



## TECHNICAL BULLETINS

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1935-1936 Terraplane Six

1938 Hudson & Terraplane

1939 Hudson



MARCH 1936.

# TECHNICAL BULLETIN

Vol. IX, No. 2

Subscription Price, \$2.00 per Year

## Illustrated Service Procedure and Specifications for 1935 Terraplane Six

**AIR CLEANER:** At 2,000 miles remove cover and pad. Clean filter with gasoline and re-oil by dipping in S.A.E. 50 motor oil.

**Fan belt Adjustment.**  
1 1/4" to 1 3/4".

**OIL PUMP:** Operation indicated by red light in jewel at right of instrument panel. Light should show when ignition switch is turned on and be intermittent at idle engine speed. At speeds above idle, flashing or burning of light indicates interruption in engine oil supply.

**LUBRICATION:** Capacity, total 6 qts.; to refill, 5 qts. Summer—S. A. E. 30. Winter—Above 0° F., S.A.E. 20W. Below 0° F., S.A.E. 10W.

### SPECIFICATIONS:

TERRAPLANE SIX, SPECIAL, DE LUXE, 1935: Bore 3", stroke 5". Piston displacement, 212 cu. in. Compression ratio, 6:1; optional, 7:1. H.P., 88 at 3800; with optional cyl. head, 100 at 3800.

# TERRAPLANE SIX 1935 - MOTOR

VALVE SPRING PRESSURE: 53 lbs.  
at 2"; 104 lbs. at 1 21/32"

Valve Seat Angle, 45°

## RUNNING CLEARANCE:

Intake, .006"

Exhaust, .008"

(hot setting)

Firing Order, 1-5-3-6-2-4

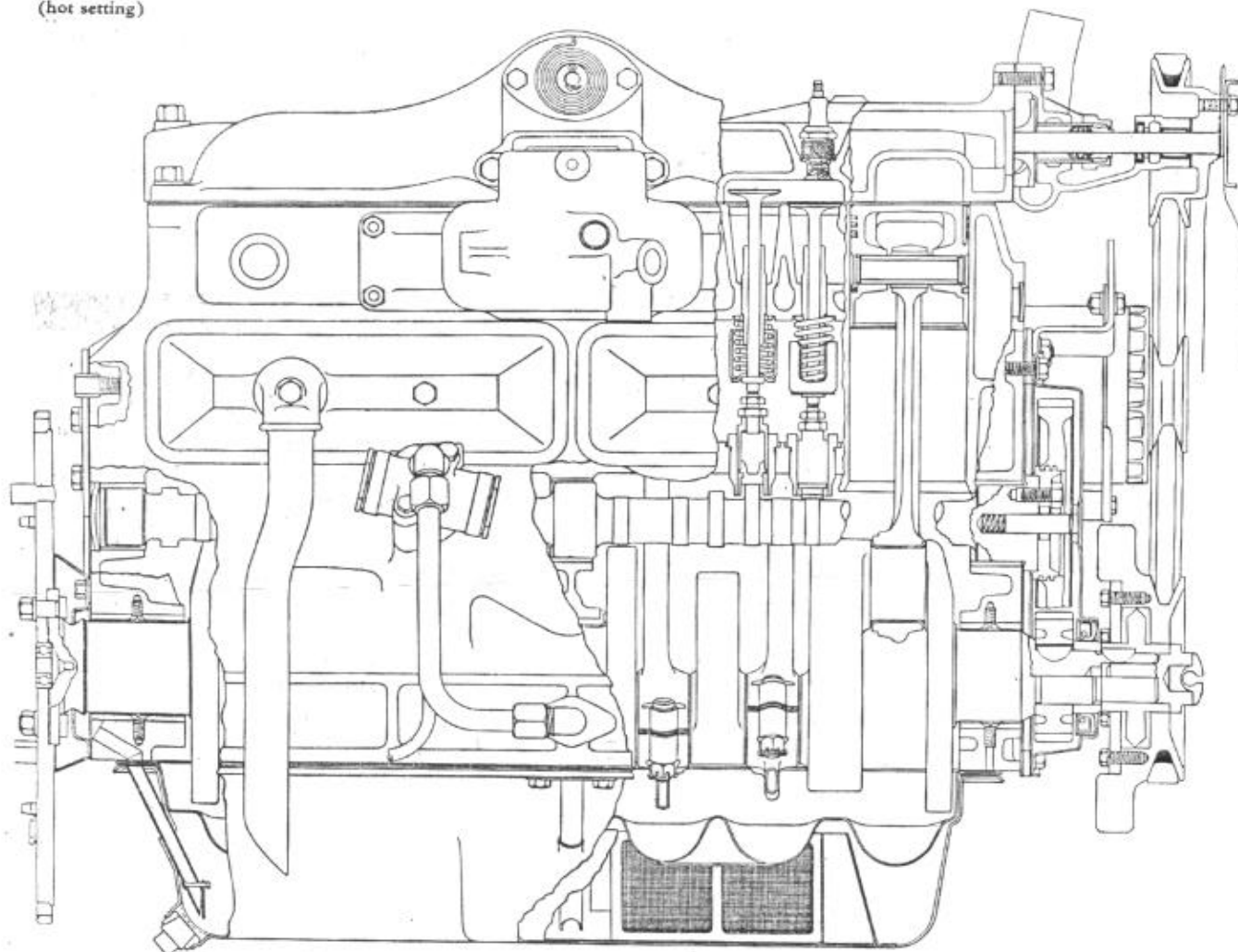
## PISTON RINGS:

Compression: two, 3/32"

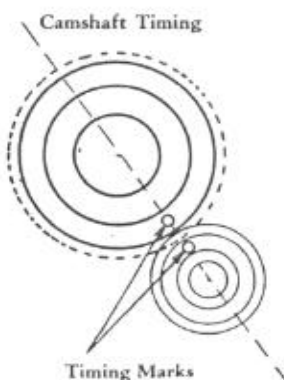
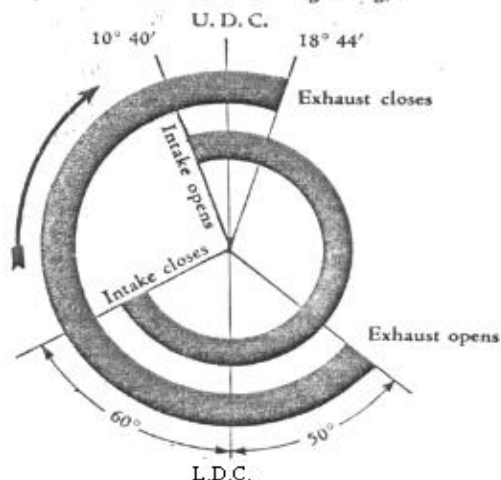
Oil: two, 3/16"

PISTONS: Remove from bottom of motor.  
Pistons aluminum alloy, cam ground. Clearance thrust side of skirt, .001". Clearance at top of piston, .016"

PISTON PINS: Full floating type. Clearance in piston and connecting rod bushings, .0003", piston heated to 200° F.



Valve clearance when checking timing, .010"



CONNECTING RODS: Offset at crankpin end. Assemble rods Nos. 1, 2 and 4 with short side of offset toward front of motor. Assemble rods Nos. 3, 5 and 6 with short side of offset toward rear of motor.

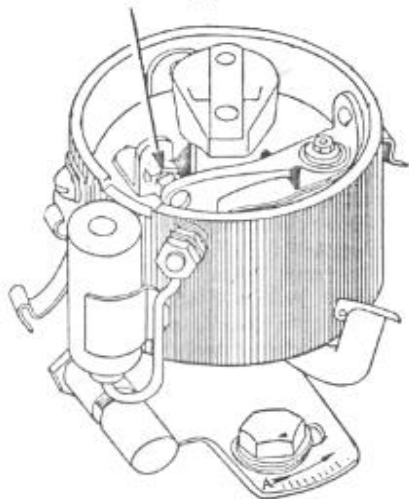
CONNECTING ROD BEARINGS: Spun type integral with rod and cap. Shims provided for adjustment. Clearance .001", with from .006" to .010" sideplay.

MAIN BEARINGS: Removable bronze back with shims for adjustment. Recommended clearance, .001" with from .006" to .012" end-play. Thrust taken on center bearing. Engine must be removed to replace.



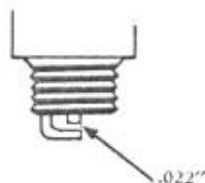
# TERRAPLANE SIX 1935 — IGNITION, CARBURETOR

Contact point gap, .020"



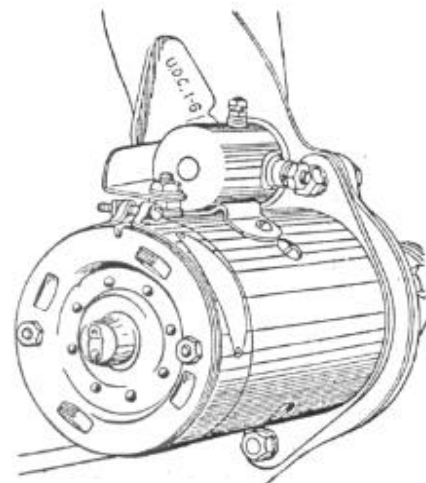
Rotation, clockwise

Firing Order, 1-5-3-6-2-4



**TIMING:** Crank motor to UDC compression stroke of No. 1 piston. Loosen clamp bolt and locate distributor so that points just separate and rotor is in position for ignition at No. 1 spark plug.

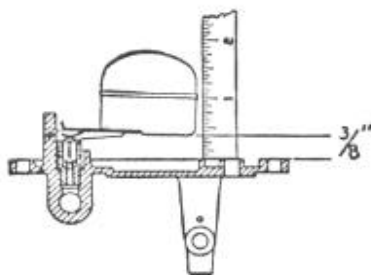
Road test car and advance timing to the point of slight "ping" upon sudden acceleration from car speed of 10 to 15 M. P. H. Final setting will be determined by octane rating of fuel used, but should not be set ahead of the  $\frac{1}{4}$ " advance mark.



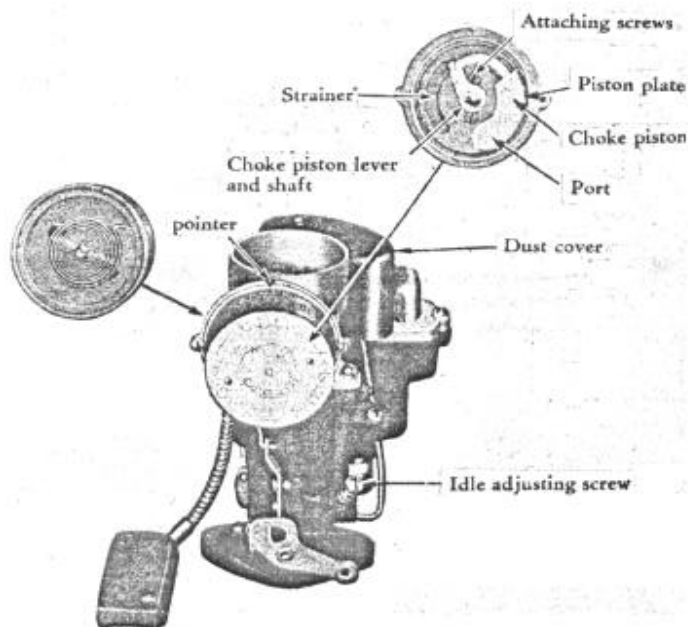
## CARBURETOR

### CARBURETOR

**CARBURETOR ADJUSTMENT:** Motor must be warmed to operating temperature before adjustment is attempted. Only adjustment provided is that for idle mixture. Normal setting is  $\frac{1}{8}$  to 1 turn off seat.



**FLOAT LEVEL:** Adjust by bending lip of float arm. Remove cork gasket when measuring float level.



**CLIMATIC CONTROL:** To service, loosen lock screw that holds flexible tubing in unit on carburetor, releasing tubing from choke housing. Remove two cover housing screws, which permits removal of thermostatic coil and housing assembly. Clean parts with compressed air only. Do not remove coil from housing, or alter shape or position.

Remaining portion of unit attached to carburetor is disassembled as follows: Carefully arrange parts in order as removed. Remove carburetor dust cover. Loosen screw of choke trip lever assembly. Remove the two screws holding choke valve to shaft. Revolve choke piston lever and shaft assembly to left; observe and remove Bakelite choke piston. Avoid losing choke piston. Remove two attaching screws at center of unit. Remove piston plate, port plate and strainer. Parts

removed may be cleaned with gasoline and dried with compressed air.

Parts remaining of the piston plate housing assembly with cork gasket insulator disk should be cleaned with air. Apply air to port in piston plate housing, which cleans passage running through the carburetor and terminating in carburetor bore at point below throttle valve.

If necessary to remove piston plate housing from air horn, be sure to use new gasket and obtain perfect seal.

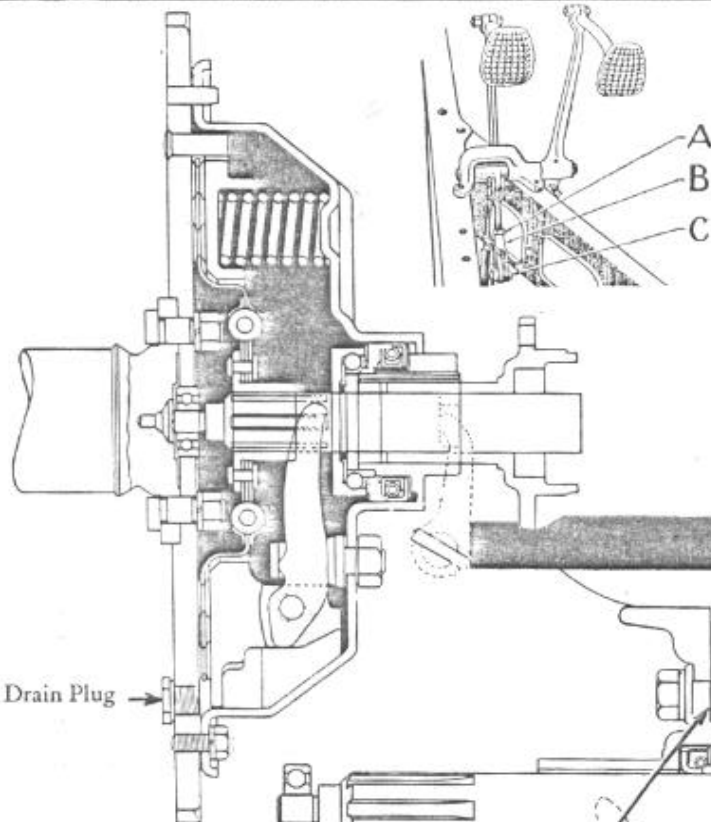
**CAUTIONS:** While assembling choker shaft only half of trip lever assembly should be placed on shaft. This permits ready installation of Bakelite piston and alignment of arm, after which shaft may be slid completely through trip lever. Choke valve must be

placed carefully, and not bind at closed position. Flexible tubing must be installed full depth in hole in carburetor. Note marked calibrations on top of thermostatic housing assembly. When assembling have markings to bottom of unit, install retaining screws and washers but do not tighten. Revolve housing counter-clockwise until spring tension is felt on choke valve. Center mark of calibration should be set in line with pointer cast at top of housing. Tighten retaining screws.

**ADJUSTMENT:** Should cold motor show indications of running lean, richen by turning counter-clockwise one mark at a time. Indications of loading, or rich mixture, corrected by turning clockwise one mark at a time.

Motor must be thoroughly cooled between adjustments by allowing to stand for at least four hours.

# TERRAPLANE SIX 1935 - CLUTCH, TRANSMISSION



**CLUTCH PEDAL ADJUSTMENT:** Adjust clutch pedal at clevis "B" by loosening lock nut "A" and removing pin "C". Turn yoke to shorten or lengthen the rod as necessary, so that pedal shank has clearance of  $1\frac{1}{2}$ " from floor board with clutch engaged.

**CLUTCH LUBRICATION:** Clutch is wet type. To service, turn flywheel to position where drain plug is accessible at timing peep-hole. Remove plug and turn flywheel so drain hole is at bottom and drain. When empty again turn flywheel to first position and fill clutch with  $\frac{1}{3}$  pint of special clutch lubricant. Replace and tighten drain plug after filling.

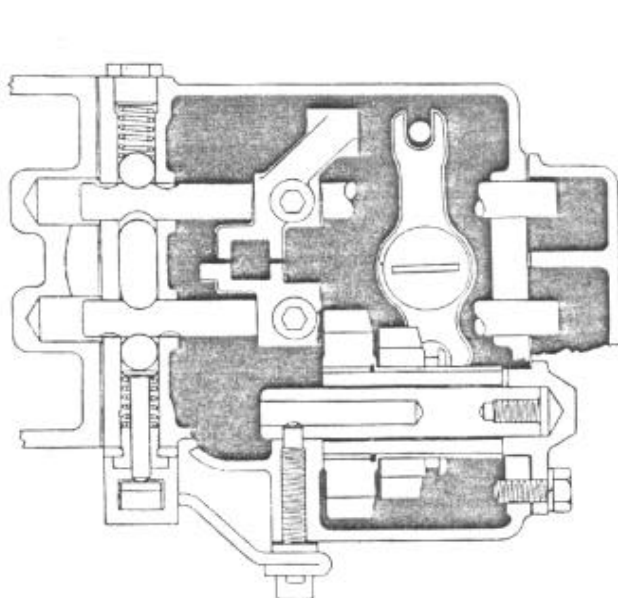
Clutch release bearing lubricated through pressure fitting located at right side of clutch bell-housing. Use light viscous grease at 1000 mile intervals.

## TRANSMISSION

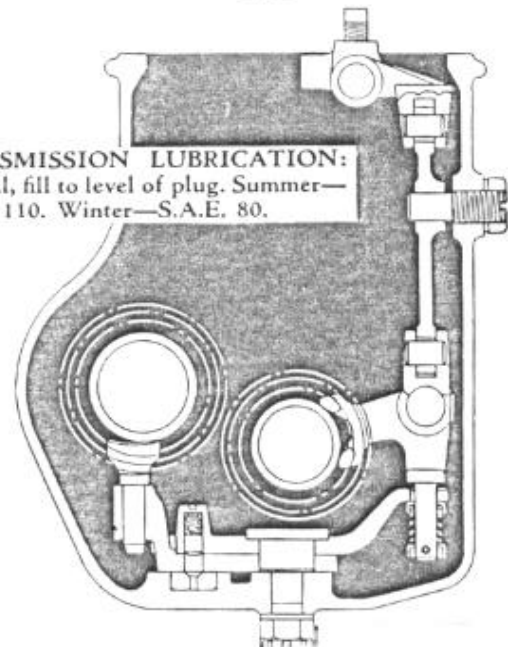
Drain Plug →

Shims for mainshaft endplay adjustment. Mainshaft endplay, .008" to .012".

Shims, Endplay, .005" to .009".



