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# WOLVERINE

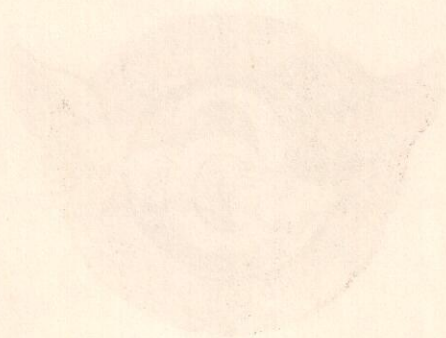


**B PASSENGER CAR  
JUNIOR SPEEDWAGON**

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WOLVERINE

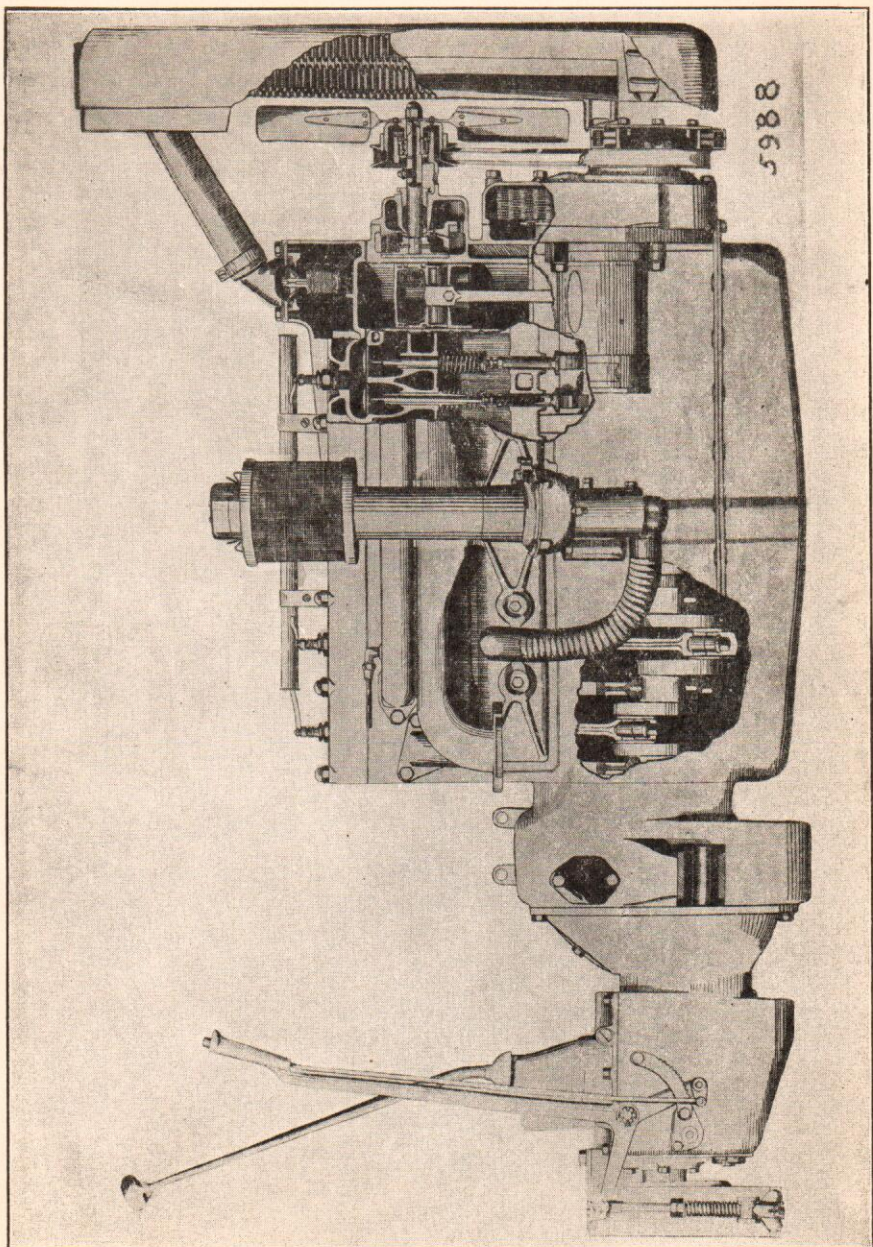


JUNIOR SPEEDWAGON  
B PASSENGER CAR

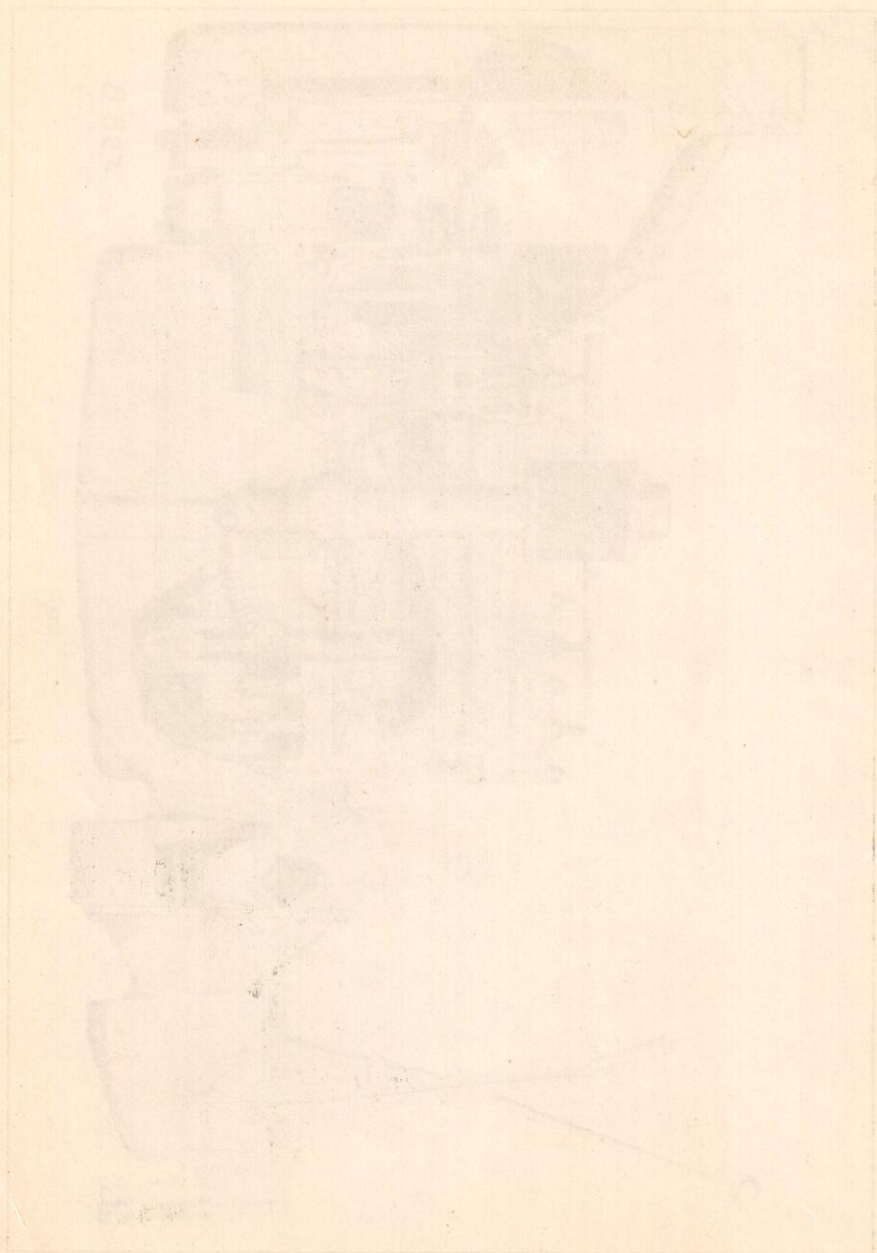
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# MODEL "A" PASSENGER CAR



MODEL A PASSENGER CAR





## MODEL "A" TOLERANCES

## PISTON

Engine firing order.....	1-5-3-6-2-4
Skirt of piston to Cyl. wall.....	.005—.0055 with 5/16" feeler
Piston ring gap.....	.004—.009
Ring groove width.....	.1875

## CRANKSHAFT

End play on rear bearing.....	.004—.006
Main bearings.....	.0015—.003: .002 preferred

## CONNECTING ROD

Rod on crank shaft.....	.0015—.003: .002 preferred
Piston to piston pin.....	.0002—.0005 selective fit
Side clearance on crank shaft.....	.005—.007

## CAM SHAFT

End play.....	.005—.015
Shaft and bushings.....	.0015
Allowable looseness in chain.....	See instructions on chain adjustment, page AA18

## VALVES

Intake valve stem and guide.....	.003
Exhaust valve stem and guide.....	.003
Intake valves and lifter.....	.004 warm
Exhaust valves and lifter.....	.006 warm
Width of valve seat.....	3/32
Valve tappet and guide.....	.0005—.001

## FAN

Pump gland and shaft.....	.010
Pump body to shaft.....	.005

## CLUTCH

Trans. drive gear to cap drive gear bearing.....	.005
Trans. drive gear to clutch pilot bushing.....	.001—.002
Back lash clutch disc hub to Trans. drive gear spline.....	.004
Clutch release shaft to clutch shaft bushing small.....	.005
Clutch release shaft to clutch shaft bushing large.....	.005

## TRANSMISSION

Trans. countershaft to Bush. Trans. counter gears.....	.002
Idler shaft to idler shaft bushing.....	.002
Trans. main shaft to main shaft pilot bushing.....	.005
End play in countershaft.....	.007
End play in main shaft—no end play—ball bearing.....	



Sliding gear key-way to spline.....	.0005—.0035
Sliding gear to shaft.....	.0005—.0025
Back lash constant mesh gears.....	.004—.006
Back lash sliding gears.....	.004—.006

## FRONT AXLE

King pin to bushing.....	.001—.002
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## SPRING BUSHINGS

Bolt to bushings.....	.003
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## BRAKES

Service brakes.....	.010 to .015
Emergency brakes—take up until brake drags with hand lever in second notch.	

## DRIVE SHAFT

Trunnion pin and ball.....	.002
Spring guide to body.....	.002
Trunnion pin end to body.....	.002
Trunnion pin to ball head.....	.0005

## REAR AXLE

## Gear Ratios:

Sedan—Brougham—Victoria.....	12-55—4.58 to 1.
Roadster and Coupe.....	12-51—4.25 to 1.
Back lash differential pinion to differential gears.....	.003—.005
Differential pinion and support.....	.0015—.003
Back lash between ring gear and pinion..	.003—.010
Differential case and differential gear....	.001—.004
Differential gear to spline on axle shaft...	.003—.005

## WHEELS

Clearance for jack.....	8½" inflated
Pitch.....	1½°
Caster.....	2°
Toe in.....	0 to ⅛"
Tread front wheels.....	56"
Tread rear wheels.....	56"
Wheel base.....	121"
Turning radius.....	23 feet

## ELECTRICAL SYSTEM

Charging rate 16-18 amperes at 27 miles per hour (cold).	
Headlights—Double filament.....	C. P. 21
Tail light.....	C. P. 3
Parking light.....	C. P. 3
Dash light.....	C. P. 3
Dome light.....	C. P. 3
Interior light.....	C. P. 3

## IGNITION

Gap breaker points.....	.015—.020
Gap spark plugs.....	.025

## FIT PISTON RINGS

1. Clean cylinder bore thoroughly.
2. Try piston rings in cylinder bore to determine clearance at gap, this should be between .004 to .009 of an inch.
3. Clean piston.
4. Assemble the rings to the piston. The rings must turn freely in the grooves, but there should be no appreciable clearance.

We recommend "Wonderspread" ring remover and replacer. Piston rings are supplied in five sizes standard: .010, .020, .030 and .040 over-size.

**CAUTION:** Be extremely careful to clean the grooves properly. Piston ring grooves should be scraped or burnished with a small strip of emery cloth or buffer the width of the groove. After completing this operation blow dust off with compressed air or clean with gasoline and dry with cloth.

**NOTE**—Allowance of .002 is given on each piston ring for fitting.



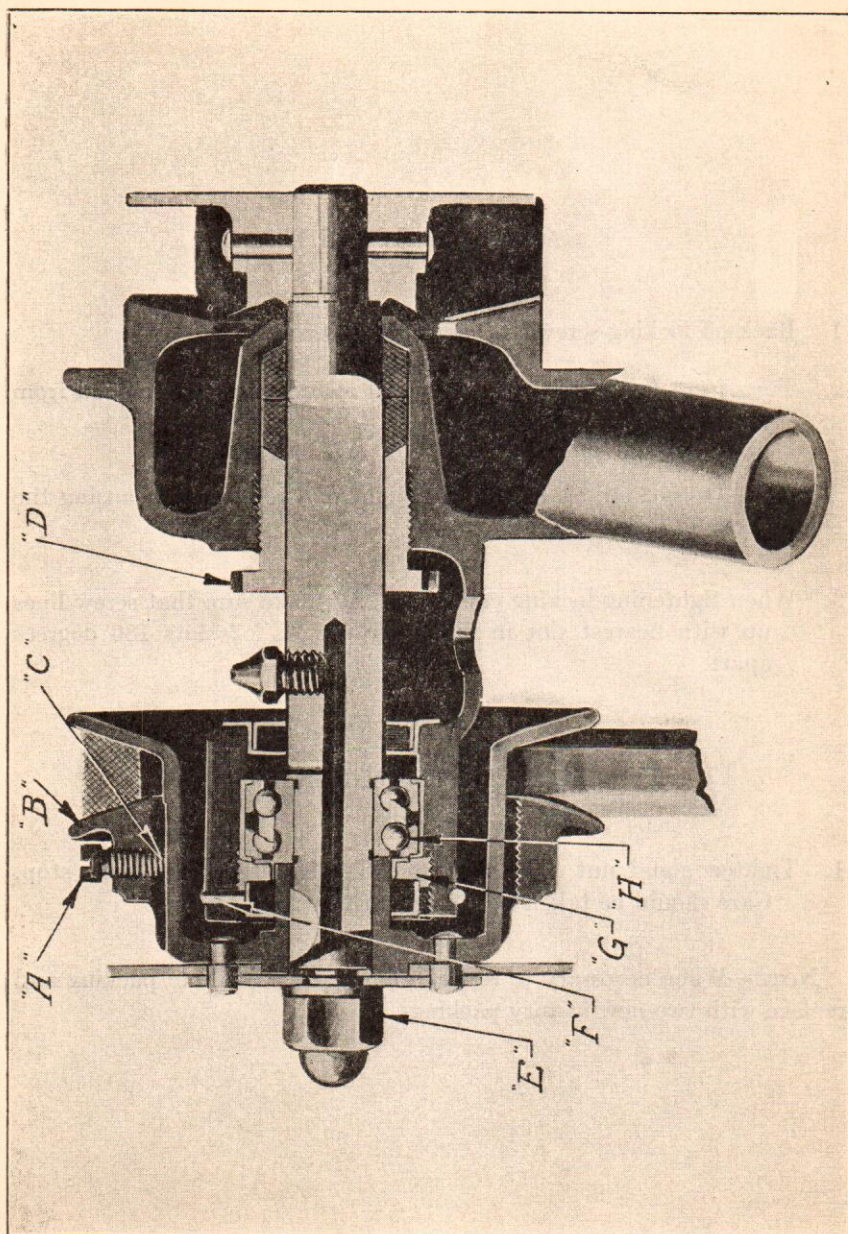
# THE PISTON RING

1. The piston ring is a ring of cast iron or steel which fits into the groove in the cylinder wall. It is used to scrape the excess oil from the cylinder wall and to seal the combustion chamber from the crankcase.
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## ADJUST FAN BELT AND PUMP GLAND



See instructions reverse side of sheet.

### ADJUST FAN BELT

1. Back off locking screw "A" as shown in cut.
2. Turn front flange "B" to right until all slackness is removed from fan belt.

NOTE—Do not adjust belt to the point of stretching or causing the belt to bottom in pulleys.

3. When tightening locking cap screw "A" make sure that screw lines up with nearest slot in pulley proper "C" 2 slots 180 degrees apart.

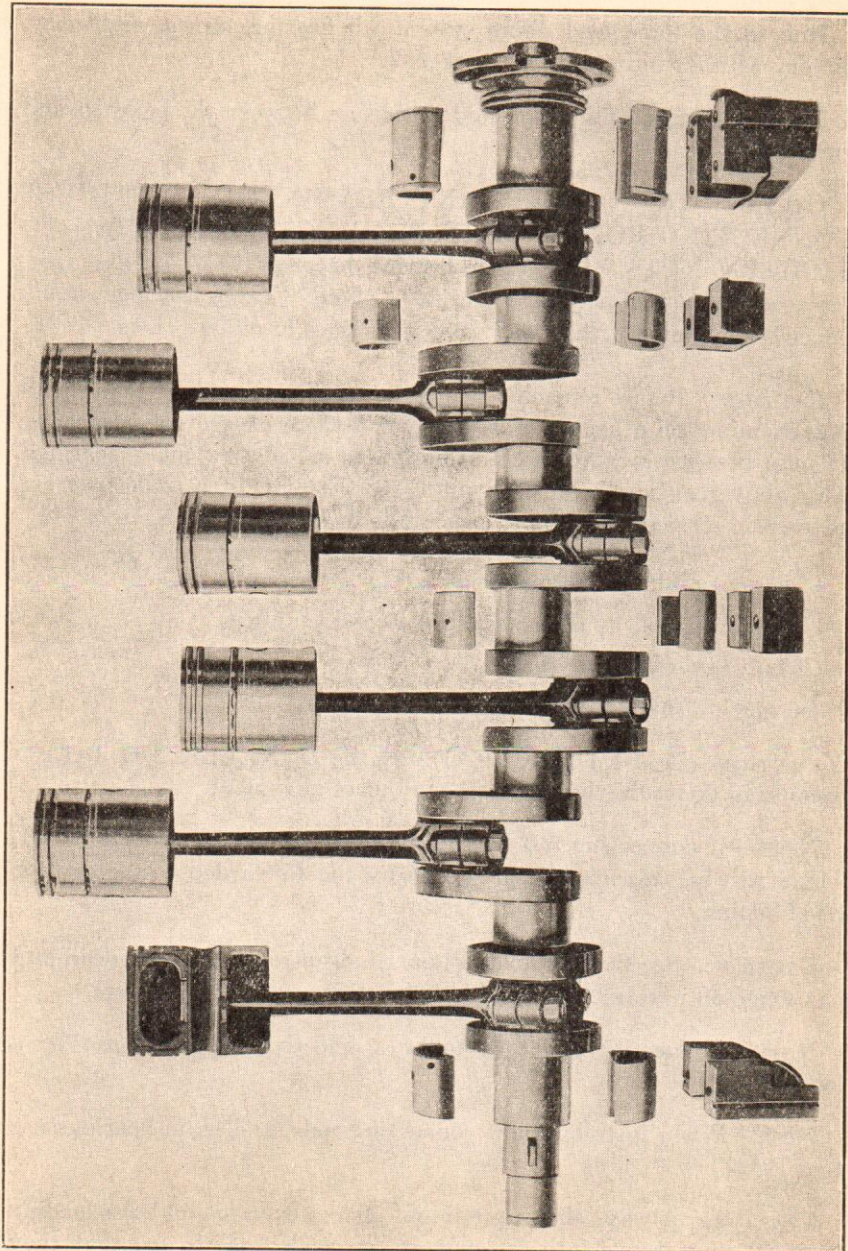
### ADJUST PUMP GLAND

1. Tighten gland nut "D" with tool T-328 until water leaks stop. Care should be taken not to draw this nut too tight.

NOTE—When necessary to repack pump, remove all old packing and replace with two new factory packings.



CONNECTING RODS AND MAIN BEARINGS



See instructions reverse side of sheet.



## CONNECTING ROD AND MAIN BEARINGS

Due to the force feed oiling system, all bearings are assembled at factory with a running clearance of .002.

There is always a film of oil under pressure between the bearings and crankshaft.

**CAUTION: DO NOT FOR ANY REASON TRY TO ADJUST CONNECTING ROD OR MAIN BEARINGS OTHER THAN TO TIGHTEN NUTS.** If a main bearing becomes worn or damaged, replace with new upper and lower half. Note—These bearings should never be tampered with in any way other than to replace them.

**CAUTION:** Before replacing new upper and lower half of main bearing, examine the other six and ascertain if there is excessive clearance. It may be necessary to install a complete set of new main bearings. This above caution is all determined by the amount of miles car has covered in service, and care it has had as to changing of oil, etc.

Clean out oil lines and oil screen.

Clean out dirt behind bearing shell in case and cap.

Clean back of bearing shells.

Do not use shims behind bearings.

**CAUTION: A BEARING CAP SHOULD NEVER BE FILED** because in doing this bearing will run out of alignment.

**NOTE—**If connecting rod bearing is damaged replace with new rod. There will be an exchange price on any rod forwarded to factory for rebabbitting.

**CAUTION:** See that oil hole in upper half of rod bearing is clean and has a free oil passage. This oil hole lubricates valve mechanism.

**NOTE—**Connecting rod bolt to be a selective fit—must not be a loose fit.

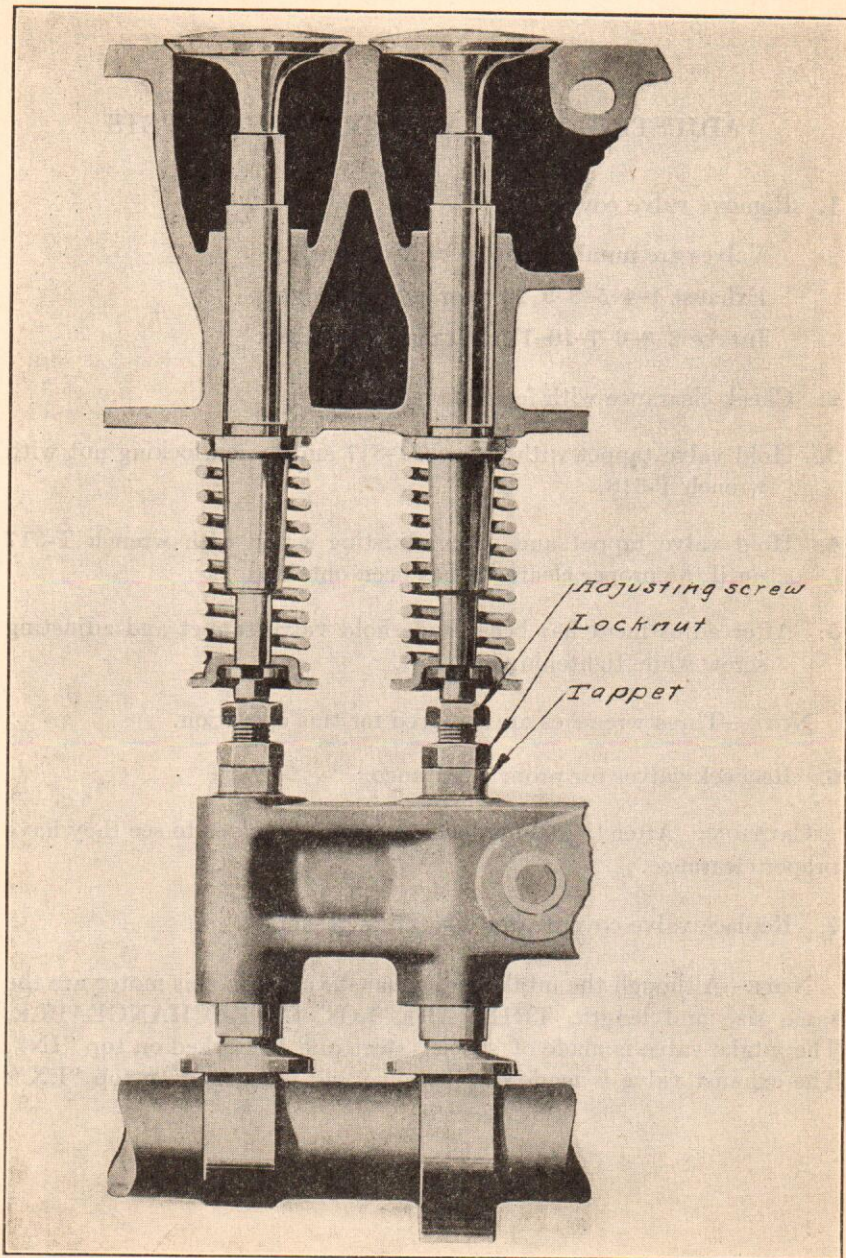
**NOTE—**When installing new connecting rods, and main bearings use tool T-327.

