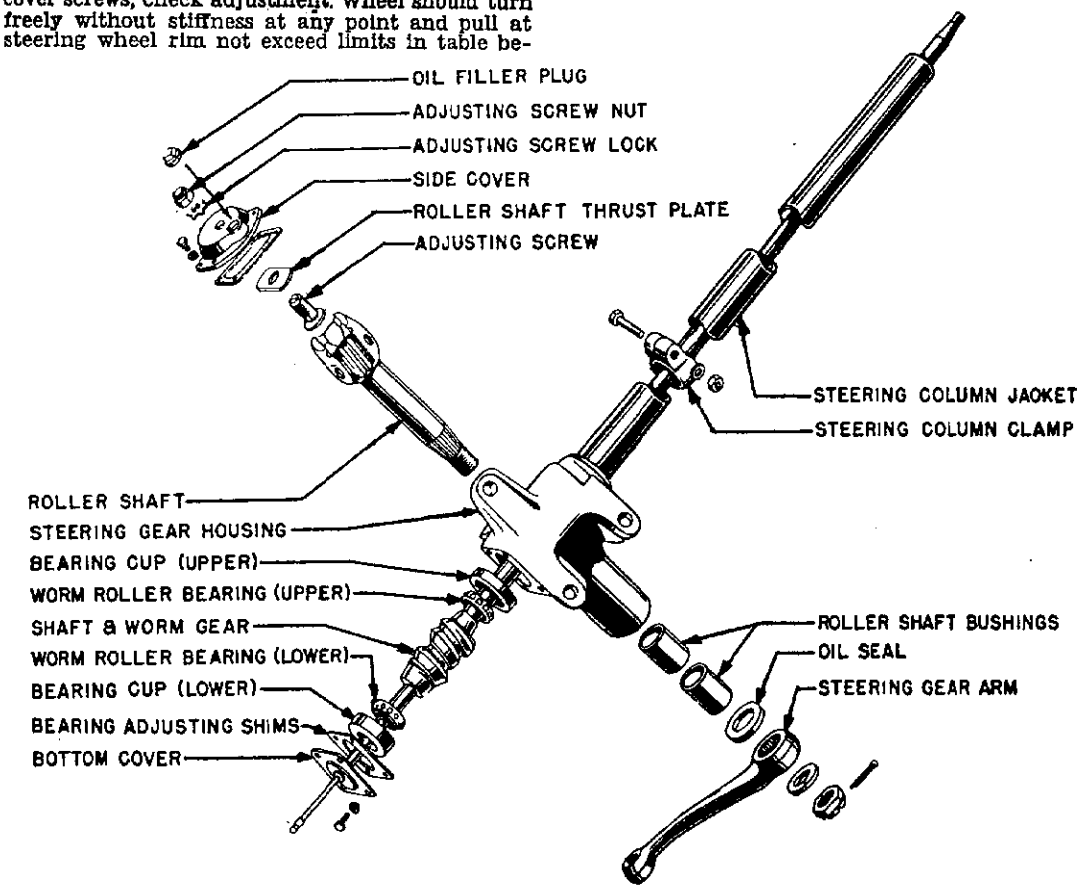
Align steering column by loosening frame bracket bolts to allow gear to shift in frame; tighten bolts. Then loosen dash bracket bolts to allow bracket to be aligned with column, if necessary shim bracket or elongate mounting holes so that column will not be sprung when bracket bolts are tightened.

Worm Bearing Endplay:—Check by turning steering wheel one turn to right, secure wheel, shake front wheels (drag link must be connected), check movement of steering wheel hub on column jacket. If endplay perceptible, adjust by loosening four screws in lower cover about ⅛", clip and remove top shim, being careful not to mar remaining shims. Tighten cover screws, check adjustment. Wheel should turn freely without stiffness at any point and pull at steering wheel rim not exceed limits in table below (check with spring scale hooked to wheel rim and apply pull tangent to rim).

Roller Mesh in Worm:—Check by turning steering wheel to center position (turn wheel back one-half total number of turns from either end position or place marked spoke straight up or straight down), shake steering arm at ball end. If play or backlash exceeds 1/32", adjust roller shaft position as follows:

Adjustment —Remove adjusting screw cap nut on side cover, slide locking plate off until it clears lock boss on cover, turn slotted adjusting screw in just enough to take up backlash (further movement will cause damage to gear), engage locking plate, replace cap nut. Steering wheel should turn freely throughout entire range without binding at any point. Check adjustment by noting pull required to turn wheel through center 'high' point (use spring scale attached to rim of wheel and apply pull tangent to rim). If pull outside limits, recheck adjustment.

Car Model	Steering Gear Setting
Ford, Lincoln, Mercury	3 lbs.



GEMMER MODEL 305, 335 STEERING GEAR

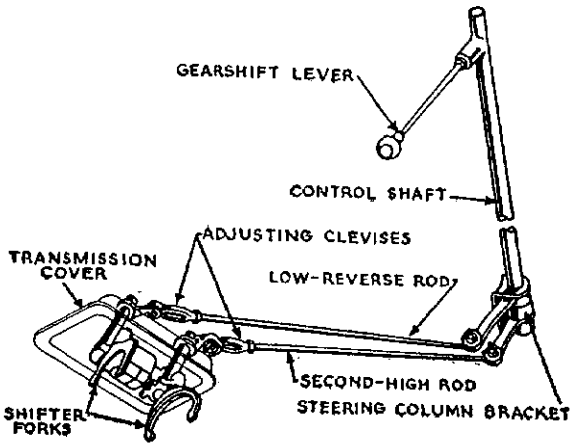
TRANSMISSION CONTROLS

FORD MODELS
6 Cyl. Passenger Cars (1941 to 1949)
V8 Passenger Cars (1940 to 1949)
MERCURY MODELS
All Models (1940 to 1949)

NOTE:—Lincoln & Mercury Models with Liquamatic Transmission—Steering column gearshift control on cars with Liquamatic Drive is similar to type used with standard 3-speed synchro-mesh transmission for which data is given below.

Lincoln and 1949 Ford & Mercury Linkage Adjustment Note—On these models, adjusting clevises or trunnions are located at forward end of control rods (lower end of steering column). On 1948 and previous Ford & Mercury models, adjusting clevises are located at transmission case end of rods.

DESCRIPTION: Remote control with steering column mounted gearshift lever. Used in connection with transmission having special shifter mechanism on transmission case side cover which consists of separate Low-Reverse (rear) shift lever and Sec-



ond-High (front) lever. Steering column unit consists of a control tube with a clutch pin at the lower end which normally engages the lower (second-high) lever on the steering column. When the gear shift lever is raised to engage Low or Reverse, the control tube is lifted up so that the clutch pin engages the upper (Low-Reverse) lever. These levers are connected to shift levers on transmission case by adjustable control rods.

ADJUSTMENT:—Adjustment should be checked whenever steering column position is changed or when linkage disconnected. Before making adjustments, make certain that both shift levers on transmission case are in neutral with detent balls engaging neutral notch in shifter shaft sectors (can be determined by feel with control rods disconnected). Disconnect Low-Reverse control rod at adjustment end (see Note), loosen locknut and adjust clevis on end of rod so that gearshift lever moves up and down freely (cross-shift at neutral) with control rod connected. Second-High control rod will not ordinarily require adjustment. Make certain that gearshift lever has full travel in both directions so that gears are fully engaged (detent balls should engage end notches in shifter shaft sectors with gears engaged).

NOTE—Adjusting nuts on control rods are located at transmission end of rods (1948 & previous Ford and Mercury), steering column end of rods (All Lincoln and 1949 Ford & Mercury). When making adjustments, rods should be disconnected at end at which adjustment is located.

SERVICING:—Steering Column Unit—Steering column unit is mounted on steering column by retainer clamped in bracket bolted on column and can be dismantled after bracket has been loosened and retainer setscrew removed. Gearshift lever is pivoted on pin in control tube elbow and inner end engages fulcrum pin within upper end of control tube. If assembly dismantled, make certain that spring installed at lower end of fulcrum pin and that bushing and boot installed on upper end of fulcrum pin when it is reassembled. Sleeve type insulator should be installed on end of gearshift lever before lever is installed.

Transmission Case Shifter Mechanism—See Transmission article for servicing data.

TRANSMISSIONS

3-SPEED

Ford 6 & V8, Pass. Cars (1936 to 1948)
Ford Comm'l ½ Ton & ¾ Ton Truck (1940 to 1948)
Ford 1 Ton Truck Models (1940 to 1947)
Mercury, All Models (1939 to 1948)

►NOTES, CAUTIONS, & CHANGES

►**Ford, Lincoln, Mercury Passenger Car Gearshift 1940 & Later Cars**—New type consisting of two independent shifting levers and shafts mounted on side cover on transmission case (no top cover used) and linked to gearshift lever on steering column by adjustable rods. Entire gearshift mechanism is removed as an assembly with the side cover and need not be dismantled.

►**Ford Truck Optl. Transmission**—Four-speed type optional on these truck models.

DESCRIPTION: Constant-mesh, synchro-mesh, helical gear (Second & High), sliding gear (Low & Reverse). Main drive gear mounted on ball bearing in case. Mainshaft mounted on roller bearing (front), ball bearing (rear). Countershaft mounted on roller bearings on stationary countershaft with thrust washer at each end. Gears are engaged by a sliding clutch sleeve (outer sleeve or synchronizing unit) which engages clutch teeth on the main drive gear and second speed gear hubs. NOTE—Countershaft on '60' model mounted on bushings pressed in gear assembly (first cars), floating bushings (later). See Countergear data.

Ford '85' Models. Transmissions with sliding spur low-and-reverse gear used on some models. This transmission serviced in same manner as others.

Synchronizing Unit: Various types used as follows:

Plain Type (1936-41)—Unit consists of an inner hub splined on the mainshaft with synchronizing rings at each end and outer clutch sleeve splined on this hub. Sleeve is centered on hub by spring-loaded detent balls (mounted in holes in hub, engage groove in sleeve) so that entire synchronizing assembly moves as a unit, when clutch sleeve shifted to engage gears, until synchronizing rings engage synchronizing cones on gear hubs. Clutch sleeve then slides further to engage clutch teeth on gears (synchronizing rings prevent this engagement until synchronization completed).

Ball & Strut Blocking Synchronizer (1937 On)—On this type synchronizer unit, both synchronizer rings are loose in ends of clutch sleeve and are actuated by struts assembled in slots in inner clutch sleeve and engaging notches in synchronizer rings. Struts are centralized in clutch sleeve assembly by the regular poppet balls and springs so that struts move with the outer clutch sleeve during initial movement to engage the synchronizer rings with the cones on the gear hubs. Teeth on outer rim of synchronizer rings block or prevent gear engagement until synchronization completed when the final movement of the outer clutch sleeve causes the clutch teeth on the inner rim of the sleeve to slide through the synchronizer ring teeth to engage clutch teeth on gear hubs. Inner clutch sleeve is stationary on mainshaft (retained as unit with second speed gear by snap ring in groove on shaft).

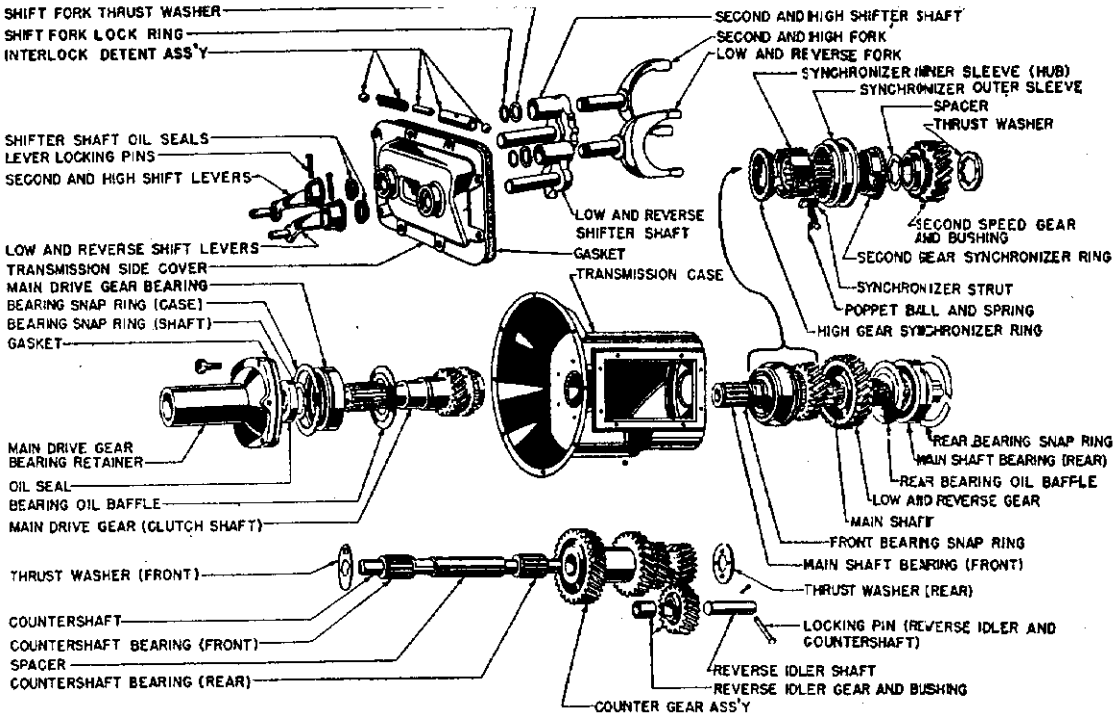
NOTE—This Ball & Strut type synchronizer can be distinguished from Wire-Bound Strut type synchronizer (below) by absence of shoulder on second speed gear end of outer clutch sleeve.

Wire Bound Strut Blocking Synchronizer (1938-39) Both synchronizer rings are loose in ends of clutch sleeve and are actuated by struts assembled in slots in inner clutch sleeve and engaging notches in synchronizer rings. Struts are centralized in clutch sleeve assembly by lock ring or wire installed in outer clutch sleeve which engages notches on struts. Struts move with the outer clutch sleeve during initial movement to engage synchronizer rings with cones on gear hubs. Teeth on outer rim of rings "block" or prevent gear engagement until synchronization completed when the final movement of the clutch sleeve causes clutch teeth on sleeve to slide through the synchronizer ring teeth to engage clutch teeth on gear hubs. Inner clutch sleeve is stationary on mainshaft (retained as unit with 2nd. speed gear by snap ring in groove on shaft).