**TRANSMISSION LUBRICATION:**  
Gear oil, fill to level of plug. Summer—S.A.E. 110. Winter—S.A.E. 80.



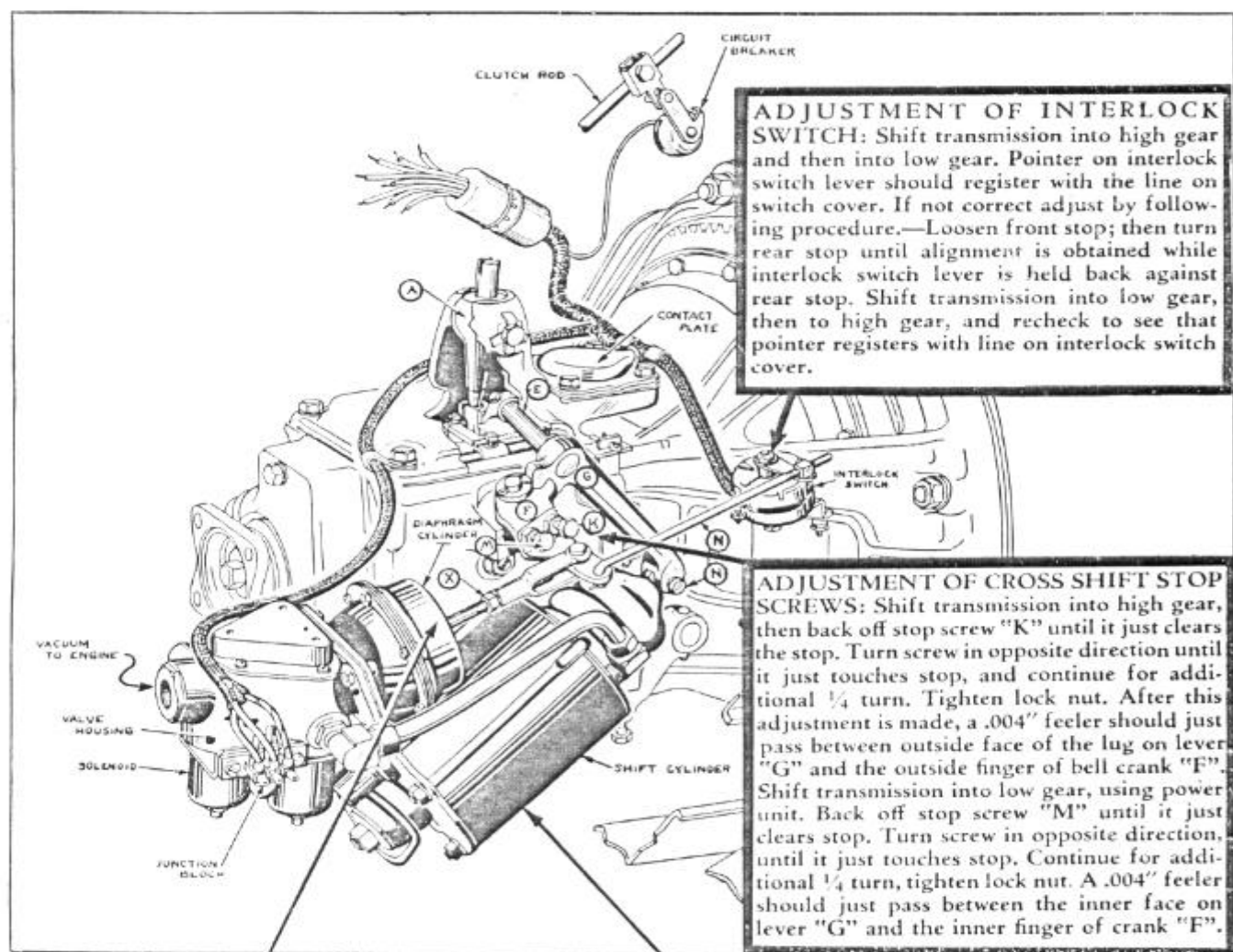
# TERRAPLANE SIX 1935 ---- TRANSMISSION

## Electric Hand

**ADJUSTMENT OF CLUTCH CIRCUIT BREAKER:** With clutch fully engaged, pointer on the lever should be in line with the arrow on top of circuit breaker housing. To adjust—(Automatic clutch control equipped). Loosen clamp nut bolt on bracket mounted on vacuum clutch rod and slide clip until pointer is in line with arrow. Tighten lock nut.—(Without automatic clutch). Remove cotter from circuit breaker lever pin. Loosen lock nut on operating rod and remove rod end from lever pin. Turn rod end until it will slip on pin with pointer in line with arrow on housing. Replace cotter and tighten

lock nut.

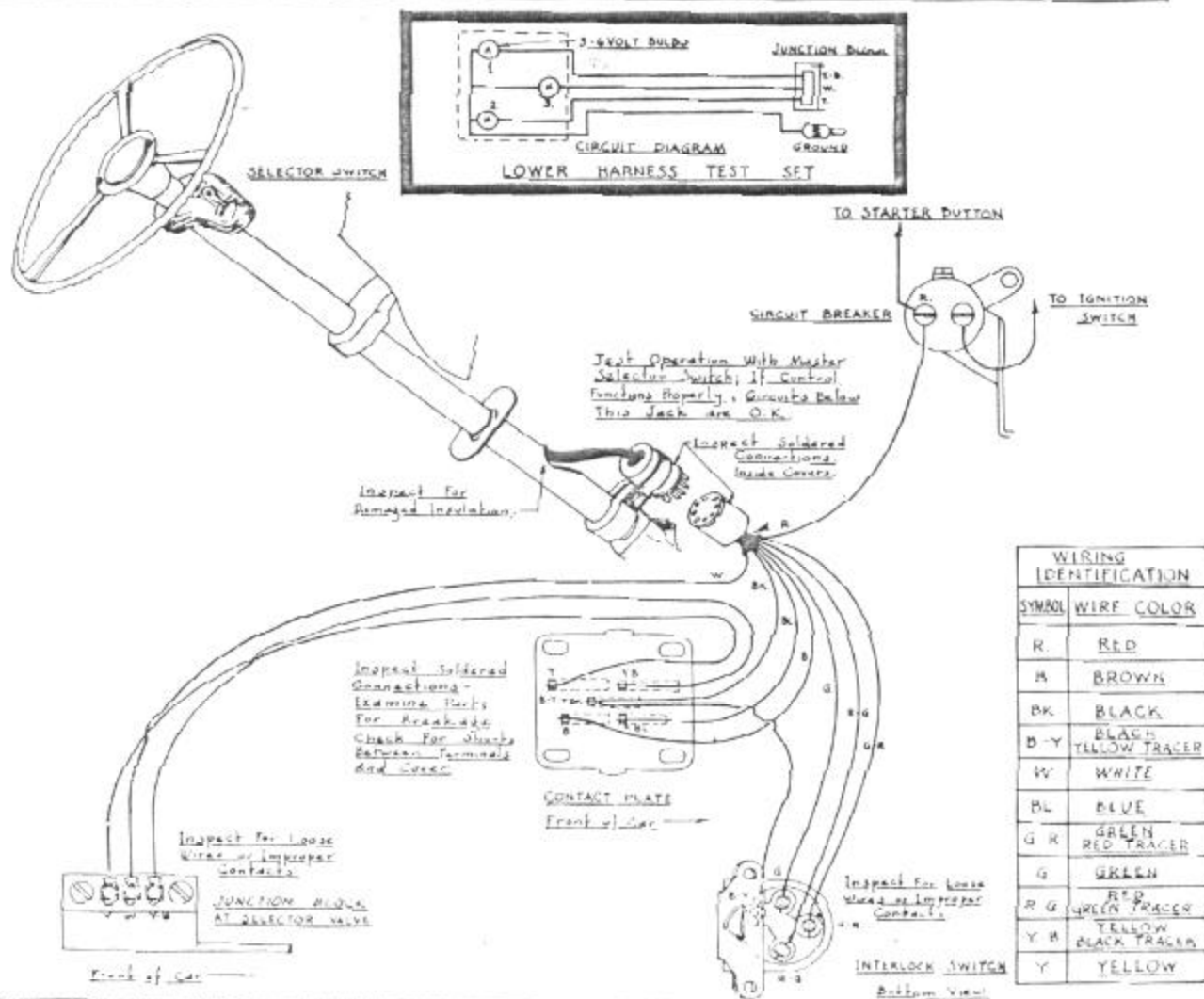
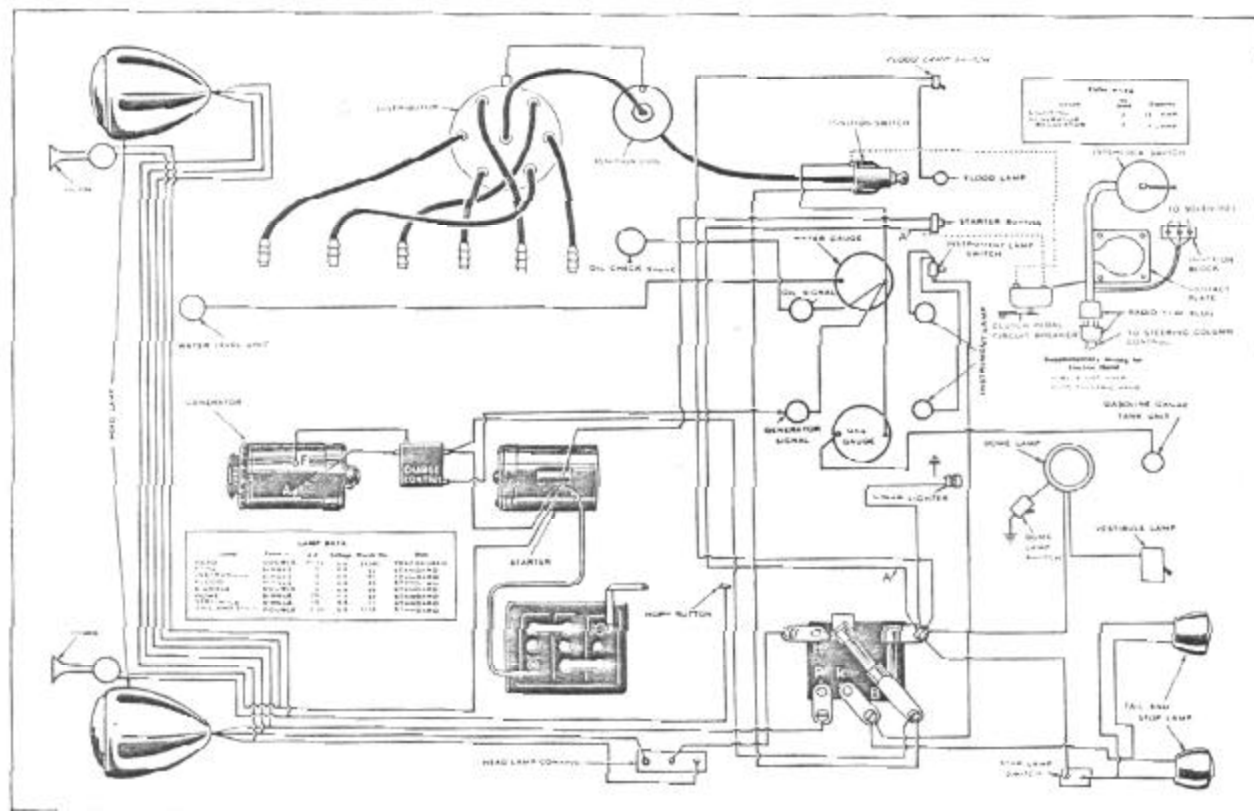
Position of circuit breaker lever is important. If contact is made with too little clutch pedal movement, clutch will be engaged when shift is made, and if a gear has been pre-selected, the shift will be made while engine is driving the car. If contact requires too much pedal travel, shift will not be completed in case gear teeth butt. It is necessary to have a slight clutch drag before the circuit is broken to rotate gears for easy engagement. For this reason it may be necessary to set circuit breaker slightly ahead of indicating arrow.



**ADJUSTMENT OF LENGTH OF DIAPHRAGM CYLINDER SHAFT:** Remove clevis pin from diaphragm cylinder rod clevis. Loosen lock nut "X". With lever "F" pushed forward so that stop screw "K" is against stop, turn clevis until pin hole is 1/4" ahead of the hole in lever when diaphragm cylinder rod is in extreme forward position. Tighten lock nut "X". Push diaphragm rod back to align holes and replace clevis pin.

**ADJUSTMENT OF POWER CYLINDER PISTON ROD:** Shift transmission into high gear and remove clevis pin "N" from lever "G". Push rubber piston rod guard back and loosen lock nut on piston rod. Turn rod end until clevis pin "N" can be inserted when piston rod is pulled to extreme forward position. Push rod back and lengthen four threads by turning clevis, then tighten lock nut. Insert clevis pin "N".

# TERRAPLANE SIX 1935---- WIRING

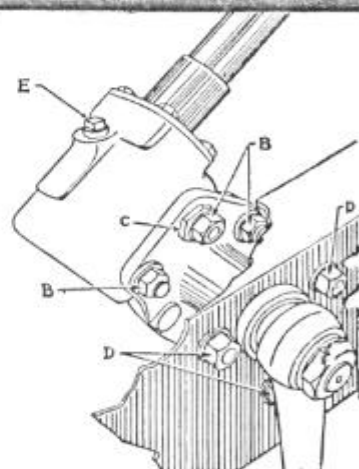




# TERRAPLANE SIX 1935 ---- STEERING, AXLES

## STEERING

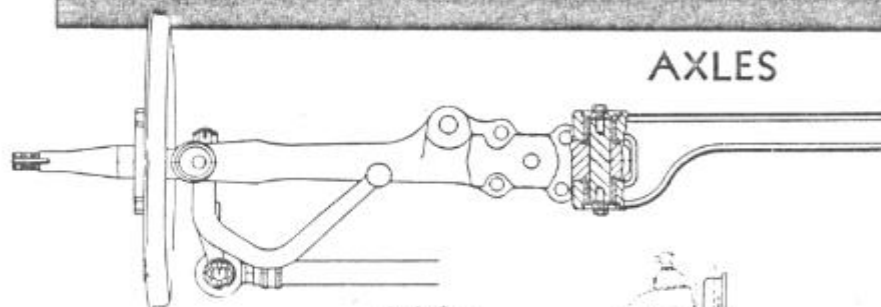
**STEERING WHEEL HEIGHT:** Adjusted by loosening stud nuts "D". Tighten nuts after adjusting wheel to desired position.



**STEERING GEAR ADJUSTMENT CROSS SHAFT ENDPLAY:** Loosen lock nut of set screw at right side of housing. Turn screw in until tight against end of shaft. Back screw off just enough to relieve bind in gear and tighten lock nut.

**MESH OF WORM AND GEAR.** Adjusted by moving housing cover. Loosen four stud nuts "B",  $\frac{1}{4}$  turn. Locate front wheels in straight ahead position and turn eccentric nut "C" clockwise until excessive play is eliminated. Tighten stud nuts "B" starting at eccentric.

## AXLES



Axleflex Front Axle

Conventional Front Axle and Hub Assembly

### Front Axle Specifications

|                     |  |
|---------------------|--|
| Caster Angle.....   | $3\frac{1}{4}^{\circ}$ to $3\frac{3}{4}^{\circ}$ |
| Camber.....         | $1^{\circ}$ to $1\frac{1}{2}^{\circ}$            |
| Toe-in.....         | $0''$ to $\frac{1}{8}''$                         |
| King pin angle..... | $7^{\circ}$                                      |

Axle shaft endplay,  $.004''$  to  $.010''$ .

Pinion shaft endplay,  $.000''$  to  $.001''$ .

Lash,  $.0005''$  to  $.003''$ .

**LUBRICATION:** Capacity 3 qts. Summer, S.A.E. 110. Winter, S.A.E. 90.



AUGUST 1936.

# TECHNICAL BULLETIN

Vol. IX, No. 7

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## Illustrated Service Procedure and Specifications for 1936 Terraplane Six

PRINTED IN U. S. A.

**ENGINE NUMBER:** Stamped on left side of cylinder block at No. 6 cylinder.

**SERIAL NUMBER:** Car serial number plate on dash under hood.

**OIL PUMP:** Operation indicated by red light in jewel at right of instrument panel. Light should show when ignition switch is turned "on" and be intermittent at idle engine speed. At speeds above idle, flashing or burning of the light indicates failure in engine oil supply.

**AIR CLEANER:** Each 2,000 miles — remove cover and pad. Wash filter in clean gasoline and dip in S. A. E. 50 motor oil. Drain excess oil and install.

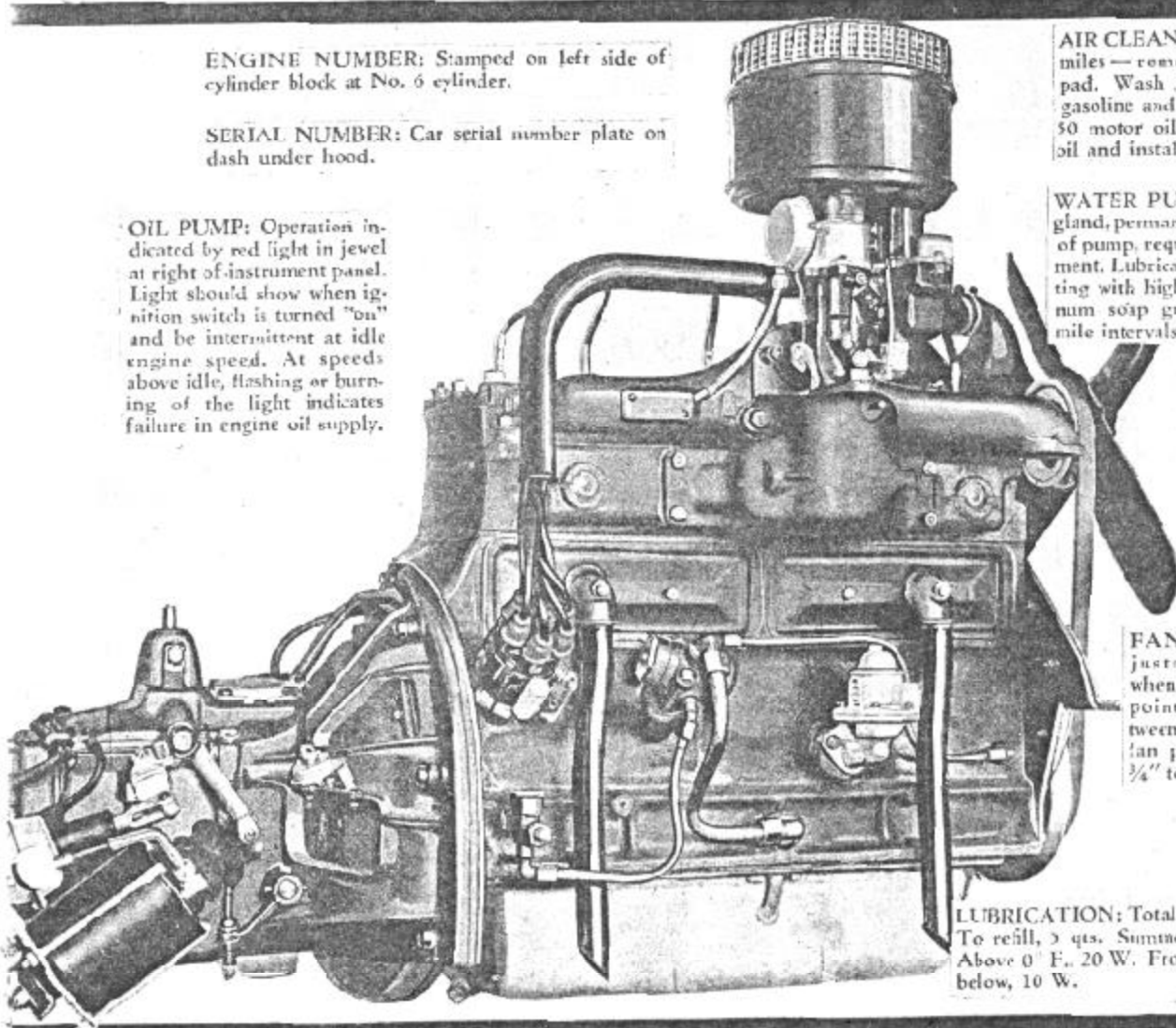
**WATER PUMP:** Packing gland, permanent type inside of pump, requires no adjustment. Lubricate pump at fitting with high grade aluminum soap grease at 1,000 mile intervals.

**FAN BELT:** Adjustment correct when slack in belt at point mid-way between generator and fan pulley is from  $\frac{3}{4}$ " to  $1\frac{1}{4}$ ".

**LUBRICATION:** Total capacity, 6 qts. To refill, 5 qts. Sumner, S. A. E. 30. Above 0° F., 20 W. From 0° F. to 15° below, 10 W.

### SPECIFICATIONS:

**TERRAPLANE SIX, 1936:** Bore, 3"; stroke, 5". Piston displacement, 212 cu. in. Compression ratio, 6:1; optional, 7:1. H. P., 83 at 3800; with optional cyl. head, 100 at 3800.