**CAUTION:** Always align up rod and piston, examine oil holes leading from oil ring groove into piston boss (on each side) to see that they are clean and have a free passage.

**NOTE—**These oil holes are to lubricate piston pin.



## ADJUST INLET AND EXHAUST VALVE



See instructions reverse side of sheet.



## ADJUSTING INLET AND EXHAUST TAPPETS

1. Remove valve covers.

Valves are numbered from radiator back.

Exhaust 1-4-5-8-9-12 clearance .006 warm.

Intake 2-3-6-7-10-11 clearance .004 warm.

2. Check clearance with feeler gauge T-353.
3. Hold valve tappet with wrench T-317 and loosen locking nut with wrench T-318.
4. Hold valve tappet and turn adjusting screw with wrench T-317 until the proper clearance has been obtained.
5. After adjustment has been made hold valve tappet and adjusting screw while tightening lock nut.

NOTE—Three wrenches are required for this operation.

6. Recheck valves for proper clearance.

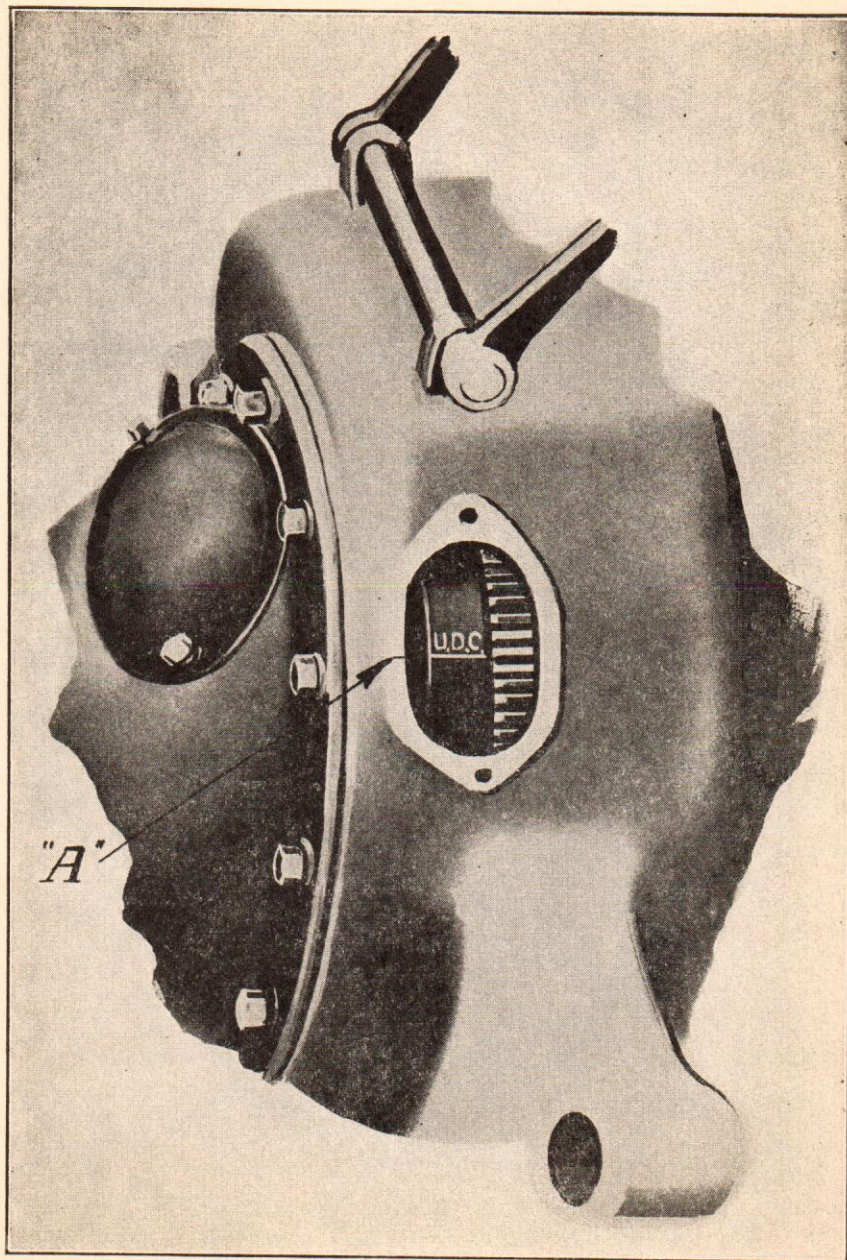
CAUTION: After tightening lock nut recheck valves to see they have proper clearance.

7. Replace valve covers after inspecting gaskets.

NOTE—Although the intake and exhaust valves in this motor are the same size and length, **THEY ARE NOT INTERCHANGEABLE**. The intake valve is made of special steel and is marked on top "IN". The exhaust valve is made of Silchrome and is marked on top "EX".

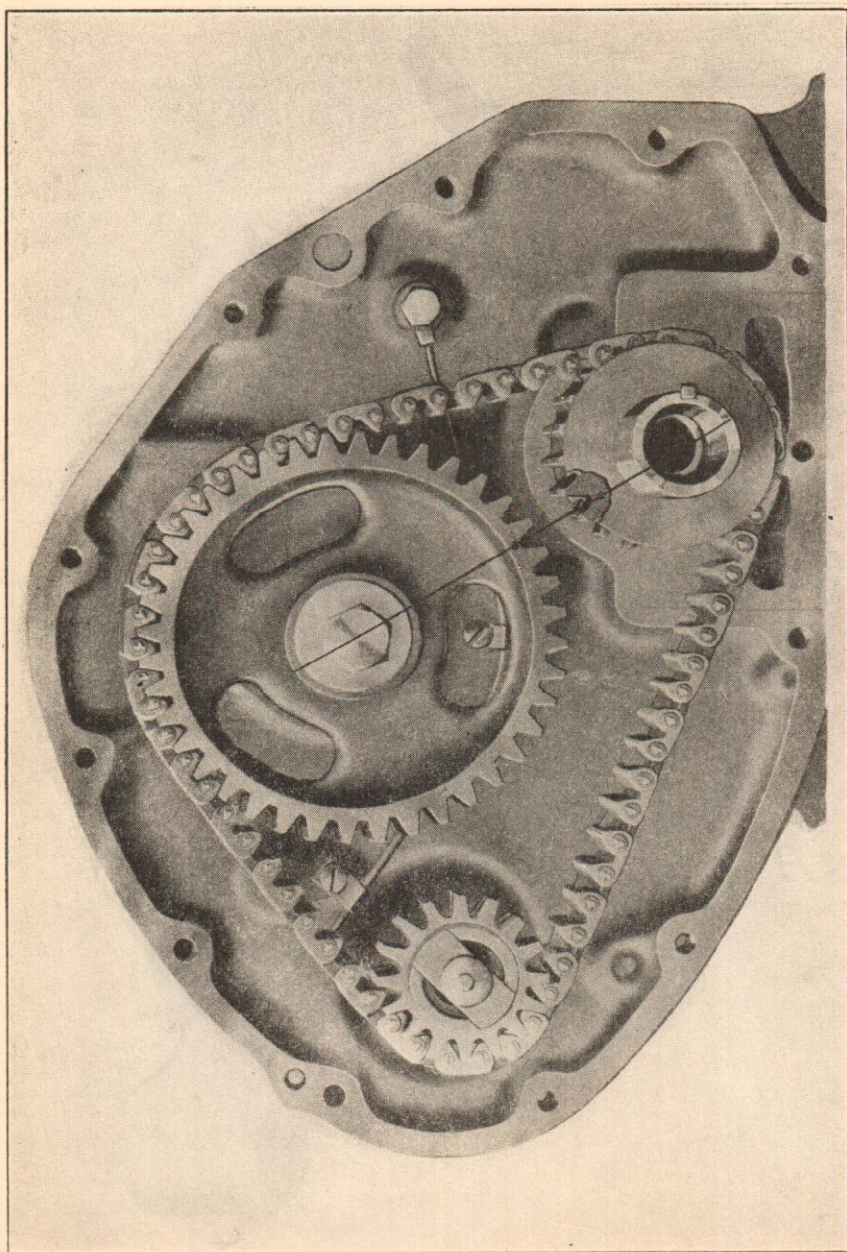


SET CAM SHAFT AND SPARK TIMING





SET CAM SHAFT





## CHECK CAM SHAFT SETTING

1. Remove rear valve plate cover and inspection plate on flywheel housing, also No. 6 spark plug.
2. Adjust No. 6 intake valve to .006 clearance with valve tappet on base of cam.
3. Turn engine till No. 6 intake starts to open.

NOTE—This is determined by moving valve spring seat back and forth until valve starts to turn. At this point U. D. C. mark on flywheel should line up with reference mark on flywheel housing. Allowable variation of  $\frac{1}{2}$  inch either way from U. D. C.

## SET CAM SHAFT

1. Suspend motor, refer to instruction sheet on suspension of motor, Page AA8I.
2. Remove sprocket case cover.
3. Remove generator drive sprocket and chain.
4. Turn crank and cam shaft sprockets until zero mark (0) on sprocket lines up with centers on crank and cam shafts.  
(Shown in cut.)

NOTE—When these zero marks are in line with centers on crank and cam shaft, No. 6 piston should be on U. D. C. just starting down on the intake stroke.

5. Replace chain, and generator drive sprocket.
6. Recheck valve timing.
7. Re-assemble and adjust timing chain.
8. Insert spring and generator driving sprocket flange pin and replace sprocket housing cover.

See cuts on pages AA9 and AA10.

# CHECK CAM SHAFT SETTING

1. Remove the valve cover and inspection plate on flywheel.

2. With the intake valve in the open position with valve tappet in the open position.

3. Turn engine till No. 1 piston starts to open.

4. Rotate the flywheel by moving valve spring seat back and forth until valve starts to turn. Put this point 1-11.5 mark on flywheel about 1/2 inch up with reference mark on flywheel housing. Adjust the valve to the correct way from 1-11.5.

## SET CAM SHAFT

1. Remove the motor, refer to the instructions on suspension of motor.

2. Remove the motor cover.

3. Remove the motor drive sprocket and chain.

4. Turn crank to 1-11.5 mark sprocket 1-11.5 mark (0) on flywheel line up with center of crank and cam shaft.

5. Note: If not these two marks are in line with center of crank and cam shaft, No. 1 piston should be in 1-11.5 just starting down on the intake stroke.

6. Recheck cam and generator drive sprocket.

7. Recheck valve timing.

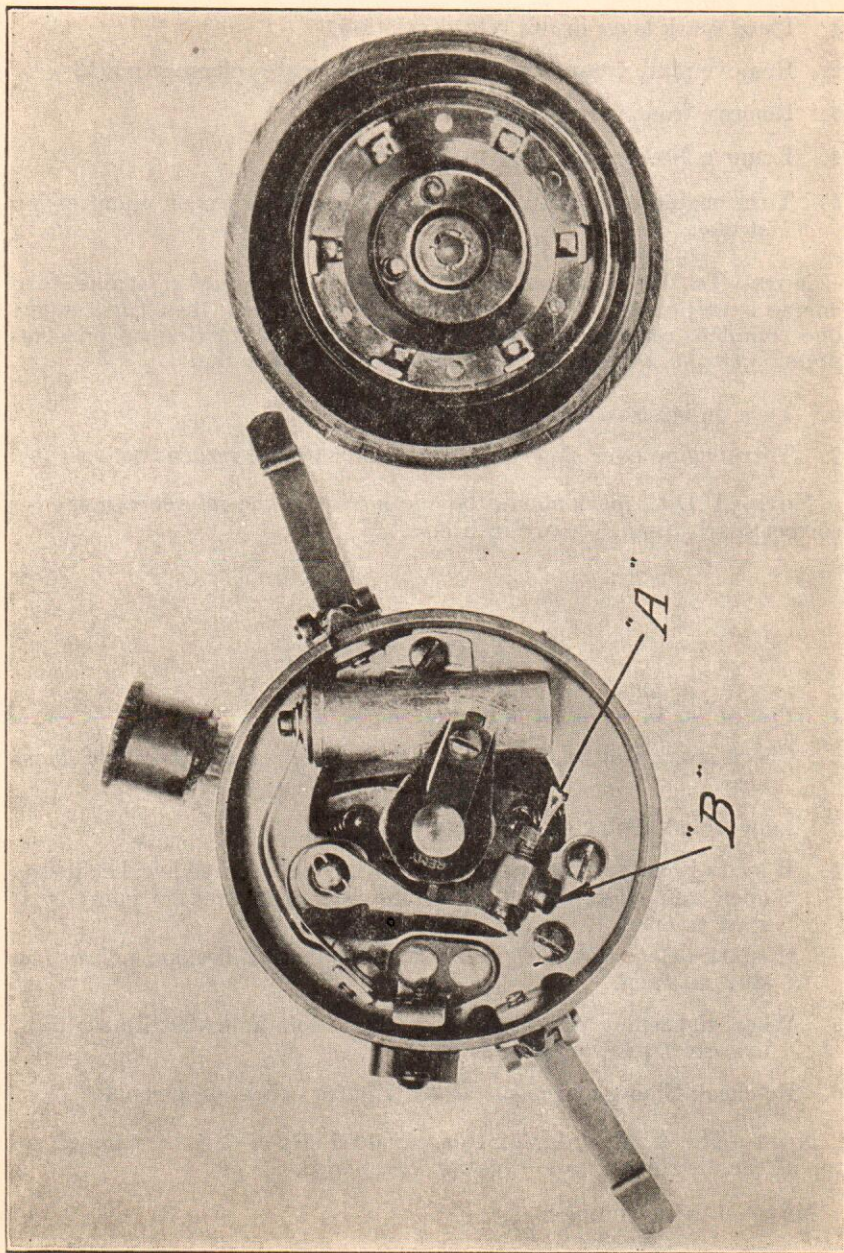
8. Re-adjust the adjusting chain.

9. Insert timing and generator driving sprocket chain pin and replace sprocket housing cover.

10. See note on pages 1-19 and 1-20.



## SET BREAKER POINTS AND SET SPARK TIMING





## CHECK SPARK TIMING

1. Place spark lever in full retard position.
2. Remove plate from flywheel housing to locate reference mark.
3. Remove front valve cover.
4. Remove No. 1 spark plug from engine.
5. Turn engine over until No. 1 piston is coming up on compression stroke.

NOTE—To determine when piston is on compression stroke turn engine over until No. 1 intake valve starts to open, then turn engine one complete revolution. When No. 1 piston is starting up on compression stroke, both intake and exhaust valves are closed.

6. Turn on ignition switch.
7. Turn engine over slowly until ammeter needle returns to zero (0).

NOTE—U.D.C. mark should be one inch past the reference mark for correct spark timing, or one inch late.

## SET SPARK TIMING

1. Proceed as in checking operation.
2. Check spark control lever to see that there is no appreciable slackness.
3. Loosen distributor clamp screw.
4. If spark is early, turn distributor (to the right) until breaker points open and close, then turn to the left until breaker points just start to open.  
If spark is late turn distributor to the left until breaker points just start to open.
5. When tightening up distributor clamp bolt hold distributor head in correct relation with rotor arm.
6. Re-check timing and re-install distributor cap in proper place.

NOTE—The firing order of this engine 1-5-3-6-2-4 is stamped on top of the distributor cap—rotation clock-wise.

NOTE—Engine timing range:

Automatic 21°  
Manual 25°

See cuts on pages AA9 and AA13.



### TO ADJUST DISTRIBUTOR BREAKER POINTS

1. Remove distributor cap.
2. Turn engine over until breaker points are wide open.
3. Loosen lock screw "B" as in cut.
4. Turn adjusting screw "A".

NOTE—Breaker points should be adjusted to a gap of not less than .015 or to exceed .020.

5. Tighten locking screw "B" and recheck clearance of gap.

### TO INSTALL NEW SET BREAKER POINTS

1. Remove distributor cap.
2. Remove lock screw "B".
3. Remove stationary breaker point by screwing out adjusting screw "A".
4. Loosen screw that holds condenser terminal and terminal for movable breaker point.

NOTE—Do not remove screw from distributor, this is unnecessary as the terminal of breaker point is slotted and slips out when screw is loosened.

CAUTION: When installing new set of points examine fibre bushing in movable point and see that it is not worn or cracked. Set breaker points not less than .015 or to exceed .020.

### REMOVING DISTRIBUTOR ASSEMBLY FROM ENGINE

1. Disconnect spark control rods.
2. Remove distributor cap.
3. Remove retaining screw.
4. Remove distributor assembly from engine.

CAUTION: When removing distributor from engine ascertain position of rotor arm and replace in same position when replacing distributor.

NOTE—If engine is turned over (as in grinding valves, etc.) to locate correct position of distributor rotor shaft, follow same operation as in setting spark timing. Page AA13.

5. Replace distributor assembly.
6. Replace retaining screw.
7. Connect up spark control rods.

NOTE—Before replacing distributor cap, re-check spark timing, refer to instruction sheet on spark timing, page AA13.

8. Replace distributor cap in proper position.

See cut, page AA13.

# TO ADJUST DISTRIBUTION BREAKER POINTS

1. Turn engine over and observe breaker points.
2. Adjust breaker points to .015 in.
3. Turn adjusting screw "1/2".
4. Repeat breaker points adjustment and adjust to .015 in.
5. Repeat breaker points "1/2" and repeat breaker points.

# TO INSTALL NEW FET BREAKER POINTS

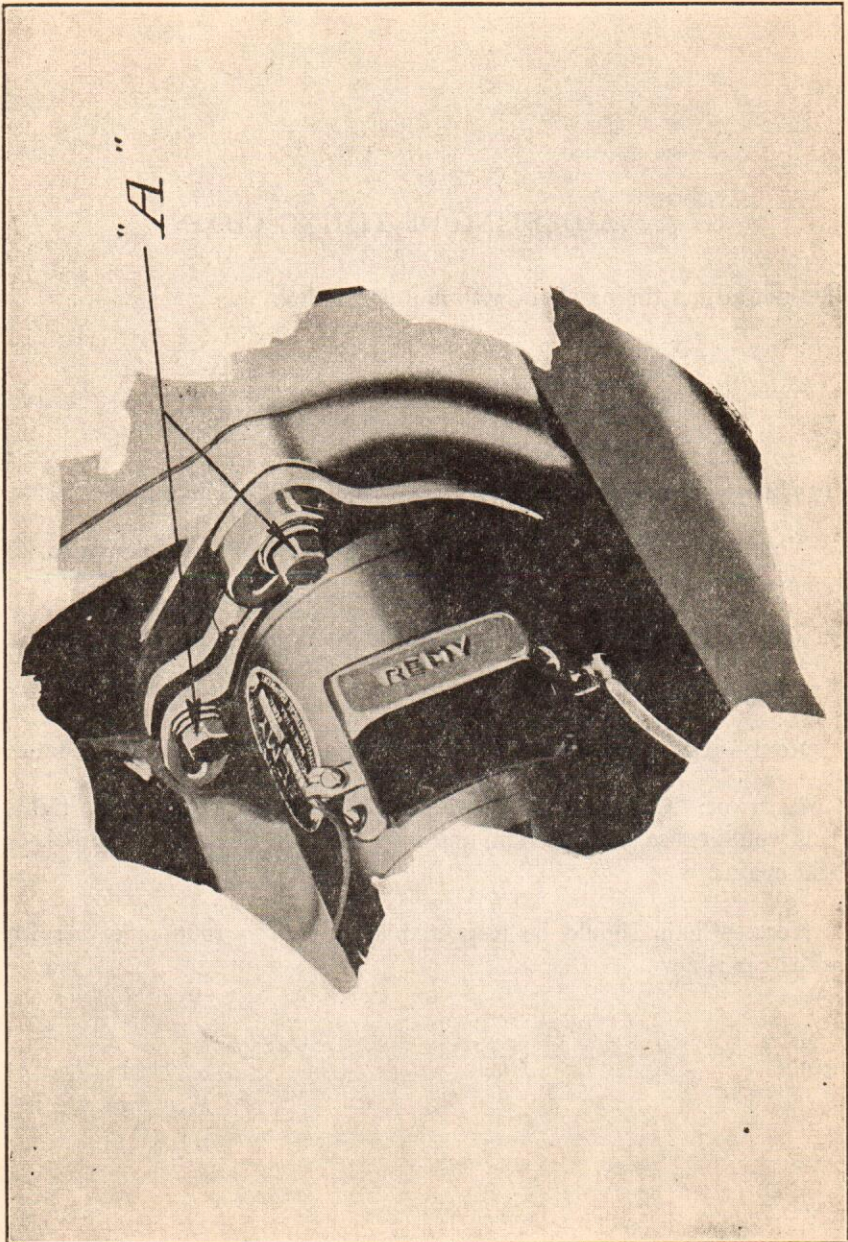
1. Remove distributor cap.
2. If new set screw "1/2".
3. Remove distributor breaker point, removing out adjusting screw.
4. Insert new that holds distributor terminal and terminal in.
5. Repeat breaker points.
6. The new breaker point is .015 in. This is necessary in terminal of breaker points .015 in. and also out when new is.
7. Adjust: When installing new set of breaker points then pushing a breaker point and set it in and screw it in. Set breaker points out less than .015 in. to avoid 100%.

# MOVING DISTRIBUTOR ASSEMBLY FROM ENGINE

1. Remove distributor cap.
2. Turn distributor cap.
3. Remove distributor cap.
4. Remove distributor assembly from engine.
5. Turn distributor cap.
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98. Turn distributor cap.
99. Turn distributor cap.
100. Turn distributor cap.



ADJUST TIMING CHAIN



See instructions reverse side of sheet.

## ADJUSTING OF TIMING CHAIN

Do not adjust timing chain with motor running.

### TO TIGHTEN TIMING CHAIN

1. Loosen the three generator support bolts "A" (as in cut).

NOTE—The two top holes in generator support are elongated to provide movement of generator.

2. Move generator to right until slackness is just taken out of chain.
3. Tighten up support bolts.

NOTE—After adjusting chain start engine and test for chain hum.

CAUTION: Care must be taken that chain is not adjusted too tight, this would cause chain to hum and may result in wear on the sprockets and chain.