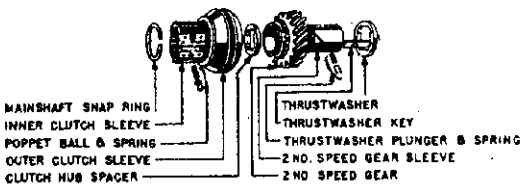
Gearshift Assy. (1940 & Later Pass. Cars): Consists of two independent shifting levers and shafts mounted on transmission case side cover (rear lever is Low-Reverse, forward lever Second-High). Fork on inner end of lever shaft engages gears directly and no shifter rails are used. Detent balls and interlock mechanism consist of a spring, plunger, and two balls assembled in a tube in a boss within the transmission case so that the balls engage notches in sectors on each of the shifter shafts. The entire gearshift mechanism can be removed as a unit with the side cover by disengaging the forks from the gears. CAUTION—When reassembling cover, make certain that rear fork engages low speed gear, forward fork engages outer sleeve of synchronizer unit.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

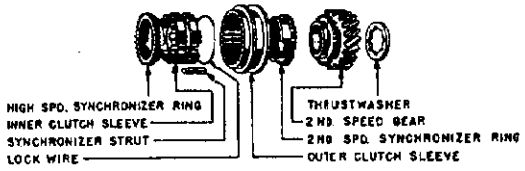
DISASSEMBLY: Remove transmission cover, lever, shifter shaft and fork assembly (1939 and earlier types), remove side cover and shifter mechanism as an assembly (1940 & later). Take out capscrews in universal joint front yoke, remove yoke from shaft. Take out capscrews mounting universal joint housing on rear of case, remove housing. Remove locking pin and drive out countershaft. Take out bearing retainer screws on front of case, withdraw clutch shaft main drive gear and bearing assembly



1940-48 FORD, MERCURY 3-SPEED (BALL & STRUT TYPE SYNCHRONIZER)



PLAIN TYPE SYNCHRONIZER



WIRE BOUND STRUT TYPE SYNCHRONIZER

Tap mainshaft back in case until rear bearing clears rear face of case, remove snap ring from bearing. Tap mainshaft forward until bearing clears inner face of case, remove mainshaft, synchronizer, and gears from the case as an assembly (lift out bearing end of shaft first). Lift out countergear cluster and thrustwashers. If reverse idler gear to be removed, tap shaft out from rear end of case (retained by same lockpin as countershaft), lift gear out.

REASSEMBLY: Reverse disassembly directions (above) and note following data on servicing of sub-assemblies.

Mainshaft Assembly: See Synchronizer, Second Speed Gear, and Sliding Gear for removal and installation of these parts. Rear bearing should be replaced as follows:

Mainshaft Rear Bearing—Press old bearing off shaft. Install oil baffle on shaft with outer edge of baffle away from bearing, press new bearing on shaft until seated against shoulder.

Synchronizing Unit:—Can be removed from front end of mainshaft without being dismantled. If clutch sleeve is to be removed from the inner clutch hub mark both parts and reassemble in same positions, use extreme care not to lose detent balls and springs (will jump out when parts separated).

Blocking Type Synchronizers—Mark both rings as well as inner and outer clutch sleeves before disassembly to insure reassembling in same relative positions. When installing struts, make certain that they engage poppet balls (Strut Type) or that locking wire engages notches in struts and is installed with hook on open end engaged between two clutch teeth on outer sleeve midway between struts (Wire Bound Strut Type). Wire Bound Strut Type Synchronizer is mounted on mainshaft as an assembly with the second speed gear as shown below.

Second Speed Gear Assembly (With Plain Type Synchronizer): Gear is retained on shaft by thrustwasher at rear and thrustwasher (spacer) at front which are locked in place by locking key and plunger within the gear sleeve. To remove the gear, insert a punch (or wire) through the hole at center of gear, rotate the gear until wire can be pushed through hole in sleeve, depress plunger, **until locking key is freed, push key forward to release rear thrust washer, turn washer until prongs (engaged in slot in splines) line up with shaft splines, move washer to rear slightly. Move key back to free front washer (plunger will engage key at center position and must be depressed again to allow key to be shifted further), withdraw wire and move second speed gear back to expose front thrust washer, turn washer until prongs are freed from splines, remove washer and gear. When installing gear, make certain that both thrust washers are turned so that prongs engage slots in splines (to prevent endwise movement) and that key engages** both washers and that key is locked by plunger.

Gear Endplay—.004-.008" (new), .020" (worn limit). Controlled by thrustwashers furnished in following thicknesses:

Front (Spacer)—B-7069—.183-.184" (new), .179" (worn limit).

Rear (Thrustwasher)—68-7071—.1875" (new), .1825" (worn limit).

Second Speed Gear Assembly (With Blocker Type Synchronizer): Gear and inner sleeve or hub of synchronizer are mounted as an assembly on the mainshaft with a thrustwasher (spacer) between the gear and synchronizer. Assembly is retained on shaft by snap ring at forward end of synchronizer clutch sleeve. To dismantle assembly, remove snap ring from groove at forward end of shaft, withdraw synchronizer assembly, thrustwasher, and second speed gear. NOTE—Gear and bushing are furnished as an assembly.

Gear Endplay—(1937-48) .004-.008" (new), .020" (worn limit). (1948 Half-Ton) .003-.011" (new), .023" (worn limit). Install spacer (front thrustwasher) of correct thickness for this endplay. This spacer furnished in two thicknesses as follows: 81A-7069-A—.0630-.06355" (new), .060" (worn limit). 81A-7069-B—.068-.071" (new), .066" (worn limit). Rear thrustwasher furnished in one thickness only: 81A-7071—.184-.185" (new), .179" (worn limit).

►**Wire Bound Blocking Synchronizer Note**—Front thrustwasher or spacer not used with this type synchronizer.

Countergear Assembly:—Counter shaft is retained by locking pin driven in through hole in case and rear end of shaft (pin also locks reverse idler gear shaft in place) and shaft can be driven out after pin removed. Gear cluster is mounted on roller bearings with spacer on shaft between bearings. When installing gear cluster, make certain that tongue on thrust washer at forward end engages slot in case and that rear thrust washer prongs engage gear.

NOTE—On '60' models, floating bushings are used. Spacer (74-7115) installed between bushings.

CONTINUED ON NEXT PAGE

Countergear Endplay—Endplay must not exceed following specifications (replace thrustwashers if excessive):

1936-48 Pass. Cars—.005-.017" (new), .025" (worn).

1936-47 Trucks—.005-.017" (new), .025" (worn).

1948 Half-Ton—.0045-.0185" (new), .0265" (worn).

1948 Other Trucks—.006-.020" (new), .028" (worn).

Reverse Idler Gear:—Shaft retained by countershaft locking pin, may be removed after pin driven out. Install gear with shoulder toward rear of case. See that locking pin hole in shaft lined up with hole in case and install locking pin after countershaft installed (same pin locks both shafts).

Gearshift Assembly (Pass. Cars):—To dismantle the shift assembly, remove lockrings on shifter shaft ends of forks, remove forks from shifter shafts. Drive out locking pins in lever at outer ends of shifter shafts, withdraw shafts from inside of cover using extreme care not to lose detent balls, spring, and plunger. Reassemble shifter mechanism in same manner. See that oil seal in recess in cover at outer end of each shifter shaft is in good condition. See Ford & Lincoln Transmission Control articles for adjustment directions.

1942 MERCURY LIQUAMATIC DRIVE

MERCURY PASSENGER CARS (1942)

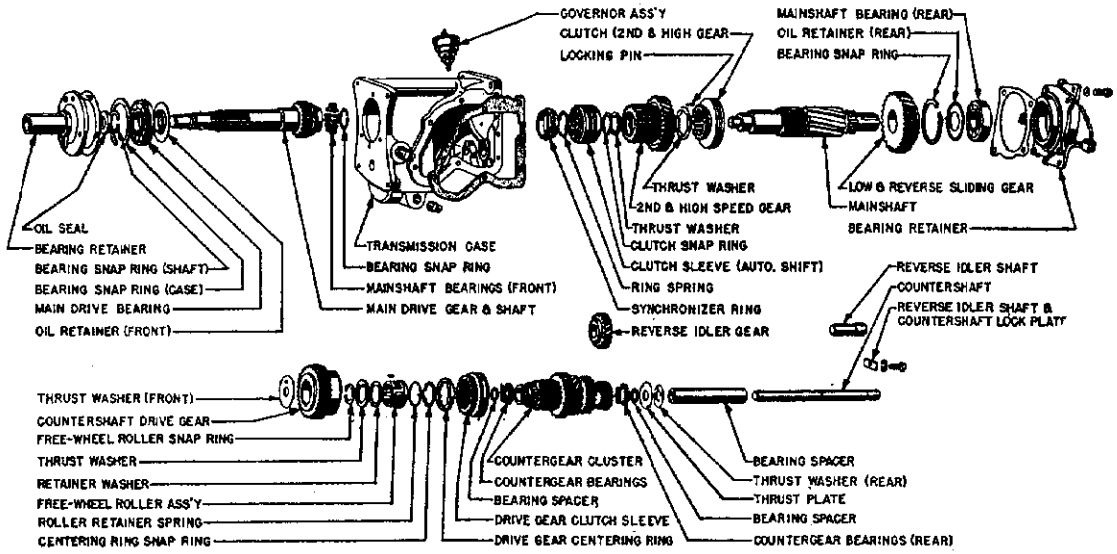
MERCURY NOTE:—Liquamatic Drive, as offered on Mercury cars, is similar to type used on Lincoln except that Overdrive is not used.

DESCRIPTION:—Liquamatic Drive consists of a Fluid Coupling, conventional Single Plate Clutch, new design 3-speed Transmission with automatic shifting between Second & High Gear, and an Overdrive Unit (Lincoln only) with Governor control.

Fluid Coupling—This unit is similar to other Fluid Couplings and consists of a driving member and a driven member within a housing mounted on the rear end of the engine crankshaft. Engine torque is transmitted through the fluid with which the case is filled and the fluid coupling eliminates vibration, insures smooth starting, and makes manual clutch disengagement unnecessary.

Automatic Transmission—Warner AS1-T94 (Mercury), T94A with R10A Overdrive (Lincoln). Special design with free-wheel unit or overrunning clutch incorporated in the drive gear on countershaft so that Second Gear or High Gear effective (depending on car speed and consequent position of automatic shift mechanism) with steering column gearshift lever in 'High' position. Transmission can be 'kicked down' from High Gear to Second Gear at car speeds below 35 MPH. by fully depressing the accelerator pedal (accelerator pedal action also controls Overdrive on Lincoln as described below). With the gearshift lever in the 'Second' position, overrunning clutch is locked out and transmission remains in second gear (automatic shift inoperative) so that engine can be used as a brake.

OPERATION:—**Mercury Transmission**—The gearshift lever on the steering column is normally left in the High position (for starting and running) but transmission automatically shifts down to Second Gear (without gearshift lever change) at car speeds below 11 MPH. so that all starts are made in Second.



MERCURY LIQUAMATIC DRIVE

When accelerator pedal is depressed to accelerate engine, fluid coupling transmits torque and car starts in normal manner. At car speeds above 11 MPH., transmission automatically shifts to High Gear when accelerator pedal is released momentarily (second speed gear is not disengaged but freewheels on countershaft) and transmission remains in High until car speed decreases to 11 MPH. or accelerator pedal is fully depressed for 'kick-down' downshift to Second for acceleration (transmission will return to High when pedal released). This kick-down downshift does not occur at car speeds above 38 MPH. and transmission remains in High.

Transmission Gearshift Mechanism:—Automatic shift mechanism consists of a special sliding clutch collar on the hub of the Second Speed Gear on the transmission mainshaft which locks this gear to the clutch gear (main drive gear) for High Gear or direct drive operation (Second Speed Gear will be locked to mainshaft by manually controlled sliding clutch collar directly behind gear when the steering column gearshift lever is in the High Gear position). This direct drive is permitted by the 'freewheel' unit in the countershaft driving gear(countershaft gear cluster overruns this driving gear as it is being driven at faster speed by the second speed gear on the mainshaft when transmission is in High). The automatic shift sliding clutch collar is operated by the vacuum power cylinder as described below. When clutch collar is shifted to rear (second speed gear free) transmission will be in Second Gear, when clutch collar shifted forward (second speed gear locked), transmission in High.

Transmission Control Vacuum Cylinder:—Consists of a piston type vacuum power cylinder and solenoid valve assembly mounted on the right hand side of the transmission case with the piston rod linked to the automatic shift clutch collar shift lever (see above). A large return spring is located within the vacuum cylinder behind the piston (downstroke or outward movement of piston rod is spring actuated, upstroke or inward movement of the piston rod only is vacuum actuated) and a 'holding solenoid' coil and Ignition Shorting Switch is built in the end of the vacuum cylinder. When the solenoid valve is energized, valve opens and admits vacuum to power cylinder so that piston and rod are drawn into cylinder shifting the transmission into Second Gear. Piston and rod are held in this inner position by the 'holding coil' in the cylinder which is connected in series with the valve solenoid and is likewise energized. In this inner position, the piston actuates the Ignition Shorting Switch plunger and closes the switch contacts but the ignition is not shorted out because right hand (ignition) contacts in control relay are normally open. When the left hand contacts of the control relay open to de-energize the solenoid valve and vacuum cylinder holding coil (actuated by Governor, Throttle Kick-down Switch, or Interlock Switch as described below), the right hand (ignition) contacts also open and, as the ignition shorting switch contacts in the vacuum cylinder are likewise open, the ignition coil is grounded and engine ignition is cut out momentarily allowing engine to coast and relieving the torque from the automatic shift clutch collar. The return spring in the vacuum cylinder then pushes the piston and rod outward to shift the automatic shift clutch collar into Second Speed position (balk ring in clutch collar prevents engagement until torque has been relieved). As soon as the vacuum cylinder piston has moved out 3/8", the contacts in the ignition shorting switch open and ignition is restored (this entire action occurs so fast that this cutting out not noticed.