# Terraplane Six, 1936 — MOTOR

**PISTONS:** Aluminum alloy, cam ground. Remove from bottom of motor. Clearance at skirt, .002"; at top of piston, .016". Check piston clearance at thrust side of skirt with .0015" feeler gauge and spring scale. Clearance is correct when 3 to 4 lb. pull is required to withdraw feeler. Piston weight, 10.5 oz. Avoid variation in weight when replacing one or more pistons, or rod assemblies.

**PISTON PINS:** Full floating type. Fit to piston bosses at hand push fit when piston is heated to 200° F. Fit to connecting rod bushing at .0003" clearance, or so that rod just turns on the pin under its own weight when held in horizontal position.

**FIRING ORDER**  
1-5-3-6-2-4

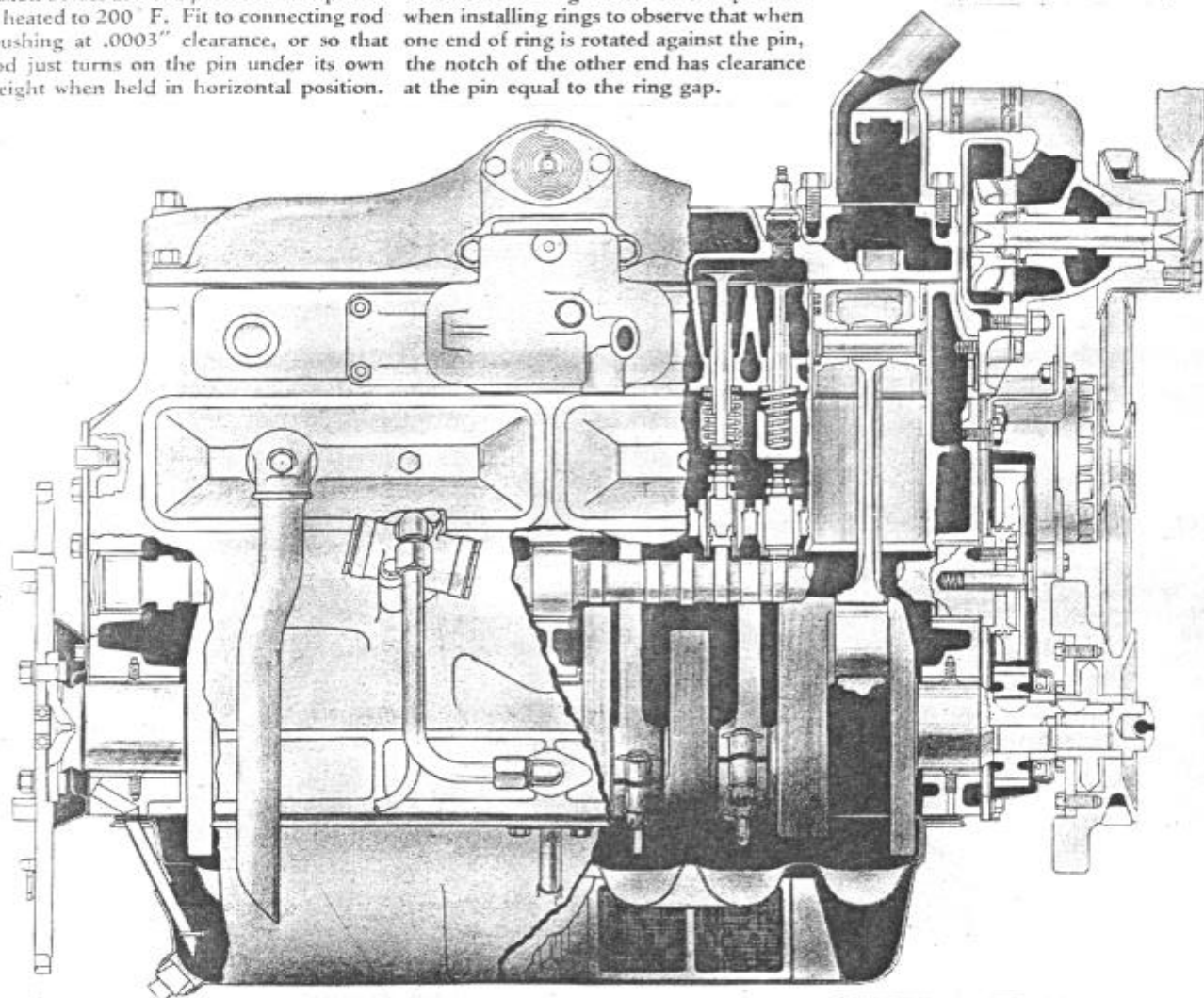
**PISTON RINGS:** Compression (two), 3/32". Oil rings (two), one above piston pin, 3/32"; ring below piston pin, 3/16". **NOTE**—Piston rings are pinned to prevent rotation in grooves. It is important when installing rings to observe that when one end of ring is rotated against the pin, the notch of the other end has clearance at the pin equal to the ring gap.

**VALVE SPRING PRESSURE:** Compressed to 2" length, 44 lbs.; at 1-21/32", 102 lbs.

**VALVE SEATS:** Angle, 45°.

**Tappet Clearance** when checking timing, .010".

**RUNNING CLEARANCE:** Intake, .006". Exhaust, .008". (Hot Setting.)  
Valve Timing    Camshaft Timing



**MAIN BEARINGS:** Bronze back type held in position in block and cap by machine screws. Motor must be removed to replace bearings. Shims provided for adjustment. Clearance, .001".

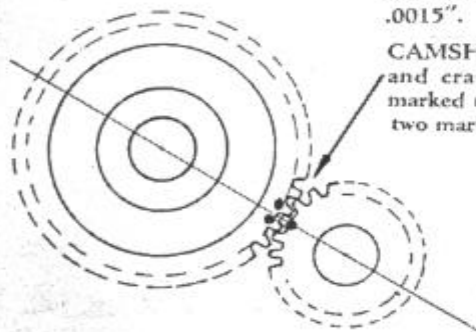
**CONNECTING RODS:** Offset at crank-pin end. Assemble rods Nos. 1, 2 and 4 with short side of offset toward front of motor. Assemble rods Nos. 3, 5 and 6 with short side of offset toward rear of motor.

**CONNECTING ROD BEARINGS:** Spun type integral with rod and cap. Shims provided for adjustment. Clearance, .001" with from .006" to .010" endplay.

**CRANKSHAFT THRUST:** Taken on center bearing. Endplay, .006" to .012".

**CAMSHAFT THRUST:** Taken on spring loaded plunger bearing on timing case cover. Camshaft bearing clearance, .0015".

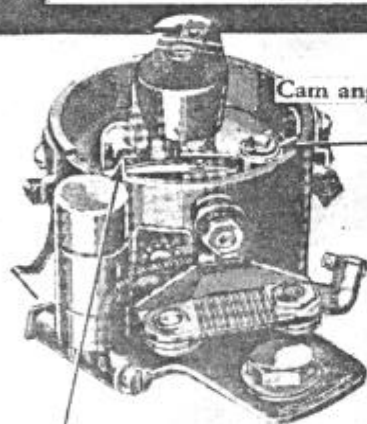
**CAMSHAFT TIMING:** Set camshaft and crankshaft in such position that marked tooth on crankshaft meshes with two marked teeth of camshaft gear.





# Terraplane Six, 1936 ---- TUNE-UP

## IGNITION



Cam angle (dwell—points closed), 40°

Spring tension, 16 to 20 oz.

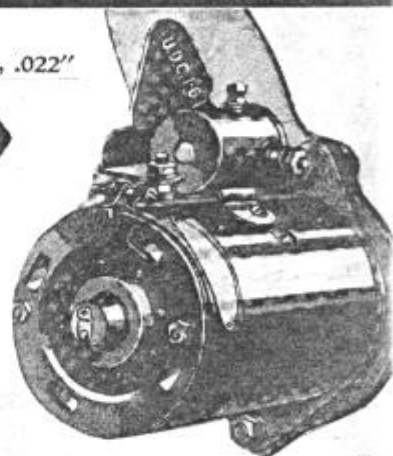
Contact point gap, .020"

Spark plug gap, .022"



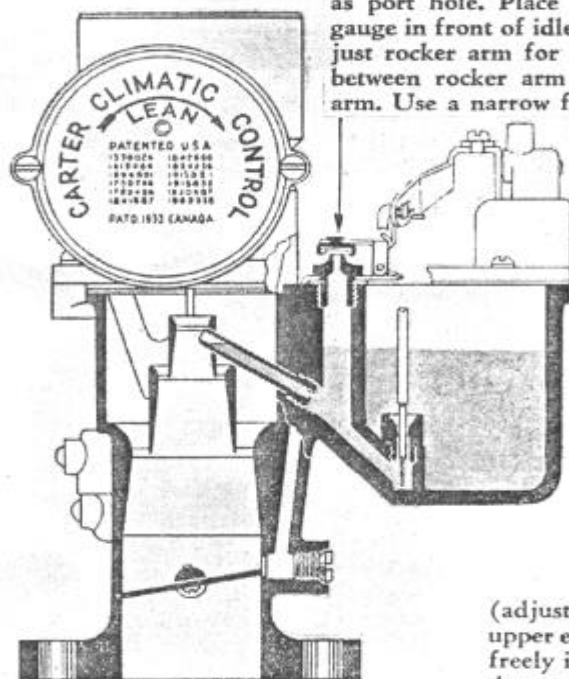
FIRING ORDER 1-5-3-6-2-4

**IGNITION TIMING:** Crank motor to U. D. C. compression stroke of No. 1 piston. Loosen clamp bolt and rotate distributor clockwise to limit of slot. From this position rotate distributor counter-clockwise until points just break contact for ignition at No. 1 spark plug. Tighten clamp bolt. Road test car and advance ignition timing, one graduation at a time, to the point of slight "ping" upon sudden acceleration from car speed of from 10 to 15 M. P. H. Final setting will be determined by octane rating of the fuel used, but should not be more than 1/4" ahead of the U.D.C. timing mark on flywheel.



## CARBURETOR

**ANTI-PERCOLATING VALVE ADJUSTMENT:** Set throttle at .030" opening between edge of valve and bore of carburetor on same side as port hole. Place .030" diameter gauge in front of idle port hole. Adjust rocker arm for .010" clearance between rocker arm lip and pump arm. Use a narrow feeler gauge.



**IDLE ADJUSTMENT:** Open idle adjusting screw one full turn. Start engine and allow to run long enough to reach proper operating temperature. Turn idle adjusting screw in or out to position where motor runs smoothly. Normal setting is from 1/2 to 1 full turn off seat. Be sure that fast idle bar is raised so that throttle can close to its normal idle position.

**METERING ROD ADJUSTMENT:** Necessary when carburetor is serviced, or when leaner than standard metering rod is installed. Special gauge is required. Insert gauge in place of metering rod, seating beveled end in metering rod jet. Hold gauge vertical to insure seating. Metering rod pin in pump arm should rest on top of gauge with throttle fully closed

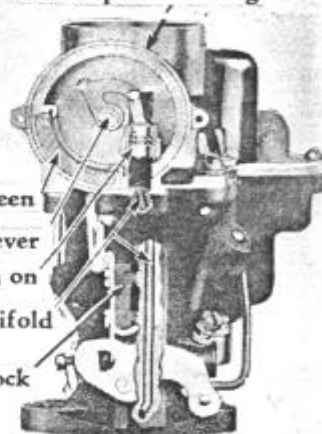
(adjusting screw backed off) and upper end of connector rod centering freely in its hole in pump arm. If it does not, bend lower end of throttle connector rod so that top end centers freely in hole. Remove gauge, replace metering rod and disc and metering rod spring. Be sure metering rod end enters jet.

**TO DISASSEMBLE CLIMATIC CONTROL:** Remove cover attaching screws and housing retainers. Remove strainer screen. Remove choker valve. Loosen clamp screws on choker lever and screw assembly and bend lip under screw so it will pass over the portion of choke shaft which is not milled flat. Remove choker piston lever, link and shaft assembly. Remove suction passage gasket from air horn. **CAUTION—** Do not remove screw that holds air horn and piston housing together, as these parts are line reamed.

Thermostatic spring assembly



Piston plate housing



Screen

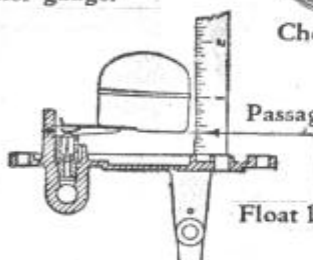
Choker shaft and lever

Pin on

Passage to intake manifold

Fast idle block

Float level, 1/8"



**FLOAT LEVEL:** Remove cork gasket when measuring float level. Adjust by bending lip of float arm up, or down as required.

**TO ASSEMBLE:** Wash all parts, except cork gaskets, in clean gasoline. Clean all passages with compressed air. Use new gaskets and replace worn parts.

Install fast idle block and link on choker lever, pin and screw assembly. Install choke piston lever, link and shaft in air horn and control assembly; at the same time install fast idle block and link assembly, choke lever, pin and screw assembly. Tighten screw on choker lever, check to see that all parts move freely. Install strainer in piston housing. Strainer must be clean. Install new suction passage gasket in air horn casting and install air horn on carburetor. Tighten air horn attaching screws and install screw beneath piston housing. Install fast idle block attaching screws. Check to see that block moves freely. Check thermostatic housing and coil assembly. Replace cork insulating strip if shrunk or damaged. Install housing and coil assembly with symbol "Climatic" at bottom, and turn counter-clockwise until center marking on piston housing lines up with mark on thermostat housing. Install retainers and housing attaching screws.

# Terraplane Six, 1936 — STEERING, AXLES

## FRONT AXLE

### SPECIFICATIONS

|                |            |
|----------------|------------|
| Caster Angle   | 2° to 2½°  |
| Camber         | 1° to 1½°  |
| Toe-in         | 0" to 1/8" |
| King Pin Incl. | 7°         |

Shims for caster adjustment. Shim .060" thick changes caster approximately 1°. Total thickness must be the same at each side of car.

## STEERING

**STEERING WHEEL HEIGHT:** Adjusted by loosening stud nuts "D". Tighten nuts after adjusting to desired position.

**MESH OF WORM AND GEAR:** Adjusted by moving housing cover. Loosen four stud nuts "B", ¼ turn. Locate front wheels in straight ahead position. Turn eccentric nut "C" clockwise, checking for play at steering gear arm. When adjustment is completed tighten stud nuts. Check adjustment by turning steering wheel from one extreme to the other.

Sector shaft endplay adjusting screw

**LUBRICATION:** Summer, S.A.E. 110. E.P. Winter, S.A.E. 90 E.P.

**SECTOR SHAFT ENDPLAY:** Loosen lock nut of set screw at right side of steering gear housing. Turn screw "in" until tight against end of shaft. Back screw off just enough to relieve bind in gear and tighten lock nut.

**ECCENTRIC RIVET:** Provides adjustment of housing cover to centralize gear and obtain equal lash at each side of high point of worm and gear. Turn steering wheel 1/3 revolution to right of high point (mid-position, wheels straight ahead) and check lash. Then turn 2/3 revolution in opposite direction and check lash. Lash should be equal at each position, 1/3 revolution from mid-position.

## REAR AXLE

Shims for adjusting pinion shaft bearings. Pinion shaft endplay, .001".

Shims for adjusting pinion position.

Lash, .0005" to .003".

Shims for axle shaft bearing adjustment. Endplay, .004" to .010".

**LUBRICATION:** Capacity, 3 pts. Summer, S. A. E. 110 E. P. Winter, S. A. E. 90 E. P.

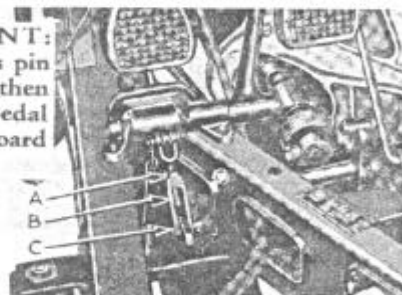
# Terraplane Six, 1936 CLUTCH, TRANSMISSION

## CLUTCH

**CLUTCH SPRING PRESSURE:** Compressed to  $1\frac{1}{4}$ " length, 135 lbs. Replace if tension is less than 125 lbs. at this length. **NOTE:** Before disassembling clutch check for, or make, punch marks to mark position of pressure plate and clutch cover relative to each other, so that balance may be maintained when assembled.

**CLUTCH LUBRICATION:** Clutch is wet type. To service turn flywheel to position where drain plug is accessible at flywheel timing peephole. Remove plug then turn flywheel so that drain hole is at bottom and allow clutch to drain. When empty again turn flywheel to first position and fill clutch with  $\frac{1}{3}$  pint of special clutch lubricant. Replace and tighten drain plug. Clutch release bearing is lubricated through pressure fitting located at right side of bell housing. Lubricate with 1 oz. of aluminum soap grease at 1,000 mile intervals.

**CLUTCH PEDAL ADJUSTMENT:** Loosen lock nut "A" and remove clevis pin "C". Turn yoke "B" to shorten or lengthen the rod as necessary, so that clutch pedal shank has clearance of  $1\frac{1}{2}$ " from floor board when clutch is engaged.



## TRANSMISSION

Main shaft needle rollers, 26 used.

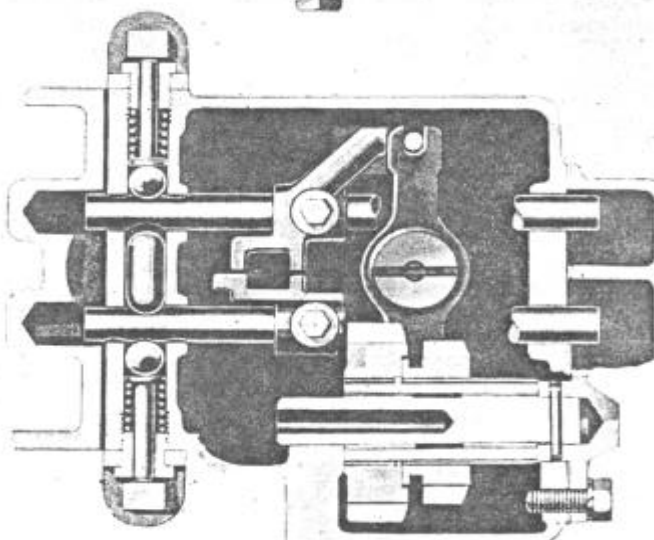
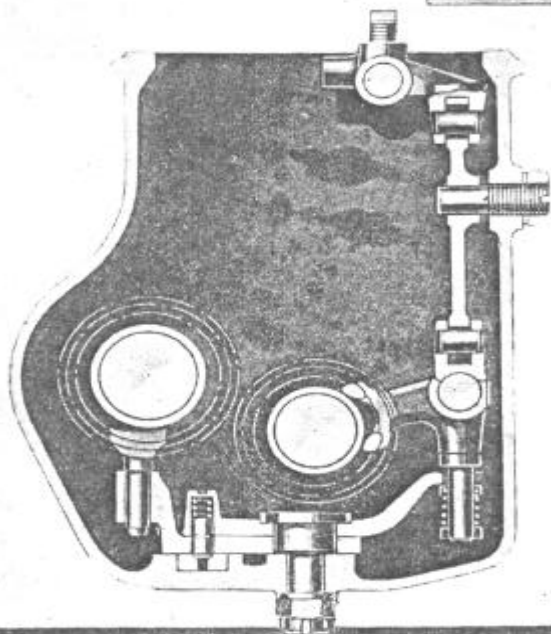
Main shaft thrust balls, 7 used.