NOTE—Chain should be inspected after 800 to 1000 miles service when car is new.

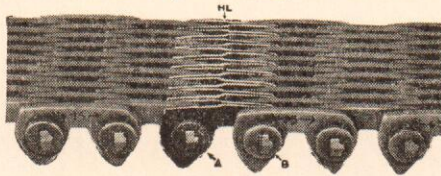


## TO REMOVE HUNTING LINK OR SHORTEN CHAIN

If all slackness is taken out of timing chain (by the moving of generator sprocket) and chain is still too loose on sprockets, the chain can be made shorter by removing the hunting link.

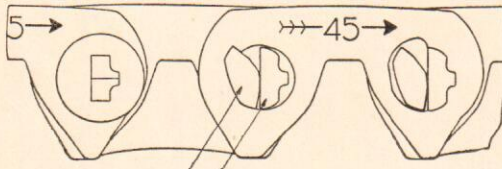
1. Suspend motor, refer to instruction sheet on suspension of motor, page AA31.
2. Remove sprocket housing cover.
3. Remove generator drive flange and sprocket.
4. Remove chain from sprockets.
5. Locate hunting link on chain.

NOTE—This can be found by locating the offset links shown in cut.

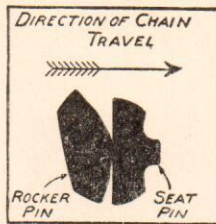


6. Split washers A. & B. with chisel and remove from pins.
7. Remove pins and hunting link.
8. Bring ends of chain together lapping links in regular order.
9. Insert seat pin "C" so that ribbed side points in directions of chain travel (to right).

NOTE—Chain travel indicated by arrows outside of chain.



10. Insert rocker pin "D" with pointed side against flat side of seat pin "C".



11. Replace old washers and seat pins with new ones.
12. Rivet over ends of pins.
13. Replace chain on sprockets.
14. Re-adjust position of generator sprocket, proceeding as in operations on adjusting timing chain, page AA18.

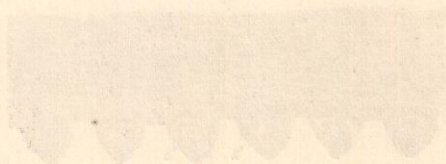
NOTE—The chain and crankshaft, cam shaft and generator sprockets all turn to the right.

15. Insert spring and bearing pin for generator sprocket driving flange and replace sprocket housing cover.

NOTE—When reassembling reverse operations.

# TO REMOVE LOCKING LINK OR SUBSTITUTED CHAIN

1. Pull release chains of locking chain by the action of the release chains and the release chains will be loose in position. The chains can be removed by moving the release chains.
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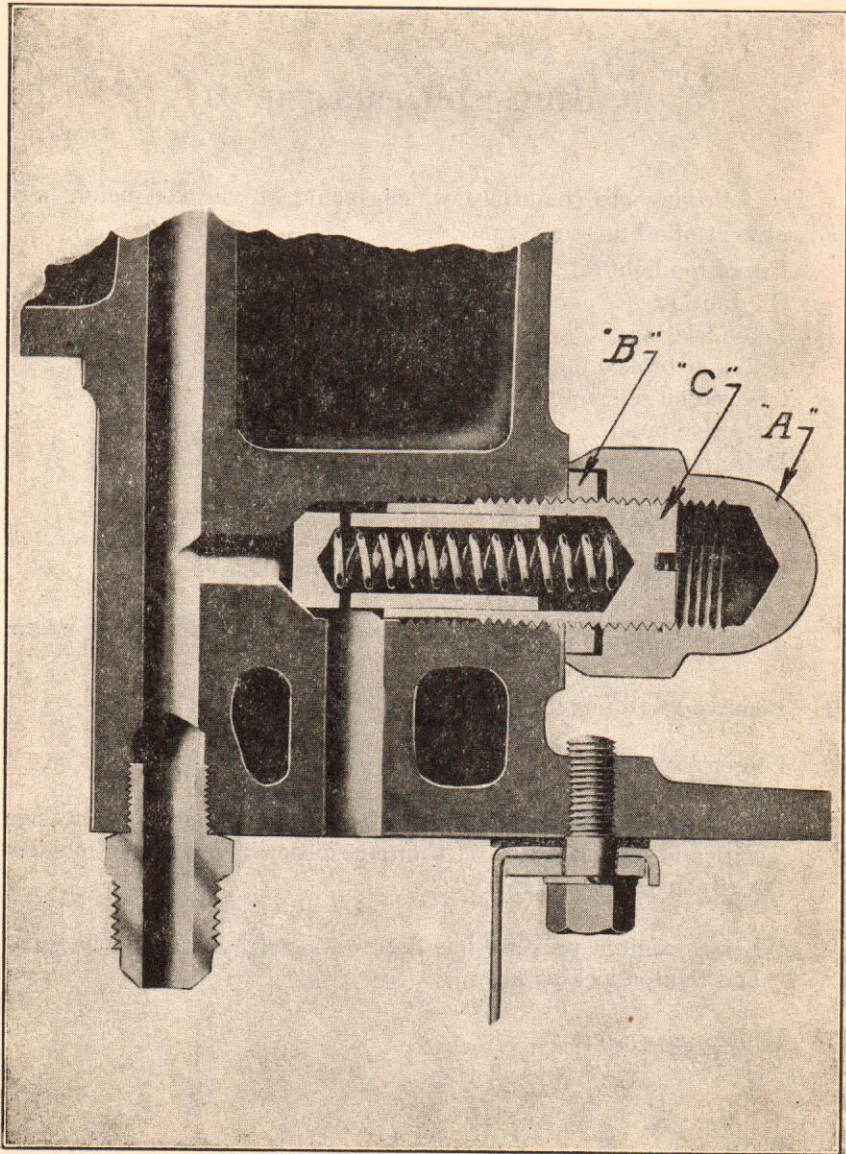
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## ADJUST OIL PRESSURE



See instructions reverse side of sheet.



## ADJUST OIL PRESSURE

The following are conditions which should be checked before any adjustment of oil pressure is made:

- Use of too light oil.
- Oil dilution.
- Loose bearings.
- Leaky or broken oil tube.
- Clogged oil screen.
- Defective pump.
- Defective oil pressure gauge.

Maximum 30 lbs.

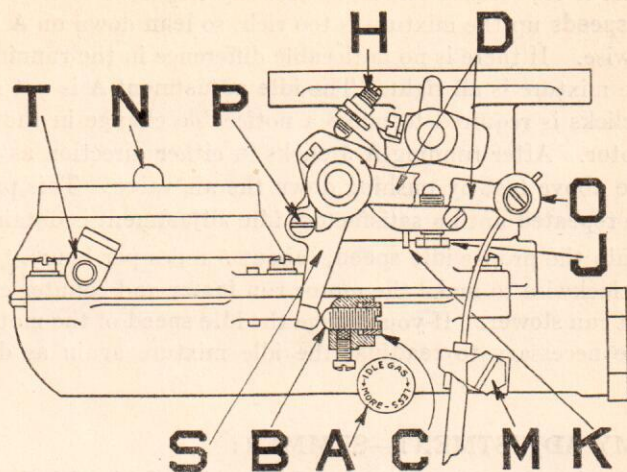
Minimum at idling speed 4 lbs.

When making this adjustment motor must be thoroughly warm.

1. Remove acorn nut "A".
2. Loosen lock nut "B".
3. Turn adjusting screw "C" until a maximum pressure is obtained with wide open throttle. (Caution: motor should be run momentarily at this speed.)
4. When maximum pressure has been obtained hold adjusting screw and tighten locking nut.
5. Replace acorn nut.



## ADJUSTMENT OF SCHEBLER MODEL "S" CARBURETOR FOR MODEL "A" CAR



### ADJUST CHOKER WIRE:

Choker wire should be set so that there is about  $1/32$ " play between the lug on the loose lever D and the screw P when the throttle is closed.

### STARTING AND WARMING UP:

Turn on ignition switch and step on starting switch button. Pull dash control to extreme position. After motor fires, immediately push dash control about half way back or to the position where the motor will operate satisfactorily. After motor warms up, move dash control back gradually. Do not use dash control any longer than is necessary.

**TO START A HOT MOTOR DO NOT USE DASH CONTROL AT ALL.** If trouble is had in starting a hot motor because it is loaded with gasoline, open the hand throttle all the way while cranking with starter until the motor fires, and then close off with the hand throttle just enough to keep the motor from racing until it is cleaned out and runs smoothly.

### IDLE ADJUSTMENT:

The motor should be thoroughly warmed up before adjusting the idle, then both the spark and throttle must be fully retarded.

To get an approximate idle adjustment turn A clockwise as far as it will go and then back off 10 to 15 clicks.



Turning the idle adjustment **A** to the right clockwise makes the mixture leaner. To the left anti-clockwise makes it richer.

Push air valve **N2** down slightly (about  $1/32''$ ). If the motor stalls the mixture is too lean, so **richen** up on **A** by turning counter clockwise. If motor speeds up the mixture is too rich, so **lean** down on **A** by turning clockwise. If there is no noticeable difference in the running of the motor the mixture is **all right**. The idle adjustment **A** is not sensitive about 5 clicks is required to make a noticeable change in the running of the motor. After running **A** 5 clicks in either direction as required repeat the above test by pushing down the air valve. This procedure should be repeated until a satisfactory idle adjustment is obtained.

To obtain the proper idle speed, (about 5 miles per hour), turn stop screw **H** clockwise to make the motor run faster and counter clockwise to make it run slower. If you change the idle speed of the motor much it may be necessary to readjust the idle mixture again as described above.

#### ECONOMY ADJUSTMENT—SUMMER:

The slotted end of the range screw **B** should be flush with the knurled bushing **C**. Idle **A** should be adjusted as described to suit.

#### ECONOMY ADJUSTMENT—WINTER:

The range screw **B** may be screwed in clockwise 3 to 5 turns depending on the temperature under which car is operated and whether the car is operated on short or long runs. This makes the mixture richer on part throttle or slow speed driving. Idle **A** should be adjusted to suit as described above and the idle speed should be reduced by unscrewing **H**.

#### POWER ADJUSTMENT:

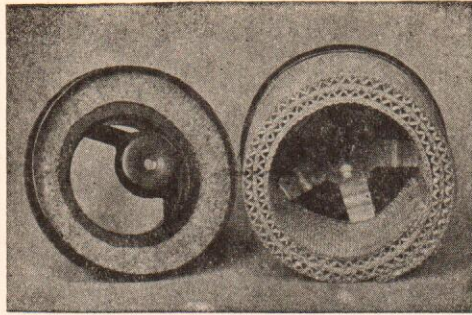
Extensive research indicates that the carburetor will give the best mixture for maximum power on the hills or at high speeds when the power screw **J** is flush with the pin **K**.

In high altitudes, however, more power may be obtained by **leaning** up on the power mixture—turning **J** to the left (counter clockwise) 3 to 5 turns.

#### GASOLINE:

High test gasoline may be used in the winter time to make starting easier. Its use in the summer time, however, will necessitate carburetor changes, as the carburetor is calibrated for and works satisfactorily on ordinary gasoline.

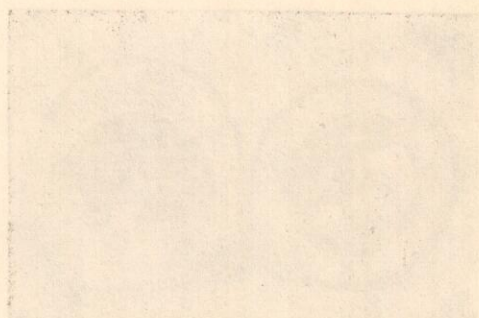




### AIR CLEANER

The air cleaner should be removed and cleaned each time the car comes in for its regular lubrication or every 500 miles. To do this operation proceed as follows:

1. Unscrew nut on top of filter.
2. Remove screen.
3. Clean screen by sloshing back and forth in gasoline.
4. Dip screen in a very light grade of oil.
5. Shake off surplus oil and reinstall.



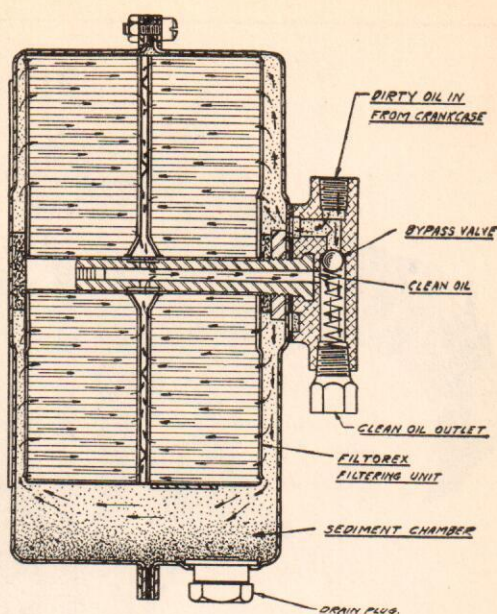
# AIR CLEANER

The air cleaner should be removed and cleaned only when the car is in the shop for a regular tune-up or every 10,000 miles. To do this, disconnect the air filter as follows:

1. Turn key on top of filter.
2. Remove screen.
3. Clean screen by dipping into and forth in gasoline.
4. Dip screen in a very light grade of oil.
5. Shake off surplus oil and reattach.



## HANDY OILFILTER

HOW TO CHANGE HANDY OILFILTER  
FILTERING UNIT

Remove oil line tubes from fitting on front of Oilfilter. Drain sediment deposited in settling chamber by removing drain plug in bottom of **FILTER**. Replace drain plug after **FILTOR** is entirely drained. Take out all screws around **OILFILTER** cover and remove **Filtorex** element from shaft in cover. Place new **Filtorex** element on shaft in cover and reassemble; replacing the screws in rim of cover. Tighten screws securely to prevent oil leaks. Attach oil lines to fitting on front of **OILFILTER**. Tighten oil line fittings securely to prevent leaks.

\* \* \*

Put two extra quarts of oil in crankcase after changing **Filtorex** unit. Two quarts of oil always remains in the **Filtor** and **Filtorex** unit.

## CARE OF HANDY OILFILTER

Drain out sediment deposited in settling chamber by removing drain plug after 2500 miles. Change **Filtorex** unit every 5000 miles and your motor oil will always remain clean and new.

## DISTRIBUTOR AND OIL PUMP DRIVING ASSEMBLY

The distributor and oil pump are both driven by a gear on cam shaft.

The driven gear is assembled on top of oil pump shaft body and has a drive key inserted in a slot in gear.

The oil pump shaft has a slot on top which inserts in bottom of drive key.

The distributor rotor shaft, has a slot in bottom which inserts in top of drive key.

If oil pump and gear is ever removed from engine the correct position can be located when re-installing by:

1. Turn engine over until No. 1 piston is on U. D. C. at the end of compression stroke, refer to instruction sheet on spark timing, page AA14.
2. Have drive key in driven gear in position parallel with crank shaft and place gear in mesh with driving gear on cam shaft. Refer to cut.

NOTE—Before starting motor check spark timing. Page AA14.



## TO SUSPEND OR REMOVE MOTOR

1. Remove hood.
2. Drain water from radiator by opening pet cock in bottom of radiator.
3. Disconnect radiator stay rods.
4. Loosen up hose connection.
5. Remove radiator.
6. Disconnect choker wire from carburetor.
7. Disconnect gas feed line from carburetor.
8. Disconnect vacuum line from intake manifold.
9. Disconnect oil lines at motor connections.
10. Remove high tension wire from coil.
11. Disconnect muffler pipe at exhaust manifold.
12. Disconnect low tension wire from distributor.
13. Disconnect spark control rods.
14. Disconnect throttle control rods.
15. Disconnect generator wire at relay.
16. Disconnect positive battery wire at starting motor, also removing constant current wire to ammeter.

NOTE—Insulate battery terminal to prevent wire shorting on frame.

17. Remove floor boards and lower toe board.
18. Remove (4) nuts, washers and bolts from rear of transmission and drop drive shaft.
19. Remove (3) motor bolts nuts.
20. Take weight of motor off motor bolts by suspending with special hooks. T-324 (2).
21. Remove (4) motor bolts.

NOTE—Left rear bolt screws into motor support.

22. Remove clutch pedal from clutch shaft.
23. Remove fan belt.
24. Remove hand starting ratchet nut that holds vibration damper.
25. Remove vibration dampener use Tool T-342.

### TO REMOVE MOTOR FROM CHASSIS

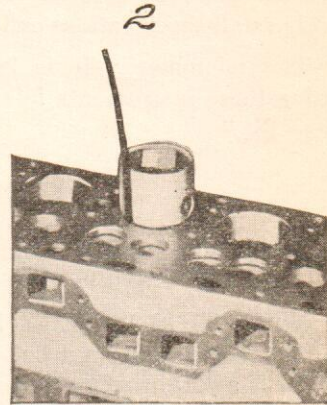
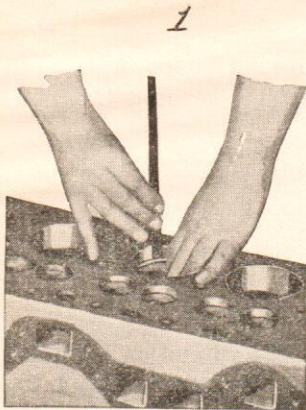
1. Remove floor boards and lower toe board.
2. Disconnect hand emergency brake at brake band.
3. Remove transmission cover.
4. Suspend motor, refer to instruction sheet on suspension of motor, page AA31, but do not remove fan belt or vibration damper.

When re-assembling motor in frame reverse operations.

**NOTE**—Check hand emergency brake on transmission, refer to instruction sheet on this adjustment, page AB14.



## TO FIT PISTONS



CORRECT METHOD



INCORRECT METHOD

See instructions on reverse side of sheet.

## PISTON FITTING

Two different size feeler gauges must be used. See chart below for the different models. It is important that these gauges be 5/16" wide as all specifications call for this width.

The micrometer fit is larger than the recommended feeler. In using these instruments follow the chart under the heading "Micrometer Fit."

## INSTRUCTIONS

1. Hold feeler in right hand between the thumb and two fingers in a vertical position (See Cut #1).

## NOTE—THIS IS VERY IMPORTANT.

The feeler should not be held as shown in Cut #3 and #4 for if the feeler is held in this position the fingers will not slip when piston is too tight.

2. Hold piston in left hand and with feeler already in cylinder insert piston until its entire length is about 1" below the top of cylinder block (See Cut #1).
3. Try pistons until one is found that the smaller feeler may be removed without the thumb and fingers slipping, and using the larger feeler the thumb and fingers will slip. The piston then is of the proper size.

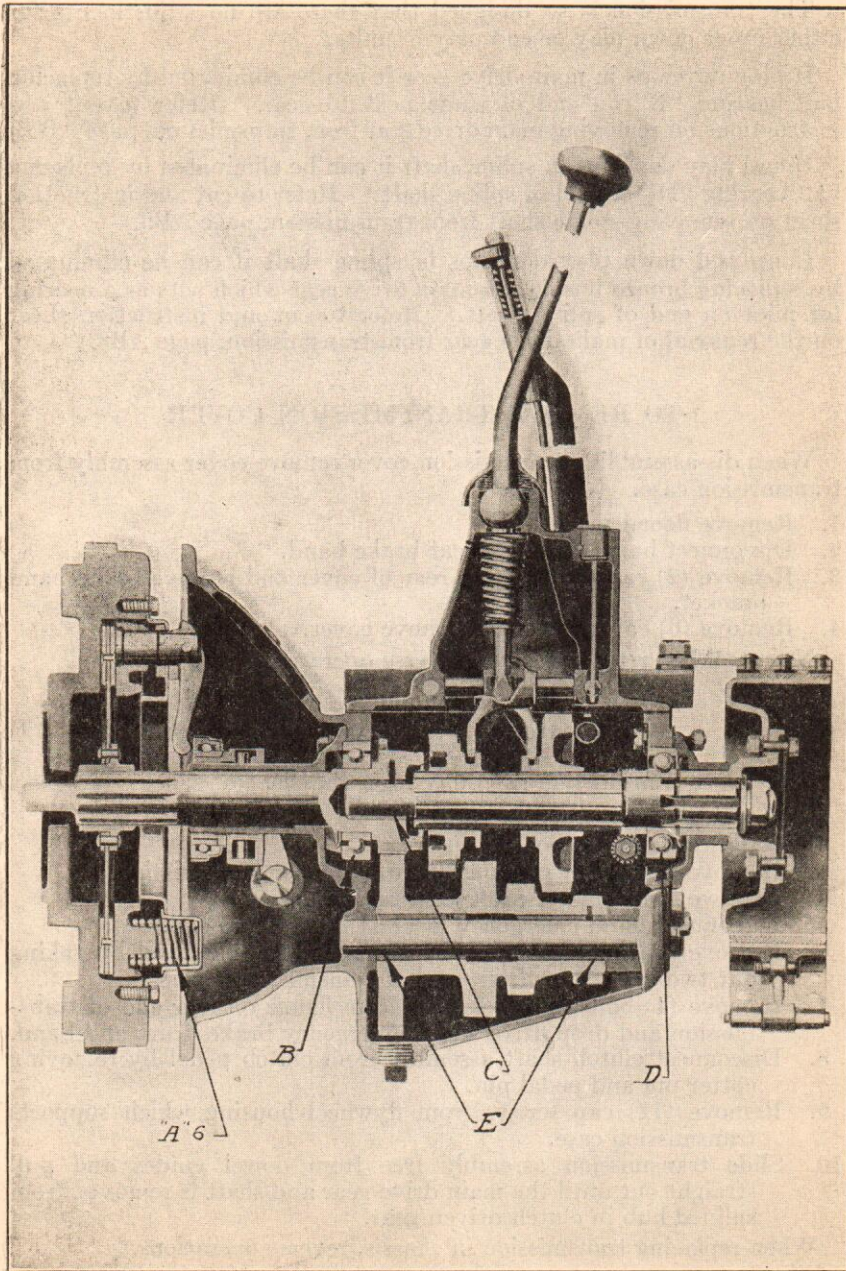
T473. Feeler gauge for checking pistons includes all sizes listed below, 5/16" wide and 9" long.

	Rated Micrometer Clearance	Rated 5/16" Feeler Stock
T6 Models.....	.006—.007	.0055 & .0065
F & G Models—FA Engine.....	.007—.008	.0065 & .0075
F & G Models—CF Engine before #6471.....	.0065—.0073	.006 & .007
*F & G Models—CF Engine after #6471.....	.0041—.0049	.004 Snug
B Models—15E Engine.....	.0025—.0033	.002 & .003
B & B 2 Models—16E Engine.....	.0025—.0033	.002 & .003
A Models—A Engine.....	.0065—.0073	.006 & .007
C Models—CA Engine before #20318..	.0065—.0073	.006 & .007
*C Models—CA Engine after #20318..	.0041—.0049	.004 Snug

\*Note clearance changes on CF and CA Engines above. Any pistons that bear a triangle mark just under the piston pin boss next to the lower edge of skirt on one side, also are of dark grey color, should be fitted with the new clearance.



CLUTCH AND TRANSMISSION



See instructions on succeeding pages.



## TRANSMISSION ADJUSTMENTS

The transmission is so designed that there are no adjustments for either up or down play or end play in units.