Transmission Control Relay:—Relay has two sets of contacts and when relay winding is energized, left hand (solenoid valve & holding coil circuit) contacts will be closed and right hand (ignition) contacts will be open. When relay winding is de-energized by opening of the control switch contacts, left hand contacts open and right hand contacts close. Relay is controlled as follows:

Governor—Governor is mounted on right side of transmission and driven from a special gear of the

LIQUAMATIC DRIVE (Cont.)

countergear cluster. Governor is two-stage type. At car speeds below 11 MPH. both sets of contacts are open. At 11 MPH., low speed contacts close to actuate relay and energize solenoid valve and vacuum cylinder holding coil so that transmission shifts to High Gear. At 38 MPH., the high speed contacts close and transmission remains in High.

Throttle Kick-down Switch—Throttle Kick-down switch is connected in Governor low speed contact circuit and is normally closed so that transmission operation is controlled by the governor. Whenever the accelerator pedal is fully depressed for 'kick-down' to Second (at car speeds between 11 and 38 MPH.), throttle switch contacts open and break the circuit to ground (through governor low speed contacts) so that solenoid valve and vacuum cylinder holding coil are de-energized and downshift to Second occurs. At speeds above 38 MPH., circuit is completed through governor high speed contacts and throttle switch operation has no effect.

Interlock Switch—Mounted on left hand side of transmission. Switch is connected in circuit between relay and governor and is normally closed. Whenever gearshift lever is moved to any other position than High Gear, interlock switch contacts open so that automatic shift is inoperative.

SERVICING & ADJUSTMENT:—Fluid Coupling—Fluid coupling is filled with SAE #10W oil which is correct for all operating conditions and need never be changed. Check fluid level at 5000 mile intervals.

CAUTION——Never remove fluid coupling plug to check oil level when oil hot (check at 70°F).

Checking Oil Level—Remove hand hole cover on top of clutch housing (left side on Mercury). Turn fluid coupling until plug in coupling cover is opposite lower mark on clutch housing (Lincoln), centered between two marks or ribs on housing (Mercury), remove plug (see Caution above). Fill coupling to point even with bottom of filler hole with SAE #10W engine oil, replace plug and tighten securely. Fluid Coupling must be turned so that plug position is correct (above) to avoid overfilling.

Capacity—10½ quarts (Lincoln).

Vacuum Cylinder Piston Rod Adjustment:—Adjust rod length so that there is slight tension on rod in Second Gear position (rod adjustment set a maximum of one turn long from point where it has no backlash in second speed position). Incorrect adjustment will cause sluggish kick-down from high to second speed or failure to kick-down.

Throttle Kick-down Switch Adjustment:—Kicker on throttle rod should be set so that switch contacts open when throttle rod extended beyond wide open throttle position. Incorrect switch adjustment will cause failure of kick-down from high to second.

FUSE:—Fuse is 15 ampere. Located in lead between ignition switch and #1 relay terminal.

TROUBLE SHOOTING:—If transmission does not operate satisfactorily, check for trouble as follows:

Sluggish High Gear Upshift—Accelerator linkage binding or sticking, engine idle speed too fast (set engine idle speed at 350 RPM when warm.

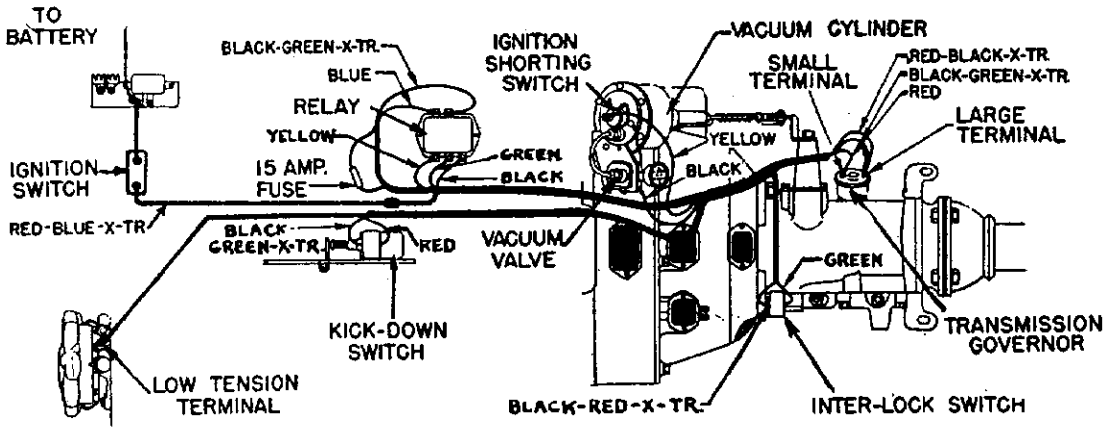
Remains in Second Gear (No High Gear Upshift). Check for burned out fuse, accelerator linkage sticking or engine idling too fast (set idle speed at 350 RPM.), check vacuum lines and connections for leaks, check automatic shift clutch lever engaging spring tension, check relay, governor, interlock and throttle kick-down switches, check vacuum valve, check all wires for loose connections and breaks.

Remains in High Gear (No Second Gear Downshift). Check relay and governor operation, check circuit between center terminal at bottom of relay and governor low-speed terminal for grounds.

Sluggish Kick-down to Second Gear. Check vacuum cylinder piston rod adjustment (above), check for loose connections at distributor primary terminal, vacuum cylinder center terminal, and relay terminals, check wiring for open-circuits.

Remains in High Gear (No Kick-down to Second). Check vacuum cylinder piston rod adjustment and throttle kick-down switch adjustment (above), check relay, ignition shorting switch (on vacuum cylinder), and circuit between ignition shorting switch and distributor primary terminal. Check ignition shorting switch spring tension (contacts should close with 6-8 ozs. pressure on plunger).

Second Gear Kick-down occurs above 38 MPH. Check relay, check high speed contacts in governor (contacts should close at 38 MPH.).



LIQUAMATIC DRIVE CONTROL MERCURY

FORD TRUCK 4-SPEED

All Trucks except ½ & ¾ Ton (1936 to 1948)

►**Half-Ton & ¾ Ton Transmission Note**—This Four-Speed Transmission Optl. on these models.

DESCRIPTION: Four-speed, sliding spur gear type. Main drive gear and shaft mounted on ball bearing **at front end of transmission case. Mainshaft mounted on roller bearing in main drive gear at front end, ball bearing in case at rear. Counter gear cluster mounted on roller bearings on stationary countershaft. Reverse idler gears mounted on bronze bushing on stationary shaft.**

1936-39 Models—Trucks have Torque Tube Drive and rear bearing retainer is flanged for mounting of front propeller shaft cover. Retainer also serves as rear engine mounting.

1940 & Later Models—Trucks have Hotchkiss Drive and shaft mounted hand brake. Transmission modified to provide mounting for hand brake mechanism (brake drum mounted on front universal joint yoke). With these exceptions, transmission is same design as used on previous models and is serviced in the same manner. NOTE—Refer to **Ford Truck car pages for hand brake adjustment.**

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY: Remove gearshift housing (transmission cover) assembly and gasket. Remove the clutch release bearing spring, release bearing, and retainer. Take out screws in bearing retainer on front end of case, remove retainer, withdraw clutch shaft main dive gear and bearing assembly (tap main drive gear with a brass hammer if required). Remove mainshaft front (roller) bearing and spacer from mainshaft. Take off nut on rear end of main shaft and remove universal joint flange and brake drum. Take out screws in bearing retainer on rear end of case, remove retainer, withdraw speedometer gear and spacer from shaft. Remove speedometer driven gear bearing and gear from retainer. Withdraw mainshaft and bearing out through rear of case (use brass hammer and tap on front end of shaft until bearing free of case) and remove sliding gears out through top of case. Take out cotter pin from front end of reverse idler, shifter shaft on left side of transmission and drive shaft out through rear of case and lift out shifter fork. Take off reverse idler retainer (lock plate) on rear of case and pry out reverse idler shaft with screwdriver engaging slot in end of shaft, lift out reverse idler gear. Drive countershaft out through rear of case, lift out cluster gear. Remove bearings and spacer from cluster gear.

CLEARANCES & PARTS CHECK: Replace gears if worn excessively or teeth chipped or broken. Replace bearings discolored by overheating or if binding or looseness noted when rotating bearing on shaft by hand. Replace parts worn beyond the following limits:

Countergear Cluster: Endplay .009-.021" (new), .025" (worn limit). Measure between gear and case. Inside diameter 1.6255-1.6265" (new), 1.630" (worn).

Countershaft: Diameter .9995-1.0000" (new), .9945" (worn limit).

►***CAUTION—Do not measure slotted end (.003" greater diameter at this point for press fit in case).***

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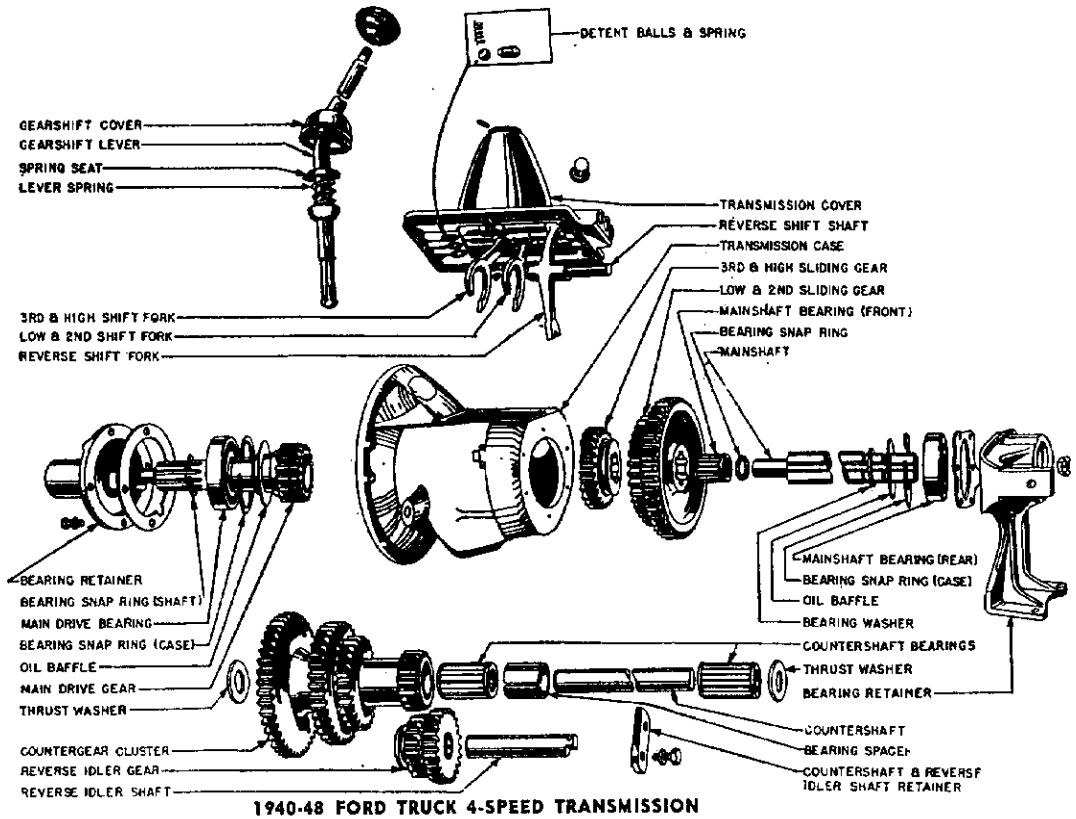


1940-48 FORD TRUCK 4-SPEED TRANSMISSION

Reverse Idler Gear: Inside diameter .9890-.9900" (new), .991" (worn limit). If bushing worn, replace gear. Do not remove bushing from gear (gear furnished with bushing installed).

Reverse Idler Shaft: Diameter .9872-.9877" (new), .986" (worn limit).

Mainshaft Assembly: 3rd & High Gear—Fit to shaft correct if gear does not slide down splines of own weight.

First & Second Gear—Backlash limit .003".

Mainshaft—Pilot (front) end diameter .8110-.8115" (new), .806" (worn limit).

Mainshaft Bearing—Use arbor press to press shaft out of bearing. When pressing on new bearing, first place bearing washer and oil baffle (with outer edge away from bearing) on shaft.

Main Drive Gear Assembly: Gear end inside diameter 1.312-1.313" (new), 1.316" (worn limit).

Main Drive Gear Bearing—To replace bearing, remove snap ring (on front side of bearing), tap on outer race evenly to remove bearing. When installing new bearing, first install oil baffle with outer edge away from bearing. Press bearing on main drive gear, install lock ring.

REASSEMBLY: Assemble in reverse order of disassembly directions given above and note following points:

Mainshaft Assembly: Install first and second gear and third and fourth gear with shifter fork channels facing each other (first and second facing toward front, third and fourth channel facing rear).

UNIVERSAL JOINTS

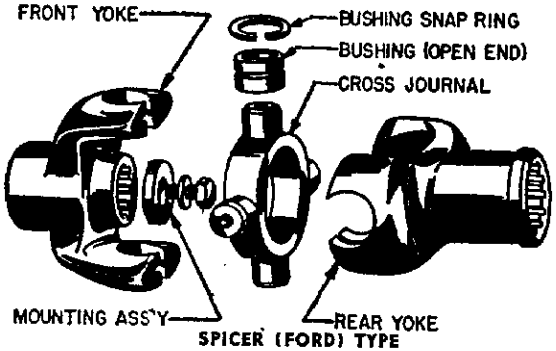
SPICER (FORD) TYPES

Ford, All Pass. Car & Comm'l (1936 to 1948)
Ford Trucks, All Models (1936 to 1939)
Mercury, All Models (1939 to 1948)

NOTE:—These models have Torque Tube Drive with a single universal within a ball housing at the rear of the transmission case. Ball housing flange mounting screws must be taken out and axle assembly pulled back to expose universal.

Ford Truck Models (1935-39). These models have additional universal mounted at intermediate bearing on frame cross-member. Both universals are needle bearing type (see Needle Bearing Service Note below).