Shims for adjusting main shaft endplay.  
Mainshaft endplay, .008" to .012"

**LUBRICATION:** Capacity, three pts. Summer, S.A.E. 90 E.P. Winter, S.A.E. 80 E.P.

Shims.  
Counter-shaft  
endplay,  
.005" to .009"

Thrust washer





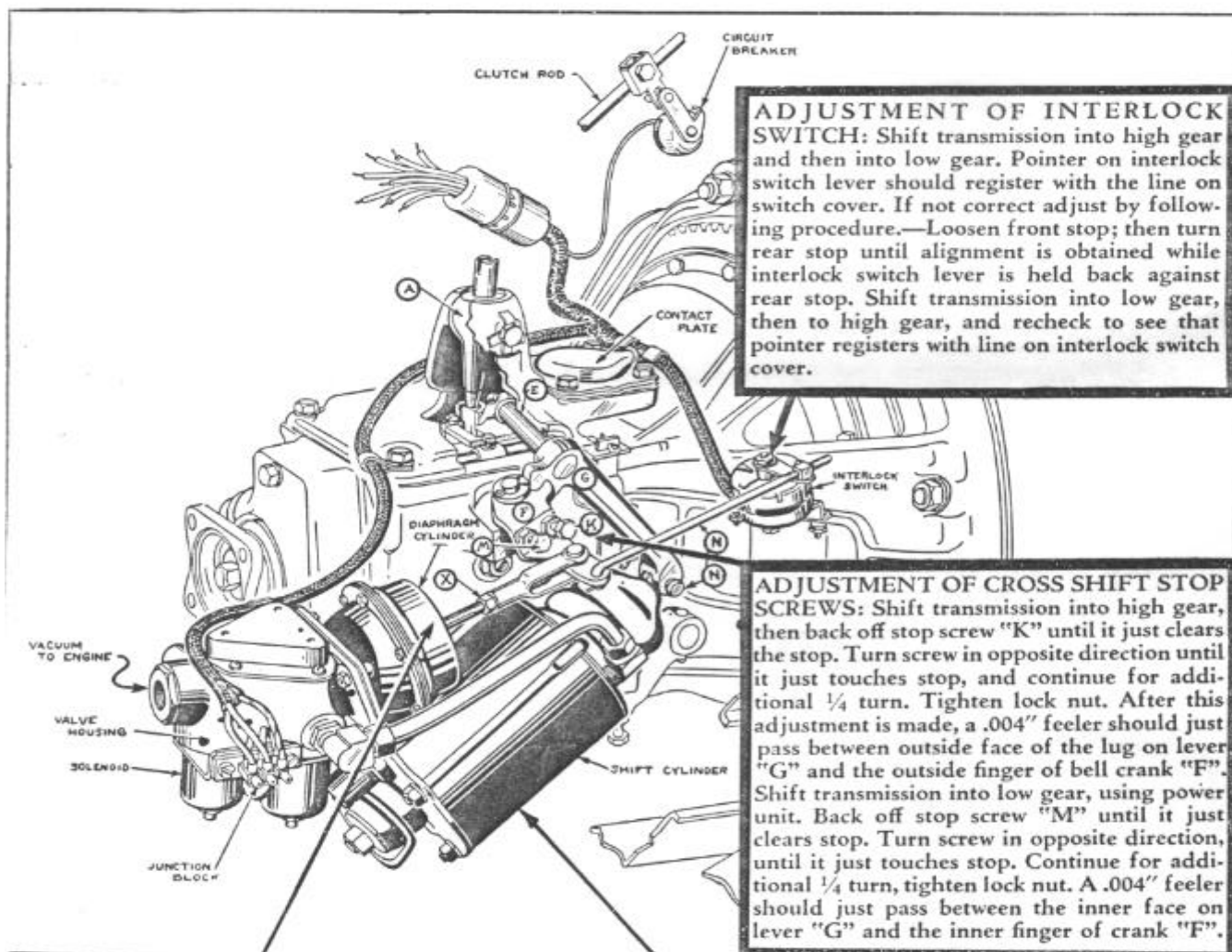
# TERRAPLANE SIX 1936 ---- TRANSMISSION

## Electric Hand

**ADJUSTMENT OF CLUTCH CIRCUIT BREAKER:** With clutch fully engaged, pointer on the lever should be in line with the arrow on top of circuit breaker housing. To adjust—(Automatic clutch control equipped). Loosen clamp nut bolt on bracket mounted on vacuum clutch rod and slide clip until pointer is in line with arrow. Tighten lock nut.—(Without automatic clutch). Remove cotter from circuit breaker lever pin. Loosen lock nut on operating rod and remove rod end from lever pin. Turn rod end until it will slip on pin with pointer in line with arrow on housing. Replace cotter and tighten

lock nut.

Position of circuit breaker lever is important. If contact is made with too little clutch pedal movement, clutch will be engaged when shift is made, and if a gear has been pre-selected, the shift will be made while engine is driving the car. If contact requires too much pedal travel, shift will not be completed in case gear teeth butt. It is necessary to have a slight clutch drag before the circuit is broken to rotate gears for easy engagement. For this reason it may be necessary to set circuit breaker slightly ahead of indicating arrow.



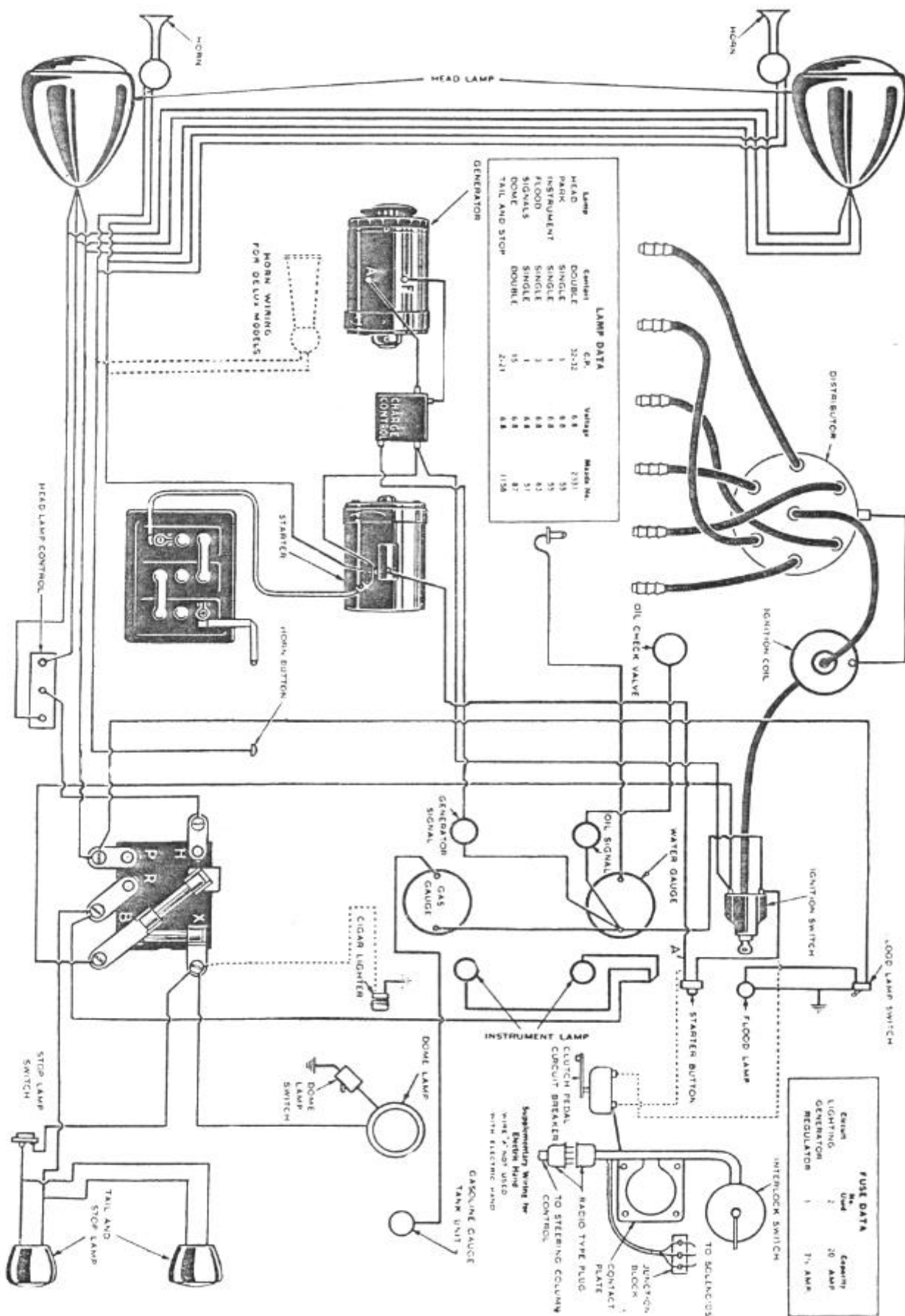
**ADJUSTMENT OF INTERLOCK SWITCH:** Shift transmission into high gear and then into low gear. Pointer on interlock switch lever should register with the line on switch cover. If not correct adjust by following procedure.—Loosen front stop; then turn rear stop until alignment is obtained while interlock switch lever is held back against rear stop. Shift transmission into low gear, then to high gear, and recheck to see that pointer registers with line on interlock switch cover.

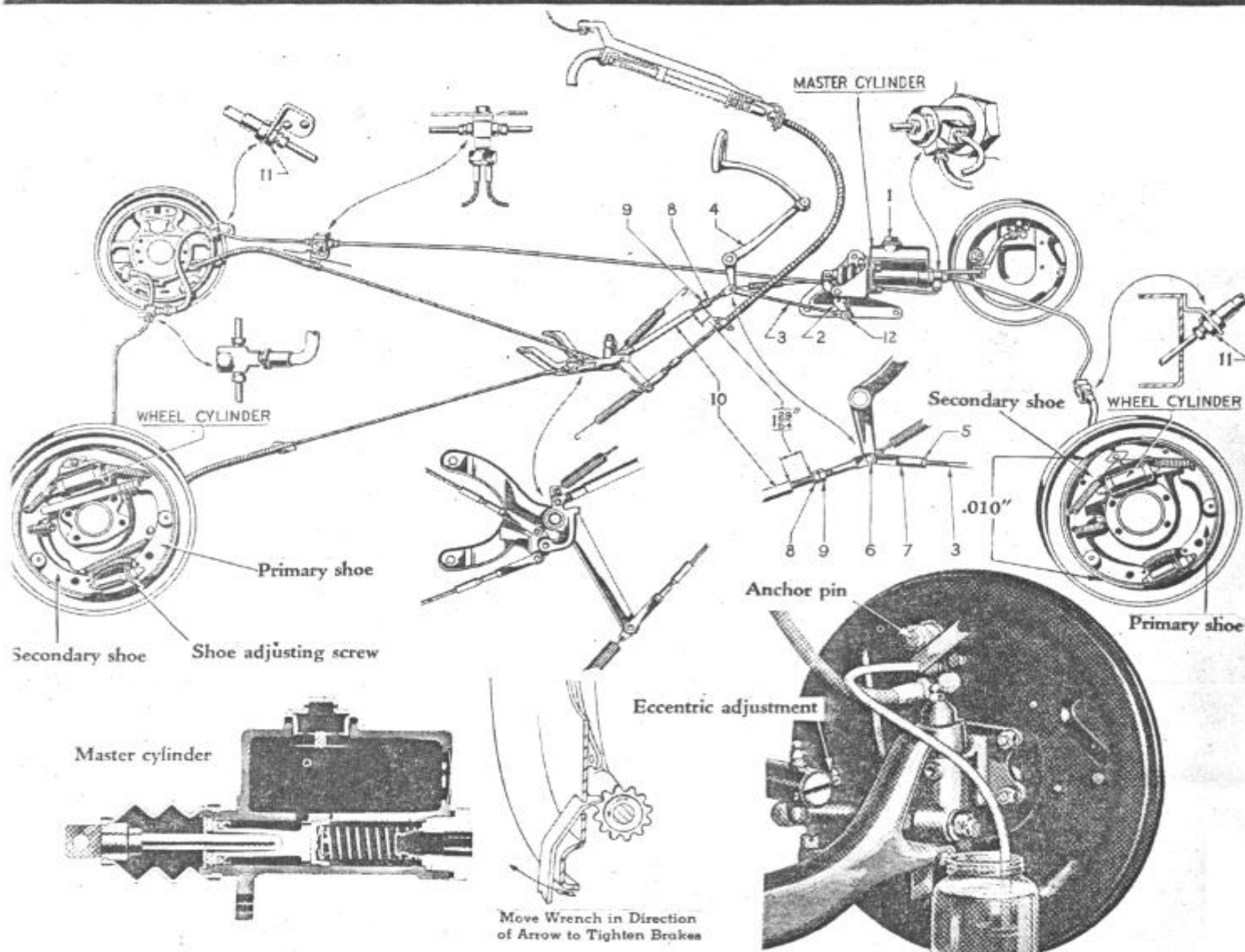
**ADJUSTMENT OF CROSS SHIFT STOP SCREWS:** Shift transmission into high gear, then back off stop screw "K" until it just clears the stop. Turn screw in opposite direction until it just touches stop, and continue for additional  $\frac{1}{4}$  turn. Tighten lock nut. After this adjustment is made, a .004" feeler should just pass between outside face of the lug on lever "G" and the outside finger of bell crank "F". Shift transmission into low gear, using power unit. Back off stop screw "M" until it just clears stop. Turn screw in opposite direction, until it just touches stop. Continue for additional  $\frac{1}{4}$  turn, tighten lock nut. A .004" feeler should just pass between the inner face on lever "G" and the inner finger of crank "F".

**ADJUSTMENT OF LENGTH OF DIAPHRAGM CYLINDER SHAFT:** Remove clevis pin from diaphragm cylinder rod clevis. Loosen lock nut "X". With lever "F" pushed forward so that stop screw "K" is against stop, turn clevis until pin hole is  $\frac{1}{4}$ " ahead of the hole in lever when diaphragm cylinder rod is in extreme forward position. Tighten lock nut "X". Push diaphragm rod back to align holes and replace clevis pin.

**ADJUSTMENT OF POWER CYLINDER PISTON ROD:** Shift transmission into high gear and remove clevis pin "N" from lever "G". Push rubber piston rod guard back and loosen lock nut on piston rod. Turn rod end until clevis pin "N" can be inserted when piston rod is pulled to extreme forward position. Push rod back and lengthen four threads by turning clevis, then tighten lock nut. Insert clevis pin "N".

## Terraplane Six, 1936 Wiring





**PEDAL ADJUSTMENT:** Check lever "2". Return spring should hold bottom of lever against stop when brakes are released. If pedal shank is against floor board, or has clearance of more than  $\frac{3}{8}$ ", loosen lock nut "5" on cylinder connecting rod and remove clevis pin "12" from bottom of bell crank. Adjust connecting link to length at which clevis pin just enters rod when pedal shank has clearance of  $\frac{1}{4}$ " at toe board and lever is against stop. Cotter clevis pin and tighten lock nut.

**PEDAL PUSH ROD ADJUSTMENT:** With equalizer bar against stop loosen lock nut and turn adjusting nut "9" until rear face is 1-29/64" from front end of push rod "10." This adjustment necessary to obtain proper mechanical follow-up of hydraulic operation of rear brakes.

#### ADJUSTMENT FOR WEAR

1) Raise four wheels clear of floor. 2) Disconnect rear brake cables at equalizer bar. 3) Remove shoe adjusting hole covers at brake support plate and gauge hole cover in brake drum. Loosen eccentric lock nut and insert .010" feeler between lining and drum of secondary shoe. Turn eccentric adjustment in direction of forward wheel

rotation until shoe is snug on feeler at anchor and adjusting ends of shoe. Clearance at both ends of secondary shoe should not vary more than .003". If variation in clearance is greater, relocation of anchor pin is necessary. In case of variation it is desirable that clearance be less at anchor end of shoe. 4) Spread shoes by turning shoe adjusting screw until brake drum can just be turned by hand. 5) Pull hand brake lever until equalizer bar plate is  $\frac{1}{8}$ " from stop. 6) Pull rear brake cables tight and adjust ends so clevis pins just enter holes in plate. Rear face of equalizer plate must be parallel to face of stop after adjustment is made. 7) Release hand brake. 8) Release adjusting screw at each wheel until brakes are just free of drag. Replace feeler hole covers, install wheels and test brakes for equal application. If adjustment is necessary, back off shoe adjusting screw of tight brakes.

**ANCHOR ADJUSTMENT:** Loosen anchor pin nut one turn and tap anchor pin slightly in necessary direction with soft hammer, turning eccentric in the direction of forward wheel rotation to give clearance of .010" at adjusting screw end and at

anchor end of shoe against which eccentric operates. Tighten anchor pin nut as tight as possible with a 16" wrench. Tighten eccentric lock nut.

**BLEEDING:** Each wheel cylinder is provided with bleeder valve for bleeding lines after system has been opened for any reason, or if there is air in the lines. To bleed system remove small cap screw from tip of valve and attach adapter of bleeder hose. Open valve by unscrewing  $\frac{3}{4}$  turn. End of bleeder hose should hang in clean glass jar so as to be submerged in fluid. Depress brake pedal by hand, observing flow of fluid. Allow pedal to return slowly to "off" position so that air will not be drawn back into lines. When fluid entering jar is solid stream free of air bubbles, operation is complete.

**NOTE—**Whenever line is disconnected from any individual wheel, then that wheel only must be bled. If a main pipe line, or master cylinder is removed or opened, system must be bled at all four wheels. Never allow fluid in supply tank to become less than half full. Use clean alcohol, only, for cleaning rubber parts or inside of cylinders.



# TECHNICAL BULLETIN.

SERIES  
TWELVE

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## 1938 HUDSON TERRAPLANE

Hudson Models 83, 84, 85, 87, 112

Terraplane Models 80, 81, 82, 88

### SPECIFICATIONS

#### 1938 BODY MODELS

MODEL 112 Wheelbase, 112"  
MODELS 31, 82 Wheelbase, 117"  
MODELS 83, 84 Wheelbase, 122"  
Brougham, Touring Brougham, Touring Sedan, Sedan, Three  
Passenger Coupe, Convertible Coupe, Victoria Coupe, Convert-  
ible Brougham.

MODEL 85 Wheelbase, 122"  
Brougham, Touring Brougham, Touring Sedan, Sedan, Three  
Passenger Coupe, Victoria Coupe.

MODEL 87 Wheelbase, 129"  
Sedan, Touring Sedan.

MODEL 88 Wheelbase, 124"  
Sedan, Touring Sedan, Cab Chassis, Cab Pickup, Panel Delivery.

MODEL 80 Wheelbase, 117"  
Utility Coach, Utility Touring Coach, Utility Coupe, Cab Chassis,  
Cab Pickup, Panel Delivery, Station Wagon.

SERIAL NUMBER, ALL MODELS: Located on right front hinge  
pillar post.

MOTOR NUMBER, ALL MODELS: Numbered same as serial  
number; located on left side of motor.

#### 1938 MOTORS

MODEL 112: Six cyl. Bore, 3"; stroke,  $4\frac{1}{8}$ ". Piston displacement, 175 cu. in.  
Compression ratio, standard, 6.25:1; optional, 7:1. H.P., A.M.A. rating 21.6.

MODELS 80, 81, 82, 83, 88: Six cyl. Bore, 3"; stroke, 5". Piston displacement,  
212 cu. in. Compression ratio, standard 6.25:1; optional 7:1. H.P., A.M.A.  
rating 21.6.

MODELS 84, 85, 87: Bore, 3"; stroke,  $4\frac{1}{2}$ ". Piston displacement, 254 cu. in.  
Compression ratio, 6.25:1. H.P., A.M.A. rating 28.8.