If play develops in main drive gear it can be eliminated by replacing ball bearing "B" on end of shaft next to gear. (Refer to cut and instructions on removing main drive gear from transmission, page AB3.)

If end play develops in spline shaft it can be eliminated by replacing ball bearing "D" on end of spline shaft. (Refer to cut and instruction sheet on removing spline shaft from transmission, page AB3.)

If up and down play develops in spline shaft it can be eliminated by replacing bronze bushing in main drive gear which acts as a bearing for pilot on end of spline shaft. (Refer to cut and instruction sheet on the removal of main drive gear from transmission, page AB3.)

## TO REMOVE TRANSMISSION COVER

When dis-assembling transmission cover remove cover assembly from transmission case.

1. Remove floor board.
2. Disconnect hand brake lever at brake band.
3. Remove (2) cap screws from rear of cover and remove brake band bracket.
4. Remove (6) cap screws and remove cover.

NOTE—When replacing cover reverse operations.

## REMOVE TRANSMISSION

To remove transmission assembly from chassis.

1. Remove floor boards.
2. Remove lower toe board.
3. Remove tie bar for running board. (Under transmission.)
4. Remove speedometer cable at transmission.
5. Disconnect hand emergency lever at brake hand end.
6. Remove bracket that supports emergency brake band by taking out two cap screws from rear of transmission cover.
7. Remove (4) bolts and lock nuts from flange on rear end of transmission and drop drive shaft, emergency brake drum and band.
8. Disconnect clutch shaft assembly from clutch pedal by removing cotter pin and pedal pin.
9. Remove (12) cap screws from flywheel housing which supports transmission case.
10. Slide transmission assembly free from dowel guides and pull straight out until the main drive gear and shaft is removed from splined hub in clutch driven gear.

When replacing transmission in chassis, reverse operations.

CARE should be exercised in removing the transmission that the transmission drive gear is free of the pilot bushing in the end of crank shaft.



### TO REMOVE MAIN DRIVE GEAR

1. Remove transmission from chassis, refer to instruction sheet on removal of transmission, page AB2.
2. Remove transmission cover.
3. Remove spring from clutch release bearing.
4. Remove (4) bolts, nuts and flat washers. (Inside of case.)
5. Remove front bearing cap.
6. Remove gear from case by tapping lightly with hammer and brass punch.

### TO REMOVE BALL BEARING FROM DRIVE GEAR

1. Remove spring ring from oil slinger.
2. Remove oil slinger.
3. Remove ball bearing from spline on gear shaft.
4. Replace with new ball bearing and reverse operations when re-assembling.

### TO REMOVE SPLINE SHAFT

The spline shaft can be removed from transmission without removing transmission from chassis.

1. Remove floor boards.
2. Remove speedometer cable at transmission.
3. Remove speedometer driven gear from transmission case.
4. Disconnect hand emergency brake from brake band.
5. Remove bracket that supports emergency brake band by taking out two cap screws in transmission cover.
6. Remove transmission cover assembly.
7. Remove (4) bolts and lock nuts from flange on rear of transmission and drop drive shaft emergency brake drum and brake band.
8. Remove nut, lock washer and flat washer from end of spline shaft.
9. Remove flange from spline.
10. Remove (4) bolts and lock nuts and bearing retaining washers from bearing cap.

CAUTION: Care should be taken not to allow bolts or retaining washers to drop in transmission case.

11. Remove bearing cap.
12. Tap ball bearing (on end of spline shaft) lightly with brass punch and hammer and remove shaft from transmission.

When replacing spline shaft reverse operations.

NOTE—After installation of spline shaft recheck hand emergency brake adjustment, refer to instruction sheet on this adjustment, page AB14.

# TO REMOVE TRANSMISSION FROM ENGINE

1. Remove the engine from the vehicle and place it on a stand.
2. Remove the engine from the vehicle and place it on a stand.
3. Remove the engine from the vehicle and place it on a stand.
4. Remove the engine from the vehicle and place it on a stand.
5. Remove the engine from the vehicle and place it on a stand.

# TO REMOVE TRANSMISSION FROM ENGINE

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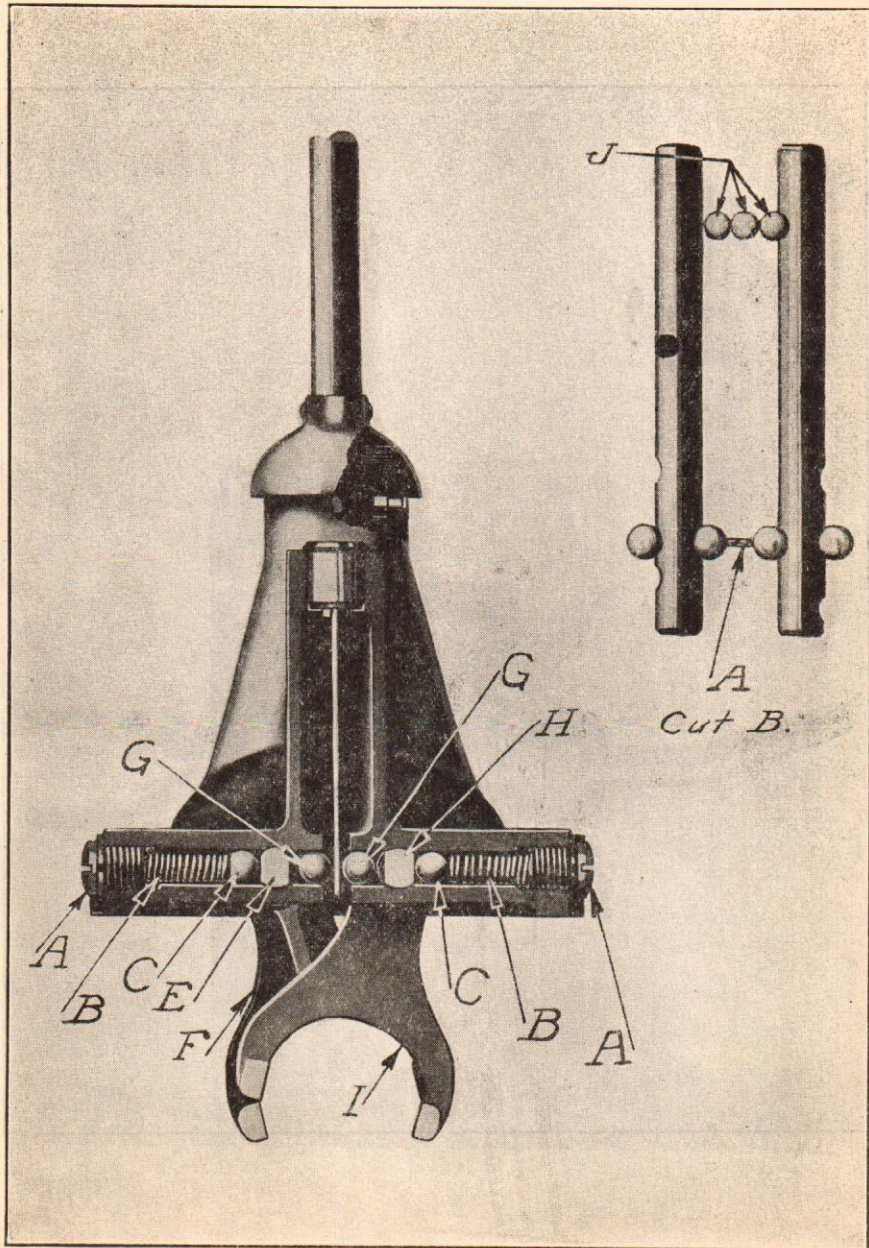
# TO REMOVE TRANSMISSION FROM ENGINE

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2. Remove the engine from the vehicle and place it on a stand.
3. Remove the engine from the vehicle and place it on a stand.
4. Remove the engine from the vehicle and place it on a stand.
5. Remove the engine from the vehicle and place it on a stand.

After the engine has been removed from the vehicle, the transmission can be removed. The engine should be placed on a stand and the transmission should be removed from the engine. The engine should be placed on a stand and the transmission should be removed from the engine. The engine should be placed on a stand and the transmission should be removed from the engine.

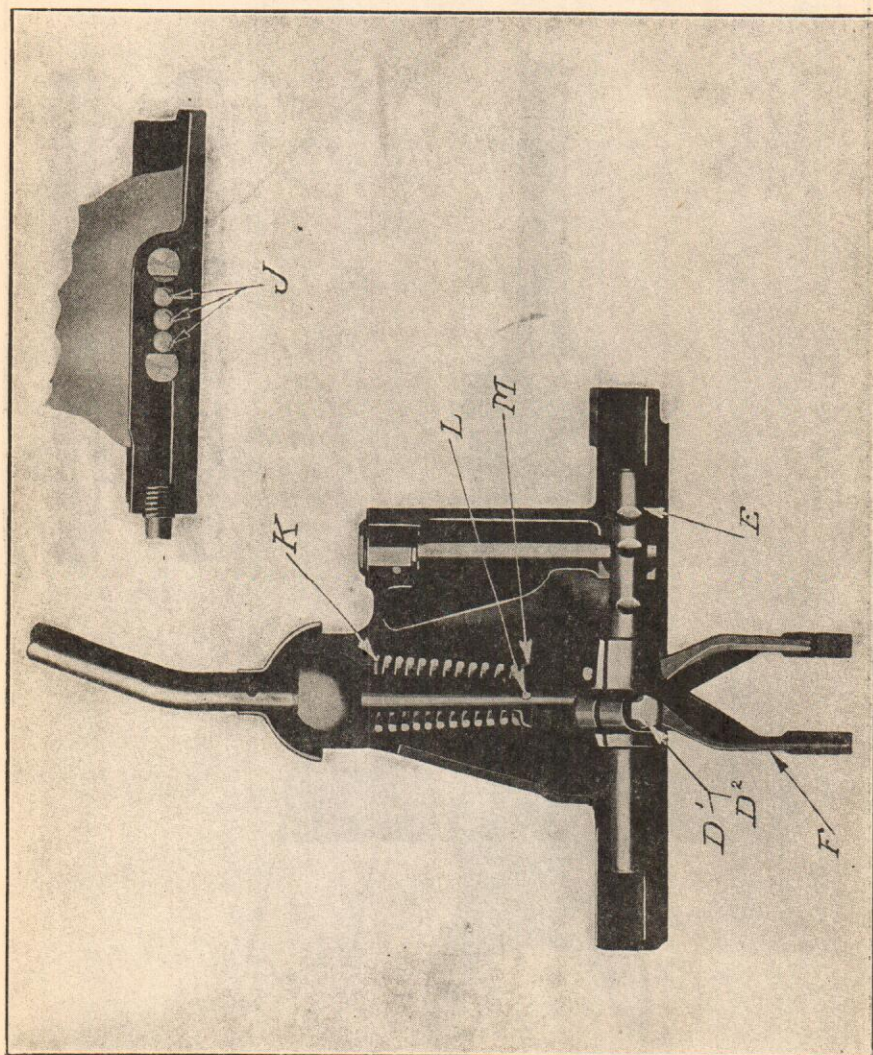


## TRANSMISSION COVER ASSEMBLY





TRANSMISSION COVER ASSEMBLY





## DIS-ASSEMBLING TRANSMISSION COVER

CAUTION: Care must be taken when dis-assembling cover that the (4) inner and outer hardened steel locking balls in rear of cover and the (3) inner locking balls in front of cover do not fall out and become lost.

1. Remove (2) finder screws "A" as in cut, from rear of cover.
2. Remove (2) finder springs "B".
3. Remove (2) 7/16" outer locking balls "C".
4. Remove cap screw "D".
5. Remove shifting rod "E" (high and intermediate) and shifting fork "F".
6. Remove (2) 7/16" inner locking balls "G".
7. Remove cap screw "D".
8. Remove shifting rod "H" (low and reverse) and shifting fork "I".
9. Remove (3) 3/8" locking balls "J" in front end of cover.
10. Compress spring "K" and remove pin "L" and spring seat "M", remove spring and shifting lever from cover.

CAUTION: When re-assembling cover care should be taken in placing the locking balls in their proper position. The (4) locking balls in rear of cover are 7/16" and should be placed in position shown in cut. The (3) front locking balls are 3/8" and should be placed in slot after one of the shifting rods and forks are assembled.

NOTE—Care should be taken when replacing shifting forks that they are put in proper place. The support end of fork (which is locked in place on rod) on high and intermediate rod is 3/8" longer than the one on the low and reverse shifting rod.

## CLUTCH

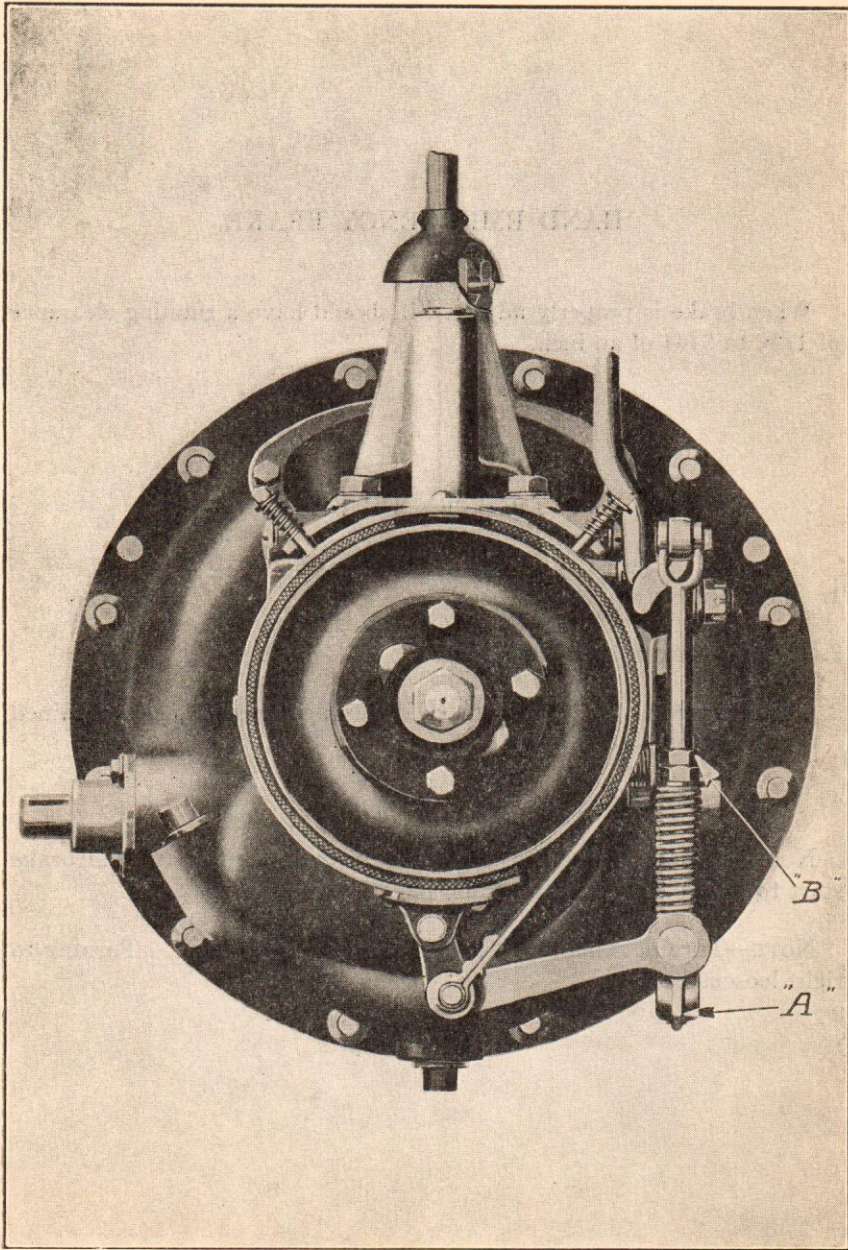
To take up on clutch pedal:

1. Turn wing nut "A" (as in cut) until clearance between pedal and rubber bumper on toe board is  $1\frac{1}{4}$  to  $1\frac{1}{2}$  an inch. (Approx.)

NOTE—No method of clutch adjustment is required as the pressure springs "A" automatically compensate for all wear of the friction facings. The total spring pressure is approximately 1400 pounds and this is more than sufficient to prevent clutch slippage.



HAND BRAKE ADJUSTMENT



See instructions reverse side of sheet.



## HAND EMERGENCY BRAKE

When brake is properly adjusted it should have a running clearance of  $1/32$  to  $3/64$  of an inch.

### TO TIGHTEN UP BRAKE

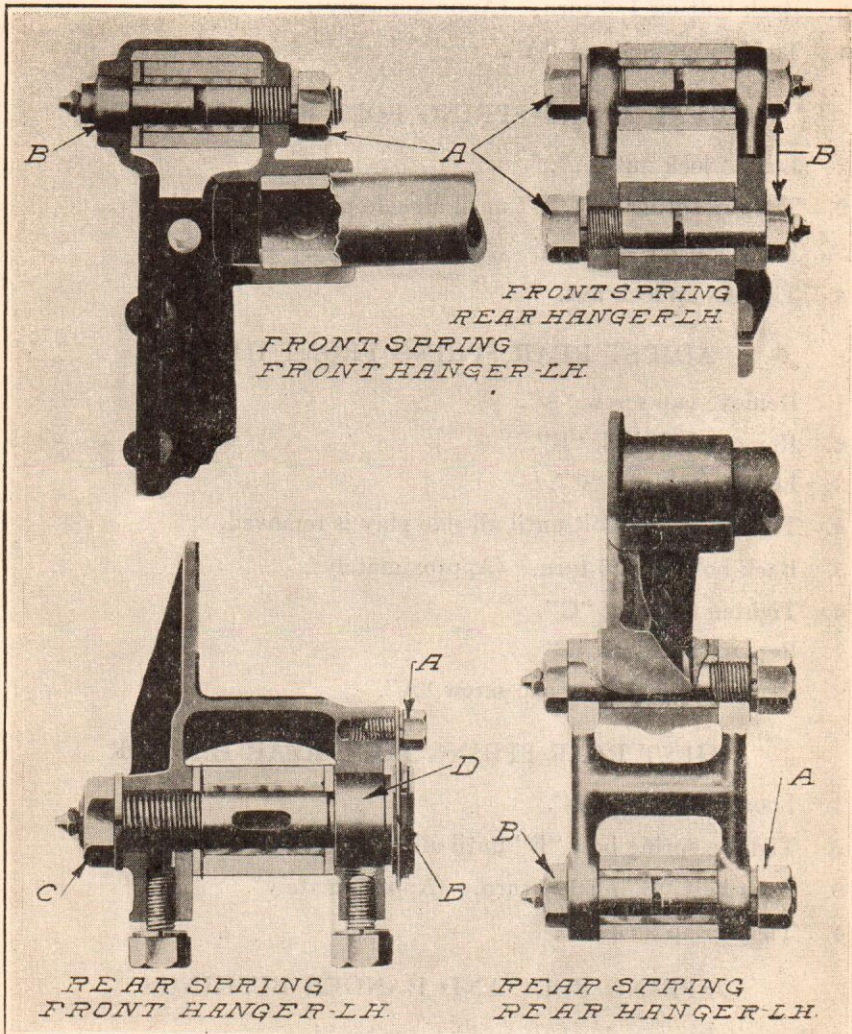
1. Jack up rear wheels.
2. Loosen lock nut "B" as in cut.
3. Turn wing nut "A" as in cut to left until proper clearance is obtained using tool T-346.
4. Tighten down lock nut "B".

NOTE—A practical setting on this adjustment is to have the brake start to drag past second notch on hand lever ratchet.

NOTE—Turning wing nut "A" to left tightens up band. Turning to right loosens band.



# ADJUST SPRING BOLTS AND HANGERS



See instructions reverse side of sheet.



**ADJUST FRONT SPRING BOLT FRONT HANGER**

1. Loosen lock nut "A".
2. Tighten spring bolt "B" until all side play is removed.
3. Back bolt off 1/6 turn. (Approximately).
4. Tighten up lock nut "A".

**ADJUST FRONT SPRING BOLT REAR HANGER**

1. Loosen lock nut "A".
2. Tighten spring bolt "B" until all side play is removed.
3. Back bolt off 1/6 turn. (Approximately).
4. Tighten up lock nut.

**ADJUST REAR SPRING FRONT HANGER**

1. Remove cap screw "A".
2. Remove bolt lock "B".
3. Loosen lock nut "C".
4. Tighten spring bolt until all side play is removed.
5. Back bolt off 1/6 turn. (Approximately).
6. Tighten lock nut "C".
7. Replace bolt lock "B".
8. Replace and tighten cap screw "A".

**ADJUST REAR SPRING BOLT REAR HANGER**

1. Loosen lock nut "A".
2. Tighten spring bolt "B" until all side play is removed.
3. Back bolt "B" off 1/6 turn. (Approximately).
4. Tighten up lock nut.

**SPRING BOLT AND HANGER BUSHINGS**

Remove front spring bolt and hanger bushing.

Install new front spring and hanger bushing.

Remove front bushing of rear spring.

Install new front bushing of rear spring.

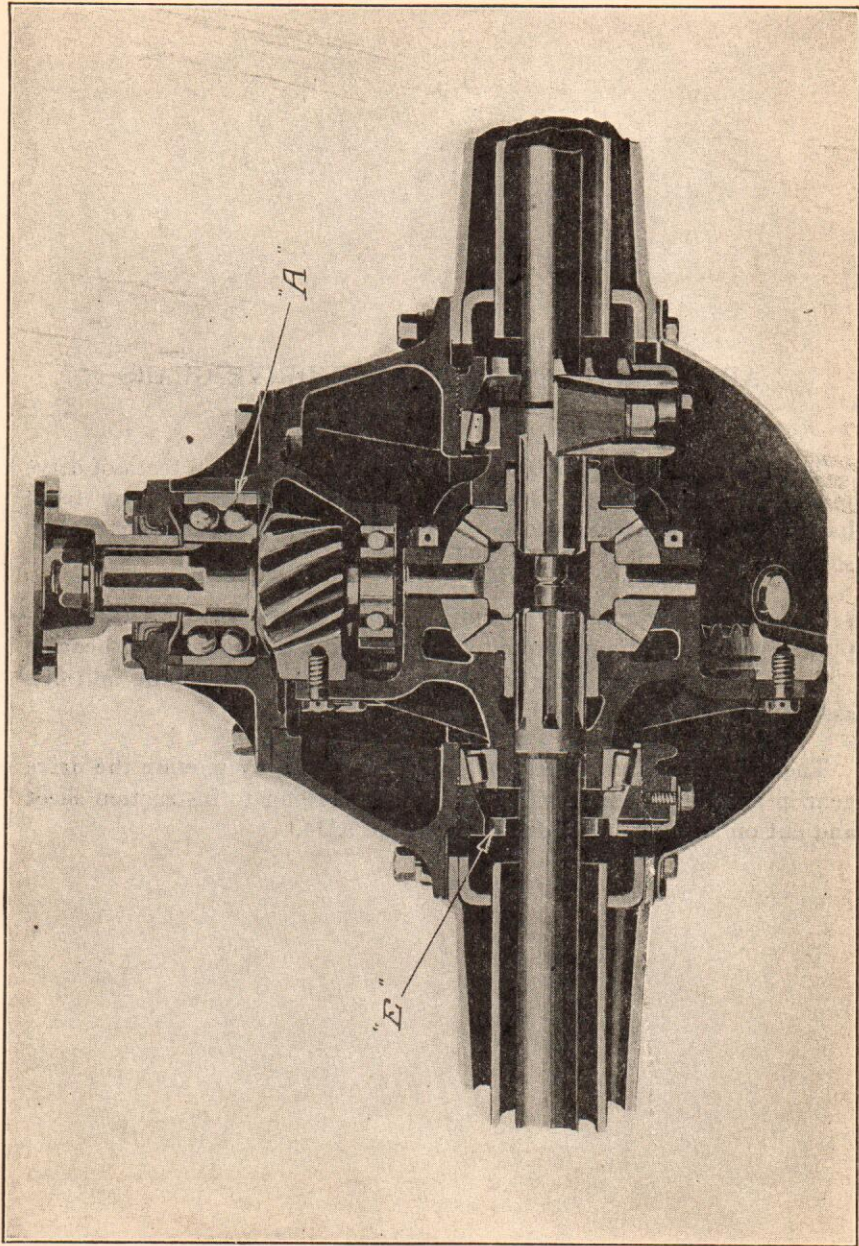
Remove rear spring bolt and hanger bushings.