NOTE—Rear yoke of front universal integral with a companion flange which is bolted to flange on splined sleeve which engages front propeller shaft. After cover screws are taken out and cover pushed back on shaft, screws can be taken out of companion flange and splined sleeve pushed back on shaft (against spring tension) to disconnect front driveshaft. This will allow transmission to be removed without disturbing intermediate universal joint or rear propeller shaft.



SPICER (FORD) TYPE

Ford Truck Models (1940-48). Hotchkiss drive is used. These trucks are equipped with Spicer Needle Bearing type universals. See Spicer Needle Bearing universal joint article (following) for complete data.

DESCRIPTION:—Universal has conventional cross or spider. Special bearing bushings are installed individually in ends of yokes on cross journals. Bushings are retained in yokes by locking rings (yokes are open end type and locking rings are inserted in yoke ends to engage recess in bushing and yoke).

Needle Bearing Types. These types have loose needle bearings assembled in retainer cup or bushing which is retained in yoke end by locking ring in same manner as bushing on hardened-bushing types. Serviced in same manner except that loose needle bearings will fall out of retainer cup when removed and care must be taken not to lose them.

REMOVAL:—Rear axle ordinarily removed by pulling drive shaft out of splined joint at rear of universal after ball housing flange bolts have been taken out (rear universal yoke integral with stub splined shaft, front yoke bolted directly on end of transmission main shaft). Universal can be disassembled or removed by taking out mounting bolt in front yoke (accesible through hole in cross).

SERVICING:—Disassembly—Remove locking ring from each yoke bushing. Drive out bushings with flat nosed punch inserted from opposite side of yoke being careful to keep bushing lined up with cross journal so that bearing surface will not be marred.

NOTE—On needle bearing types take care not to loose needle bearings which will fall out of bearing retainers or bushing when removed from cross journal. Pack needle bearings with grease before installing.

Assembly—Tap bushings in place with soft nosed hammer being careful to keep bushings lined up with cross journal to avoid marring cross journals. Line up locking ring groove in yoke and bushing, install locking rings. If universal front yoke has been removed, see that transmission rear bearing is against shoulder on shaft and that yoke shoulder is against bearing. Tighten mounting screw securely and see that washer under screw head is seated in counterbore in yoke. When correctly assembled, transmission main shaft should have no endplay.

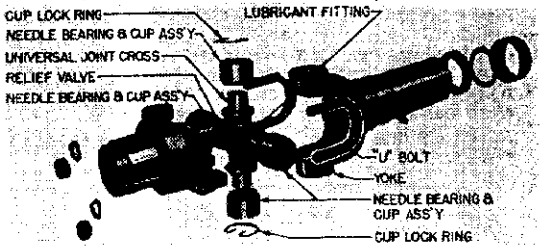
NOTE—Universal is not oiled from transmission case and should be lubricated with special universal lubricant after assembly completed.

UNIVERSAL JOINTS

SPICER NEEDLE BEARING TYPES

Ford Trucks, All Models (1940 to 1948)

Ford 1940-48 Trucks. All models have Hotchkiss Drive with an intermediate Universal Joint on the frame on long wheelbase models only.



DESCRIPTION:—Needle bearing type. Universal has conventional cross or spider with individual bearings on cross ends. Bearings consist of loose needle rollers held in place in bearing cup by retainer and assembled with cork gasket and dustcap between bearing cup and shoulder on cross to retain lubricant. Bearing cups fit directly in holes in yoke ends and are retained by locking ring in yoke at outer end or by bearing cap held in place on yoke end over bearing cup by two capscrews. On some models, bearing cups are bolted directly to trunnions on companion flange by 'U' bolt passing completely through flange with nuts on opposite side.

DISCONNECTING UNIVERSAL:—Take out bolts in companion flange or remove nuts on U bolts mounting bearing cups on flange and remove U bolts. When disconnecting this type see that bearing cups do not fall off universal cross.

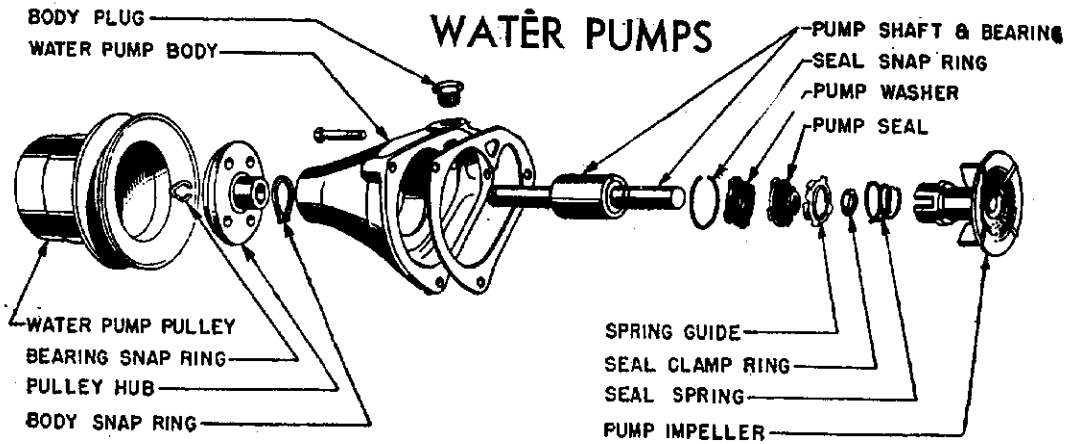
SERVICING:—Disassembly—Remove locking rings or take out capscrews and remove bearing cups. Tap or press on outer end of one bearing cup until cup on opposite side has been forced out of yoke end. Turn universal joint over and press first bearing cup out (applying pressure on exposed end of universal cross). Bearing cups are light press fit in yoke lugs.

Servicing—Wash all parts in gasoline. Clean out lubricant holes in cross. Examine all parts for wear.

Assembly—Place cross in yoke, install needle rollers in bearing cups, assemble retainer, new cork gasket, and dustcap, pack bearing cup and lubricant passage in cross with SAE. #160 oil, insert bearing cup in yoke end on cross. Use special clamp to press bearing cups in and compress sufficiently so that locking rings can be installed. See that locking rings are firmly seated in recess in yoke. On types using bearing caps, use new lock plate under screw heads, turn up lock tang against capscrew after screws have been securely tightened. On U bolt types, see that lockwashers installed under nuts.

NOTE—When shaft installed, arrows on shaft and yoke at slip joint must line up.

WATER PUMPS



FORD SIX-CYLINDER PUMP (1942-47 TYPE)

FORD NO. 9N-8501

Ford 4 Cyl., Comm'l & Truck (1941-42)

FORD NO. 2GA-8501

Ford 6 Cyl. "G", All Models (1941-42)

FORD No. 5GA-8501

Ford 6 Cyl. "G", All Models (1946-47)

TYPE:—Ball bearing, packless type with non-adjustable seal assembled on shaft within impeller hub. Pump on 4 Cylinder models is same design in 1941 and 1942. 6 Cylinder pump design is different in 1941 than on 1942 and later models (1942 and 1946 types similar except for pump pulley and hub). These pumps have following features:

4 Cyl. Pump—Pump is ball bearing type (similar to '79' type) and is mounted on front end of engine block with a back cover plate mounted on the pump body by capscrews. Fan is bolted on shaft in front of water pump pulley. This pump serviced in same manner as '79' type except that screws must be taken out and cover removed for access to impeller.

1941 6 Cyl. Pump—Pump same design as '78' type used on V8 Engines with shaft mounted on porous bronze bushing and seal assembled in impeller hub recess. This pump not lubricated from engine oiling system and reservoir in pump body should be kept filled with oil.

1942-47 6 Cyl. Pump—Bearing is integral with shaft and furnished as an assembly. Pulley hub is retained on shaft by snap ring on forward end of shaft with pulley and fan blades bolted to hub by four capscrews. Seal is similar to type used on Ford V8 models.

SERVICING:—Lubrication (6 Cyl. Pump only)—Keep oil reservoir in pump body filled with engine oil through oiler on top of body behind pulley.

OVERHAUL:—Disassembly (6 Cyl.)—Take out capscrews and remove fan blades and pulley from pulley hub, remove snap ring on forward end of pump housing, press impeller off shaft, press shaft and bearing assembly out of housing. Remove bearing snap ring from shaft, press shaft and bearing assembly out of pulley hub. Remove snap ring from impeller hub, withdraw seal parts.

CAUTION—Do not attempt to remove bearing from shaft. These parts are furnished as an assembly.

Seal Assembly—Install seal parts in impeller hub in following order: Seal Spring (large end out toward spring guide), Seal Clamp Ring, Spring Guide (tangs out toward seal), Seal (smaller end in and lugs engaged in slots in impeller hub), Seal Washer (lugs engaging slots in impeller hub), install snap ring to retain seal assembly.

Pump Assembly—Press shaft and bearing assembly into housing. Assemble seal in impeller hub (see above), press impeller on shaft until it is flush with end of shaft. Place bearing snap ring on pulley hub, press pulley hub on shaft until groove in shaft is flush with end of hub. Install bearing snap ring on end of shaft, install snap ring in housing.

Pump Installation—Use new gasket when installing pump back cover (4 Cyl.), use new gasket when installing pump on engine (all models).

FORD NO. 5GA-8509-A

Ford 6 Cyl. "H", All Models (Late 1947-48)

TYPE:—Packless type with sealed double row ball-bearing shaft (shaft serves as inner race for bearing). Bearing and shaft furnished as an assembly and cannot be dismantled. Pulley hub mounted on forward end of shaft with fan pulley and blades bolted to hub.

OVERHAUL:—Disassembly. Take off fan blades and pulley from hub. Pull hub with puller off front end of shaft. Take out bearing snap ring from slot in pump body. Press shaft and bearing assembly out through rear of pump body. Use care when pressing shaft and bearing out, if assembly not being replaced. Press shaft out of impeller exposing seal assembly.

Reassembly: Carefully press new seal assembly (with slinger) in pump body. Press shaft and bearing into pump body from front until groove in bearing aligned with slot in pump body, and insert bearing snap ring. Press pulley hub on front end of shaft until flush with end of shaft. Press impeller on rear end of shaft.

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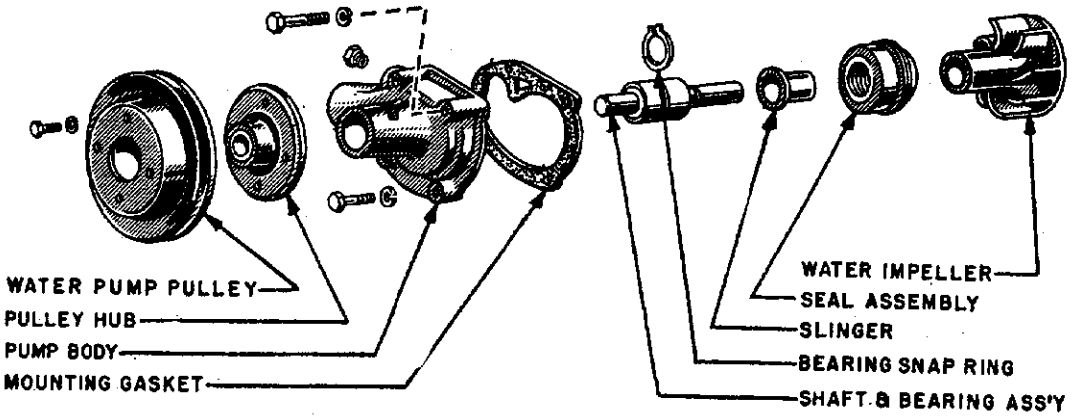


FORD SIX-CYLINDER PUMP (LATE 1947-1949 TYPE)

FORD V8 "60"

No. 52-8501-B (R.H. & L.H.)
Ford V8 "60", First Cars Only (1937)

No. 52-8501-C—See Note
Ford V8 "60", All Models (1938 to 1940)

FORD '60' NOTE:—This pump differs from 52-8501B type (used on first '60' Engines) in that pump body is not conical (inner gasket seats against shoulder on body) and no separate retaining nut is used (outer gasket seats against pump body flange). Except for these points, all '60' pumps are serviced in same manner.

TYPE:—Packless type. Pump is special design with conical body which fits into recess in engine front cover (mounting bracket and gear cover) and is retained by large nut directly behind pulley. Pump interchangeable for right and left hand mounting. Impeller is driven by shaft through tongue-and-slot coupling and is retained by spring running through shaft to retainer button under rubber cap on forward end. Shaft mounted on bushing (rear), and ball bearing (front) which is part of shaft assembly (bearing is single row ball type with shaft serving as inner race). Pump lubricated by engine oiling system through oil lead at center of body (body sealed by gasket at each side of oil channel).

OVERHAUL:—Special service tool set recommended for pump servicing (includes spring tools to remove impeller without damaging spring and drivers to install shaft and bearing assembly).

Disassembly. Remove rubber cap on forward end of pulley, use tool S-221 to pull retainer button out slightly so that wedge S-222 can be inserted between spring coils to hold spring (do not pull spring out further than necessary to avoid stretching it), unhook retainer button, remove impeller and spring at rear end. Mount pump in S-225 holder in arbor press, press pulley off shaft, remove locking ring at forward end of body, press shaft and bearing out. Press out old bushing, ream new bushing after it is pressed in place.

Assembly—Reverse disassembly directions. When installing shaft and bearing assembly, use S-226 and S-226-B drivers as a combination to prevent damage to ball bearing. Assemble spring to impeller and use S-223 tool to pull spring through shaft so that retainer button can be assembled. Use new gaskets on body when installing pump (these gaskets seal oil channel). Tighten large retainer nut securely.

FORD V8 & MERCURY (1937-48)

No. 78-8501 (R.H.), 78-8502 (L.H.)
Ford V8 '90' & '100', Pass. Cars (1937 to 1948)
Ford V8 '90' Comm'l Models (1937 to 1941)
Ford V8 '90' Truck Models (1940-41)
Ford V8 '90' & '100' Truck Models (1942 to 1947)
Mercury, All Models (1939 to 1948)

No. 79-8501 (R.H.), 79-8502 (L.H.)
Ford V8 '90' Truck Models (1937-38-39)
Ford V8 '100' Truck Models (1939-40-41)
Ford V8 Cab-over-Engine Trucks (1940-41)

►*CAUTION—These 78-8501, 2 pumps must not be used on 1948 8RT V8 Truck Engine or 1949 8BA Pass. Car Engines. No means for lubricating pumps.*

FORD TRUCK MODEL NOTE:—This 78-8501 & 2 type pump is used on 1942 Cab-over-Engine models only. 1941 and previous Cab-over-Engine Trucks are equipped with 79-8501 & 2 type pumps.