# HUDSON-TERRAPLANE, '38 — MOTOR

## FIRING ORDER:

Six, 1-5-3-6-2-4

Eight, 1-6-2-5-8-3-7-4

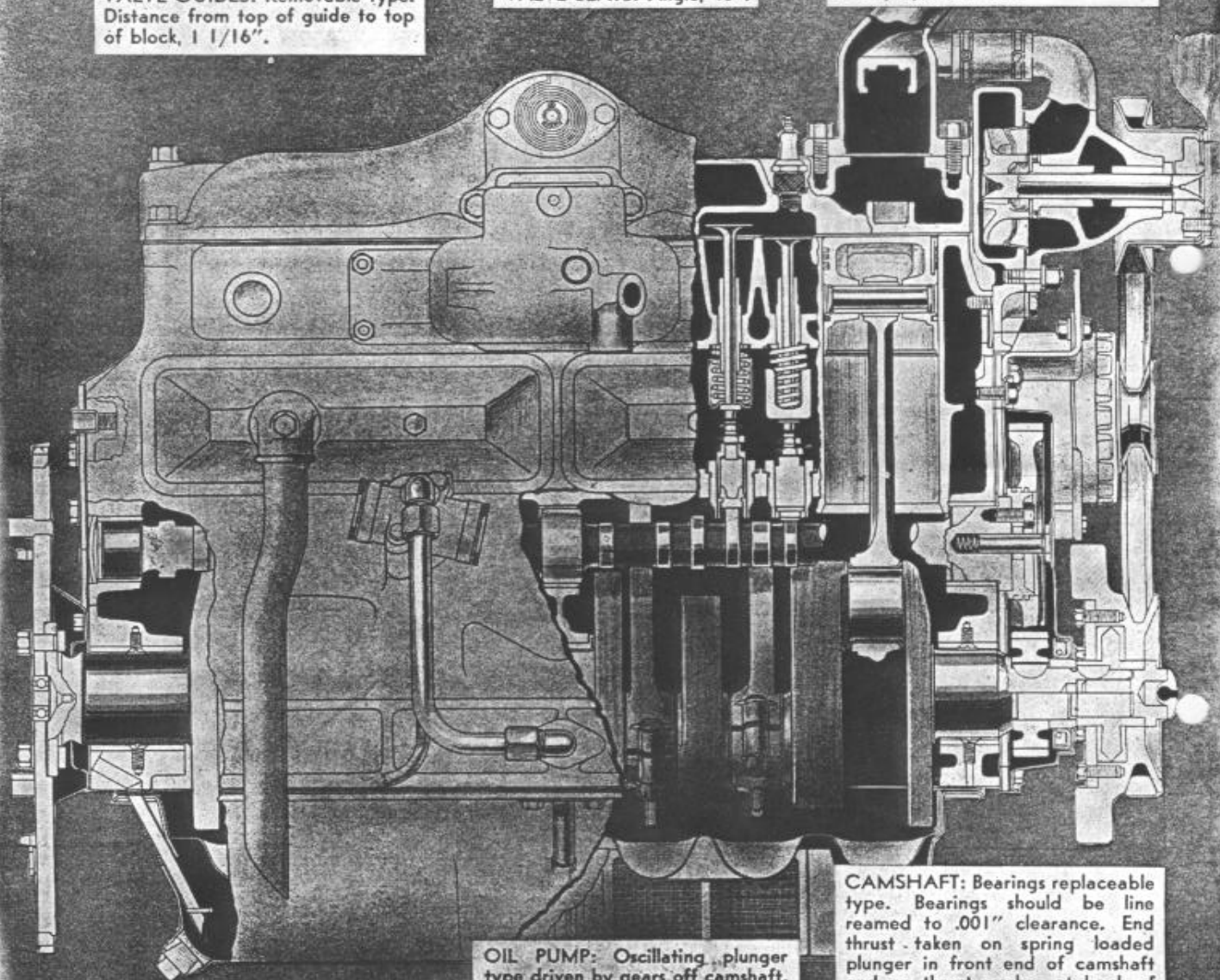
**VALVE CLEARANCE:** Running clearance with engine at normal operating temperature, intake, .006"; exhaust, .008".

**VALVE SPRINGS:** Pressure when compressed to 2" length, 44 lbs.; at 1 21/32" length, 102 lbs.

**COOLING SYSTEM:** Capacity—Hudson Eight, 5 gals.; Hudson Six and Terraplane, 3 1/4 gals; Hudson 112, 3 gals. Thermostat in cooling system restricts flow until temperature of 150° to 155° is reached and is fully open at 180°.

**VALVE GUIDES:** Removable type. Distance from top of guide to top of block, 1 1/16".

**VALVE SEATS:** Angle, 45°.



**LUBRICATION:** Capacity (Refill)—Hudson Eight, 7 qts.; Hudson Six and Terraplane, 5 qts.; Hudson 112, 4 1/2 qts. For temperature range of 50° F. to 110° F., S. A. E. 30; temperature range from 10° F. to 80°, No. 20W; temperature range from 10° F. to 40°, No. 10W.

**OIL PUMP:** Oscillating plunger type driven by gears off camshaft. Pump removed by disconnecting lines and removing two mounting screws. To disassemble, remove end hex caps and gaskets; remove dowel screw from mounting sleeve; withdraw shaft and plunger.

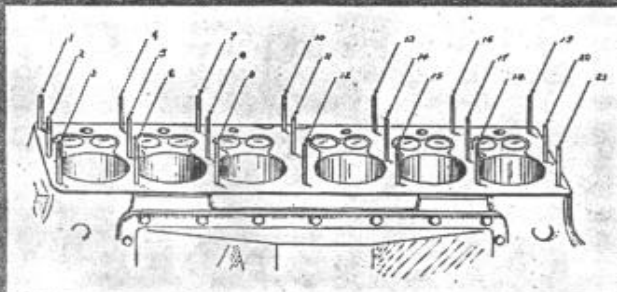
Lubrication system provided with check valve which provides pressure for operating signal light on dash. When there is no oil flowing in system, piston of valve causes dash light to burn and warn driver.

**CAMSHAFT:** Bearings replaceable type. Bearings should be line reamed to .001" clearance. End thrust taken on spring loaded plunger in front end of camshaft and on thrust washer at back of camshaft flange.

**MAIN BEARINGS:** Bronze backed babbitt. Crankshaft must be removed to replace main bearings. Clearance, .001". Shims provided for adjustment. Thrust taken on center bearing on 6 cylinder engine and on number 3 main bearing on 8 cylinder engine. Endplay, .006" to .012".



# MOTOR — HUDSON-TERRAPLANE, '38

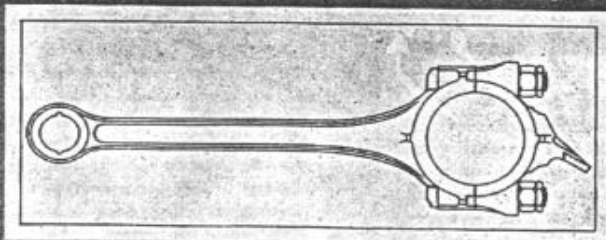


**CYLINDER HEAD STUDS:** Recommended sequence for tightening cylinder head stud nuts is 11-8-5-2-14-17-20, just pulled down snug. Then pulling down fairly tight, 11-10-12-8-7-9-14-13-15-5-4-6-17-16-18-2-1-3-20-19-21. Engine should be run and warmed up and nuts pulled down tight, following same procedure. For Hudson Eight, follow same general procedure for tightening head bolts.

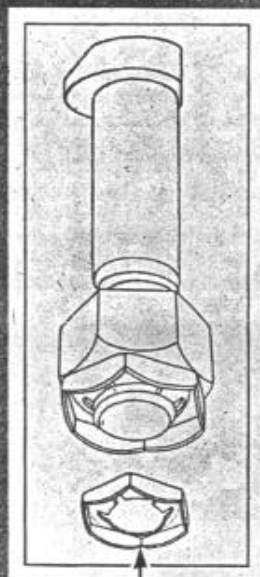
**CONNECTING ROD BEARINGS:** Spun type integral with rod and cap. There are no shims provided and it is recommended that rods be replaced when bearing adjustment is required. Bearing clearance, .001"; endplay, .006" to .010".

**CONNECTING RODS:** Offset at lower bearing end. On six-cylinder engine assemble rods Nos. 1, 2, and 4 with short side of offset toward front of engine; assemble rods Nos. 3, 5, and 6 with short side of offset toward rear. Eight-cylinder engines have short side of offset facing nearest main bearing. Connecting rod cap bolts employ "companion" or palnut instead of cotter pin to secure nut. It is recommended that palnut be turned snug with fingers and then be locked by turning with wrench from  $\frac{1}{4}$  to  $\frac{1}{3}$  turn more. New palnuts should always be used when assembling rods to shaft.

## CONNECTING ROD ASSEMBLY

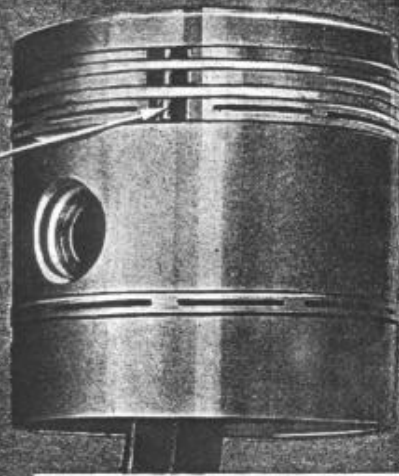


Ring Lock Pin



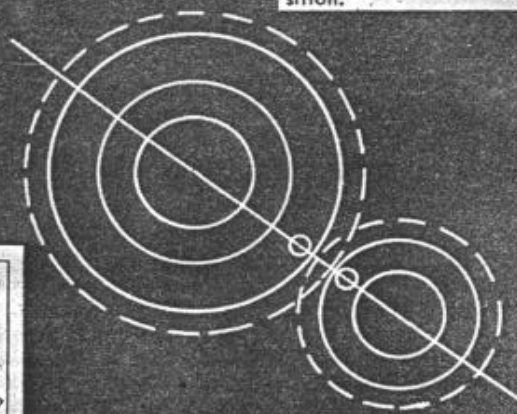
CONNECTING ROD BOLT  
"PALNUT"

**PISTONS:** Aluminum alloy cam ground. Piston assemblies removed from TOP. Piston clearance checked with .0015" feeler inserted in cylinder at thrust side of piston. Clearance is correct when from 3 to 4 lb. pull is required to withdraw feeler.



**PISTON RINGS:** Two compression rings and one oil ring above piston pin, and one oil ring on piston skirt. Important—Rings in grooves above piston pin are prevented from rotating by a locking pin. Rings are cut and notched so that clearance on pin is equal to ring gap, and so that when ring is compressed and ends together there is no clearance on the pin. Minimum ring gap is .005". Recommended ring gap, .009" to .011".

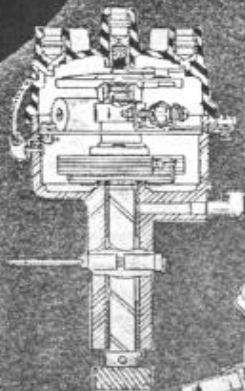
**PISTON PINS:** Full floating type. Fit pins to piston at hand push fit, piston heated to 200° F. Pins are fitted to connecting rod bushing at .0003" clearance, or so that rod just turns on pin under its own weight when held in horizontal position.



CAMSHAFT SETTING

# HUDSON-TERRAPLANE, '38 — TUNE-UP

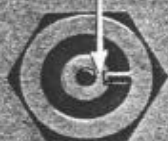
## IGNITION



**CONTACT POINT GAP:** Six, .020". Eight, .017".

**BREAKER ARM SPRING TENSION:** All, 18 to 20 oz.

**SPARK PLUG GAP:** All, .032".



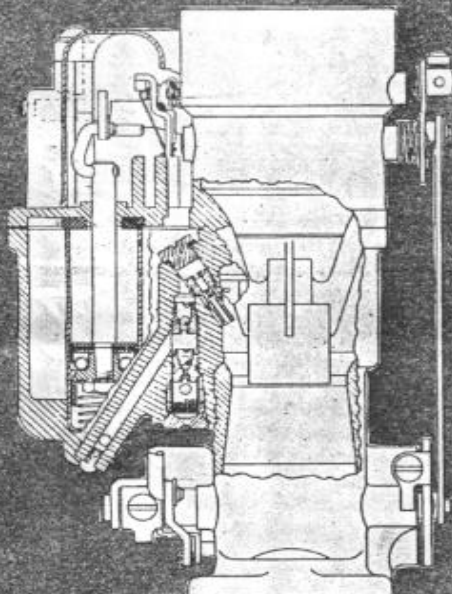
## FIRING ORDER

Six, 1-5-3-6-2-4

Eight, 1-6-2-5-8-3-7-4

**IGNITION TIMING:** To set ignition timing, crank engine to T. D. C. compression stroke of No. 1 piston. Timing mark "U. D. C." provided on flywheel and indicator at peephole in housing at left side of engine. Locate distributor so that points just break contact and rotor is in position for ignition at No. 1 spark plug. Model 112,  $\frac{1}{4}$  before "U. D. C."

## CARBURETOR



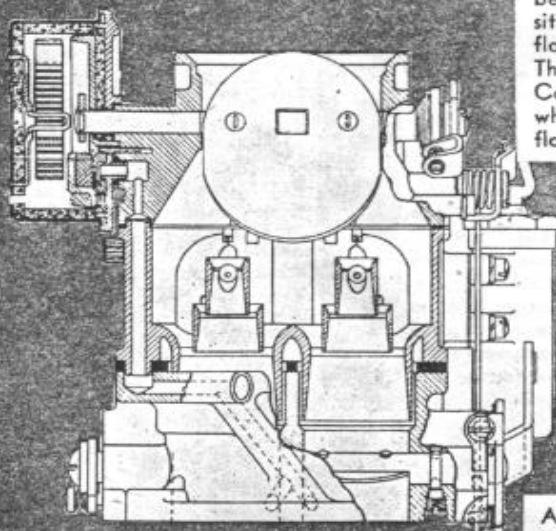
**ANTI-PERCOLATOR ADJUSTMENT, SINGLE THROAT CARBURETOR:** Set throttle valve so that distance between lower edge of valve and bore of carburetor throat, opposite port, is .030" on Model 112 and .025" on Terraplane Six. Adjust lip of anti-percolator by bending so that there is clearance of .005" to .015" between lip and pump arm with anti-percolator cap seated.

**IDLE MIXTURE ADJUSTMENT, DUAL CARBURETOR:** Warm engine thoroughly. Initial setting for idle mixture adjusting screws is  $\frac{1}{4}$  to  $\frac{3}{4}$  turn off seat. Adjust throttle stop screw to slow idle of approximately 7 M.P.H. Adjust idle mixture adjusting screws within above range to obtain smoothest engine operation.

**FLOAT LEVEL, DUAL CARBURETOR:** Remove float chamber cover. Hold in inverted position and measure distance from float to nearest point of cover. This distance should be  $\frac{15}{64}$ ". Cork gasket should be removed when checking float level. Bend float arm lip to adjust.

**IDLE ADJUSTMENT, SINGLE THROAT CARBURETOR:** Warm engine and set throttle stop adjusting screw so that engine runs at speed of approximately 7 M.P.H. Initial setting for idle mixture adjusting screw is  $\frac{3}{4}$  to  $1\frac{1}{2}$  turns off seat for Model 112; Hudson-Terraplane,  $\frac{1}{4}$  to 1 turn off seat. Adjust within these limits until engine runs smoothly.

**FLOAT LEVEL—SINGLE THROAT CARBURETOR:** With float chamber cover inverted, measure distance from end of float, away from needle and seat, to cover gasket flange. Level is correct when this distance is  $\frac{3}{8}$ ". To adjust bend lip on float arm. Cork gasket should be removed when checking float level.



**METERING ROD ADJUSTMENT:** Special gauge required.

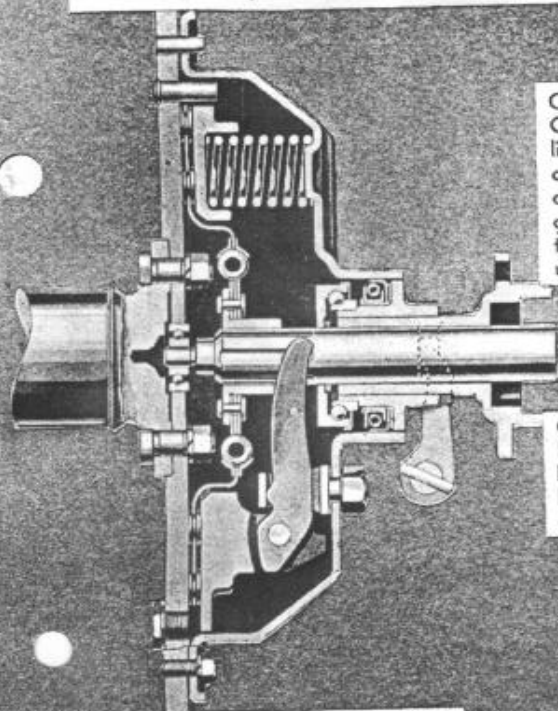
**METERING RODS, ALL MODELS:** Metering rods in "standard," and one and two stages "lean" available for economy or altitude requirements. Special gauges and procedure necessary for adjusting metering rods.

**ANTI-PERCOLATOR ADJUSTMENT, DUAL CARBURETOR:** Necessary to back out throttle stop screw so that throttle valves are closed tight. There are two anti-percolator units on the carburetor and care must be exercised to assure even adjustment of both. Insert a .015" feeler gauge between anti-percolator stem and anti-percolator arm. Adjust lips on anti-percolator arm so that stem is depressed to point where indicator line is flush with top of anti-percolator plug.



# Clutch, Transmission—HUDSON-TERRAPLANE, '38

## CLUTCH



**CLUTCH PEDAL ADJUSTMENT:** Obtained by adjusting length of link which connects clutch pedal to cross shaft lever. Loosen lock nuts of clevis and adjust link length to give  $1\frac{1}{2}$ " clearance between center of clutch pedal clamp bolt and underside of toe board.

**CLUTCH RELEASE BEARING:** Lubricate every 1,000 miles. Fitting located on right side of clutch bell housing. Lubricate with 1 oz. of viscous chassis lubricant.

**CLUTCH LUBRICATION:** Clutch is wet type. It is important that only lubricant compounded especially for this purpose be used. As the amount of lubricant affects operation, it is important that the correct amount,  $\frac{1}{3}$  pint, be put in clutch.

To service clutch, crank engine until the plug in the front face of the flywheel appears at timing indicator hole. Remove plug and crank engine approximately  $\frac{1}{3}$  revolution, which brings plug hole at bottom and allows clutch to drain. Crank engine until plug hole in flywheel is in upper position and refill with  $\frac{1}{3}$  pint of clutch lubricant. Replace plug. In cases of clutch trouble resulting from use of incorrect lubricant, clutch should be flushed with kerosene before refilling.

Clutch lubrication service recommended every 5,000 miles.