Install new rear spring and hanger bushing.

Use tool T-320 bushing press with adapters.



REAR AXLE ADJUSTMENT



See instructions reverse side of sheet.



### ADJUSTMENT OF REAR AXLE DRIVE GEARS

There is an allowance of .003 to .010 back lash between teeth of drive pinion and drive gear. Quietness of gears is determined by teeth having proper contact. Refer to Gleason Gear Company instruction sheets, pages D5 to D10, inclusive.

Do not for any reason attempt to adjust drive pinion. If any end play develops it can be eliminated by replacing the double ball bearing "A" as shown in cut, refer to instruction sheet on removing and disassembling pinion, page AD3.

The only means provided for an adjustment is by moving the drive gear in and out of mesh with drive pinion. Refer to instruction sheet and cut on adjustment of drive gear, page AD4.



## TO REMOVE PINION ASSEMBLY AND DIS-ASSEMBLE PINION

1. Remove (4) bolts, nuts and lock washers from drive shaft and flange on pinion and drop drive shaft.
2. Remove (8) cap screws from axle housing and remove pinion support and pinion assembly.
3. Remove nut lock washer and flat washer holding spline flange to pinion shaft.
4. Remove flange from pinion, using tool T-305.
5. Remove (4) cap screws from pinion support and remove bearing retainer assembly.

NOTE—The leather oil seal and spring washer is assembled in bearing retainer and the retaining washer is peened over on top to hold assembly (at 4 points).

6. Remove pinion (with front and rear bearings) from pinion support.
7. Remove top shim (oil slinger).
8. Remove front double ball bearing from pinion shaft.
9. Remove bottom ball bearing from pinion shaft.

NOTE—The end of pinion shaft is annealed allowing it to be peened over (at 4 points) on inner race of ball bearing.

10. Remove bottom shim—oil slinger.

NOTE—When re-assembling pinion reverse operations.

## TO ADJUST REAR AXLE DRIVE GEAR

If any excessive back lash develops between drive gear and pinion gear it can be eliminated by adjustment of drive gear.

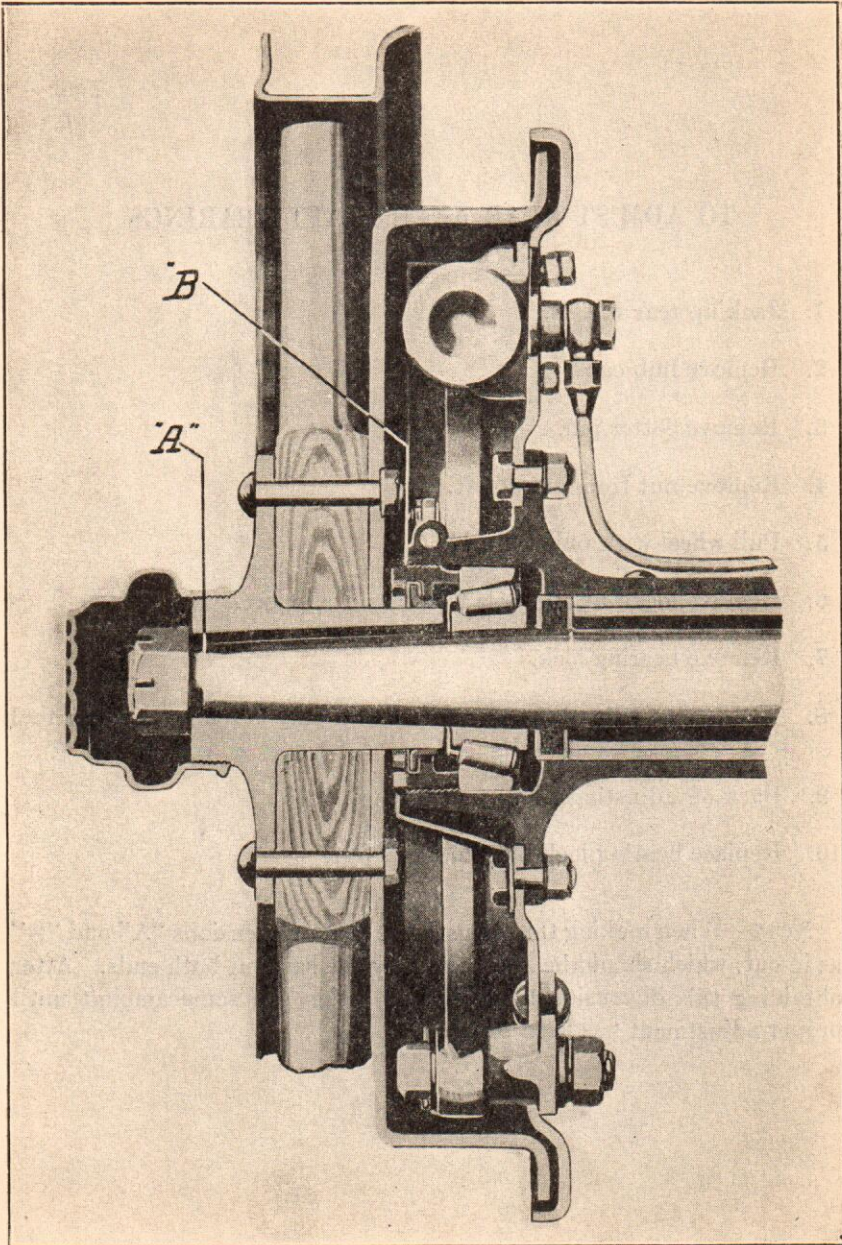
1. Jack up rear wheels.
2. Remove cap screws from axle housing cover.
3. Remove axle housing cover.
4. Remove lock screw and retaining lock from adjusting caps.
5. Loosen differential support caps.
6. Turn right hand adjusting cap to the left, using tool T-310.  
(Away from differential gear case.)
7. Turn left hand adjusting cap to right, using tool T-310.  
(Toward differential gear case.)
8. Tighten differential support caps.
9. Try out axle for noise and repeat above operations until quietness is obtained.

NOTE—These adjustments should be made by having wheels on a jack off the floor and running the car in high gear at various speeds before taking out for road test.

10. Replace retaining lock and lock screw on adjusting caps.
11. Replace new gasket on axle housing cover if necessary and replace cover with oil filler plug in proper position.
12. Replace cap screws on cover.



## TO ADJUSTING REAR AXLE SHAFT BEARING



See instructions reverse side of sheet.



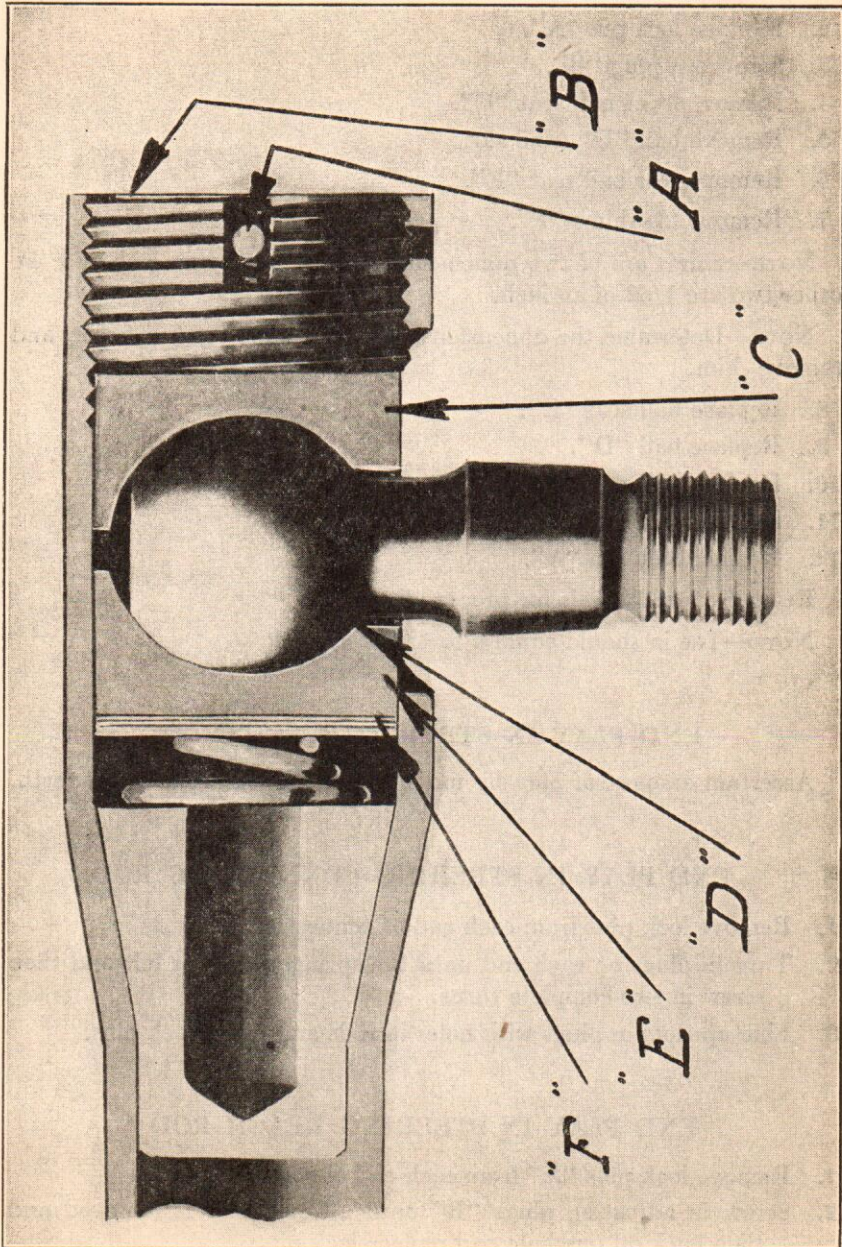
## TO ADJUST REAR AXLE SHAFT BEARINGS

1. Jack up rear wheels.
2. Remove hub caps.
3. Remove cotter pin.
4. Remove nut from axle shaft.
5. Pull wheel with puller T-322.
6. Remove lock nut and bolt from brake support.
7. Remove bearing lock.
8. Tighten up adjusting cap until all end play is removed, using tool T-309.
9. Back off adjusting collar two notches.
10. Replace bearing lock bolt and lock nut.

NOTE—When making this adjustment check dimensions “A” and “B” as in cut, which should be approximately the same at both ends. After obtaining this dimension turn each adjusting cap same amount until proper adjustment has been secured.



## HOW TO ADJUST REACH ROD



See instructions on reverse side of sheet.



**TO ADJUST REACH ROD FOR TOE IN OF FRONT WHEELS**

1. Jack up front wheels.
2. Remove lock pin "A".
3. Screw out plug "B".
4. Remove front ball seat "C".
5. Remove ball "D" from slot.
6. Remove rear ball seat "E".
7. Remove (3) shims "F".

NOTE—Shims are of two dimensions: one is  $\frac{1}{16}$  of an inch and the other two are  $\frac{1}{32}$  of an inch.

NOTE—Determine the dimension needed to make toe in correct, and remove shim.

8. Replace ball seat "E".
9. Replace ball "D".
10. Replace ball seat "C".
11. Screw in plug "B".
12. Replace lock pin "A".

Re-check front wheels for proper alignment.

NOTE—Toe in should equal 0 to  $\frac{1}{8}$  of an inch.

**END PLAY IN STEERING MECHANISM**

Ascertain amount of play by moving steering wheel back and forth.

**END PLAY IN STEERING CONNECTING ROD**

1. Remove lock pins from each end of connecting rod.
2. Turn in plugs on each end until the spring tension is felt and then screw in two complete turns.
3. Line up slots in plugs with holes in rods and insert lock pins.

**END PLAY IN STEERING REACH ROD**

1. Remove lock pins "A" from each end of rod.
2. Screw in adjusting plugs "B" until all end play is removed and then back off one hole and replace lock pin.

NOTE—After making above adjustment, check front wheel alignment.



### TO ADJUST FRONT WHEEL BEARINGS

1. Jack up front wheels.
2. Remove hub cap.
3. Remove cotter pin.
4. Draw up adjusting nut until all play is eliminated.

NOTE—Spin wheel to see if it has proper running clearance. If it is too tight, back off on nut until wheel turns freely.

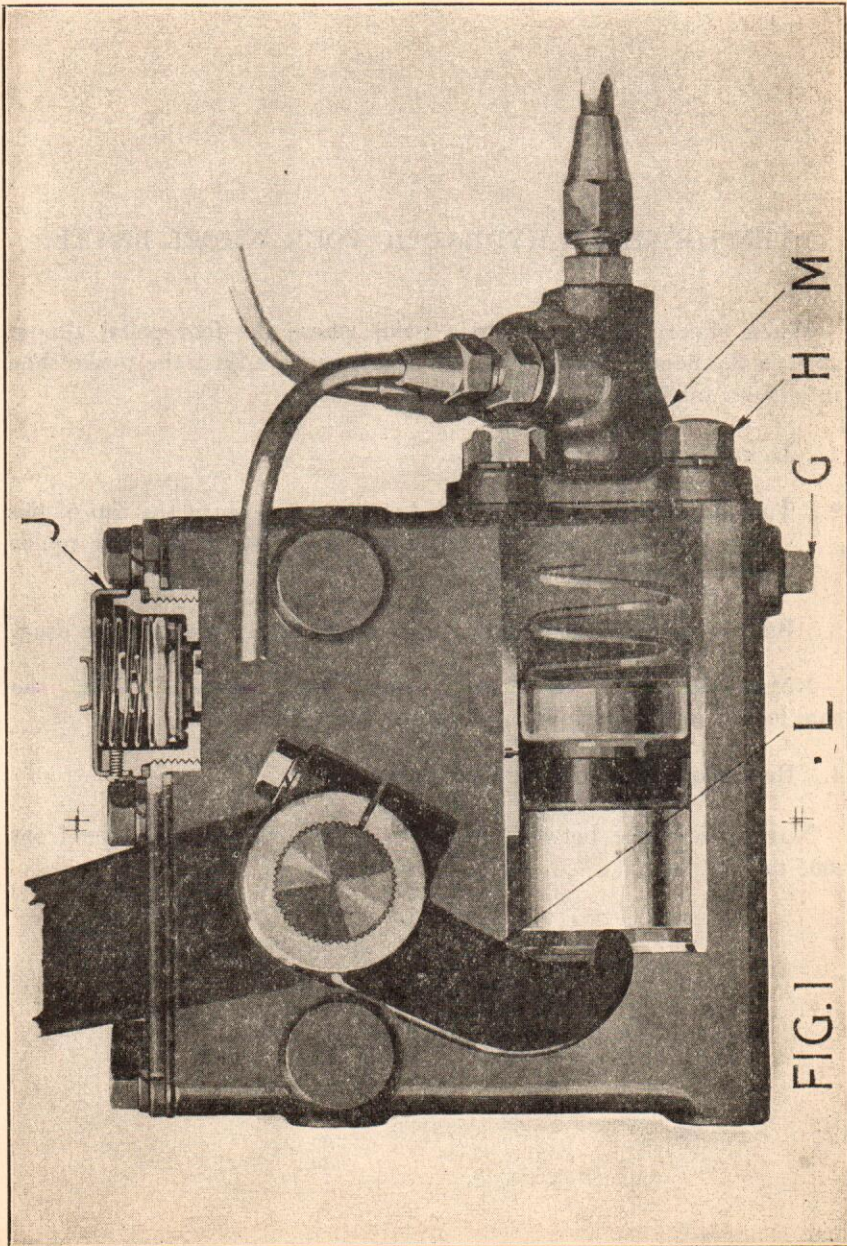
NOTE—The nut on right hand wheel has right hand thread and the nut on left hand wheel has a left hand thread.

# TO ADJUST FRONT WHEEL BEARINGS

1. Jack up front wheels.
  2. Remove hub cap.
  3. Remove cotter pin.
  4. Draw up adjusting nut until all play is eliminated.
- Note—Spin wheel to see if it has proper running clearance. If it is too tight, back off on nut until wheel turns freely.
- Note—If nut on right hand wheel has right hand thread and the nut on left hand wheel has a left hand thread.



HYDRAULIC FOUR-WHEEL BRAKES





## HYDRAULIC FOUR-WHEEL BRAKES

## THE LOCKHEED HYDRAULIC FOUR WHEEL BRAKE

When brake lining wears to a point where the foot pedal almost goes to the floor board, it becomes necessary to adjust the brake shoe into closer relation to the brake drum.

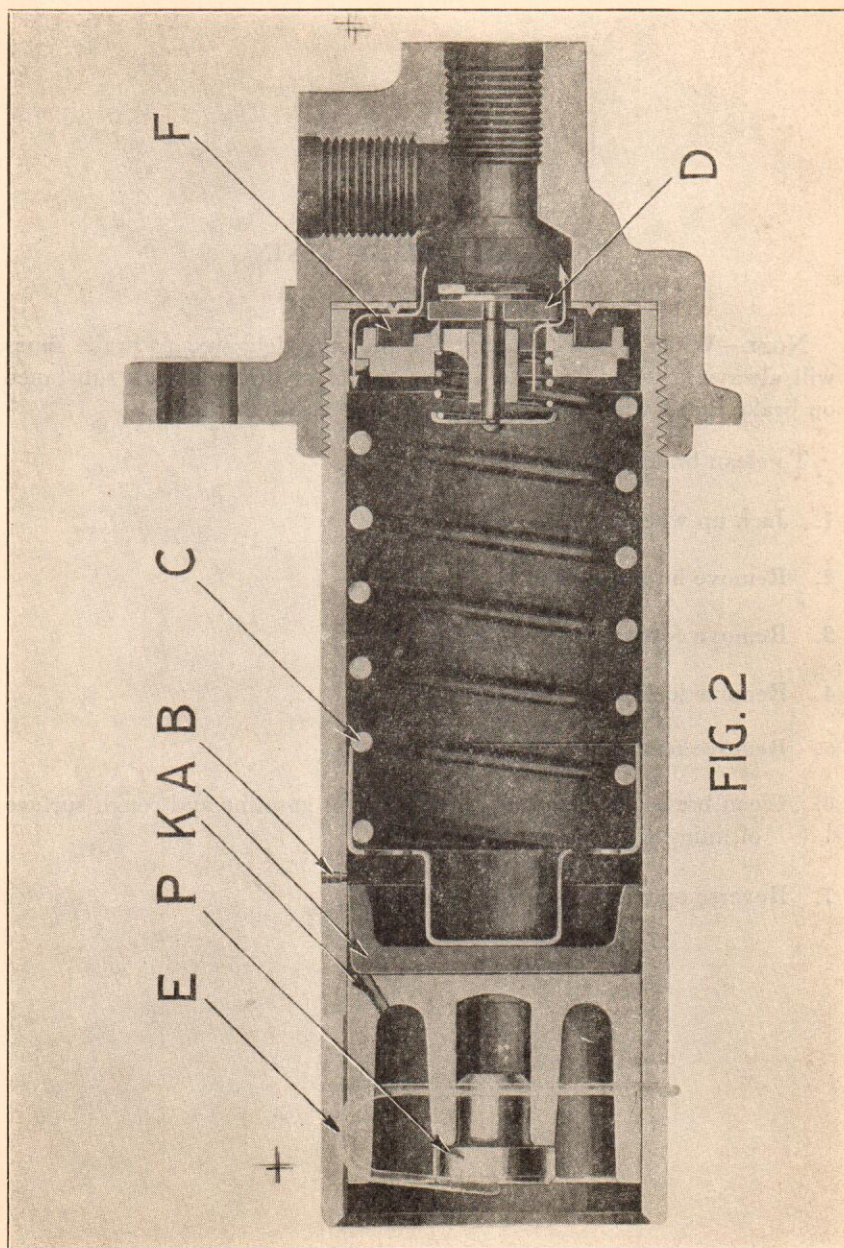
1. Jack up front and rear wheels.
2. Turn adjustment nut "C" (fig. 4) as in cut, toward the rim of the wheel (rotating wheel at the same time) until brake shoe comes into contact with the drum.
3. Back off adjusting nut until wheel rotates freely without any drag.

NOTE—The tension on friction spring "D" automatically keeps the cam locked in any position. (Shown in fig. 3.)

4. Repeat operations on all eight brake shoes.

NOTE—Clearance between brake band and drum should be from .005 to .010.





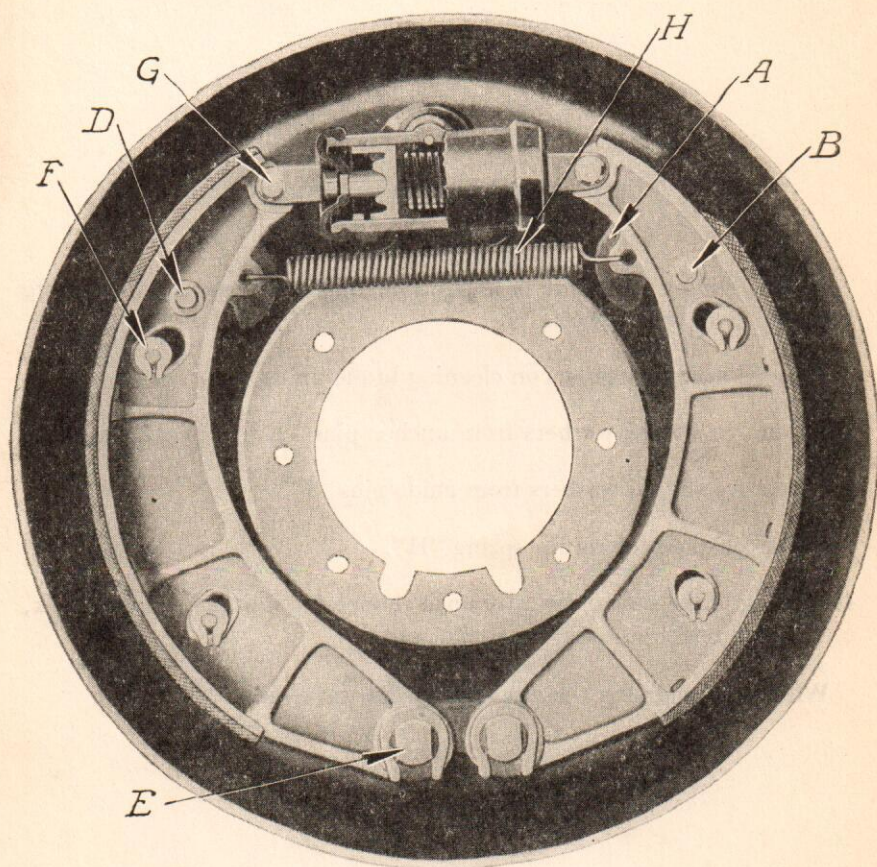
## TO CLEAN BRAKE LINING

NOTE—While it is a fact that the pressure delivered to brake shoes will always be equal, yet paint, grease, oil or other foreign substance on brake lining will cause the brakes to be unequal.