4 & 6 Cyl. Models—These models have different type pumps with ball bearing shaft. Refer to separate article for data on these types.

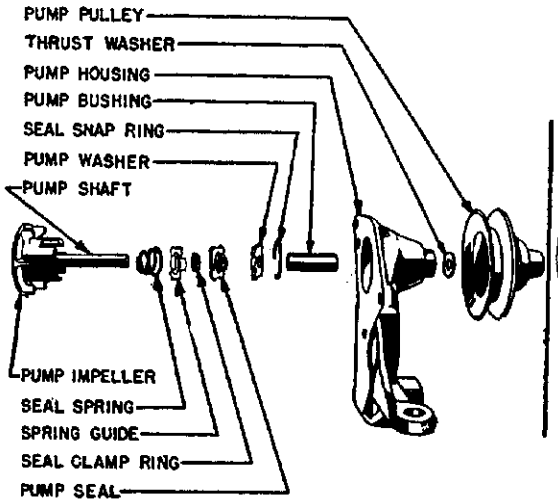
TYPE:—Packless type with shaft mounted on bronze bushing ('78' types), sealed ball bearings packed with grease ('79' types). Bronze bushing is porous type and shaft lubricated by oil seepage through bushing (lubricated from engine oiling system), both types requiring no attention in service. Seal is assembled in recess in impeller hub and retained by snap ring in groove in hub. All models serviced in same manner except for shaft and bearing removal (see special directions below).

OVERHAUL:—**Disassembly.** Place pump in arbor press, press impeller and shaft assembly out of pulley (see note below for '79' types), lift off pulley and front thrust washer, remove impeller and shaft through rear of housing. Press old bushing out of housing. To dismantle seal, remove snap ring within impeller hub at forward end, remove seal parts (note order and assemble in same positions).

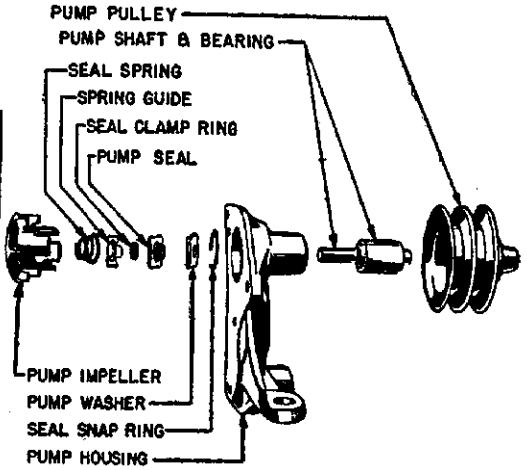
NOTE FOR '79' PUMPS. Shaft and bearing assembly must be pressed out of housing toward forward end (bearing seats against shoulder in housing at rear).

Seal Assembly. When installing seals, install parts in following order: Spring (small end in toward impeller), Spring Guide (tangs out), Seal Clamp Ring, Seal (with projecting face in, and lugs engaging slots in impeller hub), Thrust Washer (engage lugs in impeller hub slots), Snap Ring.

Pump Assembly—Use special tool V-247 to reface front and rear thrust faces of pump housing (necessary to prevent excessive thrust washer wear). Assemble pump by reversing disassembly instructions.



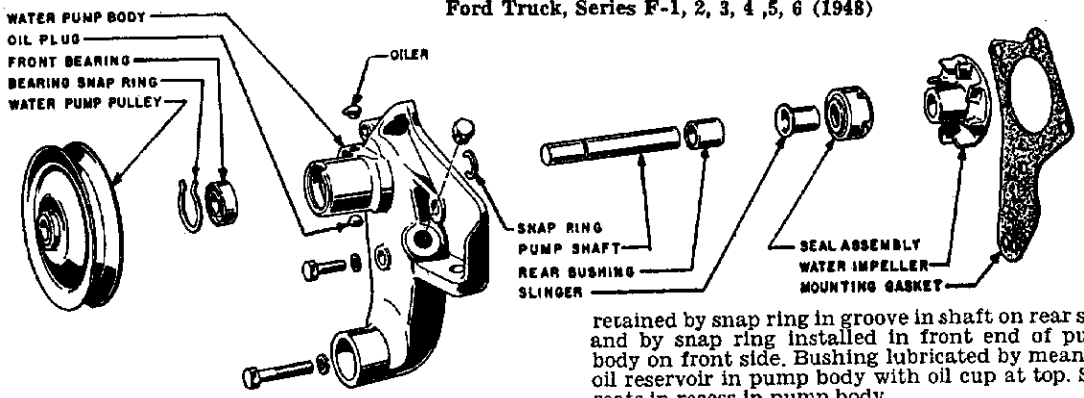
PASSENGER CARS
FORD V8 & MERCURY '78' TYPE PUMP



TRUCKS
FORD V8 TRUCK '79' TYPE PUMP

WATER PUMPS

No. 8RT-8501 (R.H.), 8RT-8502 (L.H.)
Ford Truck, Series F-1, 2, 3, 4 ,5, 6 (1948)



TYPE:—Packless type with sealed single-row ball-bearing in forward end of pump body with bronze bushing pressed in body next to seal. Front bearing retained by snap ring in groove in shaft on rear side, and by snap ring installed in front end of pump body on front side. Bushing lubricated by means of oil reservoir in pump body with oil cup at top. Seal seats in recess in pump body.

LUBRICATION:—*CAUTION—When installing new pump on engine, fill oil reservoir with SAE #20 engine oil. Use a piece of wire inserted in oil cup to allow air trapped in reservoir by wicking to escape.*

Regular Lubrication—Fill oil reservoir through oil cup at top of pump (SAE 20 oil every 1000 miles).

OVERHAUL:—**Disassembly.** Remove pulley from shaft (use Puller Tool No. 8505-N). Remove bearing snap ring from front of pump body. Remove impeller from shaft (use Puller Tool No. 8505-N). Press shaft and bearing out through front of pump body, and press bushing and seal out through rear of pump If required, press ball-bearing off shaft.

►*CAUTION—Use new impeller, seal, shaft, and bearing whenever water pump disassembled.*

Reassembly: Press new bushing in pump body with .5925" arbor (inside diameter of bushing installed should be .5920-.5925"). Press new seal in pump body with Tool No. 8564-P. Insert bearing snap ring on shaft and install bearing. Use Tool No. 8530 and press shaft and bearing into pump body (must press on outer race of bearing to avoid damaging bearing). Insert bearing snap ring in front of pump body. Support rear end of shaft and press pulley on front end until it bottoms against inner race of ball-bearing. Press impeller on rear end of shaft (clearance between impeller blades and pump body must be .030-.040"). Fill oil reservoir with #20 engine oil.

KING-SEELEY ELECTRIC OIL PRESSURE GAUGES

DESCRIPTION:—This is an electric oil pressure gauge comprising an engine unit, and a dash or recording unit connected by a wire. The dash unit is also connected to the ignition switch (gauge operative only with engine turned on) and the gauge circuit is completed to ground through the engine unit contacts. The dash unit consists of a thermostatic bi-metal arm linked to the instrument pointer around which is wound a heating coil. The engine unit has a similar bi-metal arm and heating coil. One of the engine unit contacts is mounted on this bi-metal arm and the other contact is mounted on a diaphragm which is deflected when oil pressure is built up in the engine so as to increase the contact pressure and lengthen the time period over which the contacts are closed. The diaphragm contact completes the gauge circuit to ground.

OPERATION:—When the engine is operated and oil pressure is built up, the pressure deflects the diaphragm in the engine unit and, with the contacts closed, a current flows through the heating coils of the dash and engine unit. The heating effect of the coil in the dash unit tends to bend the bi-metal arm which is linked to the pointer and record a reading on the gauge. At the same time, the heating coil in the engine unit causes the bi-metal arm to flex to a point where the contacts open and the current is interrupted. When this occurs the bi-metal arm in the engine unit flexes in the opposite direction and again closes the contacts. Contact pressure and length of time (amount of flexing necessary to open contacts) is directly proportionate to the oil pressure in the engine, and as this determines the amount of current flowing in the gauge circuit and the deflection of the bi-metal arm in the dash unit. the dash unit indicates the oil pressure. Contacts open and close at approx. 120 cycles per min. with 25 lbs. pressure.

SERVICING:—No service operations are necessary other than to see that connections are tight and that lead is properly connected to engine unit. If readings unsatisfactory, check Trouble Shooting Table and Testing (All Units). NOTE—Manufacturer recommends replacement of defective units.

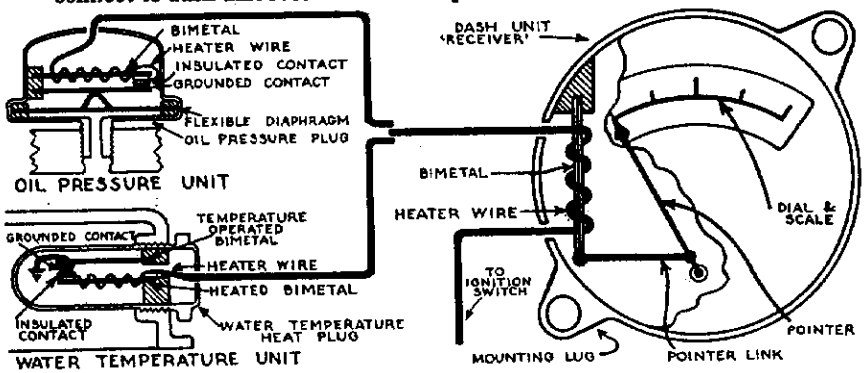
Trouble Shooting Table

1. **Gauge pointer is erratic.** Engine unit probably defective.
2. **Gauge reading inaccurate.** Engine unit probably defective.
3. **Gauge does not register.** Engine unit defective or dash unit burnt out as result of short-circuit in lead between units.
4. **Gauge registers with engine not running (ignition on).** Short-circuit in lead between dash unit and engine unit or short-circuit in dash unit (a short-circuit of this type will usually result in dash unit burning out, resulting in no reading).

TESTING (ALL UNITS):—Use a gasoline gauge tank unit which is known to be OK. for test purposes. Connect flexible test lead to terminal on this test unit and second lead to test unit mounting flange (for ground circuit). Make tests in order as given below before removing units from car.

Testing Dash Unit Receiver. Disconnect engine unit Sender, connect test unit terminal lead to this wire, ground test unit to engine block. Turn on ignition switch. With float of test unit at bottom (tank empty) position, dash unit receiver pointer should be even with lowest mark on dial. Move test unit float rod up to top position. Dash unit receiver pointer should move to top mark on dial (allow one minute for pointer to come to rest). If dash unit receiver does not operate satisfactorily, see that connections at receiver and ignition switch are tight, check line to ignition switch and line to engine unit, then replace receiver. NOTE—When testing temperature gauges, readings will be reversed (Hot reading with test unit float at bottom, Cold reading with float at top).

Testing Engine Unit Sender. If receiver tests OK. (above), see that motor unit is well grounded, disconnect and check radio condenser (shorted condenser will cause high reading on dash unit). Then replace engine unit sender, connect to dash unit receiver and note performance.



TEMPERATURE GAUGES

KING-SEELEY ELECTRIC TEMPERATURE GAUGES

IMPORTANT PRODUCTION CHANGES:—Engine Unit—Two different types of engine units have been used—**No. 7000**—1939 & Later, **Nos. 5700 & 6540**—1938 and before. These units operate differently and must be used with the particular type of Dash Unit designed to be used with them. Earlier type engine units are not furnished for service and when it is necessary to replace them the new type (No. 7000) Engine unit must be installed. This requires installation of a ½"-⅜" No. 7113 adapter bushing. CAUTION—New type Dash Unit must be installed whenever the engine unit is changed to the new type. Service Kits are furnished which include a new type Dash Unit, replacement type Engine Unit, and Adapter Bushing.

IMPORTANT NOTE:—1939 & Later Models—Gauge will read "HOT" or 212° with the ignition switch turned off (engine not running). This reading does not mean that gauge is defective and is caused by the linkage design which is designed to conserve current (less current consumed when engine is at normal running temperatures). Gauge readings should only be taken with the ignition switch turned on.

Ford V8 & Mercury 1941 Models. A temperature switch King-Seeley No. 8355, Ford No. 01A-10990, is used in the temperature gauge circuit (between the dash unit and the engine unit) so that temperature can be measured in both engine blocks. The regular engine unit or heat plug King-Seeley No. 7000, Ford No. 99A-10884, is used in conjunction with this temperature switch.

DESCRIPTION:—Dash unit or Receiver same design as for Oil Pressure Gauge. Two types of Engine Units have been used. Both types consist of a heat bulb which is designed to be screwed in the engine block so that cooling water temperature actuates the bi-metal arms within the bulb. A heating coil (connected to dash unit) is wound on the bi-metal arm and connected to the insulated contact at the free end of the arm. The ground contact is mounted on the free end of a second bi-metal arm (Types 5700 & 6540), or on a stationary support (Type 7000). Contacts are normally closed (with arms not flexed) and gauge circuit is completed through heating coil and contacts to ground when the ignition is turned on.

OPERATION:—Types 5700 & 6540. When heating coil in engine unit is energized, the temperature rise tends to flex the arm and open the contacts. This interrupts current flow, allows bi-metal arm to cool off and flex back so that contacts are again closed. This action is extremely rapid and arm has a vibrating motion. Second bi-metal arm is longer and thinner than heater arm so that flexing action, as engine temperature increases, is greater and tends to increase contact pressure and length of time contacts are closed. Consequently current flow in gauge circuit increases in proportion to the rise in engine temperature and this increased current produces a greater deflection of the dash unit bi-metal arm so that a higher reading is indicated on the dial.

Type 7000. This type operates similarly to earlier types (above) except that contact pressure and current are at maximum when engine unit is cold. Increase in engine unit bulb temperature (as engine warms up) tends to flex the bi-metal arm away from the stationary contact support so that contact pressure and length of time contacts are closed tend to decrease. The consequent decrease of current in the gauge circuit causes the dash unit pointer to move toward the "hot" end of the scale.