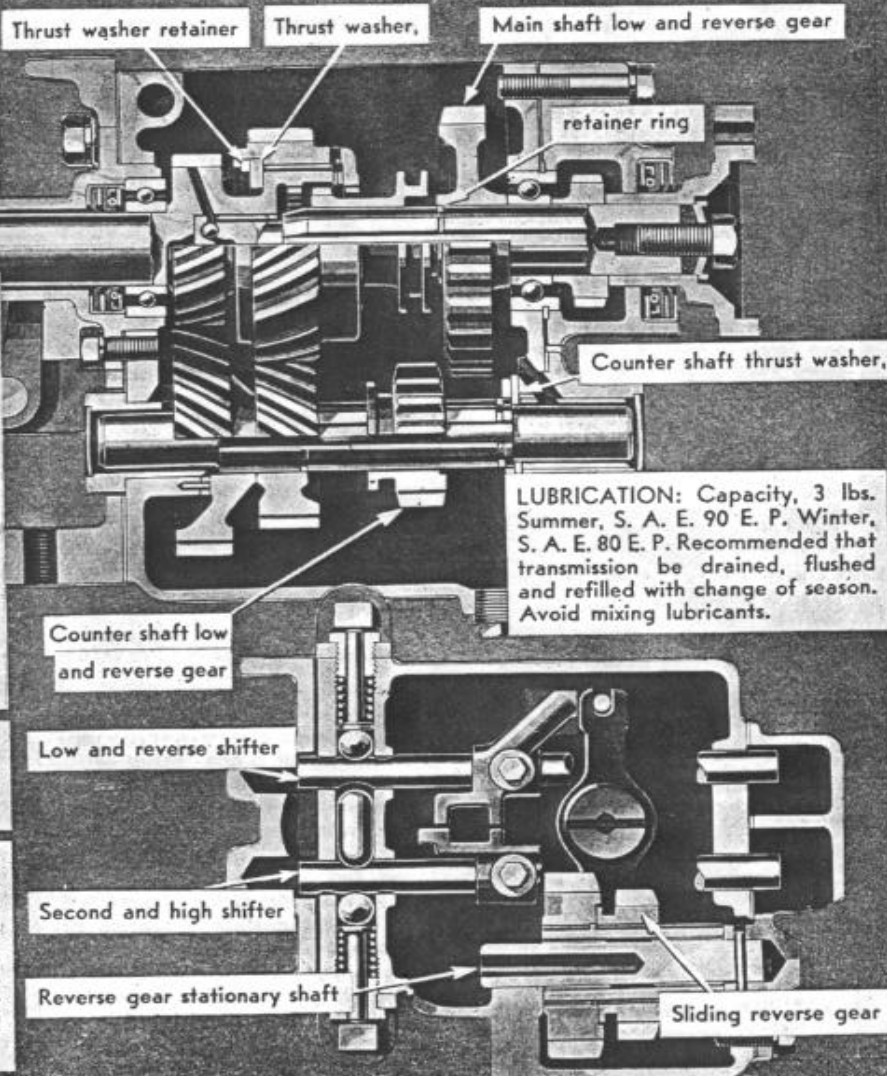
## TRANSMISSION

**MAIN SHAFT ENDPLAY:** Main shaft endplay is adjusted by shim or gasket thickness between main drive gear bearing retainer and front of transmission case. Recommended endplay is from .008" to .012". Check by dial indicator at front end of main drive gear shaft.

**MAIN SHAFT REMOVAL:** Remove bell housing from front of transmission case. Remove universal joint companion flange. Remove speedometer gear housing from rear of transmission case. Remove speedometer drive gear. Clear shifting rail mechanism from top of case. Remove main drive gear retainer at front of case. Drive main shaft low and reverse gear toward rear on main shaft far enough to permit removing retainer ring. Pull main shaft and rear bearing out of case. Remove low and reverse gear and second and high shifter sleeve from case. Lift main drive gear assembly out through top of case.

**MAIN SHAFT DRIVE AND INTERMEDIATE GEARS:** Remove needle rollers and thrust balls from pocket of main drive gear assembly.

To remove second speed gear it is necessary to clear front thrust washer. This is accomplished by collapsing one end of thrust washer retainer ring through opening in side of gear, and angling out of recess. With retainer removed, split thrust washer may be cleared and assembly pulled apart.



# HUDSON-TERRAPLANE, '38 — STEERING, AXLES

## STEERING GEAR ADJUSTMENT

**STEERING GEAR ALIGNMENT:** Loosen the mounting bolts that hold steering gear body to frame just enough to allow steering gear to shift in frame. Loosen steering gear bracket on instrument panel. With these two points loosened, steering gear and shaft assembly will shift to aligned position. Tighten panel bracket and gear mounting bolts.

**WORM SHAFT ADJUSTMENT:** Adjustment of worm shaft taper roller bearings is obtained by means of shims located between bottom of steering gear housing and worm cover. Loosen cover nuts and carefully remove one shim at a time until correct adjustment is obtained. Cover bolts should be tightened when checking adjustment. Adjustment is correct when endplay has been eliminated and there is no stiffness noted when steering wheel is turned. Stiffness noted when turning steering wheel indicates excessive shim thickness removal, or mis-alignment of steering gear.

## FRONT AXLE SPECIFICATIONS

|                          |           |
|--------------------------|-----------|
| Caster Angle .....       | 2°        |
| Camber .....             | 1°        |
| Toe-In .....             | 0 to 1/8" |
| King Pin Inclination.... | 7°        |

**CROSS SHAFT AND ROLLER TOOTH ADJUSTMENT:** Adjusting screw located at right side of steering gear housing. Remove adjusting screw lock nut and clear lock plate from engagement with boss on housing cover. Set front wheels at straight ahead position by turning steering wheel to mid point of steering gear. Tighten roller shaft adjusting screw until there is noticeable bind and then back out just enough to relieve bind. Replace lock plate, install and tighten lock nut.

**STEERING GEAR LUBRICATION:** Change lubricant each season. Re-fill with S. A. E. 90 E. P.

**STEERING GEAR MID POSITION:** Turn steering wheel so that front wheels are straight ahead. Remove horn button and locate groove on end of main column tube which is in line with flat spot on side of serrated end. When steering gear is in mid position flat spot should be pointing straight down. With flat spot pointing straight down, check position of front wheels. They should be pointing straight ahead. If wheels point slightly to right or left, adjustment of drag link will be necessary.

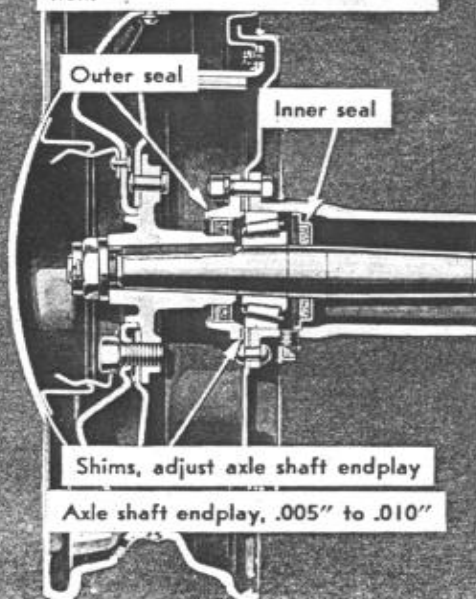
**DRAG LINK ADJUSTMENT:** Shim packs are provided in drag link end at front and rear of ball joint of pitman arm to provide adjustment for length so that steering gear may be set at mid position or high point when front wheels are straight ahead. If wheels incline to right remove shims from rear pack and add them to those at front. If wheels incline to left, remove shims from front pack and add to rear pack.

## REAR AXLE

**AXLE SHAFT THRUST BUTTON:** If replacement is necessary, thrust button may be removed by grinding flush with end of shaft. A 1 1/32" hole may be drilled through center of button and then the hole tapped with 3/8-16 tap. Install 2" cap screw in hole. By holding cap screw head in vise and tapping on end of shaft, thrust button may be removed. After thoroughly cleaning hole in end of shaft, new thrust button may be drifted into position.

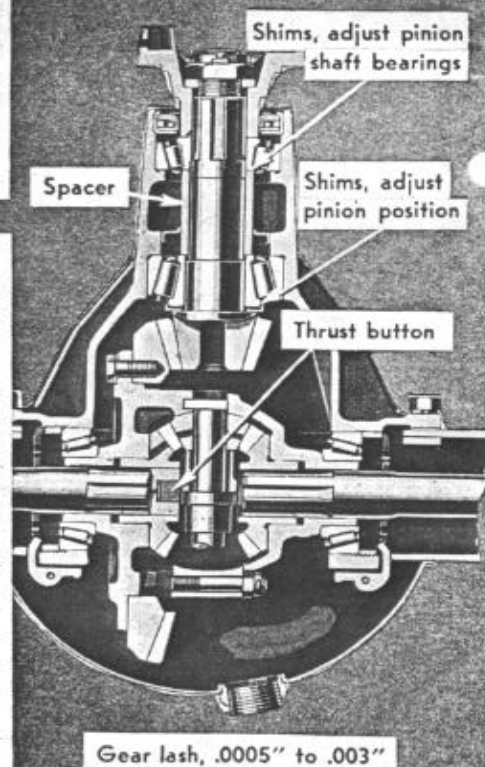
**AXLE SHAFT BEARING ADJUSTMENT:** Remove both rear wheels. (Use wheel puller. Do not drive on end of shaft.) Remove nuts from bolts holding bearing adjusting cap to brake plate and housing flange. Push bolts in so that ends will clear adjusting plate. Remove thin shim at each side as required to obtain correct axle shaft endplay. Shim thickness should be equal at each end of housing. Recommended axle shaft endplay, .005" to .010".

**LUBRICATION:** Capacity — All models, 2 3/4 lbs. Summer and Winter, S. A. E. 90 E. P.



**TO ASSEMBLE PINION SHAFT AND BEARINGS:** Install front and rear pinion shaft bearing cups in housing. Locate front pinion shaft bearing cone assembly in cup and then install oil seal.

Assemble pinion position shim pack on pinion shaft and then install rear bearing cone assembly. (Shim pack must be of same thickness as when disassembled.) Install bearing spacer, and then bearing adjustment shims. Insert assembly in housing, passing end through front bearing and oil seal. Install universal companion flange on pinion shaft, pulling nut up tight. If bearing adjustment shim pack is of correct thickness, it should be possible to just turn pinion shaft by hand. Add or remove shims as required to obtain correct bearing adjustment.





# HUDSON-TERRAPLANE, '38 — STEERING, AXLES

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## FRONT AXLE SPECIFICATIONS

|                          |           |
|--------------------------|-----------|
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| Camber .....             | 1°        |
| Toe-In .....             | 0 to 1/8" |
| King Pin Inclination.... | 7°        |

**CROSS SHAFT AND ROLLER TOOTH ADJUSTMENT:** Adjusting screw located at right side of steering gear housing. Remove adjusting screw lock nut and clear lock plate from engagement with boss on housing cover. Set front wheels at straight ahead position by turning steering wheel to mid point of steering gear. Tighten roller shaft adjusting screw until there is noticeable bind and then back out just enough to relieve bind. Replace lock plate, install and tighten lock nut.

**STEERING GEAR LUBRICATION:** Change lubricant each season. Refill with S. A. E. 90 E. P.

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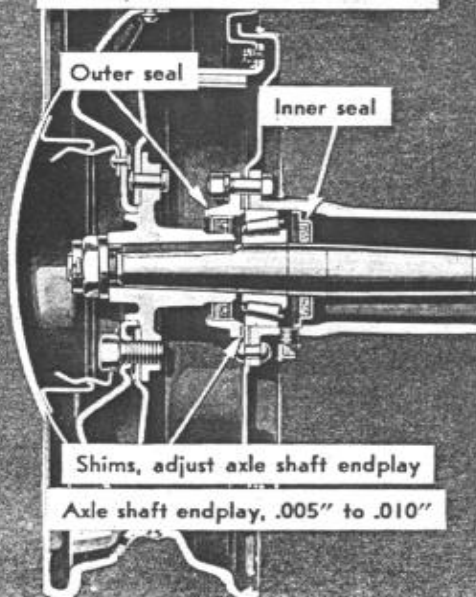
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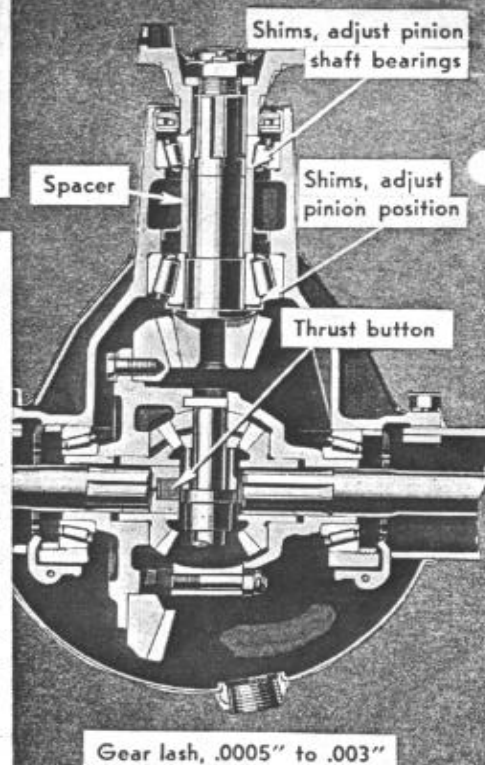
**AXLE SHAFT BEARING ADJUSTMENT:** Remove both rear wheels. (Use wheel puller. Do not drive on end of shaft.) Remove nuts from bolts holding bearing adjusting cap to brake plate and housing flange. Push bolts in so that ends will clear adjusting plate. Remove thin shim at each side as required to obtain correct axle shaft endplay. Shim thickness should be equal at each end of housing. Recommended axle shaft endplay, .005" to .010".

**LUBRICATION:** Capacity — All models, 2 3/4 lbs. Summer and Winter, S. A. E. 90 E. P.



**TO ASSEMBLE PINION SHAFT AND BEARINGS:** Install front and rear pinion shaft bearing cups in housing. Locate front pinion shaft bearing cone assembly in cup and then install oil seal.

Assemble pinion position shim pack on pinion shaft and then install rear bearing cone assembly. (Shim pack must be of same thickness as when disassembled.) Install bearing spacer, and then bearing adjustment shims. Insert assembly in housing, passing end through front bearing and oil seal. Install universal companion flange on pinion shaft, pulling nut up tight. If bearing adjustment shim pack is of correct thickness, it should be possible to just turn pinion shaft by hand. Add or remove shims as required to obtain correct bearing adjustment.



# HUDSON TERRAPLANE '38

**Fan Belt Adjustment:** Loosen generator bracket bolt nut and adjusting arm nut. Swing generator away from engine until slack in fan belt is 1" below the center of a straight edge laid across the water pump and generator pulleys. For Model "112" this distance should be  $\frac{3}{4}$ ".

**Testing Clutch Pressure Plate for Warp-  
age:** Lay clutch pressure plate on a surface plate or new pressure plate. If a .010" feeler gauge can be inserted at any point too much warpage exists and the pressure plate should be replaced.

**Universal Joints:** Both front and rear universal joints are the needle bearing type. The lubricant is sealed in at the time of assembly. The units should be disassembled, cleaned, and repacked at 10,000 mi. intervals. A plug is fitted into the front universal joint at the spline in place of a lubrication fitting to maintain balance. To lubricate the front universal spline the plug must be removed and a lubrication fitting installed. Replace the plug upon completion of this service. Lubricate at 1,000 mi. intervals with a viscous chassis grease.

**Cylinder Size Code:** Identification is by capitalized letters located on the lower face of the valve chamber. "Standard" size is designated by the letter "A", and is equivalent to 3.000". Size increases are in steps of .0005", and symbolized by letters "A", "B", "C", etc., up to and including the letter "E", which represents 3.002". Beginning again with 3.010", size increases are in .0005" sequences represented by the letters "A0", "B0", "C0", etc., up to and including letters "E0", with "E0" representing 3.012".

**Piston Weights:** Piston weights are stamped on all original pistons in ounces and quarter ounces. To preclude rough engine operation, new pistons should be of the same weight as those to be replaced.

**Engine Mountings:** Two rubber cushions are used at the ends of the front engine support plate, and a single rubber cushion under the front of the transmission case to support the engine. Mounting bolt nuts should be drawn tight so both upper and lower plates are drawn against the bolt spacers. Two rubber bumpers are held against the sides of the transmission case to steady the rear of the engine. If the pressures of the bumpers are insufficient excessive movement of the gear shift lever is evident, especially on rough roads.

**Fuse Block:** A two-circuit fuse block is mounted on the under edge of the instrument panel flange. Twenty amp. fuses are used. One fuse carries the light switch load, while the other fuse carries all other circuits.

**Headlamp Lens and Door Assembly Removal;**  
**Hudson Models:** Remove the screw at the base of the door assembly and swing upward to unhook from lip at top of lamp body. Care should be exercised to line up the door with the lamp body before pressing into place upon assembly. The

lens gasket should be in good condition and in place.

**Headlamp Lens Removal; Model 120:** Loosen screw at bottom of lamp body. Push bottom of lens backward and downward until top of lens is clear of the top of the lamp body and lift out.

**Door Alignment:** Doors should be aligned to close easily and completely at both top and bottom. If, when shut, the door closes at top and not at the bottom the misalignment may be corrected by "springing".

With knee placed along the lower edge of the door, pull out top corner with hands until the correct fit is obtained. When door closes at bottom and not at top, block lower portion of door on the inside, and press top in toward closed position until fit is obtained. Because doors are all steel welded into a single unit, they may be sprung without danger of opening joints. CAUTION: Do not attempt to make the correction with one bend.

**Hinge Alignment:** If a wide gap exists at the latch pillar, the door is set too close to the hinge pillar post. To correct, place hammer between door and hinge pillar post, in line with upper hinge. Press door toward the closed position gently. Repeat procedure until the correct alignment is obtained. Repeat operation at lower hinge.

If latch edge of door is high, spread upper hinge; if latch edge of door is low spread lower hinge.

When door sets too close to latch pillar post the door must be removed. Remove the hinge pin. Remove the door. Bend body half of upper and lower door hinge by use of fibre block and hammer. Body half of hinge should be bent away from latch pillar post until proper alignment is secured.

**Door Dovetail Adjustment:** Adjustment is correct when the door is raised  $\frac{1}{16}$ " when the door dovetail enters female member. To adjust, loosen two screws and move male member until correct door elevation is obtained upon closing. Retighten screws.

**Striker Plate Adjustment:** Striker plate should be set to hold door against bumpers firmly. Slamming door for latch engagement should not be necessary. To adjust loosen two screws in striker plate and shift plate as necessary. Tighten screws securely.

CAUTION: Do not remove screws from striker plate. This would allow tapping plate to fall out of position.

**Oil Level Gauge:** Bayonet type attached to the oil filler cap. When gauge is in place, the bottom is on a level with the bottom of the oil suction line. Two graduations on face of gauge cover LOW range, and OIL LEVEL RANGE. The top mark is the normal oil level when crankcase is filled to specification capacity. The mark at bottom of "oil level range" indicates two quarts below crankcase capacity.



# TECHNICAL BULLETIN.

SERIES SEVEN  
1939

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## 1939 HUDSON

Models 90, 91, 92, 93, 95, 97, 98,



### 1939 Body Models

|   |                |
|---|----------------|
| Model 90  | Wheelbase 112" |
| Model 91  | Wheelbase 118" |
| Model 92  | Wheelbase 118" |
| Model 93  | Wheelbase 122" |
| Model 95  | Wheelbase 122" |
| Touring Sedan, Touring Brougham, Convertible Brougham,<br>Convertible Coupe, Victoria Coupe, Three Passenger Coupe. |                |
| Model 97  | Wheelbase 129" |
| Touring Sedan   |                |
| Model 90 (Business)   | Wheelbase 112" |
| Utility Coupe, Utility Coach, Cab, Cab Pickup, Panel Delivery,<br>Station Wagon.                                    |                |
| Model 98 (Business)   | Wheelbase 119" |
| Cab, Cab Pickup, Panel Delivery and Touring Sedan.  |                |

### 1939 Motors

MODEL 90: Six cyl. Bore, 3"; stroke,  $4\frac{1}{8}$ ". Piston displacement, 175 cu. in. Compression ratio, 6.50:1. H.P., A.M.A. rating, 21.6; brake, 86 at 4000.

MODELS 91, 92, 93, 98: Six cyl. Bore, 3"; stroke, 5". Piston displacement, 212 cu. in. Compression ratio, 6.25:1. H.P., A.M.A. rating, 21.6. Brake H.P.: Models 91, 92, 98—Single Carburetor, 96 at 3900 R.P.M.; Models 92, 93—Dual Carburetor, 101 at 4000 R.P.M.

MODELS 95, 97: Eight cyl. Bore, 3"; stroke,  $4\frac{1}{2}$ ". Compression ratio, 6.25:1. H.P., A.M.A. rating, 28.8; brake, 122 at 4200 R.P.M.