To clean brake lining.

1. Jack up wheels.
2. Remove hub cap.
3. Remove cotter pin from lock nut.
4. Remove lock nut.
5. Remove rear wheels using puller T-379.
6. Clean brake parts and brake lining with gasoline and rough surface of lining with file or wire brush.
7. Reverse operations when re-assembling.





### TO REMOVE BRAKE SHOES

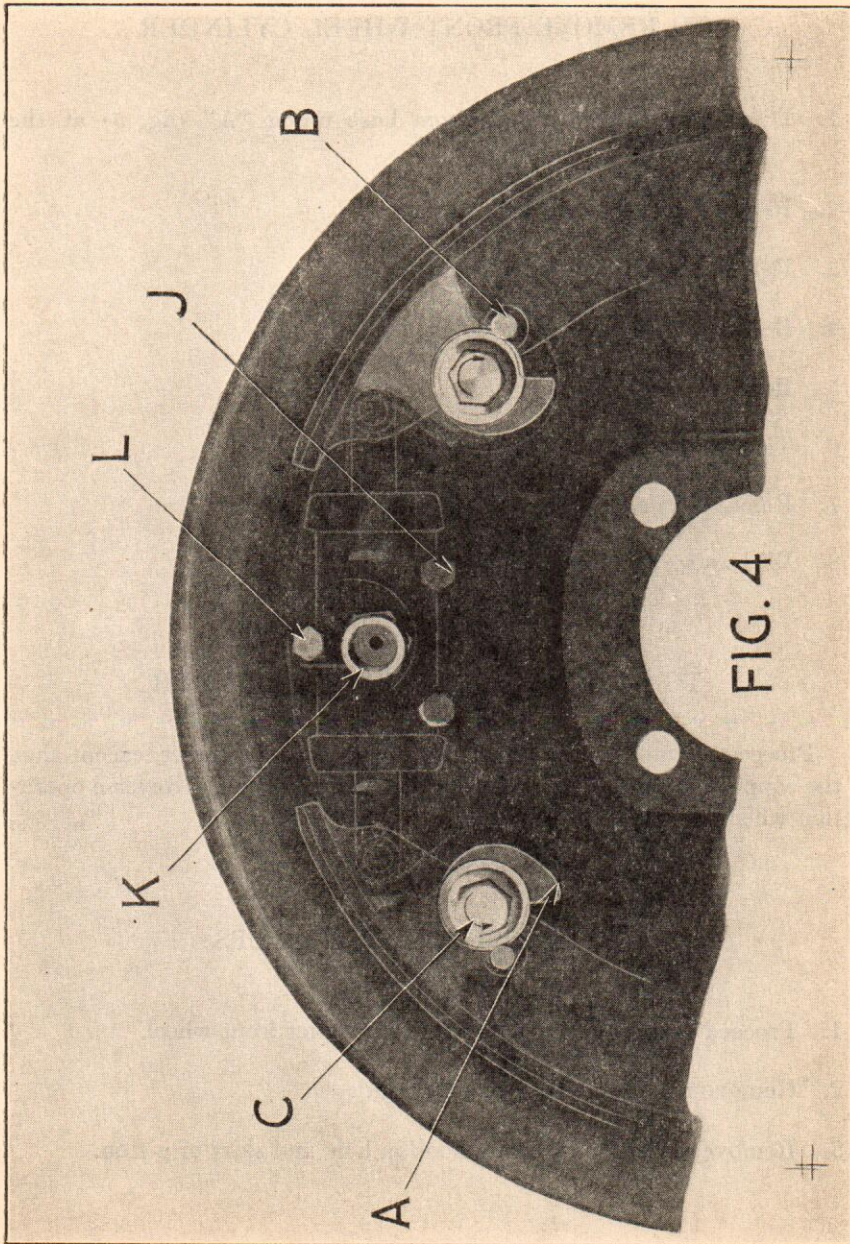
When relining brakes it is imperative that the same kind of lining be used on all four wheels.

Proceed as in operations on cleaning brake lining.

1. Remove slotted washers from anchor pins "E" as in cut. Fig. 3.
2. Remove slotted washers from guide pins "F".
3. Unhook the shoe return spring "H".
4. Swing brake shoe outwardly until connecting link is free from hook, then remove shoe from anchor pin.

When re-assembling these operations are reversed.







### TO REMOVE FRONT WHEEL CYLINDER

1. Disconnect copper tubing from hose union "A" (fig. 5) at the frame.
2. Remove nut "B" and lock washer.
3. Remove hose union from bracket.
4. Remove cotter pins from clevis pins.
5. Remove clevis pins.
6. Tip clevis down until clear of shoe.
7. Remove (2) cap screws "J" (fig. 4).
8. Withdraw cylinder and hose.

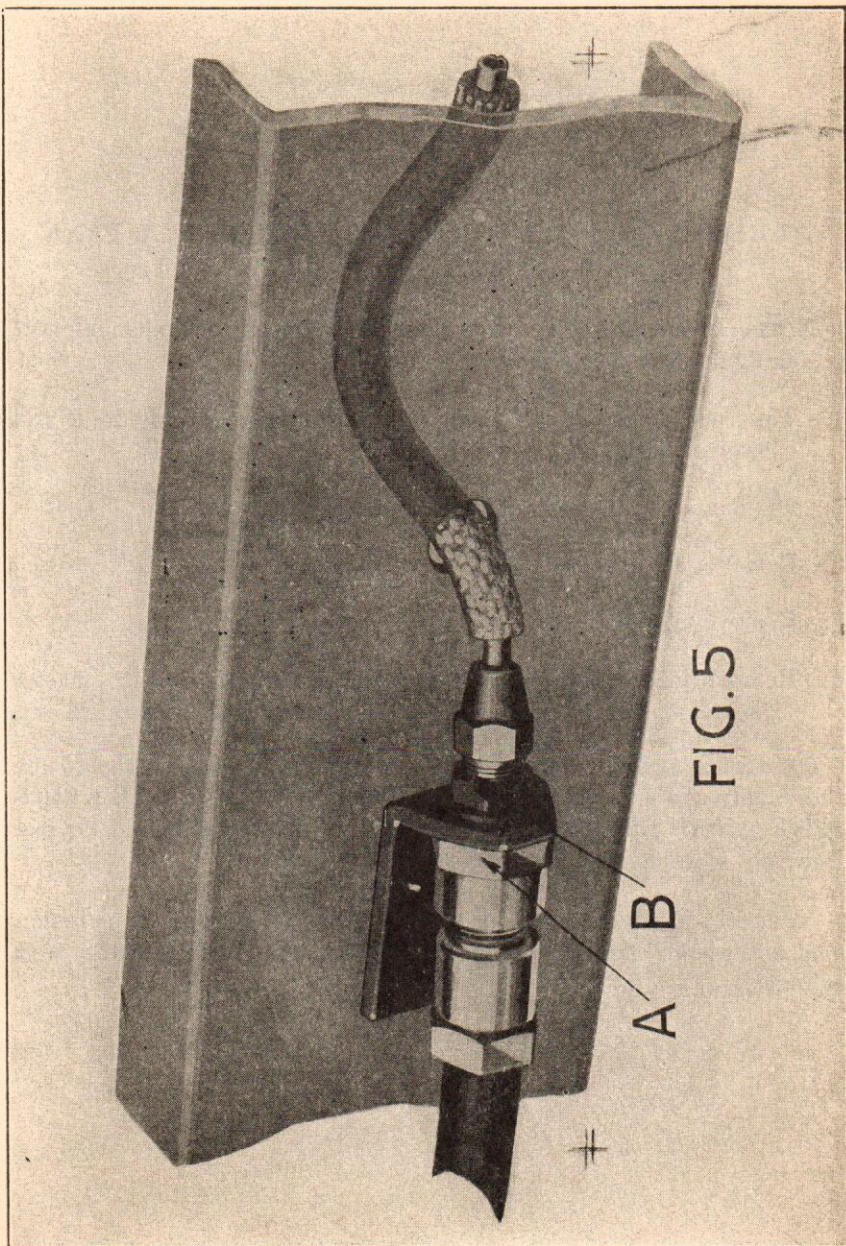
### TO REMOVE REAR WHEEL CYLINDER

Proceed as in operations to remove front wheel cylinder, except that the copper tubing is disconnected at the cylinder inlet. Reverse operation when reassembling.

### TO REMOVE CYLINDER CUPS

1. Proceed as in operations to remove cylinder front wheel.
2. Remove rubber boots from either end.
3. Remove piston by inserting hook in hole and skirt of piston.







### TO REMOVE MASTER CYLINDER FROM SUPPLY TANK

NOTE—It should not be necessary to remove any cylinder unless it is leaking fluid by the rubber cups.

1. Take out draw plug "G" (fig. 1) in bottom of supply tank and draw off fluid.
2. Disconnect (3) copper tubes in rear of supply tank.
3. Remove (4) cap screws "H".
4. Remove cylinder.
5. Remove lock wire from end of cylinder which allows the master piston cup, return spring and combination valve to be taken out.

CAUTION: Before re-assembling a cylinder the bore should be thoroughly cleaned and washed with alcohol. (DO NOT USE KEROSENE (COAL OIL) GASOLINE, ETC.). The bore should be free from any score marks, rust, corrosion or pits.

NOTE—It is advisable to use new cups when servicing a cylinder. Cup and piston should be dipped in brake fluid before inserting in a cylinder.



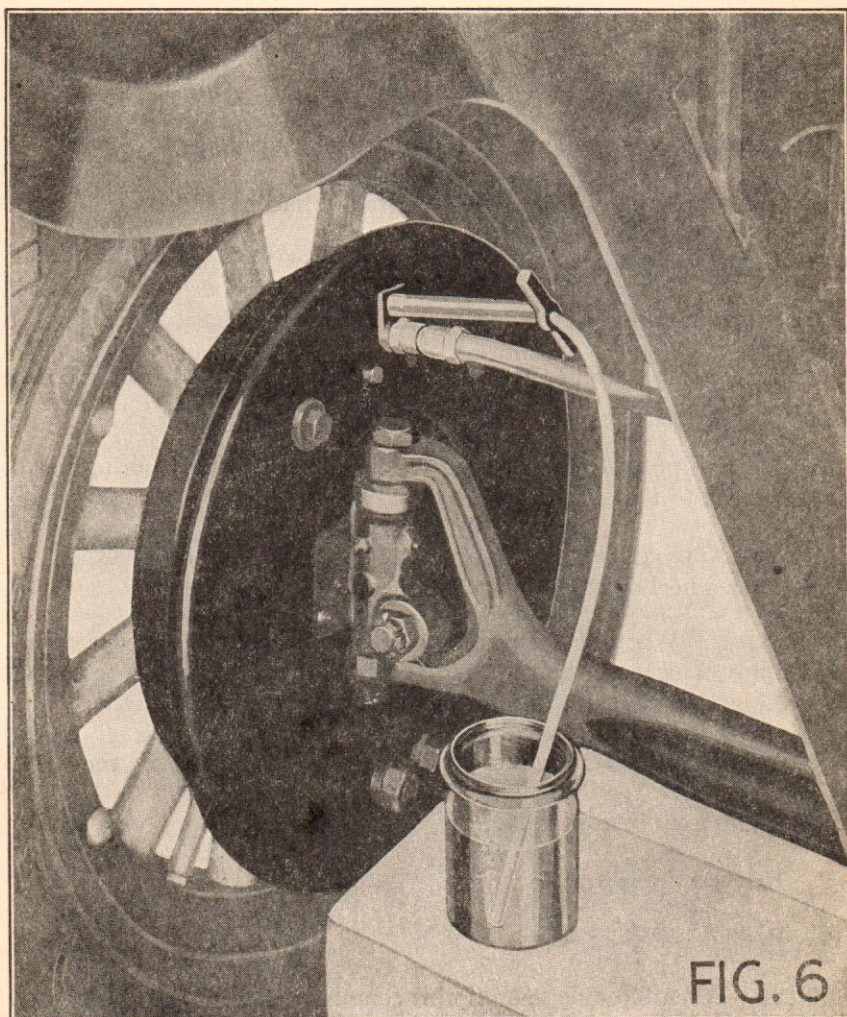


FIG. 6



## BLEEDING THE LINE

Bleeding the system is necessary only when some part of the hydraulic mechanism has been disconnected.

1. Remove floor board.
2. Unscrew filler plug "J" (fig. 1).

CAUTION: Do not allow dirt to get into this opening.

3. Fill supply tank with Lockheed Brake Fluid.
4. Remove shoulder screw from bleeder screw "L" (fig. 4).
5. Screw in nipple at the end of the rubber drain tube. (See fig. 6.)
6. Place end of drain tube in clean container such as fruit jar and open valve  $3/4$  turn of the wrench.
7. Depress pedal by hand allowing the return spring to bring pedal back to the off position.

NOTE—Approximately ten strokes of the pedal will be necessary to bleed each wheel cylinder.

CAUTION: When bleeding brakes be sure to keep the master cylinder supply tank more than  $1/2$  full of fluid, otherwise air will be drawn into the system necessitating re-bleeding.

NOTE—Never bleed any more than one wheel cylinder at a time.

8. Tighten up bleeder valve.
9. Remove drain tube.
10. Replace shoulder screw.

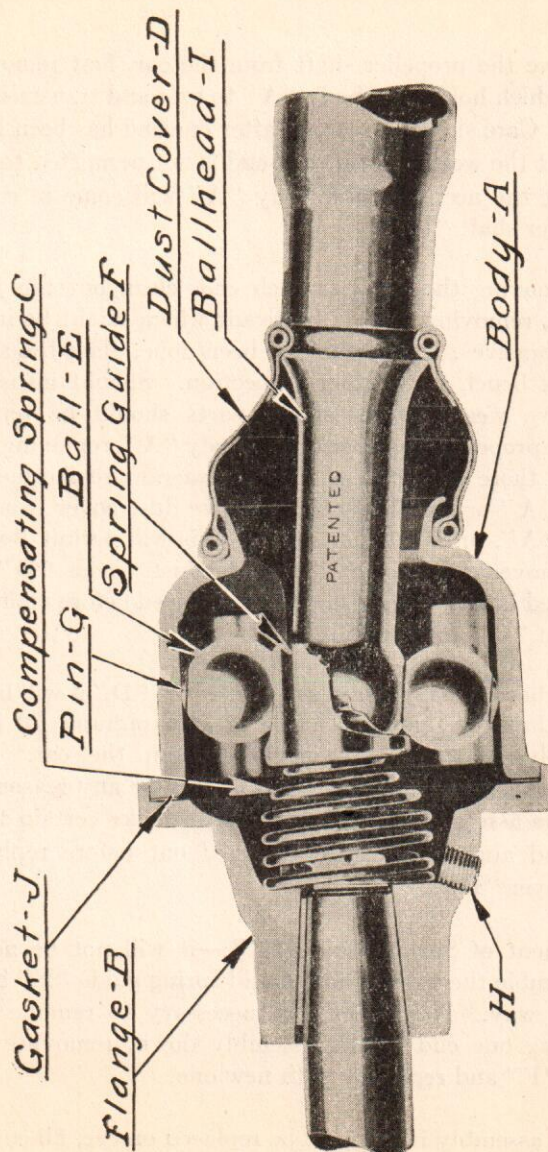
NOTE—When bleeding operation is completed refill supply tank.

11. Replace filler plug and screw down tight.

If there are any indications that dirt has found its way into the fluid by dropping off the fenders or frame, replace with new fluid. Protect the fluid by using a fruit can with a hole in the cover the exact size of the tube.



## ADJUSTMENT OF DRIVE SHAFT UNIVERSALS





## INSTRUCTIONS FOR DISASSEMBLING AND REPLACEMENT OF PARTS

1. To remove the propeller shaft from the car, first remove the four bolts which hold main body "A" to axle and transmission flanges "B". Care should be taken, after one end has been loosened, to see that the weight of this one end is not permitted to drop down so that the neck of main body "A" will come in contact with propeller shaft "I".
2. After removing the bolts at each end, clean out the joints thoroughly, removing the old lubricant which might be impregnated with abrasives. After this has been done, place the assembly on a work bench for further inspection. Should inspection show excessive wear, the necessary parts should be replaced. To inspect properly, push back main body "A", removing Balls "E". Should there be sufficient wear to warrant replacement of main Body "A" or Pin "G", first remove dust cover from groove in Body "A", press out pin "G". This will permit Body "A" to be removed from shaft "I". If dust cover "D" has been damaged in any way, it should be replaced before main body "A" and Pin "G" are reassembled.
3. Should it be necessary to replace dust cover "D" it will be necessary to go thru the same procedure as in paragraph (2) in that the assembly should be disassembled from the car. It is very important, should dust cover "D" fail for any reason whatever, that the assembly be disassembled to make certain that all the dirt and abrasives may be cleaned out before replacement of dust cover "D".
4. Replacement of Spring Guide "F":—it will not be necessary to disassemble the whole joint should spring guide "F" be damaged in any way. It will only be necessary to remove four bolts, dropping one end of the assembly down, removing old spring guide "F" and replacing with new one.
5. After the assembly is ready to be replaced on car, fill compensating spring "C" with proper kind of lubricant, (see instructions for Lubrication) putting the large end of spring "C" in spring pocket of Flange "B", bolting main Body "A" up against flange "B" with gasket "J" in place. Care should be taken to see that the

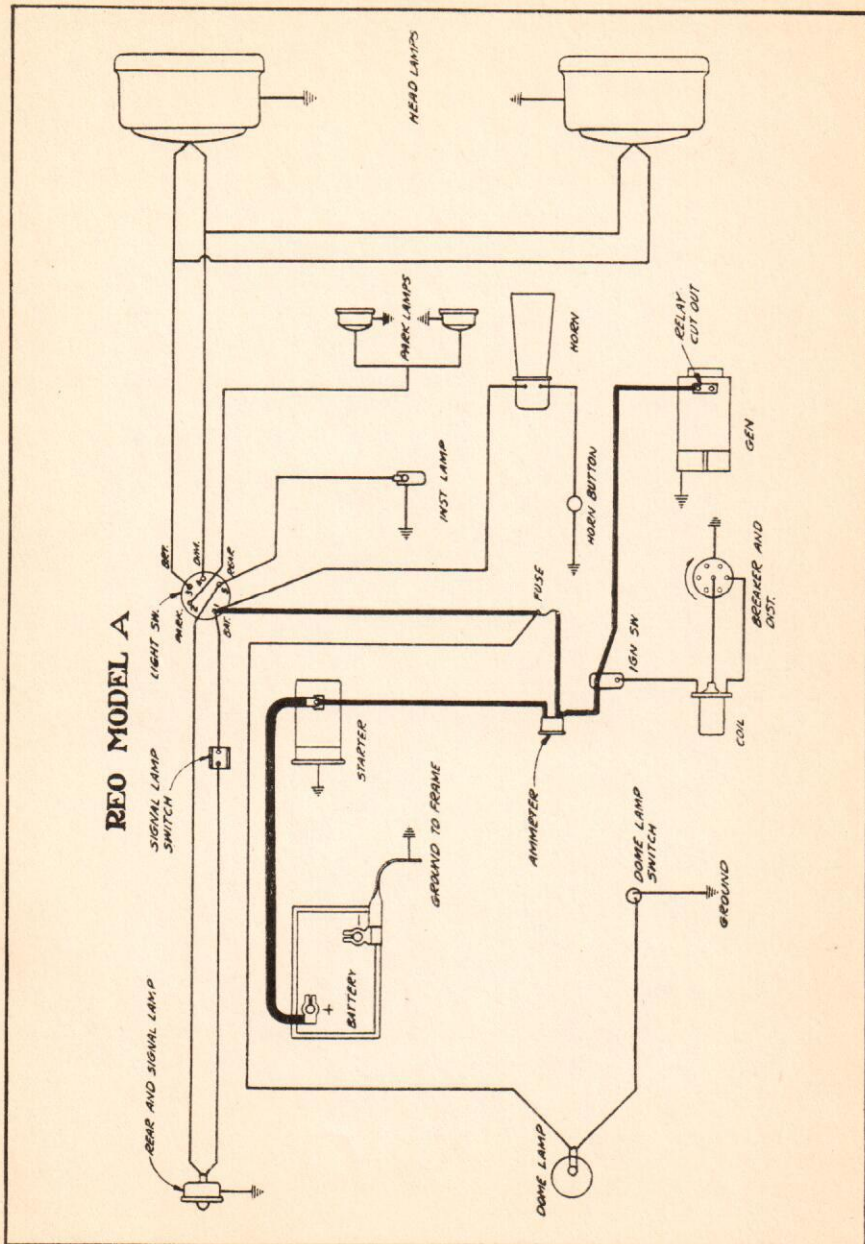


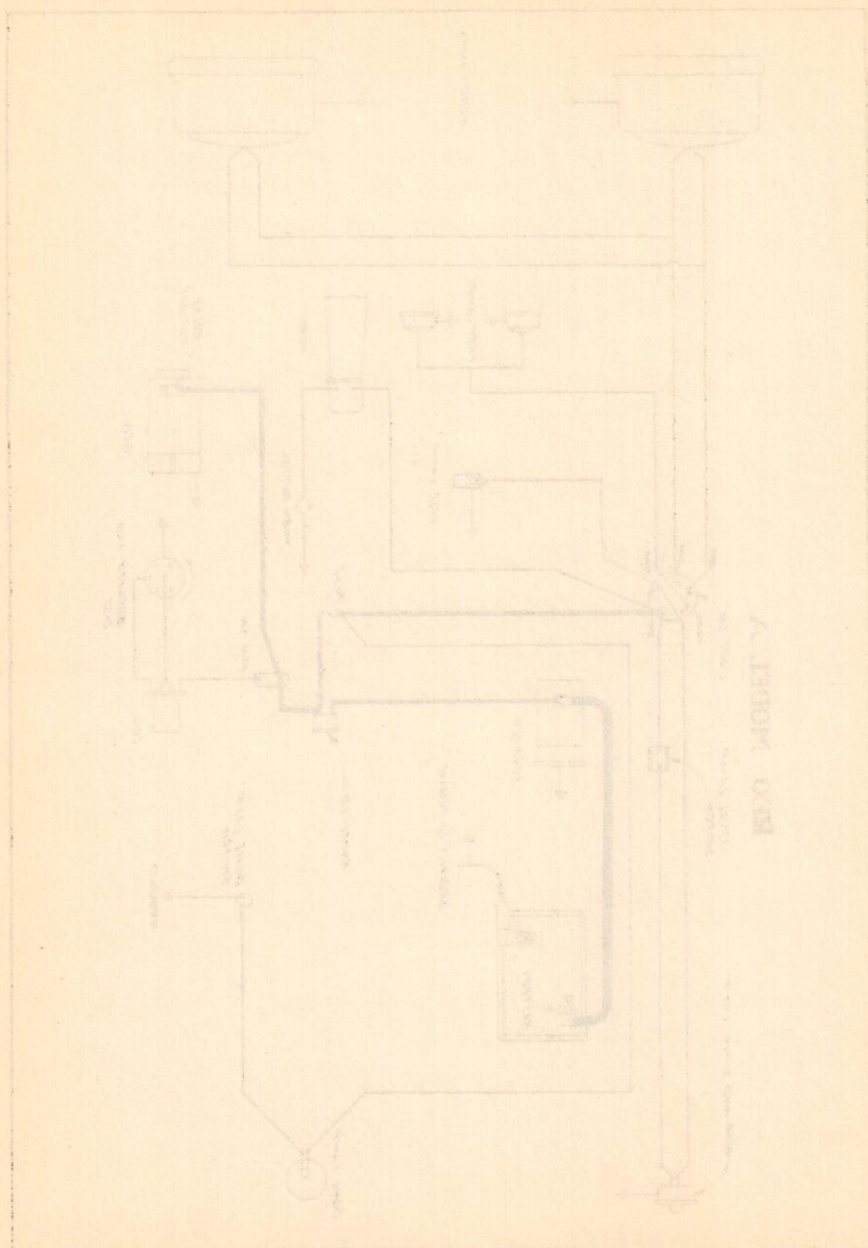
compensating spring fits over spring guide "F". After this one end has been assembled, go thru the same procedure on the other end. Extreme care should be taken when main Body "A" is pushed up in place to see that compensating spring guide "F" is in place. This can be done by sliding the body back, holding propeller shaft "I" with one hand and taking a thin piece of flat steel, putting it between end of propeller shaft "I" and spring "C", carefully pushing the shaft up so that it lines up with transmission shaft, then carefully pull out the flat piece of steel, watching the spring to see that it slips in place when this flat piece of steel is removed.