TESTING & SERVICING:—Manufacturer recommends use of a regular Gasoline Gauge Tank Unit as a test "Sender" to check operation of units which do not operate satisfactorily. Make tests as directed below.
CAUTION—When testing later type temperature gauges (with No. 7000 Engine Unit), dash unit readings will be reversed (HOT with tank unit float in "empty" position, COLD with tank unit float in "full" position).

Testing Sender:—Disconnect lead of Sender unit on car, connect this lead to test Sender and ground this Sender to the car frame. Turn on ignition, move Sender float up to 'full' position and note reading on Receiver. If Receiver reading is correct (after 10-15 seconds time), check following points before replacing Sender unit:

1. **Ground.** Sender is grounded through case. See that all paint and grease are removed under flange and both surfaces make good contact.
2. **Radio By-pass Condenser Shorted.** If by-pass condenser is connected at Sender on cars with radio, test for short-circuit by disconnecting condenser and noting gauge operation. If gauge is satisfactory, replace condenser.

If reading secured with test Sender is same as that with Sender on car, check wire connecting Sender and Receiver. Replace if open-circuited or grounded.

Testing Receiver—Disconnect wires on Receiver on car and connect to same terminals on test Receiver. Turn on ignition switch and note reading on gauge. If test Receiver reading is correct, replace Receiver on car. If test Receiver reading is same as car Receiver, repeat tests on Sender and wiring.

SERVICING:—No service operations are required other than to see that wires are properly connected and terminals are tight. No repair operations are possible and defective Senders and Receivers should be replaced.

KING-SEELEY ELECTRIC TEMPERATURE GAUGE (FORD V8 & MERCURY)

NOTE:—The Temperature Gauge Switch listed below was furnished as an accessory in Temperature Gauge Kit, King-Seeley No. 8464, Ford No. 11A-18381, and will be found installed on Ford and Mercury Pass. Cars and Ford Trucks. This Temperature Switch was Std. Equipment starting on late 1941 V8 models.

DESCRIPTION:—This special Temperature Gauge installation is designed to detect overheating of the cylinder bank in which the regular temperature gauge Engine Unit is not installed (Engine Unit normally installed in one bank of Vee type engines and will not detect overheating occurring in the other cylinder bank only). Installation consists of a special Temperature Gauge Switch installed in one cylinder bank and connected in series with the regular Temperature Gauge Engine Unit installed in the other cylinder bank.

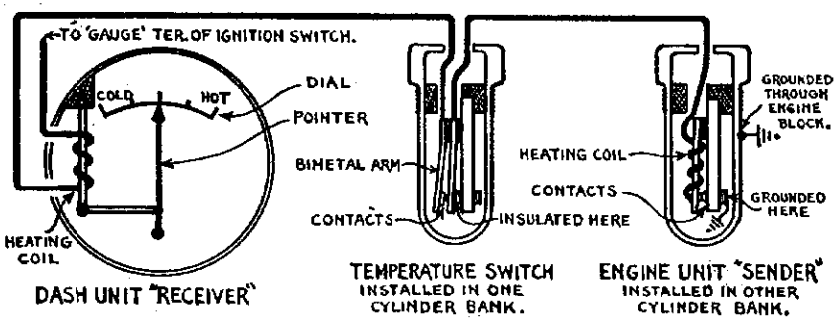
Temperature Gauge Switch—This unit resembles a conventional engine unit in appearance but differs in internal construction. One contact is mounted on a stationary insulated arm with the other contact mounted on a special bimetal insulated arm. A lead is connected to each arm so that the contacts are in series in the circuit between the Temperature Gauge Dash Unit and regular Engine Unit (see illustration).

Temperature Gauge Engine Unit—This unit is same type used on other gauges with movable contact mounted on bimetal arm on which the heating coil is wound and grounded contact mounted on a stationary arm.

OPERATION:—At all normal temperatures, the contacts of the special Temperature Gauge Switch are closed and engine temperature is recorded by the regular Engine Unit in the usual manner. When the temperature in cylinder bank in which the Temperature Gauge Switch is mounted reaches the point for which the unit is set, the flexing of the bimetal arm opens the contacts and breaks the temperature gauge circuit. This causes the dash unit to read 'hot'. The switch is merely a circuit breaker which opens the circuit at this predetermined temperature so that the dash unit reads hot, it does not control dash unit operation at temperatures below this point.

Setting—Temperature Gauge Switch contacts open at 195°F. (plus or minus 5°). NOTE—A special switch designed for use with a special cooling liquid opens at 240°F.

SERVICING:—No servicing required. Replace defective units.



TEMPERATURE GAUGES

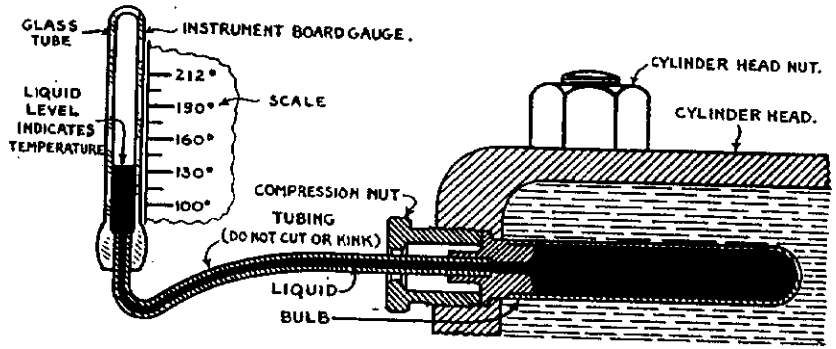
KING-SEELEY HEAT INDICATOR

DESCRIPTION:—The K-S Heat Indicator or temperature gauge is a thermometer in which the glass tube or indicator (dash unit) and the bulb (engine unit) are connected by a sealed copper tube. The entire device is assembled as a unit and the copper tubing must not be cut or the joints broken.

OPERATION:—The liquid with which the bulb and tubing are filled expands evenly with temperature increases and rises into the glass tube so that a reading is obtained when the engine warms up. The location of the bulb in the cylinder head is selected to accurately indicate the cooling water temperature and should not be changed.

SERVICING:—No service operations are necessary. The entire unit must be replaced if found to be defective as a result of mutilation or breakage.

Removal of Bulb from Engine—To disconnect gauge when removing cylinder head, loosen corrosion or sediment around bulb by tapping on cylinder head with a ball-pein hammer, take out compression nut, withdraw bulb. If bulb cannot be withdrawn without great effort, pry gently with a screwdriver. Bulb must not be distorted and must retain its original round shape in order to read correctly.



WINDOW REGULATORS

POWER WINDOW REGULATORS HYDRO-LECTRIC TYPE

1946-48—Ford & Mercury Sportsman

►**PRODUCTION CHANGE:**—Two different pumps have been used, a low pressure pump (200-210 p.s.i.), and a high pressure pump (250-260 p.s.i.). These pumps can be identified by relief valve plug at rear of pump: low pressure has cadmium plated plug, high pressure a copper plated plug.

DESCRIPTION: This type control consists of an electric motor with direct-connected hydraulic pump which supplies fluid under pressure to a single acting power cylinder incorporated for each window regulator used (additional cylinder located under front seat for front seat adjustment on some models). Fluid is pumped into the cylinders by the motor to raise the windows (switch closes motor circuit and operates solenoid valve in cylinder), but windows are lowered by a spring hooked to the regulator and the motor does not operate (switch only operates solenoid valve in cylinder). When the switch is in the "off" or center position, the solenoid valve is closed and fluid is trapped in the cylinder to hold windows in desired position. The system is made up of the following control uits:

Power Unit—Consists of motor, hydraulic pump, and fluid reservoir assembly. This unit is same as type used for Convertible Top Control on these same cars (See Hydro-Lectric Top Control article for complete description).

Control Switches: Consist of simple two-way switches (one for each window—duplicate switches for rear window control located in drivers compartment). Switch lever is normally in "off" or center position and must be held in the "up" or "down" position while the window is operating. In the "up" position, switch completes motor circuit (actuates magnetic switch on power unit), and opens solenoid valve in cylinder to permit fluid to flow into cylinder to raise window. In the "down" position, switch merely opens solenoid valve in cylinder which permits window regulator spring to lower window and force fluid out of cylinder and back to fluid reservoir (motor does not operate).

Window Regulator Cylinder—Single acting cylinder in window well with piston rod linked to window regulator arm. Fluid flow into and out of the cylinder is controlled by a simple solenoid-actuated valve at the lower end (valve is normally closed and is opened when the solenoid is energized).

REMOVAL: Control units can be removed for servicing or replacement as follows:

Power Unit: Removed in same manner as power unit used on Convertibles with top control (see preceding article on Hydro-Lectric Top Control for complete data).

Window Regulators (including Power Cylinder): Remove units on each model as follows:

Lincoln Models—Lower the window, remove switch by prying spring clips at top and bottom and pulling out, disconnect wires. Remove handle, window moulding, and trim panel. Disconnect hydraulic line at cylinder and cap line. Loosen 2 nuts securing regulator to window channel, slide window up by hand. Remove 2 door nuts at bottom of regulator and nut at aligning screw. Disconnect solenoid wire, remove regulator.

SERVICING: Filling Fluid Reservoir—Lower all windows completely (where seat adjuster cylinder used, place seat in extreme rear position also). Check fluid level in reservoir under power unit and fill to ½" below top with brake fluid (see Fluid Recommendation Note. Operates windows up and down at least a dozen times to remove all air from the lines and cylinders, then recheck fluid level. It is not necessary to bleed the hydraulic lines.

Service Period—Once each year—Fall recommended (for General Motors cars). Every 5000 miles—each spring and fall (Ford, Lincoln, Mercury,

Fluid Recommendation— Ford M-4835 brake fluid (for Ford, Lincoln, Mercury)

PRESSURE REGULATOR VALVE: Pressure in system is controlled by combination maximum pressure relief and flow control valve in power unit.

►*CAUTION*—**Two different valves used:** Check color of relief valve plug at rear of pump.

1—Cadmium plated plug. Valve set for maximum pressure of 210 lbs. for use with low pressure pump.

2—Copper plated plug. Valve set for maximum pressure of 260 lbs. for use with high pressure pump.

See PRODUCTION CHANGE NOTE above.

These valves are not interchangeable.

NOTE—If plug removed and washers are used under plug, these same washers must be reinstalled on reassembling plug.

POWER OPERATED TOPS

POWER OPERATED TOPS HYDRO-LECTRIC TYPE

Used On Convertible Models:

1946-48—Ford & Mercury Sportsman

►**PRODUCTION CHANGE:**—Two different pumps have been used, a low pressure pump (200-210 p.s.i.), and a high pressure pump (250-260 p.s.i.). These pumps can be identified by relief valve plug at rear of pump: low pressure has cadmium plated plug, high pressure a copper plated plug.

DESCRIPTION: This type control consists of an electric pump with direct-connected hydraulic pump which supplies fluid under pressure to two double-acting hydraulic cylinders which raise and lower the top. Motor operation and directional control (to raise or lower top) is controlled by a button on the instrument panel. Top design is conventional with top bows and side-irons modified for power actuation. On cars listed above, **motor is not reversible** and selective control (to raise or lower top) is secured by use of a hydraulic valve by which the fluid is directed to the bottom of the hydraulic cylinders (to raise the top), or to the top of the cylinders (to lower the top). Opposite end of cylinder is vented to fluid reservoir through valve.

Power Unit—Consists of motor, hydraulic pump, and fluid reservoir assembly on front of dash with magnetic motor switch on side of motor and thermostatic relay type circuit breaker (for motor circuit protection) is mounted near the motor.

Control Valve & Switch—Mounted in back of instrument panel or dash and operated by button on panel. Consists of two separate units in one assembly: (1) Hydraulic Valve by which fluid is directed to top or bottom of hydraulic cylinders to lower or raise top, (2) Motor Switch by which the motor is turned on when top operation is desired. Both units are controlled by a single control button on the instrument panel

POWER OPERATED TOPS ELECTRIC TYPE (Cont.)

Power Cylinders—Double acting type, two used. Mounted on each side of car body, at rear, with piston rod linked to top mechanism. Cylinders are mounted on pivot bracket to permit rocking action as top is raised and lowered and the hydraulic tubing is looped at the pivot to permit this movement. Cylinders are plain piston type and cylinder ends are crimped in place to provide a fluid tight assembly (upper end rubber piston rod seal and also provides bearing for piston rod).

ADJUSTMENT (TOP CONTROL): No adjustment required other than adjustment of control rod to provide proper operation of the control valve.

Control Valve Rod Adjustment—Should be set to provide 1/8" over-travel in each direction. To adjust, loosen setscrew holding control rod in control valve lever, position control rod so that distance from ferrule on control support bracket at instrument panel to forward end of control rod knob (this is distance along shaft from bracket ferrule to knob) is 1 3/32" maximum, tighten operating valve setscrew. NOTE—If control rod is not long enough to permit this adjustment, rod can be lengthened by removing retaining nut at bracket, and removing entire control rod assembly from the bracket. Clamp control rod securely in vise, loosen locknut and unscrew control knob assembly from rod as necessary.

ADJUSTMENT (CONVERTIBLE TOP): If top not correctly positioned in up or down position, adjust as follows:

Forward-and-Backward Adjustment (Clearance at windshield header when top up)—If top is too far forward or does not move far enough forward to permit windshield header dowels to enter dowel holes in roof rail, adjust as follows: Raise top slightly above windshield header, loosen attaching bolts in corner braces at front end of side roof rail, move front roof rail forward or backward to align dowels and dowel holes (attaching bolt holes are slotted to permit this adjustment), tighten attaching bolts.

Up & Down Adjustment (Clearance at top of door and quarter window)—If side roof rail too high or too low when top is up, unlatch top at windshield and raise top approximately halfway. Remove rear seat cushion and back, and quarter trim panel, loosen three plate attaching screws in top adjusting plate at rear quarter section of body, move adjusting plate down to raise side roof rail or up to lower side roof rail (attaching screw holes are slotted to permit this adjustment).

Folded Top Position Adjustment—If top does not contact bumper in each side of top compartment when lowered, loosen attaching screws in top adjusting plate (see Up-and-down adjustment above), and move plate to rear slightly but **do not raise or lower the plate.** Moving plate to rear will allow top to lower further into the top compartment.