# HUDSON, '39—Motor

## FIRING ORDER

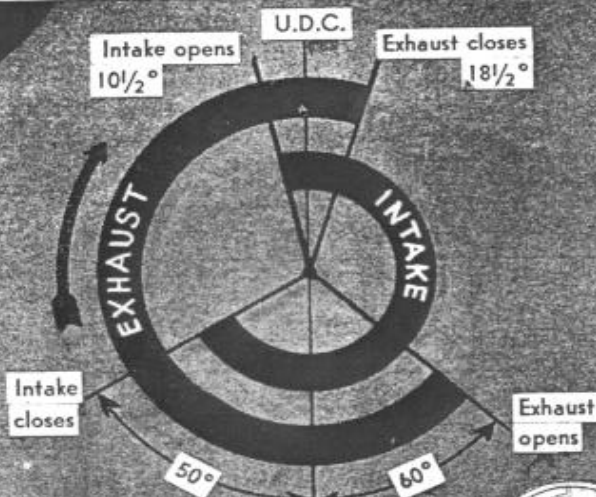
Six, 1-5-3-6-2-4.

Eight, 1-6-2-5-8-3-7-4.

**VALVE SPRINGS, ALL SERIES:**  
Pressure when compressed to 2" length, 40 lbs.; at 1 21/32", 80 lbs.

**VALVE GUIDES, ALL SERIES:**  
Removable type. Distance from top of guide to top of block on Six, 1 1/16"; Eight, 15/16". Stem clearance, intake, .0025", exhaust, .004".

**COOLING SYSTEM:** Capacity—Six, 12 1/2 qts. Eight, 17 1/2 qts. Thermostat designed to start opening at from 150° to 155° F., and fully open at 185° F.



**VALVE SEATS, ALL SERIES:** Angle, 45°.

**VALVE CLEARANCE, ALL SERIES:** Running clearance, intake, .006"; exhaust, .008" (HOT).

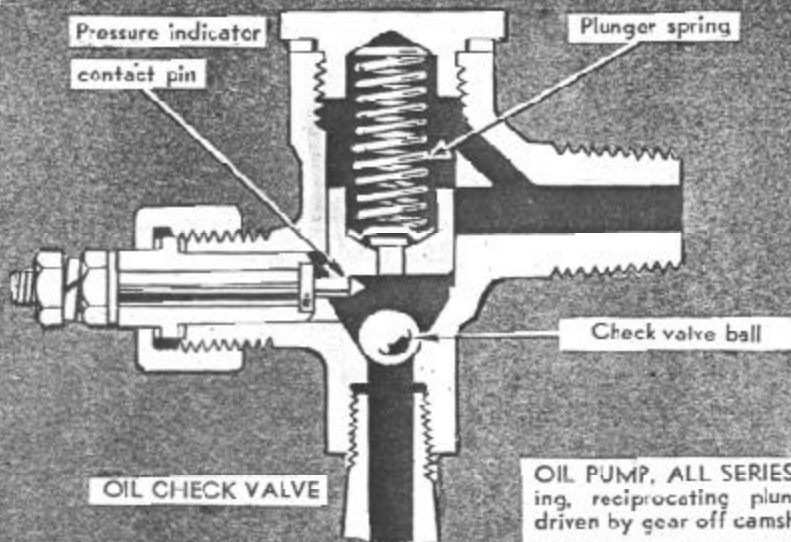
**LUBRICATION:** Capacity (Refill)—Six, 4 1/2 qts.; Eight, 7 qts. Temperature range of 70° to 110° F., S.A.E. 30. As low as 30° F., S.A.E. 20. As low as 10° F., No. 20W. As low as minus 10° F., No. 10W.

**MAIN BEARINGS, ALL SERIES:** Bronze back, special bearing metal lined. Interchangeable in pairs, upper and lower. Crankshaft must be removed to replace main bearings. Shims provided for adjustment. Clearance, .001". Six, thrust taken on center bearing. Eight, thrust taken on No. 3 bearings. End-play, .006" to .012".

**CAMSHAFT SETTING**



## Motor—HUDSON, '39

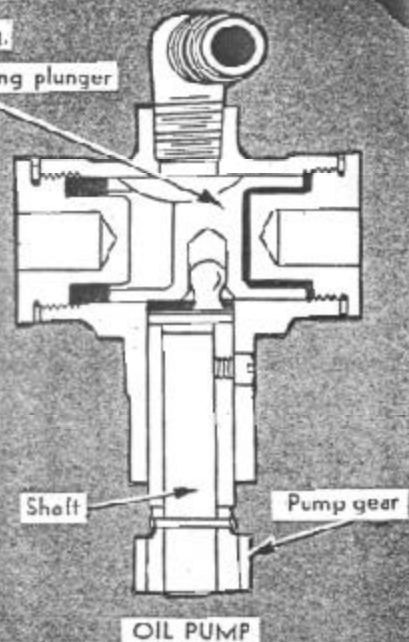


OIL CHECK VALVE

**CAMSHAFT BEARINGS, ALL SERIES:** Replaceable type. Bearings should be line reamed to .0025" clearance. End thrust taken on spring loaded plunger in front end of camshaft and on thrust washer at back of camshaft gear flange.

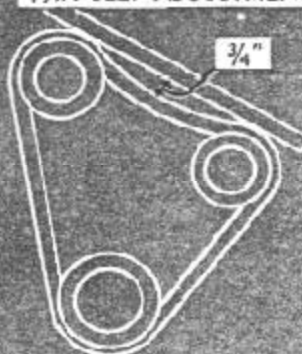
**OIL PUMP, ALL SERIES:** Oscillating, reciprocating plunger type, driven by gear off camshaft.

Oil system provided with spring loaded plunger check valve switch, which operates signal light on dash to warn driver. When engine is started, light will burn until sufficient pressure is developed to raise plunger breaking switch contact.

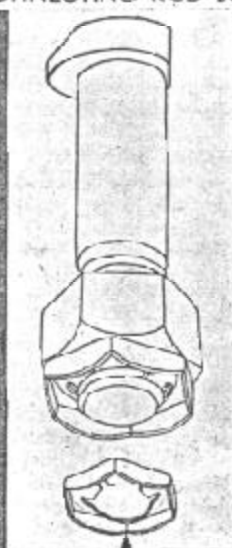


OIL PUMP

### FAN BELT ADJUSTMENT



### CONNECTING ROD BOLT



"Palnut"

**CONNECTING RODS:** Offset at lower bearing end. On six cylinder engines assemble rods Nos. 1, 2, and 4 with short side of offset toward front of engine. Nos. 3, 5 and 6, short side of offset toward rear of engine. Eight cylinder engines, Nos. 1, 3, 5 and 7 short side of offset toward front of engine. Nos. 2, 4, 6 and 8 short side of offset toward rear of engine.

**NOTE:** Connecting rod cap bolts employ companion or "palnut" instead of cotter pin to secure nut. To install, tighten regular nut to desired tension. Spin "palnut" (smooth face to nut) onto bolt with fingers until snug against nut. Then tighten with wrench from 1/4 to 1/2 turn more. When assembling rod to shaft always use new "palnut."

**PISTON PIN, ALL SERIES:** Full floating-type. Fit pin to piston at hand push fit, piston heated to 200° F. Clearance in connecting rod bushing .0003", or so that rod just turns on pin under its own weight when held in horizontal position.

**RINGS, ALL SERIES:** Two 3/32" compression, one 3/16" oil control ring located above piston pin, and one 5/32" oil control ring located on piston skirt. All rings are pin locked at gap end. When fitting ring, pin lock notch clearance should equal ring gap clearance. Recommended gap clearance, compression and oil control .009" to .011".

**PISTONS, ALL SERIES:** Aluminum alloy, cam ground. Remove from top of block.

**PISTON CLEARANCE, ALL SERIES:** Check with .0015" feeler gauge inserted at thrust side of piston. Clearance correct when 3 to 4 lbs. pull is required to withdraw feeler. Micrometer, at bottom of skirt .0005" to .001". Top of head .014". Install pistons with slot in skirt at left side of engine.



Piston ring lock pin

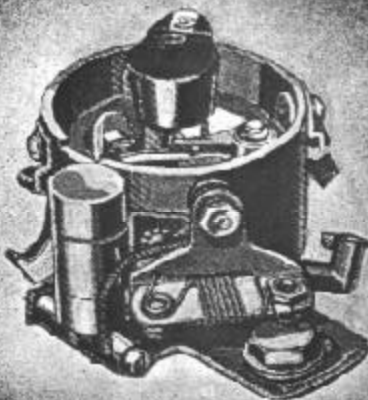
**CONNECTING ROD LENGTH:** Series 90 and 98, 8 3/8" center to center. All other series, 8 3/16" center to center.

# HUDSON, '39—Tune-up

## FIRING ORDER

Six, 1-5-3-6-2-4.

Eight, 1-6-2-5-8-3-7-4.



**CARBURETOR:** Carter Model 437S and 438S (Single Throat).

**FLOAT LEVEL (CARTER 437S, 438S):** With float bowl cover inverted, gasket removed, measure distance from free end of float to machined surface of bowl cover. Correct distance  $\frac{3}{8}$ ". Adjust by bending lip on float arm.

**IDLE MIXTURE ADJUSTMENT (CARTER 437S, 438S):** Initial setting for idle mixture adjusting screw  $\frac{1}{2}$  to  $\frac{1}{4}$  turns open. With engine warm, set throttle stop screw so engine idles approximately 7 M.P.H. To richen mixture turn screw "out". Adjust so engine fires evenly without loping, or stalling.

**ACCELERATING PUMP ADJUSTMENT (CARTER 437S, 438S):** Back out throttle lever stop screw until throttle valve seats in carburetor bore. Install connector link in lower hole (medium stroke). In this position, pump plunger should travel  $\frac{7}{32}$ " from closed to wide open throttle. Adjust by bending throttle connecting rod at lower angle. Three holes provided for high, or low temperature operation. Long stroke for cold, and short for hot temperatures.

**ANTI-PERCOLATOR ADJUSTMENT (CARTER 437S, 438S):** Crack throttle valve .030" between lower edge of throttle valve and bore of carburetor (opposite port). (Use .030" drill.) Clearance between anti-percolator lip and pump arm should measure .005" to .015", with anti-percolator cap seated.

**CONTACT POINT:** Six, .020"; Eight, .017".

**BREAKER ARM SPRING TENSION:** Six and Eight, 18 to 20 oz.

**SPARK PLUG GAP:** Six and Eight, .032".

**IGNITION SETTING:** All Series except 90 and 98—Turn engine until No. 1 piston is approaching U.D.C. of compression stroke. Stop when U.D.C. 1-6, or U.D.C. 1-8, mark on face of flywheel is in register with pointer at inspection hole in housing on left side of engine. Locate distributor so that points just break contact and rotor is in position for ignition at No. 1 spark plug.

Series 90 and 98—Follow same procedure as outlined except points should break  $\frac{1}{4}$ " before U.D.C.

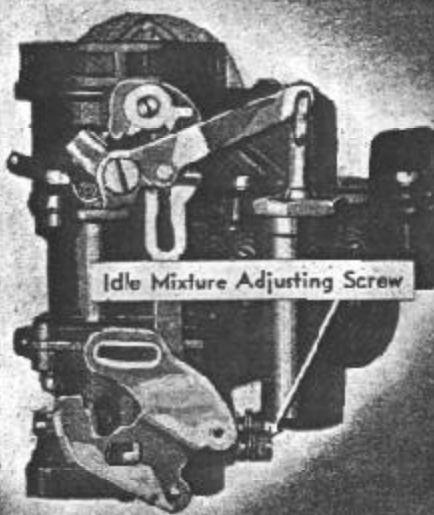


A timing light or synchroscope is recommended for accurate ignition timing. To check, chalk mark specified mark on face of flywheel and connect synchroscope to No. 1 spark plug. Idle engine speed to equivalent of 6 to 7 M.P.H. Flash should occur when flywheel mark and pointer are in register. Mark should move up when engine speed is increased and return to pointer when engine idles.

Best performance is obtained when ignition timing is set so a light "ping" is heard on full throttle acceleration at 10 to 15 M.P.H.

## CARBURETOR

**METERING ROD ADJUSTMENT (CARTER 437S, 438S):** Back out throttle lever stop screw so throttle valve seats. Insert metering rod gauge in place of metering rod, seating tapered end in metering rod jet. Push down piston link until metering rod pin rests on notched shoulder of metering rod gauge. In this position there should be less than .005" clearance between lip on piston link and pump arm. Adjust by bending lip on piston link.



**CARBURETOR:** Carter, Model 430S. (Dual Throat).

**FLOAT LEVEL (CARTER 430S):** With float bowl inverted, gasket removed, measure distance from float to surface of bowl cover. Correct distance  $\frac{3}{32}$ ". Check both ends of float. Adjust by bending lip on float arm.

**ACCELERATING PUMP ADJUSTMENT (CARTER 430S):** Back out throttle lever stop screw until throttle valve seats in carburetor bore. Install connector link in long stroke position. Pump plunger travel should measure  $\frac{9}{32}$ " from closed to wide open throttle. Adjust by bending throttle connector link at lower angle.

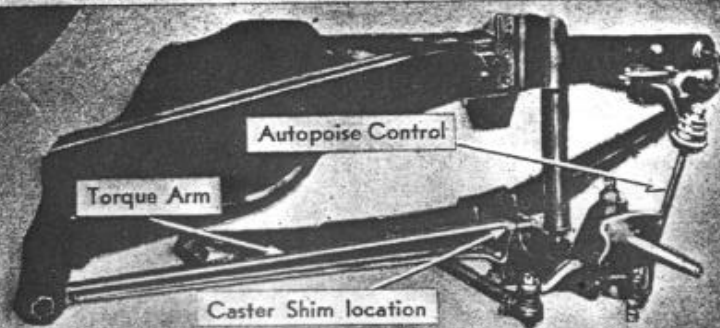
**IDLE MIXTURE ADJUSTMENT (CARTER 430S):** Initial setting for idle mixture adjusting screws  $\frac{1}{4}$  to 1 turn open. With engine warm, set throttle stop screw so engine idles approximately 7 M.P.H. To richen mixture turn adjusting screws "out". Adjust one idle mixture adjusting screw at a time until engine fires evenly without loping, or stalling.

**ANTI-PERCOLATOR ADJUSTMENT (CARTER 430S):** Back out throttle lever stop screw, seating throttle valve in carburetor bore. With throttle valve seated, carefully bend anti-percolator valve lips so that center of indicator lines are just flush with top of anti-percolator plugs. Adjustment should be made after adjusting pump and metering rod.

**METERING ROD ADJUSTMENT (CARTER 430S):** Back out throttle lever stop screw, seating throttle valve in carburetor bore. Insert metering rod pin in vacuum piston shaft. Replace one metering rod with metering rod gauge, seating tapered end in metering rod jet. Depress vacuum piston shaft lightly until contact is made with tongue on anti-percolator arm. Clearance between metering rod pin and notched shoulder of gauge should be less than .005". Adjust by bending tongue on anti-percolator arm.



# HUDSON, '39—Steering, Axles



## SPECIFICATION, ALL SERIES

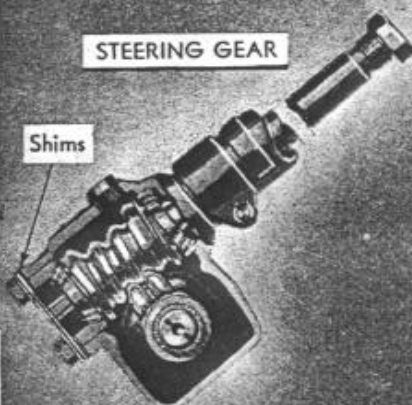
|                |          |
|----------------|----------|
| Caster Angle   | 1° to 2° |
| Camber         | 1 to 1½  |
| Toe-In         | 0 to ⅛"  |
| King-pin Incl. | 7°       |

**CASTER ADJUSTMENT, SERIES 91, 92, 93, 95, 97:** Caster Angle may be changed by installing flat spacer shims (.020" thick and equal ½") between machined surfaces of axle center and torque arm. To increase caster, remove both lower torque arm to axle center bolts and loosen upper bolts. Install spacer shims on lower side. To decrease caster, install spacer shims on upper side.

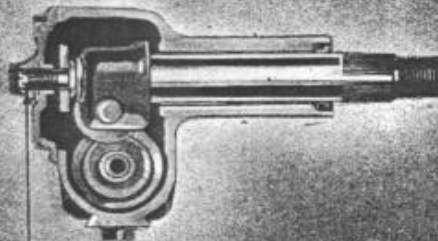
**NOTE—**Changing caster angle will change relationship of front wheels to steering gear high point, or mid-position. See Drag Link Adjustment.

**CASTER ANGLE SERIES 90, 98:** Conventional Axle. Caster may be increased by installing wedge type caster shims between front spring and axle spring perches with thick edge of shim to rear.

**WORM SHAFT BEARING ADJUSTMENT, ALL SERIES:** Adjustment of worm shaft tapered bearings obtained by means of shims located between bottom of steering gear housing and worm housing cover. To adjust, loosen four housing cover retaining cap screws and remove one shim at a time until end play has been eliminated. Steering gear must turn without stiffness, or bind.

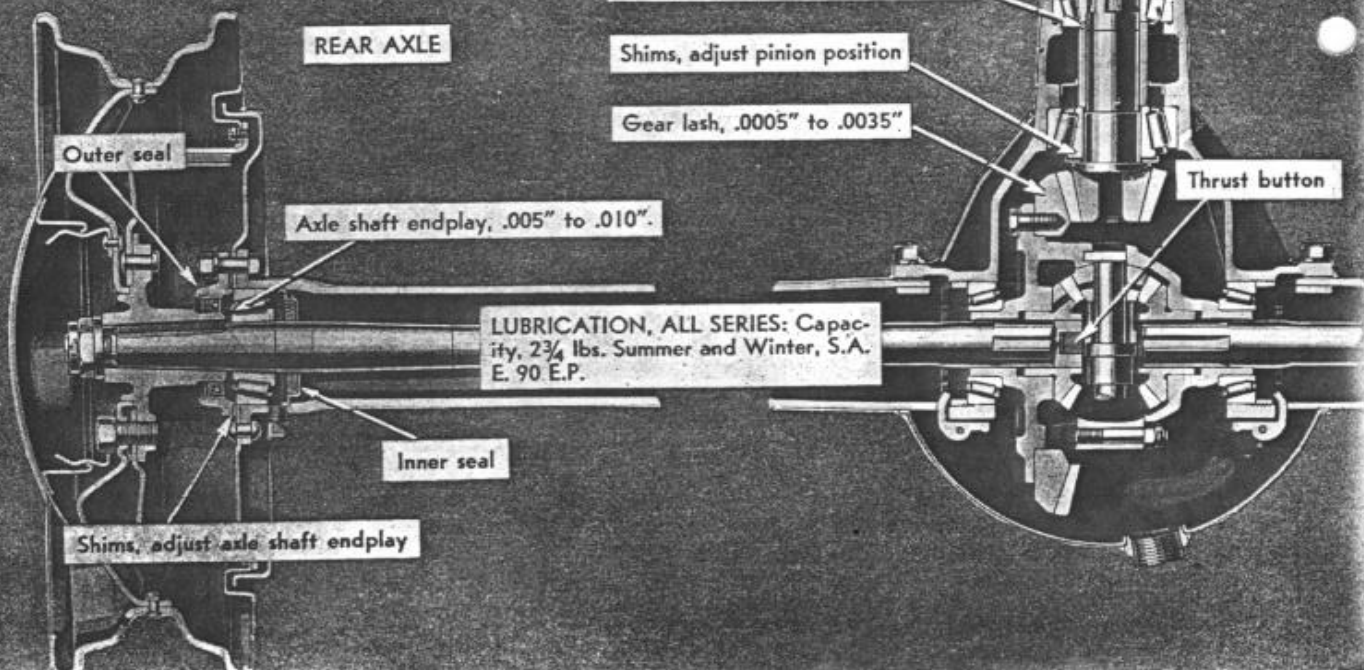


**DRAG LINK ADJUSTMENT, ALL SERIES:** Shim packs are provided in drag link end at front and rear of pitman ball joint, to adjust front wheel straight ahead position relative to steering gear mid-position. To adjust front wheels to left (steering gear in mid-position) remove shims from rear pack and add them to front pack. To adjust wheels to right, remove shims from front pack and add them to rear pack.