6. For excessive back lash or wear in the assembly, care should be taken to see that the four bolts which fasten main Body "A" to flange "B" are properly tightened.











**CORRECTION SHEET FOR THE K-S GASOLINE TELEGAGE**

Made by King-Seeley Corporation, Ann Arbor, Mich.

Correction of a faulty Telegage installation is very simple. This is assuming that you will actually **DO** what is set down for your guidance; that you will make no substitutions, but do exactly as dictated, **OR GET NO RESULTS.**

**WARNING: DO NOT REMOVE GAUGE FROM INSTRUMENT BOARD OR START PUTTING ON NEW UNITS UNTIL YOU HAVE FOLLOWED THESE INSTRUCTIONS.**

**SPECIAL** { Before starting to correct the Telegage be sure the gasoline  
**Reo Bus** { tank is not so full that there is some gasoline in the filler  
neck.

**FOUR ADJUSTMENTS**  
Make these first

**I—Remove tank filler cap.** See that vent in cap is free and open. Do not replace cap.

**II—Disconnect Gauge Line (Air Line) at front end from Gauge Head and make gauge read exactly "zero".** Liquid can be added or removed at the top of the Brass Tube where the Air Line comes off. To fill, use a Medicine Dropper, being careful not to over-fill. To remove liquid, use a tooth-pick or a match to absorb some from the Brass Tube.

**USE ONLY K-S TELEGAGE LIQUID, NONE  
OTHER WILL DO**

**III—Dry Air Line.** (Follow exactly or get no results.)

1. Use a Hand Tire Pump. (We don't mean anything but a Hand Tire Pump.)
2. Cut metal connection from tire pump. (Positively.)
3. Push hose securely over front end of Air Line.
4. Give 40 good full strokes. (At least.)

**IV—Reconnect Air Line, being sure that connection is tight.** Before you connect, verify that gauge holds its zero reading and therefore does not leak. Try rear connection to be sure it is tight. Replace tank filler cap.

You are now ready to check to see if the trouble is a defective unit or a faulty installation which you have corrected by the above adjustments.



**CHECK I**—Determine whether you can bring gauge up to proper reading by supplying air to the Tank Unit.

Method—(a) A short cut, but not a complete check is to remove the fuel feed line from top of vacuum tank and blow back with mouth into main tank.

(b) The only complete check of air supply, however, is to drive the car until the Red Liquid no longer comes up.

If you can get a reading that will stay set with motor dead, the Telegage is O. K. If you cannot get a reading by driving or blowing back through the line or if the reading drops and will not stay set with the motor dead, locate failure by Check No. II.

**CHECK II**—Determine whether the failure is in the Air line or Tank Unit.

1. Disconnect the Air Line Front and Rear.
2. Inspect connections for dirt and flaws.
3. Hold a finger over one end and suck on the other. If the suction created will hold the tongue for one minute, the Air Line is O. K.
4. If the Air Line shows a leak, change it.
5. If Air Line and connections check O. K. the defect is in the Tank Unit, which should be changed.

**CAUTION:** Whenever repairs are made on the Telegage the Air Line should be blown out from the front end to clear it of any gasoline which may have been driven into the line when it was disconnected.

**SERVICE**—Every distributor and dealer should have a bottle of K-S Liquid to cover emergencies. These bottles can be ordered in  $\frac{1}{8}$  oz., 1 oz., 2 oz., and 6 oz., sizes on regular parts orders.

The Liquid is especially selected because of its specific gravity and other characteristics. **POSITIVELY NO OTHER WILL DO.**

Any Telegage part which fails from manufacturing defects will be replaced, no charge. Telegage Heads which fail from mishandling will be replaced at a flat service charge of 50 cents when returned to King-Seeley Corp.



The K-S Telegauge consists of three units—the Head, Tank Unit and Air Line. In operating condition the Air Tube and Top Bell of the Tank Unit and the Air Line connecting the Tank Unit to the Head are filled with air, (See Figures 1 and 2). The gasoline tries to rise to the same level in the Tank Unit as it is in the tank. This is not possible because of the air trapped between the bottom of the Tank Unit and the Liquid in the Head. However, the effort of the gasoline to get into the Top Bell presses on the trapped air. This pressure is communicated through the Air Tube and Air Line to the Head on the Instrument Board, where it is recorded by the rise of the Red Liquid in the Glass Tube.

The Telegauge provides a reserve of approximately one gallon; that is, the bottom gallon in the tank never shows on the gauge as the reading starts at the bottom of the Top Bell. Above this point the gauge reads exactly, gallon for gallon, all gasoline put into the tank.

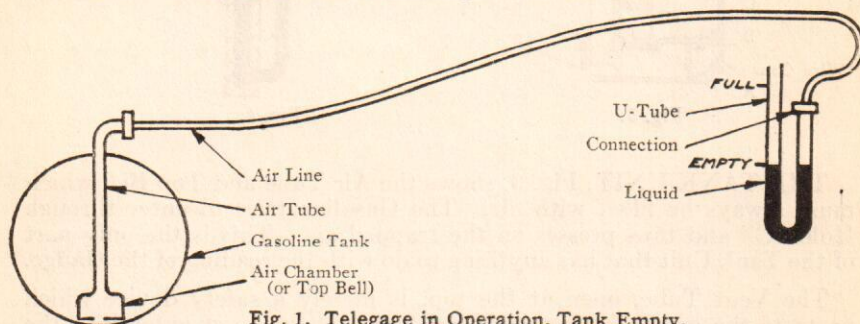


Fig. 1. Telegauge in Operation, Tank Empty.

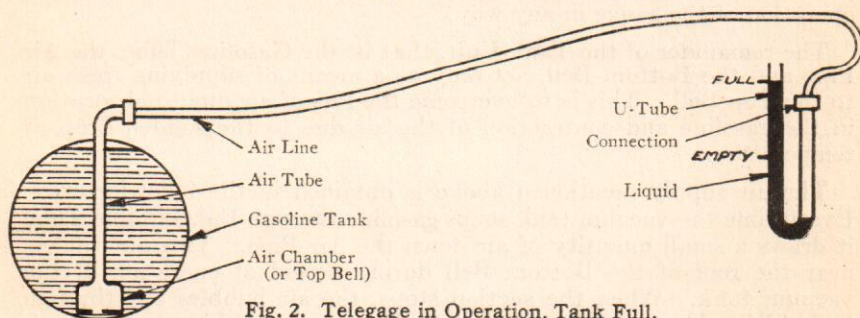


Fig. 2. Telegauge in Operation, Tank Full.

Figures 1 and 2 show a simple Telegauge. The Bottom Bell and Gasoline Tube have been omitted as they take no part in the reading of the gauge. They are simply used as a means of supplying air to the Top Bell to overcome any loss by absorption.

If one of the connections be opened while the tank contains gasoline the trapped air will escape and gasoline will rise in the Tank Unit to the same level as in the tank. Similarly the Liquid in the U-tube will fall until the same level has been reached in both sides, which should be at the "Empty" mark. Now, if the connection is again made the gauge will still read "Empty" until the Top Bell and Air Tube are cleared of gasoline and again filled with air, by the operation of the vacuum tank as explained in the "Correction Sheet" under "Check No. 1".



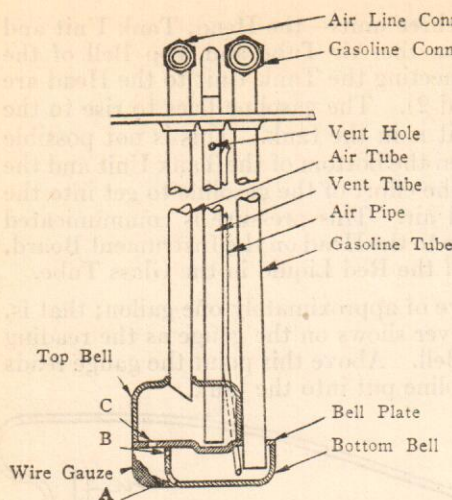


Fig. 3.

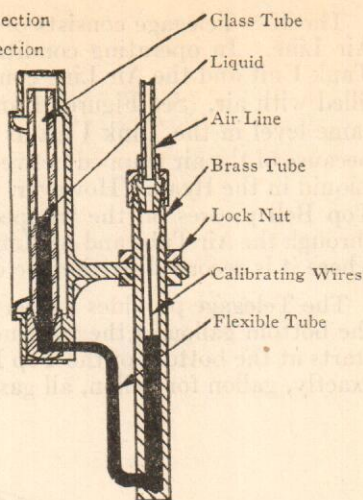


Fig. 4.

THE TANK UNIT, Fig. 3, shows the Air Tube and Top Bell which must always be filled with air. The Gasoline tries to enter through Hole "C" and thus presses on the trapped air. This is the only part of the Tank Unit that has anything to do with the reading of the Gauge.

The Vent Tube, open at the top, is merely a safety device which protects the gauge against high pressure. It does not enter into the operation of the gauge in any way.

The remainder of the Tank Unit, that is, the Gasoline Tube, the Air Pipe and the Bottom Bell, act only as a means of supplying fresh air to the Top Bell. This is to overcome the loss of air due to absorption in the gasoline and contraction of the air due to the sudden drop of temperature.

The air supply mentioned above is obtained in the following way: Every time the vacuum tank sucks gasoline through the Gasoline Tube it draws a small quantity of air down the Air Pipe. This air collects near the roof of the Bottom Bell during period of operation of the vacuum tank. When the suction stops, the air bubbles out through Hole "B". Due to the tendency of air to rise, it bubbles up through Hole "C" into the Top Bell to replace any gasoline which may have collected there. When the Top Bell is full of air these bubbles simply pass off through the gauze and are not used.

THE HEAD, shown in Fig. 4, is mounted on the Instrument Board. It is simply a U-tube containing a special heavy red liquid. The front half of the U-tube is a Glass Tube open at the top. The back half is a Brass Tube. A U-tube containing liquid is the most accurate instrument known for measuring pressure.

THE AIR LINE, coming from the Tank Unit, is connected at the top of the Brass Tube. Any pressure which comes through the Air Line will press the liquid downward in the Brass Tube and upward in the Glass Tube. In fact, the difference in levels of the liquid in the



two tubes is an exact measurement of the pressure coming through the Air Line and hence records the depth of gasoline in the tank. By calibrating the gauge in gallons an EXACT reading in gallons is shown on the instrument board.

To have the Gauge read correctly, three things are necessary.

1. **The Head Must Hold Liquid and Read Zero when Disconnected.** If the head shows a leak and will not hold liquid, it should be returned to the King-Seeley Corporation for replacement.
2. **The Air System Must Be Free from Leaks or Obstructions.** The most common obstruction is gasoline, which, however, **CAN ONLY BE DRIVEN INTO THE LINE WHEN THERE IS A LEAK OR CONNECTIONS ARE NOT PROPERLY MADE.** Gasoline being a moving obstruction will cause a very erratic reading of the Gauge.
3. **The Tank Unit Must Supply Air** each time the vacuum tank sucks gasoline.

When you have the three conditions given above and the gauge is reconnected the Liquid in the Head will start to rise after the car has been driven a short distance and will continue to rise until it records the true contents of the tank. After this it will not again lose its reading unless disconnected.

## SERVICE POLICY

### Replacements:

Any part which is defective within the 90-day warranty period will be replaced by the King-Seeley Corporation without charge when the old unit is returned accompanied by a claim.

### Special Exchanges:

There is a special exchange price on dash units only, requiring maintenance service after the warranty period. On receipt of such units the King-Seeley Corporation will make replacement with new ones at a flat charge of \$1.50 each.

The purpose of this document is to provide information regarding the use of the system and the responsibilities of the user. It is intended to be used as a reference for the user and is not to be used as a contract.

The user is responsible for the proper use of the system and for the security of the information stored on the system.

The user must read the user manual and the system manual before using the system. The user must also read the terms and conditions of use before using the system.

The user must not use the system for any purpose other than the purpose for which it was designed. The user must not use the system to store or transmit any information that is illegal, obscene, or otherwise prohibited by law.

The user must not use the system to access any information that is not authorized for the user.

The user must not use the system to create or modify any information that is not authorized for the user. The user must not use the system to delete any information that is not authorized for the user.

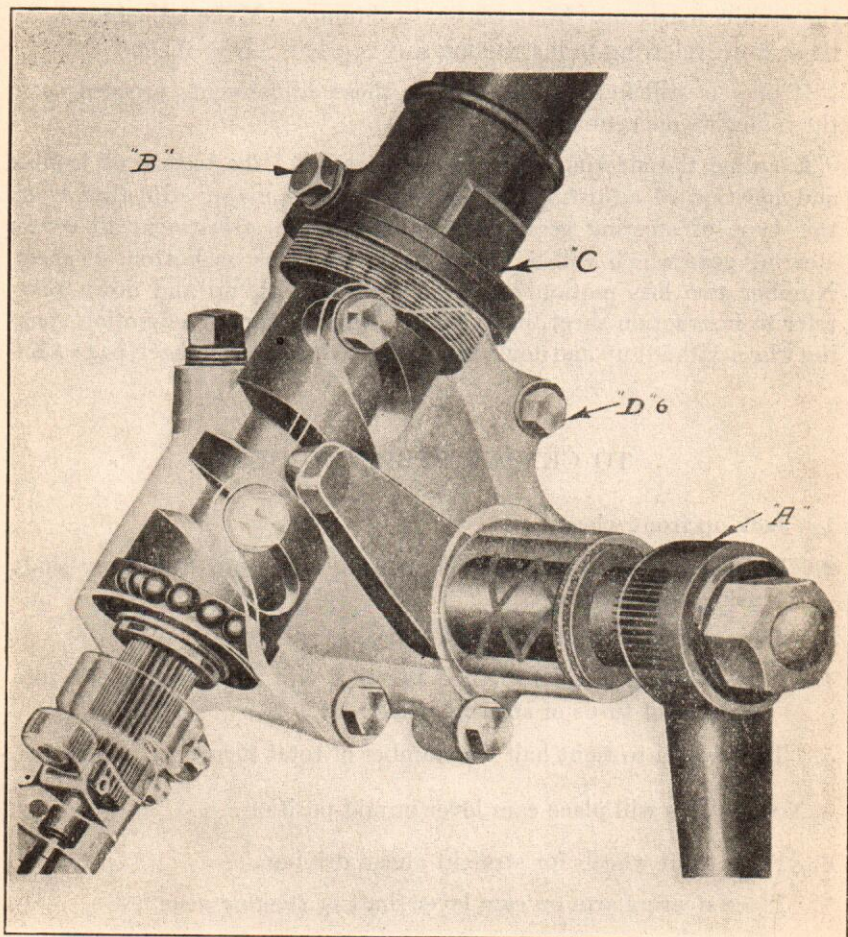
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## ADJUST STEERING GEAR



See instructions reverse side of sheet.



## STEERING GEAR MECHANISM

**CAUTION:** Before making any adjustment of steering gear, inspect the steering connecting rods, front wheel bearings, and king pins to see if any excessive amount of end play is found in these units. Play in these units may cause front wheels to shimmy. Make adjustments on these units referring to instruction sheets, pages AD8—AD9.

If play is still found after making these adjustments proceed as in the following operations:

Examine the steering gear itself determining the nature of trouble and location of adjustment. There are three major adjustments on this type of steering gear, number one is the adjustment to center steering gear which will be found on instructions on bottom of sheet. Number two loss motion of steering wheel with up and down play, refer to instruction sheet, page AK3. Number three loss motion steering wheel without up and down play, refer to instruction sheet, page AK4.

### TO CENTER STEERING GEAR

1. Jack up front wheels.
2. Remove lock nut, washer and steering arm from cam lever shaft, using tool T-307.
3. Turn steering wheel to right as far as it will go.
4. Turn steering wheel to left as far as it will go, counting the total number of turns of steering wheel.
5. Turn wheel to right half the number of total turns.

**NOTE**—This will place cam lever in mid-position.

6. Place front wheels for straight ahead driving.
7. Place steering arm on cam lever shaft of steering gear.

**NOTE**—If steering connecting rod is properly adjusted the arm should be in a vertical position. If it is not in a vertical position, adjust steering connecting rod accordingly.

8. Replace lock washer and nut.

**CAUTION:** Do not for any reason drive steering arm on or off cam lever shaft or internal parts of gear may become damaged.

**NOTE**—Tighten steering arm by drawing up on nut.



## LOST MOTION OF STEERING WHEEL WITH UP AND DOWN PLAY

1. Jack up front wheels.
2. Loosen clamping screw "B".
3. Loosen dash bracket holding outer tube.
4. Back off thrust adjusting nut "C", use tool T-307 and remove a shim.
5. Screw thrust adjusting nut back in position and test gear.

NOTE—If end play still exists repeat operations.

CAUTION: Do not screw thrust adjusting nut down any farther than is necessary to remove end play as it will make gear turn hard and may break the balls in the thrust bearings or ruin the races.

6. Tighten clamp screw "B".
7. Tighten dash bracket.

NOTE—When tightening clamp screw be sure that the split in lock washer is against the main steering gear housing.

## LOST MOTION OF STEERING WHEEL WITHOUT UP AND DOWN PLAY

1. Jack up front wheels.
2. Place steering arm in mid-position for straight ahead driving.

NOTE—This is necessary as the cam thread is narrowed at this point to compensate for cam wear.

3. Test the cam lever shaft for end play and estimate the amount.
4. Remove (6) bolts, nuts and lock washers holding the cam lever shaft housing to main housing.
5. Separate the two halves of the housing.
6. Remove sufficient shims to take out all end play.
7. The best way to make this adjustment is to reduce the shims until there is no end play and then insert a .003 shim.

NOTE—These series of shims are made in three thicknesses, (.003, .007, .014) and are placed between paper gaskets whose function is to prevent oil leakage.

CAUTION: When making this adjustment there must be some slight end play in mid-position otherwise gear will be damaged.

8. Replace housing in proper position.
9. Replace lock washers and cap screw and bolts.

NOTE—After housing is all assembled refill with SPECIAL STEERING GEAR LUBRICANT. Refer to lubrication chart.



**MODEL "B" TOLERANCES****PISTON**

Motor firing order 1-5-3-6-2-4.  
Clearance skirt of piston to cylinder wall .003 to .004.  
Piston ring gap .003 to .011.  
Ring groove width  $1/8"$ ; oil ring  $5/32"$ .

**CRANKSHAFT**

End play on front bearing .002 to .006.  
Clearance all main bearing .001 to .0035.

**CONNECTING ROD**

Clearance rod on crankshaft .0005 to .0025.  
Clearance piston to piston pin—Zero.  
Side clearance on crankshaft .004 to .008.

**CAM SHAFT**

End play—Zero.  
Clearance shaft and bushings .001 to .0025.  
Allowable looseness in chain—Chain adjustment instructions:—Turn generator adjusting screw until chain begins to emit a humming or singing noise, then back screw one and one-half turns.

**VALVES**

Clearance intake valve stem and guide .002 to .004.  
Clearance exhaust valve stem and guide .002 to .004.  
Clearance intake valves .005.  
Clearance exhaust valves .007.  
Width of valve seat  $1/16"$ .  
Clearance between valve tappet and guide .0012.

**FAN**

Pump gland and shaft .005 to .025.  
Pump body bushing to shaft .0015 to .003.

**CLUTCH**

Pilot bearing to flywheel—Press in place with hands.  
Transmission drive gear to clutch pilot bearing—.0005 to .0015.  
Clearance clutch disc hub to Transmission drive gear spline .001 to .003.  
Clutch release shaft to case—.005.

**TRANSMISSION**

Transmission countershaft to bushing transmission countershaft gear .0035.  
Idler shaft to idler shaft bushing .003.  
End play in countershaft gears .014 to .015.  
End play in main shaft .007 to .015.  
Clearance sliding gear keyway to spline .0015 selective fit.

Clearance sliding gear to shaft .001 selective fit. By this selective fit, we mean that we fit the sliding gears on the main shaft by selection until the gears will just slide along the shaft.

Clearance at pitch line constant mesh gears .008 to .010.

Clearance at pitch line sliding gears .008 to .010.

### FRONT AXLE

King pin to bushing..... .001 to .003

### SPRING BUSHINGS

All spring bushing ..... .003

### BRAKES

Service brakes ..... 1/16 of an inch

Emergency brakes—take up until brake drags with hand lever in second notch.

### DRIVE SHAFT UNIVERSALS

Clearance trunnion pin and ball..... .002

Clearance spring guide to body..... .002

Trunnion pin end to body..... .002

Trunnion pin to ball head..... .0005

### REAR AXLE

Gear Ratio: 4.45 to 1. (49-11).

Clearance differential pinion to differential gears .005.

Clearance differential pinion and pinion shaft—.000—.003.

Clearance between ring gear and pinion—.010 to .015.

Clearance differential case and side gear—free to less than .010.

Clearance differential side gear on spline—.001 to .005 loose.

### WHEELS

Clearance for jack..... 7-3/4"

King pin transverse inclination..... 7°

Spindle transverse inclination..... 1-1/2°

Castor angle..... 1-1/2°

Toe in..... 0 to 1/8

Wheel base..... 114

Turning radius..... 20 Ft.

### LIGHTING SYSTEM

Charging rate 16 amperes (cold).

Headlights..... 21 C. P. Cowl-light..... 3 C. P.

Tail-light..... 3 C. P. Dash-light..... 3 C. P.