Side Rail Center Hinge Hump or Sag Adjustment (on Packard)—If side rail humped or sagged above door window, adjust by means of slotted screw and locknut under arm at pivot. Ends of side rail at pivot should be slightly above horizontal. Turning screw in lowers rails, turning out raises rails.

REMOVAL: Units can be removed for replacement or servicing as follows:

Power Unit—Disconnect battery cable as a safety precaution (hydraulic fluid is inflammable). Disconnect ground strap and wire at motor. Disconnect hydraulic tubing at pump and cap ends (CAUTION—fluid is inflammable—soak up spilled fluid with absorbent cloths). Remove bolts from rubber mountings (one at top, two at bottom—on Buick and Cadillac it will be necessary to remove fluid reservoir for access to bottom bolts). Lift out unit.

Control Valve—Disconnect battery cable as a safety precaution. Disconnect control rod at operating lever by removing setscrew. Disconnect two switch wires. Disconnect hydraulic tubing and cap ends of tubing (CAUTION—fluid is inflammable—soak up spilled fluid with absorbent cloths). Remove screws holding valve on mounting bracket.

Power Cylinders—Remove nut on bolt linking piston rod to top mechanism while top is up but do not remove the bolt. Lower the top (see note below). Disconnect battery cable as a safety precaution. Remove rear seat cushion and back, remove rear quarter trim panel assemblies (dome lamp switch must be loosened and wires disconnected to remove right panel). Disconnect hydraulic tubing at tees located at right center of body, cap ends of tubing (CAUTION—fluid is inflammable, soak up spilled fluid with absorbent cloths). Remove bolt linking piston rod to top mechanism (from which nut previously removed), take out clevis pin and remove lower mounting bolt from anchorage plate. Free hydraulic tubing from retaining clips. Work cylinder back and forth until free from mounting bracket. lift cylinders and tubing out as an assembly.

SERVICING:—Cleaning and Filling Fluid Reservoir. On cars with power operated windows and front seat, lower all windows and set seat in full rear position. Remove reservoir at bottom of power unit, clean with alcohol and refill to within 1/2" of top with brake fluid (see Fluid Recommendation Note below). After replacing reservoir, operate top several times to remove all air from lines. It is not necessary to bleed the lines.

Service Period— Every 5000 miles—each spring and fall (Ford, Lincoln, Mercury.

Fluid Recommendation— Ford M-4835 brake fluid (for Ford, Lincoln, Mercury),

CAUTION—Do not use a mineral base oil in the system nor lubricate piston rod stem with mineral oil. If necessary to lubricate piston rod stem or seal, use castor oil or brake fluid.

PRESSURE REGULATOR VALVE: Pressure in system is controlled by combination maximum pressure relief and flow control valve in the power unit.

►*CAUTION*—**Two different valves used:** Check color of relief valve plug at rear of pump.

1—Cadmium plated plug. Valve set for maximum pressure of 210 lbs. for use with low pressure pump.

2—Copper plated plug. Valve set for maximum pressure of 260 lbs. for use with high pressure pump. See PRODUCTION CHANGE NOTE above.

These valves are not interchangeable.

NOTE—If plug removed and washers are used under plug, these same washers must be reinstalled on reassembling plug.

POWER OPERATED TOPS AUTO-LITE ELECTRIC TYPE

Used On Convertible Models:

Ford, Lincoln, Mercury ('41-48)—except Sportsman

DESCRIPTION & OPERATION:—This type control control consists of two electric motors each mounted as a unit with its worm-and-gear type power screw at sides of car with the power screw linked directly to the top frame (conventional top bows and braces are modified for this power connection). Motors are reversible and are controlled directly by a switch on the instrument panel so that they operate to raise or lower the top when the switch is actuated.

Motors—Series wound type with field connected in two sections to separate terminals on motor frame. When the control switch is actuated one-half of the field is energized which causes the motor to revolve in the correct direction to raise or lower the top. The motors are geared directly to the power screw which is connected to the top frame.

Control Switch—Consists of a two-way switch which is spring-loaded so that it is normally in the 'off' position and must be held in the 'up' or 'down' position while the top control is operating.

Control Relay (for EWG-4002 motors). Two opposed windings, 1 connected in series with each top one of which is connected in series with each top control motor. This results in relay contacts remaining closed as long as load and current of each motor is equal. A differential of 20-30 amperes between the two motor circuits (caused by binding or obstruction on one side of top) causes relay contacts to open so that the motors stop.

Circuit Breakers (for EWG-4005, 6 motors). 30-ampere circuit breakers (one for each motor). One motor brush grounded through this breaker, cricuit is broken when current draw greater than 30 amperes. Used to equalize operation of both motors.

Circuit Breaker—On control switch. Protects motors and relay from overload. Circuit breaker kicks out in 1 min. or less with current of 80 amps.

SERVICING:—To check operation of top, disconnect top from power screw, see that folding arm assembly works freely without binding at any point. Check control switch to make certain that circuits are completed through switch in 'up' and 'down' positions. To check power screw for sticking or binding, remove motor (see below) and operate screw by inserting screwdriver in slot in pinion shaft. Shaft should turn easily and freely. If it does not, check for bent power screw. See that power assembly is not binding on base pivot.

Power Unit—To replace power unit, remove trim side panels in rear seat compartment, disconnect motor wires, remove bolt linking power screw to top and pivot bolt in mounting bracket, lift out power screw and gear box assembly. Install new assembly in same manner, taking great care not to kink or bend the power screw and see that power screw installed in top bracket so that it is perfectly straight between top attaching bolt and body mounting pivot bolt. Connect motor leads and check top operation before replacing trim panels.

TESTING:—If top control does not operate satisfactorily, test each unit as follows:

Control Switch—Disconnect motor leads at

CONTINUED ON NEXT PAGE

POWER OPERATED TOPS
AUTO-LITE ELECTRIC TYPE

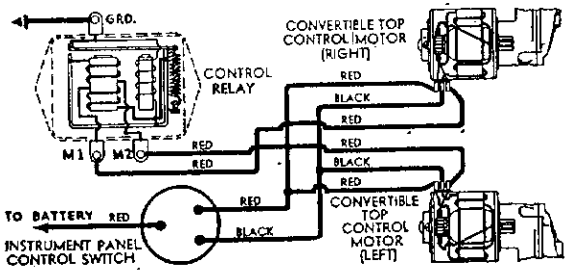
CONTINUED

switch. Connect one test lamp lead to ground, touch other lead to switch 'up' terminal, place switch in 'up' position. Lamp should light. Test 'down' terminal in same manner.

Top Motor—Disconnect guide mechanism from top slat irons and operate motors. If motors do not run freely when disconnected, check motor brushes for sticking or wear, see that commutator clean check field coils for grounds and open-circuits.

Motor Performance

Torque	R.P.M.	Volts	Amperes
2 oz. ft.	4000-5000	6.0	29-34



EWG-4002 MOTORS WITH HRF-4001 RELAY

Control Relay—If motor does not operate with switch in up or down position, ground relay terminals. If motors run, check relay contacts. If contacts are open and motors run when contacts held closed, check motors for unequal load (relay should operate in this manner if motor loads unequal). If relay buzzes and contacts do not hold open, check relay voltage coil for open-circuit.

Relay Specifications
(Auto-Lite HRF-4001)

Contacts Open—25-35 amperes through either series winding at 5.0 volts (or 20-30 ampere differential between both coils). Opening amperage for each coil must be equal within 2 amperes. Adjust by bending lower spring hanger.

Contacts Close—.2 volt minimum.

Air Gap—.030-.034" with contacts closed. Measure between current coil (series winding) core and armature. Adjust by shifting upper stationary contact up or down. CAUTION—See that both sets of contacts open and close simultaneously.

Contact Servicing—Clean contacts with strip of clean linen tape moistened with carbon tetrachloride and then rub with clean dry tape (draw tape through between contacts). If contacts burned or pitted, resurface by filing lightly with very fine contact file (ST-290) parallel and lengthwise of armature and then clean contacts as directed above. See that no lint is left on contact surfaces.

Voltage (Shunt) Winding—Winding resistance is 4.68-5.18 ohms. Measure between stationary contact and movable contact with contact points held open.

POWER OPERATED TOPS
VACUUM POWER TYPE

Used On Convertible Models:

1940 CAR MODELS

NOTE:—Power tops on all cars are of similar design with differences in power cylinder mounting, linkage design and control hook-up as noted below.

Electric & Hydro-electric Types—These types also used. See separate articles for data.

DESCRIPTION:—Convertible tops used on cars with power actuation have the conventional top bows and braces modified for connection of the vacuum power cylinders and are equipped with counterbalancing springs. Two vacuum power cylinders are mounted at sides of car behind seat trim (one on each side) and are linked to the top frame. Each cylinder is double acting type, with vacuum line hose connection to upper and lower end, and operate when control valve button on dash is manipulated to connect either end of cylinder to engine manifold vacuum line (both strokes of cylinder piston rod are positive and top is both raised and lowered by vacuum power). Control valve is double acting type and is normally centered in the 'off' position by a spring within the valve. When the control valve button is pushed in, or pulled out, vacuum connection is made through the valve to one end or the other of both power cylinders. Button must be held in or out during entire time cylinders are operating to raise or lower top.

OPERATION:—Engine should be running (idle engine with closed throttle) and car should be stopped when top control is operated. CAUTION—Do not raise or lower top with car in motion.

Lowering Top—Unlatch top from widshield header on both sides, raise top slightly so that locating dowels or pins are free of header ———— pull out on control valve button ———— **hold in this position** until top is completely lowered. **In this position, control valve connects lower end of each cylinder to engine manifold vacuum line and opens upper end of each cylinder to atmospheric pressure.**

Raising Top—See that top straps or boots are removed so that top is free. Press in on control valve button

hold in this position until the top is raised. Top should come to rest within 1-2" of windshield header and side rail should be straight

SERVICING:—Vacuum Cylinder—To remove vacuum cylinder, remove rear quarter trim panel, take out bolt linking piston rod to top, disconnect both connections, remove bolt mounting cylinder on body bracket at lower end (on General Motors cars, remove locknut on end of bolt, then remove bolt with a 5/16" Allen setscrew wrench), lift cylinder out.

Lubricating Vacuum Power Cylinder—If piston is tight in cylinder, lubricate with half-and-half mixture of Neatsfoot Oil and Kerosene by submerging hose connection at upper end of cylinder (hose removed) in 1 oz. glass of lubricant and operating piston downward which will draw lubricant into cylinder. Work piston up and down several times.

Control Valve—To remove valve, disconnect and tag hose connections (to insure correct reassembly), remove mounting nut and withdraw valve assembly. To disassemble valve, remove large nut on stem end of valve and withdraw plunger. On General Motor cars, air cleaner (retained by locking ring) mounted under perforated plate on end of valve.

TROUBLE SHOOTING:—If top does not operate satisfactorily, check the following points:

Vacuum Lines—Check all connections for leaks, see that hose connections and metal tubing are not kinked or broken. NOTE—Lines can be checked with vacuum gauge by noting gauge reading at engine manifold, and then connecting gauge to each hose connection at cylinder (hose to opposite cylinder must be plugged, and control valve button

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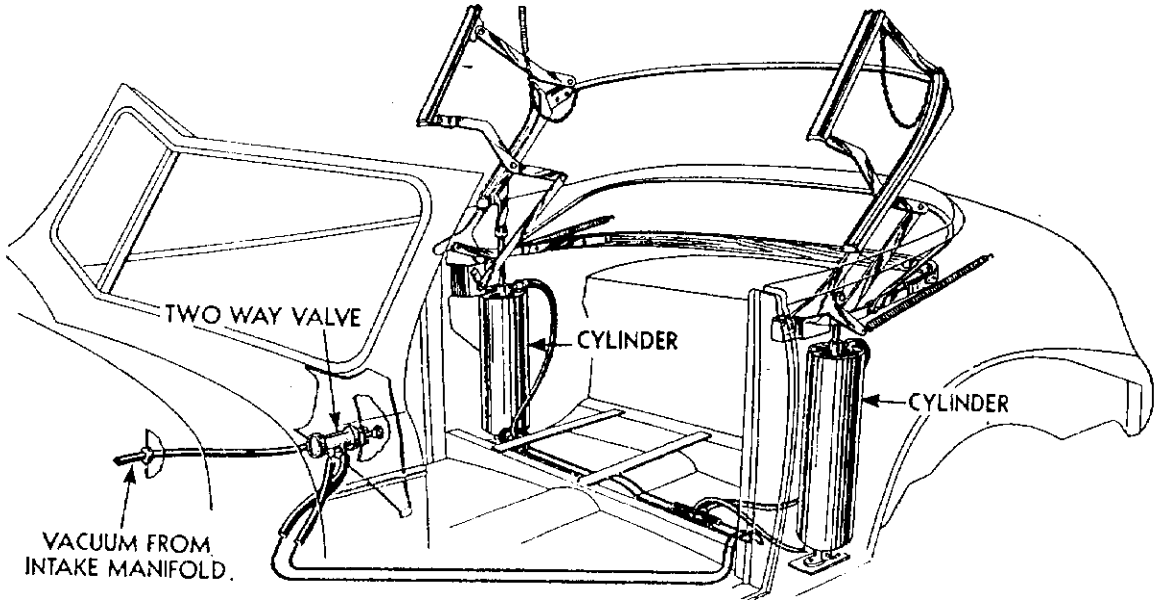

POWER OPERATED TOPS
VACUUM POWER TYPE

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must be operated to open valve in order to secure gauge reading). See Vacuum Line connections above.

Vacuum Power Cylinder—Check piston rod for binding or tightness caused by lack of lubrication (see Cylinder Lubrication in Servicing section above). To check cylinder, disconnect bolt linking piston rod to top, see that piston moves freely in cylinder. Check alignment by raising top in stages, and checking piston rod in each position. Check piston rod seal for damage caused by misalignment or binding of the piston rod. A leak at the seal will cause sluggish action or failure to raise top.

IMPORTANT NOTE—Cylinder rocks on pivot bolt as top is raised and lowered. Any mis-alignment caused by top and bottom mounting bolts not being in same plane (so that cylinder or piston rod cocked sideways) will cause binding and faulty operation.