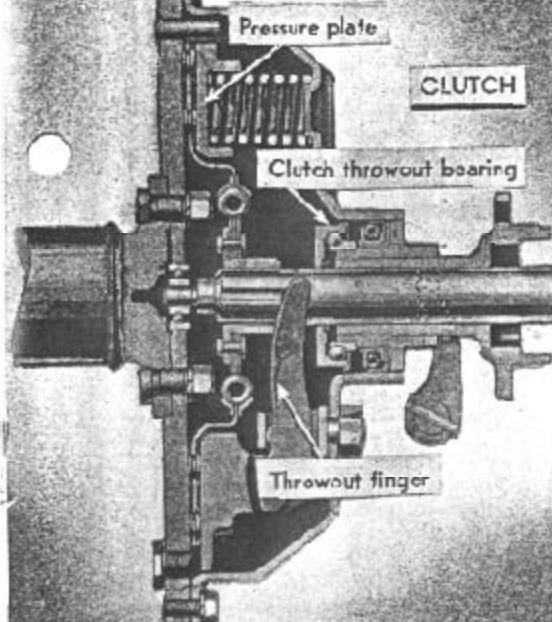


## CROSS SHAFT AND ROLLER TOOTH ADJUSTMENT, ALL SERIES:

Adjusted by means of slotted screw extending through right side of gear housing. To adjust, remove adjusting screw cap and slide off lock plate, far enough to clear lock boss on gear housing. With drag link disconnected at drop arm and steering gear in mid-position, turn screw in clockwise direction for closer mesh. Back screw off just far enough to prevent bind. Check end play at steering gear drop arm. It is preferable to have a slight amount of end play at this point rather than a bind.



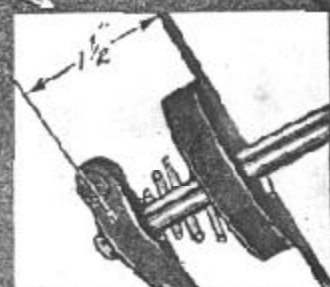
# Clutch, Transmission—HUDSON, '39



**CLUTCH PEDAL ADJUSTMENT, ALL SERIES:** Obtained by adjusting length of rod which connects clutch pedal to cross shaft lever. To adjust, loosen clevis lock nut and remove clevis pin. Shorten, or lengthen rod to give  $1\frac{1}{2}$ " clearance between center of clutch pedal clamp bolt and underside of toe board.

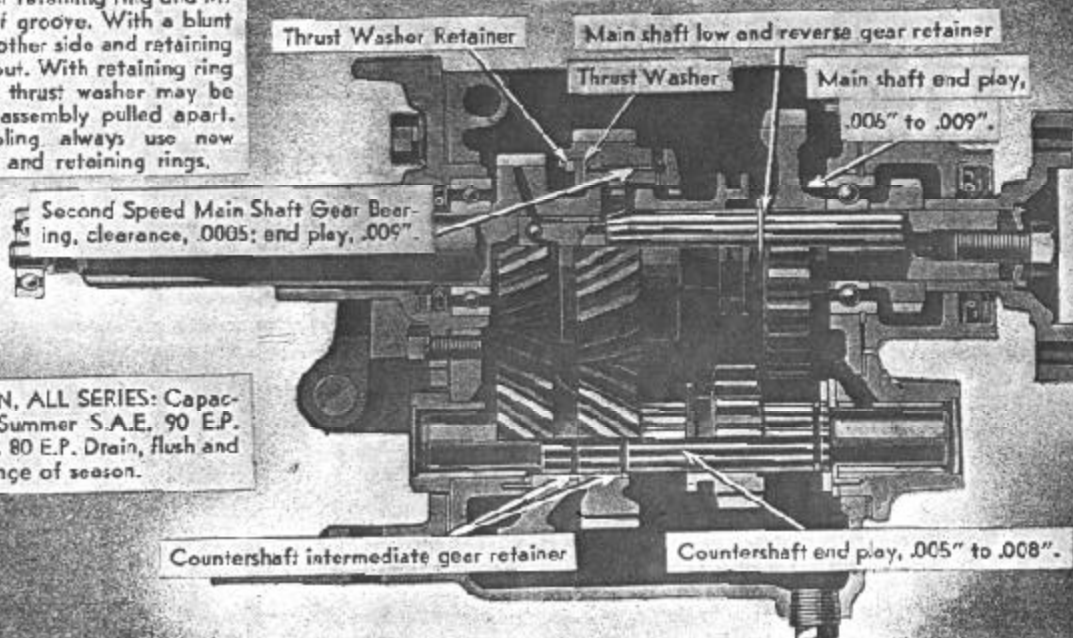
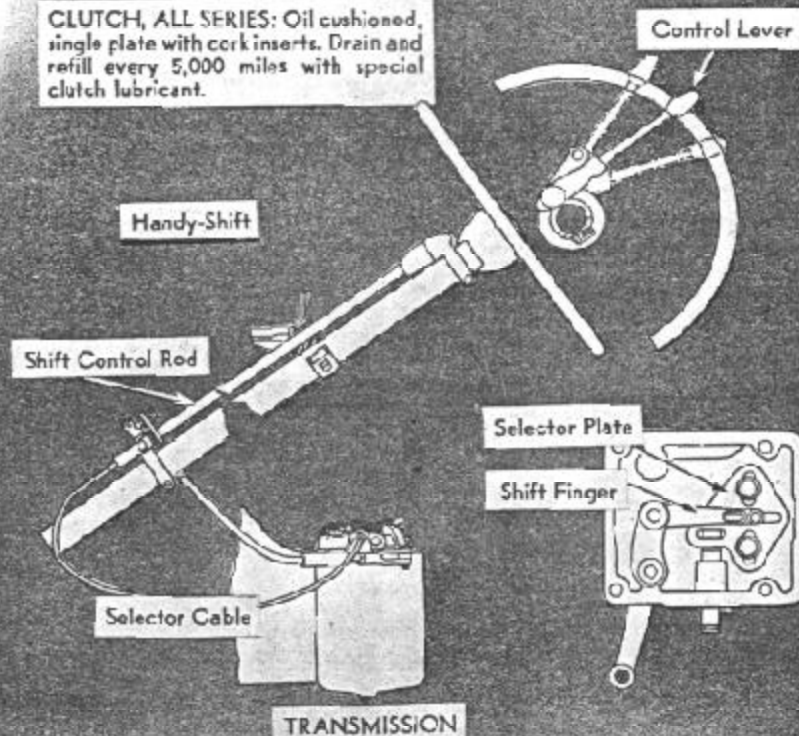
**CLUTCH RELEASE BEARING, ALL SERIES:** Lubricate every 1,000 miles, with 1 oz. of viscous chassis lubricant. Fitting located on right side of bell-housing.

**CLUTCH, ALL SERIES:** Oil cushioned, single plate with cork inserts. Drain and refill every 5,000 miles with special clutch lubricant.



**COUNTERSHAFT REMOVAL:** Remove counter shaft rear bearing cap. Remove thrust washer. Insert beveled edged tool between countershaft drive gear and countershaft intermediate gear and separate gears. Force countershaft and intermediate gear back far enough to clear splines in countershaft drive gear. With low and reverse shift lever in reverse position, move countershaft to one side, far enough to return shift lever to neutral position, clearing reverse gear shifter. In this position countershaft may be moved back far enough to clear. Remove gears and shaft through top opening.

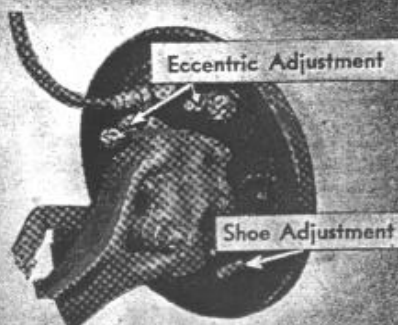
**DISASSEMBLE MAIN SHAFT DRIVE AND INTERMEDIATE GEAR, ALL SERIES:** Place intermediate gear securely in vise. Through opening milled in front end of gear compress one side of thrust washer retaining ring and lift one side out of groove. With a blunt punch tap the other side and retaining ring will snap out. With retaining ring removed, split thrust washer may be removed and assembly pulled apart. When assembling always use new thrust washers and retaining rings.



**LUBRICATION, ALL SERIES:** Capacity,  $2\frac{1}{4}$  lbs. Summer S.A.E. 90 E.P. Winter, S.A.E. 80 E.P. Drain, flush and refill with change of season.



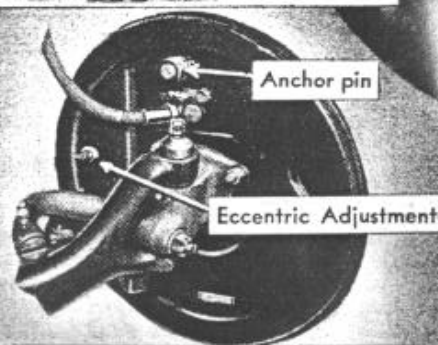
## Brakes—HUDSON, '39



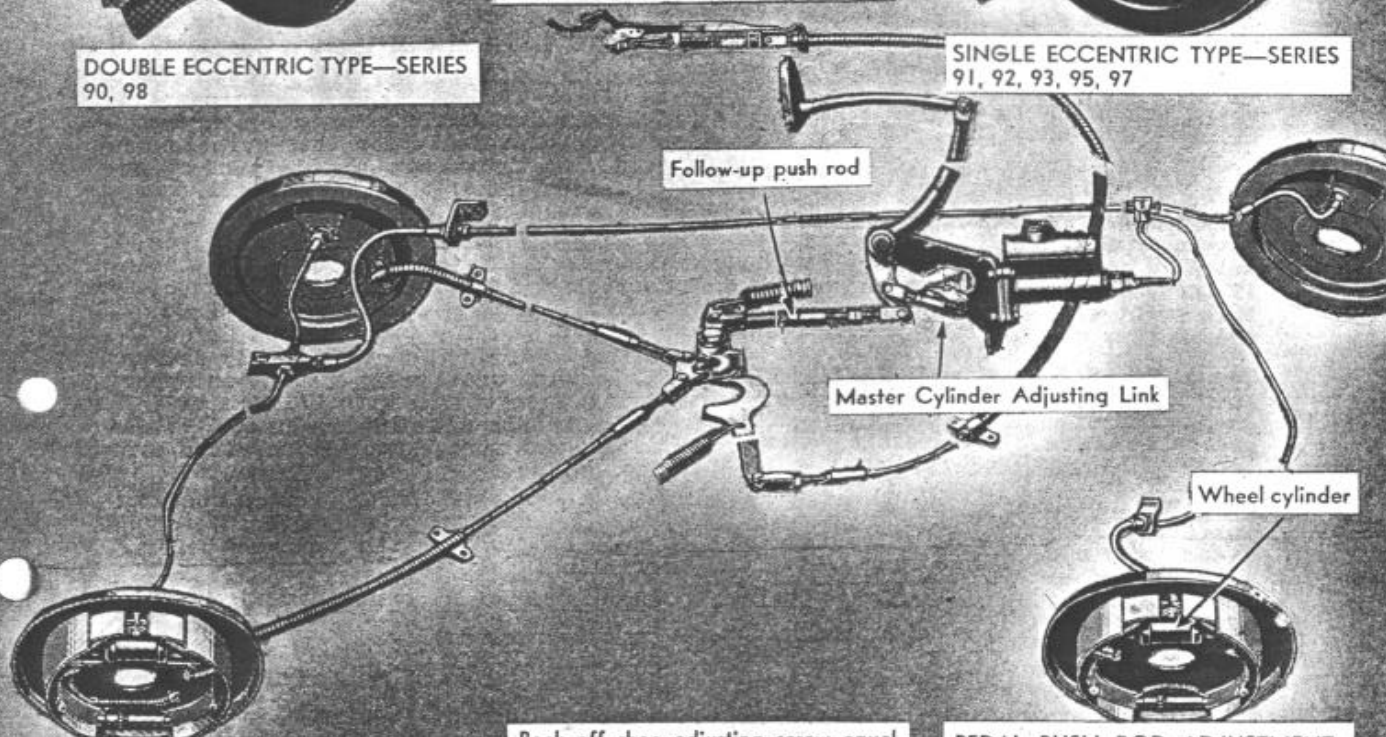
DOUBLE ECCENTRIC TYPE—SERIES 90, 98

### PEDAL ADJUSTMENT, ALL SERIES:

To insure full return of master cylinder piston when brake is released, there must be  $\frac{1}{4}$ " clearance between pedal shank and under side of toe board. To obtain this clearance, adjust length of pedal connecting link so that clevis pin just enters rod with pedal shank  $\frac{1}{4}$ " from toe-board and bell crank against its stop. This adjustment is important, as failure of piston to return to end of cylinder will cause brakes to drag.



SINGLE ECCENTRIC TYPE—SERIES 91, 92, 93, 95, 97



**BRAKE SHOE ADJUSTMENT (DOUBLE ECCENTRIC TYPE), SERIES 90, 98:** Three points of adjustment provided. To adjust, raise all wheels clear of floor. Remove wheels. Disconnect cables at equalizer. Remove inspection and adjusting hole covers from drums and brake backing plate. Insert .010" feeler gauge between lining and drum at upper end of primary shoe (front shoe). Loosen primary eccentric lock nut and turn eccentric in direction of forward wheel rotation until feeler gauge is just snug. Hold eccentric position and tighten lock nut. Insert .010" feeler gauge between lining and drum at upper end of secondary shoe (rear shoe) and adjust as outlined for primary shoe. Insert shoe adjusting tool through slotted opening at brake backing plate. Expand shoes by turning notched adjusting screw, moving end of tool toward axle center until drum can just be turned by hand. Repeat above operations at other three wheels. Pull hand brake two notches from full release, or until  $\frac{1}{8}$ " clearance is obtained between equalizer plate and its stop. Pull cables tight and adjust ends so clevis pin just enters hole in equalizer bar. Release hand brake.

Back off shoe adjusting screw equal number of notches until drums are just free of lining drag. Replace inspection and adjusting hole covers and reinstall wheels. Test car for operation.

**BRAKE SHOE ADJUSTMENT, SINGLE ECCENTRIC TYPE:** Procedure same as for Double Eccentric type, except that only single eccentric adjustment is provided. Note—Should clearance at both ends of secondary shoe vary more than .003", anchor pin must be adjusted.

**ANCHOR PIN ADJUSTMENT, SINGLE ECCENTRIC TYPE:** Necessary when shoes are relined, or satisfactory wear adjustment cannot be obtained. To adjust anchor, loosen anchor lock nut one turn and tap anchor pin in necessary direction with soft hammer, while turning eccentric in direction of forward wheel rotation to give .010" clearance at adjusting screw end and .010" clearance at anchor end of shoe against which eccentric operates. Tighten anchor pin nut with 16" wrench. Tighten eccentric lock nut.

**PEDAL PUSH ROD ADJUSTMENT, ALL SERIES:** Mechanical follow-up feature of Hudson braking system and its value as a safety factor is dependent upon proper adjustment. Adjustment should be carefully checked, whenever any brake work or inspection is made. Adjust with equalizer bar against stop, loosen pedal push rod lock nut and turn adjusting nut until rear face of nut is  $1\frac{7}{16}$ " from end of push rod. Tighten lock nut securely.

**BLEEDING BRAKES, ALL SERIES:** Should master cylinder run dry or a main line be disconnected, system must be bled at all four wheels. When line is disconnected at one wheel, that wheel only must be bled. Master cylinder reservoir must be full before bleeding operation is started. To bleed, remove bleeder screw at wheel cylinder and attach drain tube. Bleeder tube should hang in clear glass jar with free end submerged in brake fluid. Unscrew bleeder valve  $\frac{3}{4}$  turn. Depress pedal by hand, allowing pedal to return slowly. Continue this operation until fluid entering jar is solid stream free of air bubbles. Close bleeder valve, remove tube and replace screw. Refill master cylinder reservoir.

# HUDSON, 1939

## Front and Rear Main Bearings, All Series:

Special puller required to remove front and rear main bearing caps, as sufficient force must be applied to shear packing in the horizontal oil seal grooves. After cap is removed, grooves in cap and case should be thoroughly cleaned. When caps are replaced and drawn up tight, drive cotton wicking into front cap horizontal hole first, then into vertical holes in both front and rear caps. This operation should be carefully done, as an oil leak may result.

Oil Reservoir, All Series: Always use new gaskets when replacing oil reservoir. Be sure holes provided in gaskets register with rear main bearing oil return tube holes in reservoir and dip trough tray. If these holes are not open an oil leak at this point will result. Always fill dip trough tray with oil before reinstalling.

## Connecting Rod Bearings, All Series:

Spun type integral with rod and cap. Reducing rod or cap for bearing adjustment not recommended. Bearing clearance, .0003" to .0006". Endplay .007" to .013".

Unloader Adjustment, Carter 430S: With throttle valve wide open, clearance between upper edge of choke valve and inner wall of air horn should measure 1/4". Adjust by bending lip on fast connector link. With throttle valve wide open, push choke valve open. Choke should lock in this position. If valve fails to lock, recheck unloader adjustment.

## Fast Idle Adjustment, Carter 430S:

With choke valve tightly closed adjust fast idle arm screw to give a .018" opening between edge of throttle valve and bore of carburetor, side opposite port.

Main Shaft Removal, All Series: Remove bell housing from front of transmission case. Remove universal companion flange. Remove speedometer gear housing and gear from rear of case. Clear shifting rail mechanism from top of case. Drive main shaft low and reverse gear and rear main shaft bearing toward rear on main shaft far enough to clear low and reverse gear retaining ring. Slide main shaft out through rear of case. Remove main shaft second and high shift sleeve and low and reverse gear. Remove main drive gear bearing retainer, being careful not to damage spacing shims. Remove main shaft and intermediate gear assembly out through top of case.

## Steering Gear Mid-Position, All Series:

Remove horn button and locate groove machined on end of main tube. When steering gear is in mid-position (high point), groove should be pointing straight downward and front wheels should be in straight ahead or driving position. If

wheels point slightly to right or left, adjustment of drag link will be necessary. See "Drag Link Adjustment".

## Steering Gear Alignment, All Series:

Loosen steering gear body to frame mounting bolts. Loosen steering gear bracket on instrument panel. With these two points loosened, steering gear will shift to aligned position.

## Clutch Lubrication, All Series:

Clutch is oil cushioned single cork insert disc. It is important that only lubricant compounded especially for this purpose be used. As the amount of lubricant affects operation, it is important that the correct amount, 1/3 pint, be used.

To service, turn engine until plug on inner face of flywheel appears at timing inspection hole in rear engine support plate. Remove plug and turn engine approximately 1/3 revolution and allow clutch to drain. When completely drained, turn engine until plug opening in upper position and refill with 1/3 pint of clutch lubricant. Replace plug. It is recommended that clutch be serviced every 5,000 miles.

Note--In case of clutch trouble resulting from the use of improper lubricant, clutch should be flushed with kerosene before refilling.

## Steering Wheel Position, Series 91,

92, 93, 95, 97: To insure the best steering wheel position a spacer adjustment is provided in the steering gear column bracket. To adjust to higher position, loosen steering gear body to frame mounting bolts, and remove spacers at column bracket. Range of adjustment approximately 1/2". When changing steering wheel position, drag link should be adjusted to re-locate steering gear in mid-position.

Note--Series 90, 98 may be adjusted lower by installing spacers at column bracket.

## Head Lamp Rim and Lens Removal, All Series:

To remove lamp rim, remove screw at bottom of rim and lift upward. Remove two screws and clip at top of lens and lens may be removed.

## Head Lamp Beam Adjustment, All Series:

Aiming of lamp beam is by means of two screws on the lamp body, underneath the lens rim. Screw marked "V" for vertical aiming, and screw marked "H" for horizontal aiming.

## Water Pump Seal Thrust Washer, All Series:

When assembling water pump care should be exercised in the installation of seal thrust washer. The unfinished or non-thrust side of thrust washer has a small notch ground in one ear. When assembling make sure that the ground and lapped surface of washer is assembled next to thrust face of pump shaft bushing.