Top Mechanism—See that top folding arm assembly operates freely without binding. This can be checked by operating top with vacuum cylinders disconnected, or by operating top manually with engine not running (operate control valve in usual manner so as to permit piston to move up or down in vacuum cylinder).

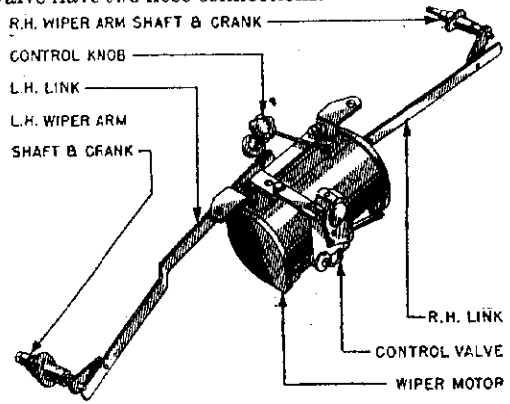
VACUUM WINDSHIELD WIPER

VACUUM WINDSHIELD WIPER LINK & CRANK ARM

Ford, All except Convt. & Sta. Wgn. (1939)
Ford, All Models (1941-49)
Mercury, All Models (1939-49)

DESCRIPTION: Wiper consists of a single motor unit connected to left and right hand wiper arm shafts by flat metal links. Motor control valve is built-in or separate (see illustration).

Wiper Motor—Half-round or cylindrical type. Motors with built-in valve have single manifold hose connection, motors used with separate control valve have two hose connections.



LINK-AND-CRANK ARM WIPER (CYLINDRICAL MOTOR)

Windshield Washer Connection—Vacuum line connection provided on some motors for washer operation (capped if washer not used).

Wiper Arm Shaft & Link Assembly—Left and right (non-interchangeable) assemblies consisting of arm shaft and crank connected to the motor arm by a flat metal link. Assembly is not adjustable.

Separate Control Valve—Mounted separately behind instrument panel and connected to motor by two vacuum lines (in addition to manifold vacuum line) as follows: 1) Running or operating vacuum line (large hose), 2) Parking vacuum line (small hose).

►*CAUTION—These hose connections must not be interchanged.*

REMOVAL & INSTALLATION: Wiper units can be serviced separately as follows:

Wiper Arm: Various types of retainers used. Remove each type as follows:

Retainer Nut—Remove nut on arm at outer end of wiper shaft, pull arm off shaft.

Lock Wire—Disengage lock wire from recess in shaft at back of arm, pull arm off serrated end of shaft.

Flat Spring Lock—Pull blade end of arm out or away from windshield to disengage spring from recess in shaft, pull hub end of arm straight off serrated end of shaft.

Wiper Arm Shaft & Link Assembly: *CAUTION—See special removal instructions required for cars listed below.*

Removal—See special car data below. Remove wiper arm (above), disconnect link at motor shaft arm (free spring lock or remove clip, pull link off motor arm pin). Unscrew retainer nut (remove driver or "burr" from end of shaft if nut will not clear), remove cover and gasket. Pull shaft and link assembly out to rear and remove from beneath instrument panel.

Ford & Mercury (1948-49)—Do not disconnect motor links. After removing shaft retaining nuts and covers, **remove shafts and links as an assembly with the motor** (see Motor Removal below).

Motor: *CAUTION—See special removal instructions required on cars listed below.*

Removal—See special car data below. Disconnect vacuum line hoses at motor, disconnect links at motor shaft arm (free spring lock, pull links off arm pin), take out motor mounting screws, lift motor out and disengage control valve link (types with built-in control valve).

Ford & Mercury (1941-42)—On cars with radio, drop radio for access to motor as follows: Disconnect radio feed wire at fuse block. Unscrew and remove wing nuts attaching radio to underside of instrument panel. Disconnect antenna lead. Hold radio up in position, unscrew coupling on upper part of panel, then lower radio downward and to right to clear ventilator handle.

Ford & Mercury (1946-47)—Do not remove motor mounting screws—take out bracket mounting screws and **remove motor and bracket as an assembly.**

Ford & Mercury (1948-49)—After removing wiper arm shaft retaining nuts (above), disconnect wiper motor vacuum hose, disconnect control valve cable (1949 models only), pull entire wiper assembly to rear (motor, links, shaft & arms, and mounting arm) until shafts clear cowl, then remove assembly from beneath instrument panel.

Installation—Install motor but do not fully tighten mounting screws, connect vacuum lines and links. With motor control "off", operate engine to supply vacuum which will cause wiper motor to centralize itself, then tighten motor mounting screws securely. Install the arms and blades, check operation (see Adjustment data below), adjust arms if required.

Separate Control Valve: *CAUTION—See special removal instructions required on cars listed below.*

Removal—See special car data below. Disconnect all vacuum line hoses, remove control knob, use spanner wrench to remove nut and washer on valve stem, remove valve from behind instrument panel.

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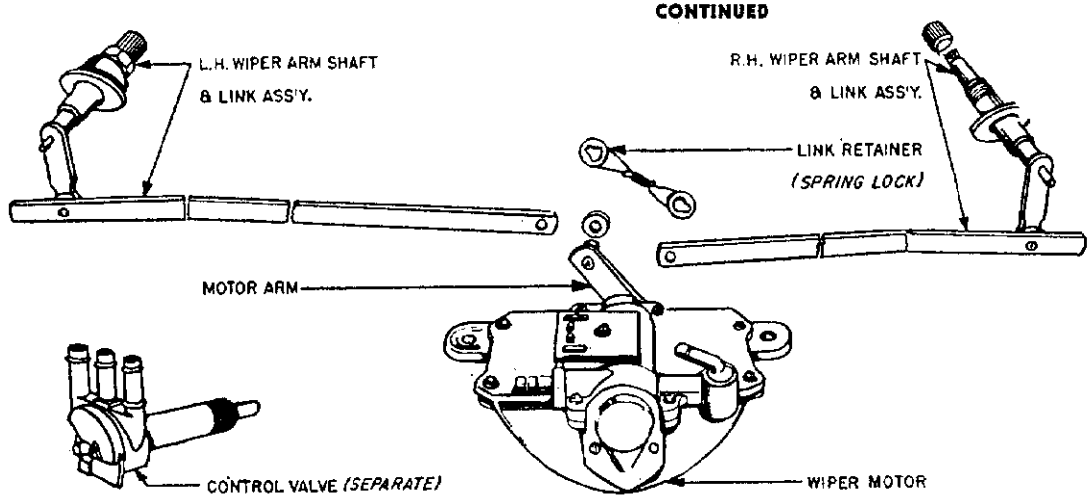


LINK-AND-CRANK ARM WINDSHIELD WIPER (WITH SEPARATE CONTROL VALVE)

VACUUM WINDSHIELD WIPER LINK & CRANK ARM (Cont.)

Installation—Make certain that vacuum line hoses are correctly connected at control valve.

►*CAUTION—Hose connections must not be interchanged.*

ADJUSTMENT: Wiper blades can be adjusted for correct "park" position and for desired sweep or travel of the blades on the windshield. Motor can be adjusted to correct uneven blade travel.

Park Position of Blades: Operate wiper with arms and blades removed (see Wiper Arm Removal), turn wiper off to establish the "off" or park position of arm shafts, install arm so that blade just clears molding at lower edge of windshield glass.

Sweep or Travel of Blades: If arm stroke not uniform (one blade has longer travel than other), loosen wiper motor mounting screws, shift motor in direction of arm which has shorter travel. If necessary, change arm position on shaft (see Park Adjustment above).

VACUUM WINDSHIELD WIPER LINK & CHAIN TRANSMISSION

Ford, Convt. & Sta. Wgn. (1937-39), All (1940).

DESCRIPTION: Wiper consists of a single motor unit connected to left and right hand wiper arm shafts (Transmission Assemblies) by flat metal links. Motor control valve is built-in or separate (see illustrations).

Wiper Motor—Half-round type. Motors with built-in valve have single manifold hose connection, motors used with separate control valve have two hose connections (see illustrations).

►**Windshield Washer Connection**—Vacuum line connection provided on some motors for washer operation (capped if washer not used).

Transmission Assembly (Wiper Arm Shaft)—Left and right (non-interchangeable) assemblies with upper (wiper arm) and lower (link connector arm) sprockets connected by a chain which transmits power to the wiper arm. Adjustment provided to take up slack in chain (see ADJUSTMENT).

Separate Control Valve—Mounted separately behind instrument panel and connected to motor by two vacuum lines (in addition to manifold vacuum line) as follows: 1) Running or operating vacuum line (large hose), 2) Parking vacuum line (small hose).

►*CAUTION—These hose connections must not be interchanged.*

REMOVAL & INSTALLATION: Wiper units can be serviced separately as follows:

Wiper Arm: Various types of retainers used. Remove each type as follows:

Retainer Nut—Remove nut on arm at outer end of wiper shaft, pull arm off shaft.

Lock Wire—Disengage lock wire from recess in shaft at back of arm, pull arm off serrated end of shaft.

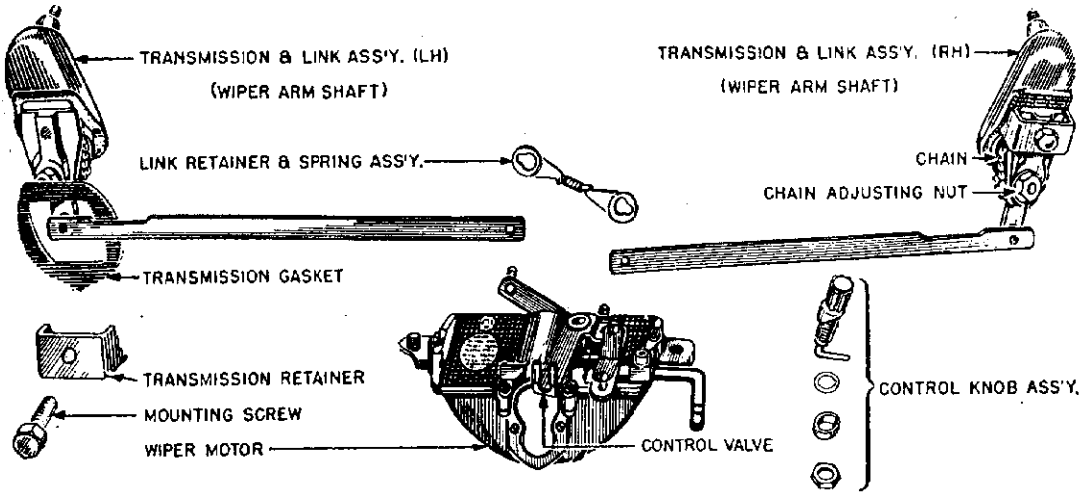
Flat Spring Lock—Pull blade end of arm out or away from windshield to disengage spring from recess in shaft, pull hub end of arm srtaight off serrated end of shaft.

Transmission Assembly (Wiper Arm Shaft & Link):

►*CAUTION—See special removal instructions required on cars listed below.*

Removal—See special car data below. Remove wiper arm (above). Disconnect link at motor shaft arm (free spring lock, pull link off arm pin). Disconnect washer hose (if used) at transmission. Remove capscrew, lockwasher, and retainer from back of transmission assembly under cowl. Lift transmission and link assembly up and out of cowl from outside. Remove old gasket, thoroughly clean old gasket cement from cowl and transmission mounting flange.

Installation—Coat mounting surfaces of cowl, new rubber gasket, and transmission assembly with rubber cement, install gasket on cowl, and use extreme care that gasket does not slip out of position while installing transmission.



LINK-AND-CHAIN TRANSMISSION WINDSHIELD WIPER (WITH BUILT-IN CONTROL VALVE)

►*CAUTION—Correct positioning and cementing of gasket important to prevent water leaks.*

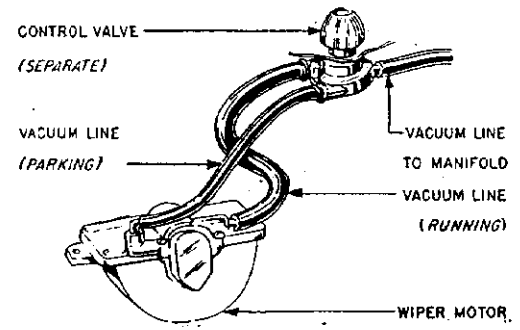
Motor: *CAUTION—See special removal instructions*

Removal—Disconnect vacuum line hoses at motor, disconnect links at motor shaft arm (free spring lock, pull links off arm pin), take out motor mounting screws, lift motor out and disengage control valve link (types with built-in control valve).

Installation—Install motor but do not fully tighten mounting screws, connect vacuum lines and links. With motor control "off", operate engine to supply vacuum which will cause wiper motor to centralize itself, then tighten motor mounting screws securely. Install the arms and blades, check operation (see Adjustment data below), adjust arms if required.

Separate Control Valve: *CAUTION—See special removal instructions required on cars listed below.*

Removal—See special car data below. Disconnect all vacuum line hoses, remove control knob, use spanner wrench to remove nut and washer on valve stem, remove valve from behind instrument panel.



WIPER MOTOR SEPARATE CONTROL VALVE

Installation—Make certain that vacuum line hoses are correctly connected at control valve.

►*CAUTION—Hose connections must not be interchanged.*

ADJUSTMENT: Wiper arms can be adjusted for correct "park" position and for desired sweep or travel of the blades on the windshield. Motor and transmission can be adjusted to correct uneven blade travel or short choppy strokes or noise caused by excessive play.

Park Position of Blades: Operate wiper with arms and blades removed (see Wiper Arm Removal), turn wiper off to establish "off" or park position of arm shaft, install arm so that blade just clears molding at lower edge of windshield glass.

Sweep or Travel of Blades: Check and adjust transmission chain (below). If arm stroke not uniform (one blade has longer travel than other), loosen wiper motor mounting screws, shift motor in direction of arm which has shorter travel. If necessary, change arm position on shaft (see Park adjustment above).

Transmission Chain: Loosen hexagonal nut on lower end of transmission assembly (accessible from under instrument panel—nut on back of transmission), move bolt and nut downward to take up play or slack in the transmission chain, tighten nut securely.

►*CAUTION—Do not overtighten chain (nut can be moved upward to loosen chain).*