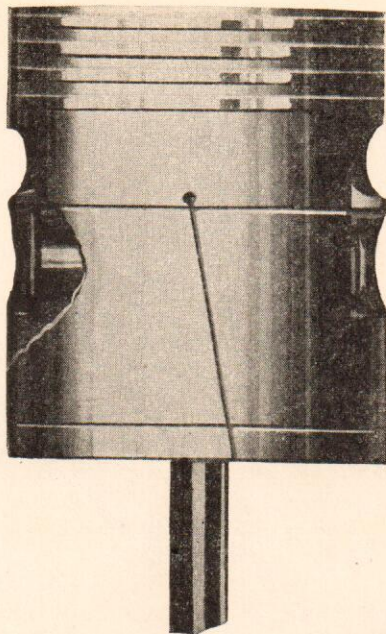
Stop-light..... 15 C. P. Dome-light..... 3 C. P.

### IGNITION SYSTEM

Gap breaker points..... .020 Gap spark plugs..... .025



## FIT PISTON RINGS AND PINS



## FIT PISTON RINGS

Refer to instructions given on AA-1. Piston rings are supplied in seven sizes standard .010-.020-.030-.040-.050-.060 oversize.

NOTE—No allowance is given for fitting rings.

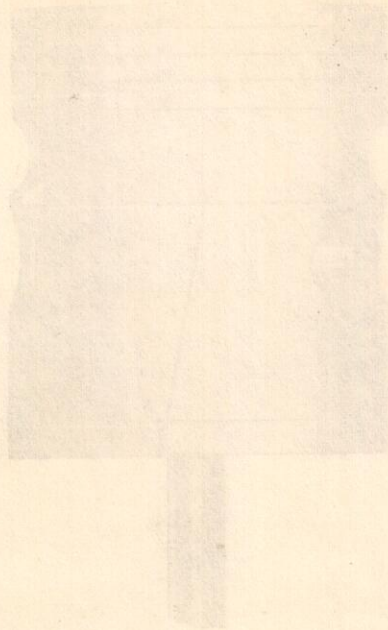
## PISTON PINS

When piston pins are replaced be sure that the springs are inserted at either end to secure pin in place. It is advisable to replace the locking springs whenever a new pin is installed.

There should be no clearance between the piston and pin. In order not to distort the piston, it should be heated by immersing it in boiling hot water before the pin is assembled.

Pins will be supplied in the following oversizes: .002-.003-.005 and .010.

# THE HISTORY OF THE UNITED STATES



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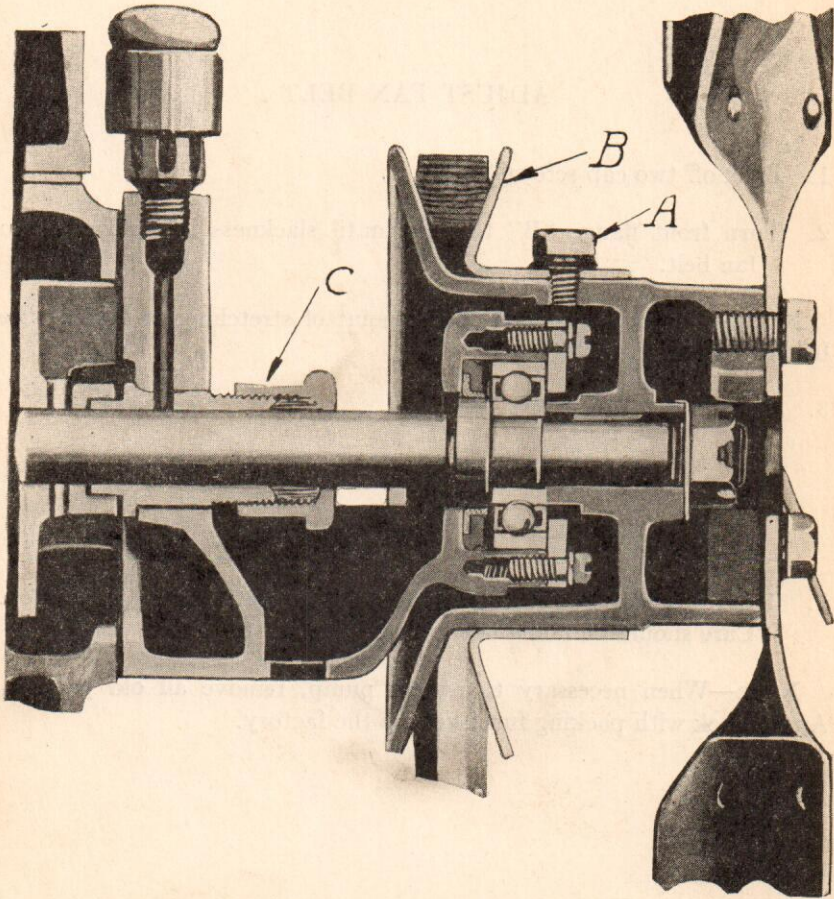
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## ADJUST FAN BELT AND PUMP GLAND



Instructions on reverse side of sheet.

### ADJUST FAN BELT

1. Back off two cap screws "A".
2. Turn front flange "B" to right until slackness is removed from fan belt.

NOTE—Do not adjust belt to the point of stretching or causing the belt to bottom in pulleys.

3. Tighten two cap screws "A".

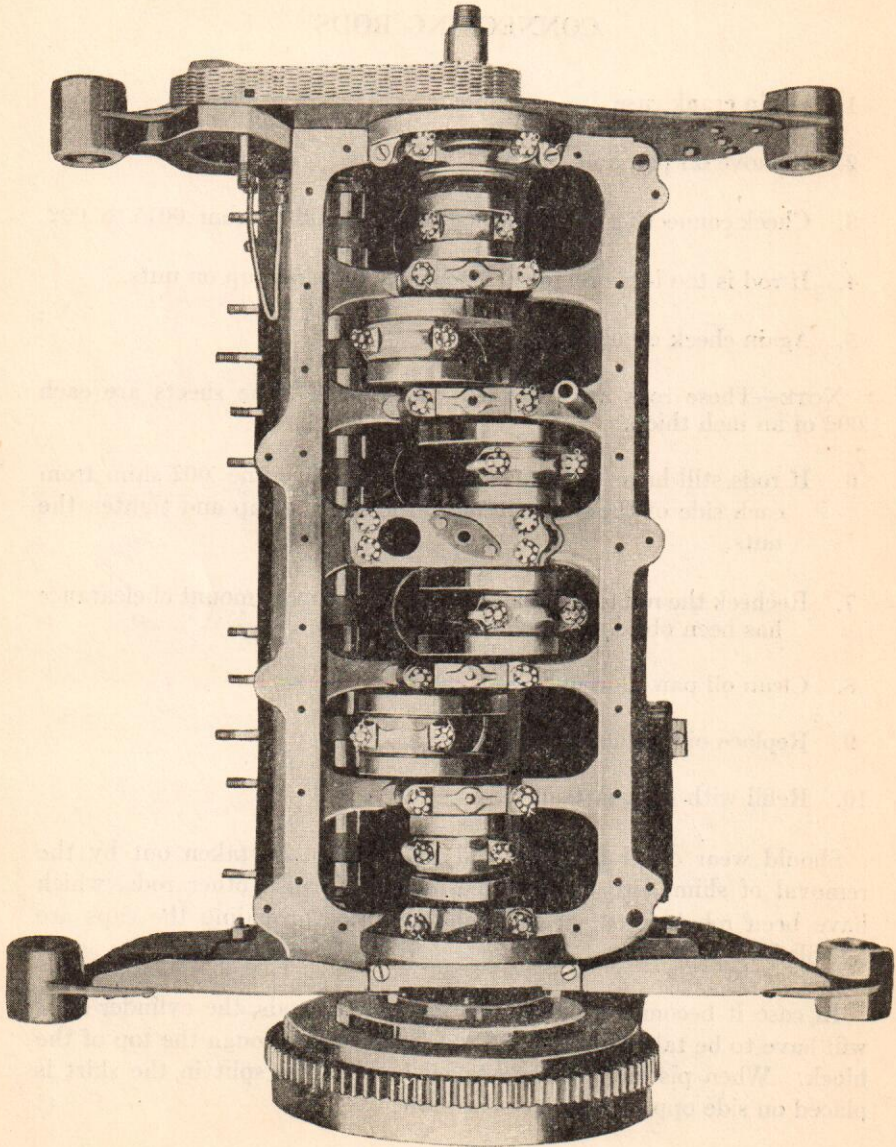
### ADJUST PUMP GLAND

1. Tighten gland nut "C" with tool T363, until water leaks stop. Care should be taken not to draw this nut too tight.

NOTE—When necessary to repack pump, remove all old packing. And repack with packing furnished by the factory.



CONNECTING RODS AND MAIN BEARINGS



See Instructions on succeeding sheets.

## CONNECTING RODS

1. Drain crank case.
2. Remove oil pan and gasket.
3. Check connecting rod clearance which should be from .0015 to .002.
4. If rod is too loose remove cotter pins and draw up on nuts.
5. Again check clearance.

NOTE—These rods are provided with shims. The sheets are each .002 of an inch thick.

6. If rods still have too much clearance, remove one .002 shim from each side of the rod. Replace the bearing cap and tighten the nuts.
7. Recheck the rod for clearance and if the proper amount of clearance has been obtained, replace the cotter pins.
8. Clean oil pan thoroughly.
9. Replace oil pan using new gaskets.
10. Refill with six quarts of oil.

Should wear develop in the rod that cannot be taken out by the removal of shims, we are in a position to furnish other rods, which have been rebabbitted, at an exchange price providing the caps are not filed.

In case it becomes necessary to remove the rods, the cylinder head will have to be taken off and the rods taken out through the top of the block. When pistons are re-installed be sure the split in the skirt is placed on side opposite to the cam shaft.



## MAIN BEARINGS

1. Drain oil.
2. Remove oil pan.
3. Check bearings for .002 clearance.
4. If too loose, remove locking wires and draw up on bearing nuts.
5. Recheck for clearance.

NOTE—If there is still too much clearance it will be necessary to replace the bearing. **THESE BEARING CAPS MUST NOT BE FILED OR SHIMMED.** To replace main bearing it will be necessary to remove motor from frame.

6. Remove the bearing nuts and caps.
7. Remove the crankshaft.
8. \*Replace all main bearings.
9. Replace the crankshaft.
10. Replace the bearing caps.

NOTE—All of the upper bearings should be replaced with the small 3/16" oil hole, on the side next to the camshaft. Care should be taken to remove oil and dirt from the case and bearing caps.

11. Draw up nuts.
12. Turn motor over and try for bearing clearance.
13. If clearance is O. K. replace locking wires.
14. Replace oil pan using new gaskets.
15. Refill with six quarts of oil.

\*NOTE—Whenever it is necessary to replace a main bearing examine the other six and ascertain if they still have the proper clearance. If there is any doubt about this, replace them. This will again give you the original factory alignment.

## TO REMOVE END PLAY FROM CRANKSHAFT

NOTE—The end play in crankshaft is controlled by #1 or front bearing. There are fourteen shims (7 shims of .002 thickness and 7 shims of .008 thickness) which are placed behind the thrust plate on crankshaft. The thrust plate is held in position by the main drive sprocket.

The end play should be from .002 to .006.

To eliminate excessive end play from crankshaft, remove necessary number of shims.

1. Remove oil pan.
2. Determine the amount of end play by prying the crankshaft (slightly) back and forth between the #1 bearing shell and crankshaft with feeler gauge.

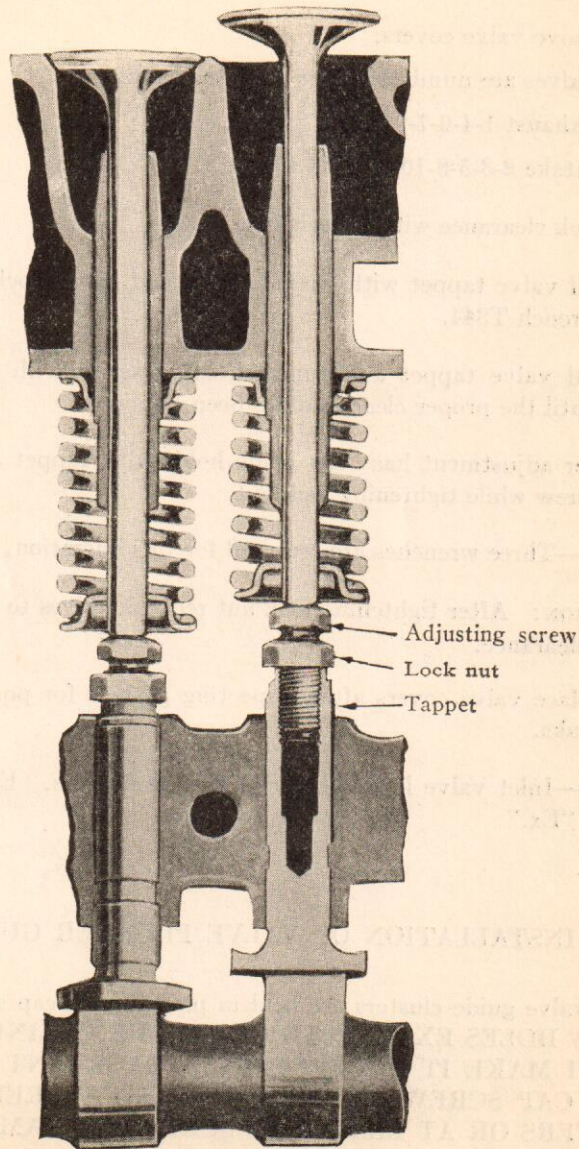
NOTE—If excessive clearance is found proceed as follows:

3. Remove radiator.
4. Remove fan belt.
5. Remove starting crank jaw socket nut.
6. Remove vibration damper and fan pulley (use tool T-342).
7. Remove timing sprocket cover.
8. Remove timing chain.
9. Remove drive sprocket (use tool T-358).
10. Remove thrust plate.
11. Remove necessary shim or shims.
12. Reassemble reversing operations.

CAUTION: Be certain that the starting crank jaw socket nut is drawn up tight, as this holds the adjustment.



## ADJUST INLET AND EXHAUST TAPPETS



See Instructions on reverse side of sheet.

## ADJUST INLET AND EXHAUST TAPPETS

1. Remove valve covers.

Valves are numbered from radiator back.

Exhaust 1-4-6-7-9-12 .007 warm.

Intake 2-3-5-8-10-11 .005 warm.

2. Check clearance with feeler gauge T353.
3. Hold valve tappet with wrench T313 and loosen locking nut with wrench T344.
4. Hold valve tappet and turn adjusting screw with wrench T317 until the proper clearance has been obtained.
5. After adjustment has been made hold valve tappet and adjusting screw while tightening lock nut.

NOTE—Three wrenches are required for this operation.

CAUTION: After tightening lock nut recheck valves to see they have proper clearance.

6. Replace valve covers after inspecting gaskets for possibility of oil leaks.

NOTE—Inlet valve is the larger of the two valves. Exhaust valves marked "Ex."

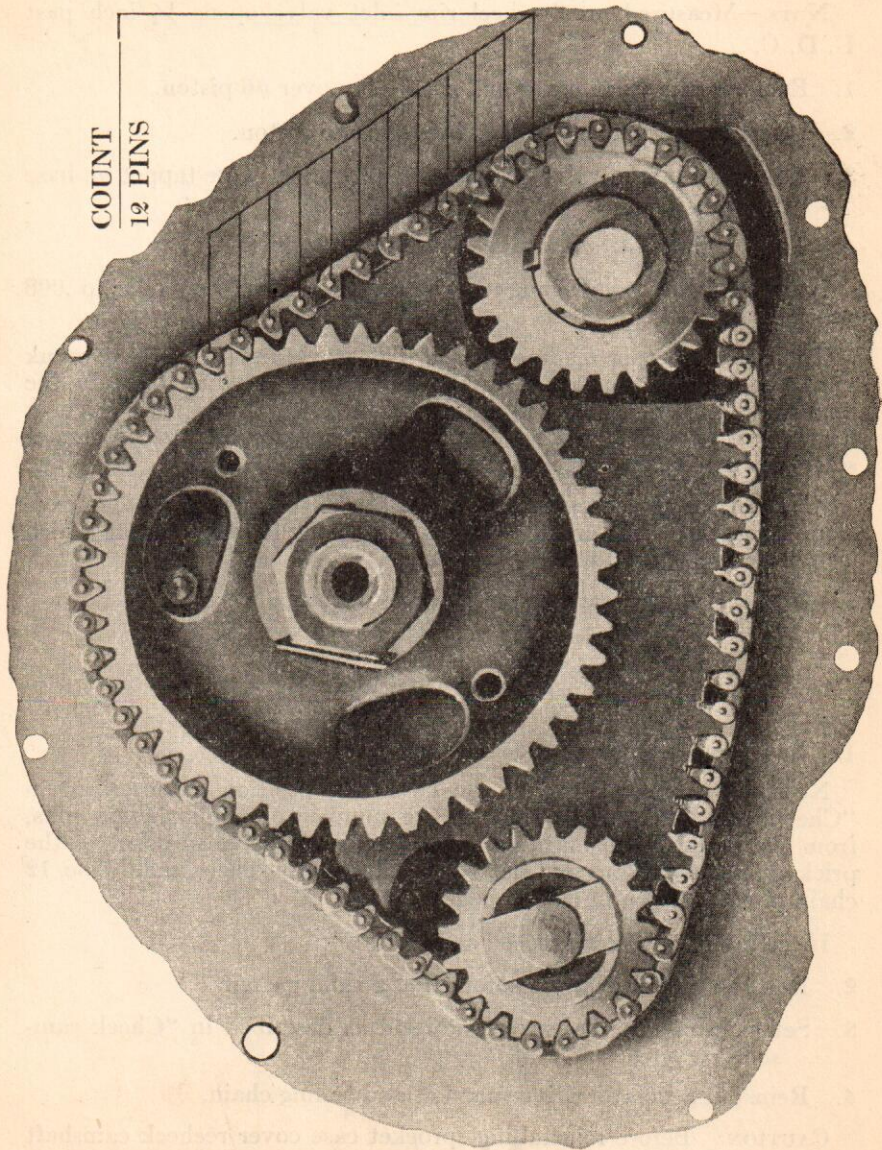
## INSTALLATION OF VALVE PLUNGER GUIDES

The valve guide clusters are held in place by six cap screws. THE SCREW HOLES EXTEND THROUGH THE CYLINDER WALLS WHICH MAKE IT EXCEEDINGLY IMPORTANT THAT THE SAME CAP SCREWS SHOULD BE USED TO REPLACE THE CLUSTERS OR AT LEAST CAP SCREWS OF SAME LENGTH.

A SCREW THAT IS TOO LONG WILL EXTEND THROUGH THE INSIDE WALL OF THE CYLINDER.



CAMSHAFT SETTING



See Instructions on reverse side of sheet.



## CHECK CAMSHAFT SETTING

NOTE—Measured on flywheel rim inlet valve opens  $\frac{1}{2}$  inch past U. D. C.

1. Remove rear valve cover and small plug over #6 piston.
2. Insert timing gauge T-476 in hole over #6 piston.
3. Adjust #6 intake valve to .008 clearance with valve tappet on base of cam.
4. Turn engine until #6 intake valve starts to open.

NOTE—At this point, gauge T-476 should register very near to .008 past U. D. C.

To obtain a proper reading on dial indicator, turn the starting crank until the instant the arrow on the dial starts to swing back in the opposite direction. This will indicate that U. D. C. has been reached. Then turn the dial face around until the arrow points to zero. Exact setting depends largely on accuracy in locating U. D. C.

After setting the arrow at zero, turn the starting crank in the direction of rotation until arrow registers .008 which is the point at which #6 intake valve should start to open.

5. Recheck valve clearance with engine warm.

## SET CAMSHAFT

1. Remove radiator and sprocket case cover.

NOTE—With the engine in the U. D. C. position as described in "Check camshaft setting," count the number of timing chain pins, from the prick punch mark on crankshaft main drive sprocket to the prick punch mark on camshaft drive sprocket. There should be 12 chain pins as shown in cut on page BA11.

If setting is incorrect proceed as follows:

2. Remove generator drive sprocket and timing chain.
3. Set camshaft in the correct position as described in "Check camshaft setting."
4. Reinstall generator drive sprocket and timing chain.

CAUTION: Before reinstalling sprocket case cover recheck camshaft setting.

5. Reinstall sprocket cover and radiator.
6. Adjust timing chain.
7. Adjust intake valve to proper clearance.



## CHECK SPARK TIMING

The purpose of checking spark timing is to ascertain if the spark is produced at the proper time with respect to the position of the pistons in the cylinders.

A spark which is timed early causes a slight metallic knock (or ping) on acceleration of engine.

A spark which is timed late, will cause the engine to drag and heat.

1. Be certain ignition switch is turned off and gear shift lever is in neutral position.
2. Place spark control in full advance position.
3. Remove #6 spark plug also plug over #6 piston.
4. Insert timing gauge T-476 in hole over piston.
5. Turn engine until dial indicator shows engine is on U.D.C. Refer to instructions on page BA12.
6. Next place thumb over spark plug hole and turn starting crank until piston just starts coming up on compression stroke. At this point both intake and exhaust valves are closed.
7. Continue to turn the starting crank in the direction of rotation until the dial reads .008 before U. D. C. compression stroke. This is the firing point and ammeter on dash should turn from discharge to zero.

NOTE—Measured on the flywheel rim, spark should be set  $\frac{1}{2}$  inch before U. D. C.

# CHUCK SPARK PLUGS

The purpose of this spark plug is to provide a spark in the combustion chamber of the engine. The spark plug is inserted into the cylinder head and is connected to the ignition system by a spark plug wire.

A spark plug which is inserted into the cylinder head will cause the spark to jump the gap between the electrodes and ignite the mixture of fuel and air.

A spark which is inserted into the cylinder head will cause the spark to jump the gap between the electrodes and ignite the mixture of fuel and air. The spark plug is inserted into the cylinder head and is connected to the ignition system by a spark plug wire.

The spark plug is inserted into the cylinder head and is connected to the ignition system by a spark plug wire.

1. Remove the spark plug wire from the spark plug.

2. Insert the spark plug into the cylinder head.

3. Turn the engine over and check the spark plug. If the spark plug is not firing, check the spark plug wire and the spark plug.

4. After the spark plug is inserted into the cylinder head, the spark plug wire should be connected to the spark plug. The spark plug wire is connected to the spark plug by a spark plug wire.

5. Continue to turn the engine over until the spark plug is firing. The spark plug is firing when the spark plug wire is connected to the spark plug and the spark plug is inserted into the cylinder head.

6. After the spark plug is firing, the spark plug wire should be connected to the spark plug. The spark plug wire is connected to the spark plug by a spark plug wire.



## SET SPARK TIMING

1. Proceed as in checking operation.
2. Remove any slackness from control levers.
3. Loosen distributor lever clamp screw.
4. Place rotor arm directly beneath #6 terminal on cap.

NOTE—If spark is early turn distributor to the left until breaker points open and close then turn to the right until breaker points just start to open. If spark is late turn distributor to the right until breaker points just start to open. Hold thumb against rotor arm when making this adjustment so there will be no slackness.

5. Tighten distributor clamp screw, be sure to hold distributor head in correct relation with rotor arm while doing this.
6. Recheck timing and reinstall distributor cap.

NOTE—The firing order of this engine, 1-5-3-6-2-4 is stamped on the distributor cap—rotation counter clockwise.

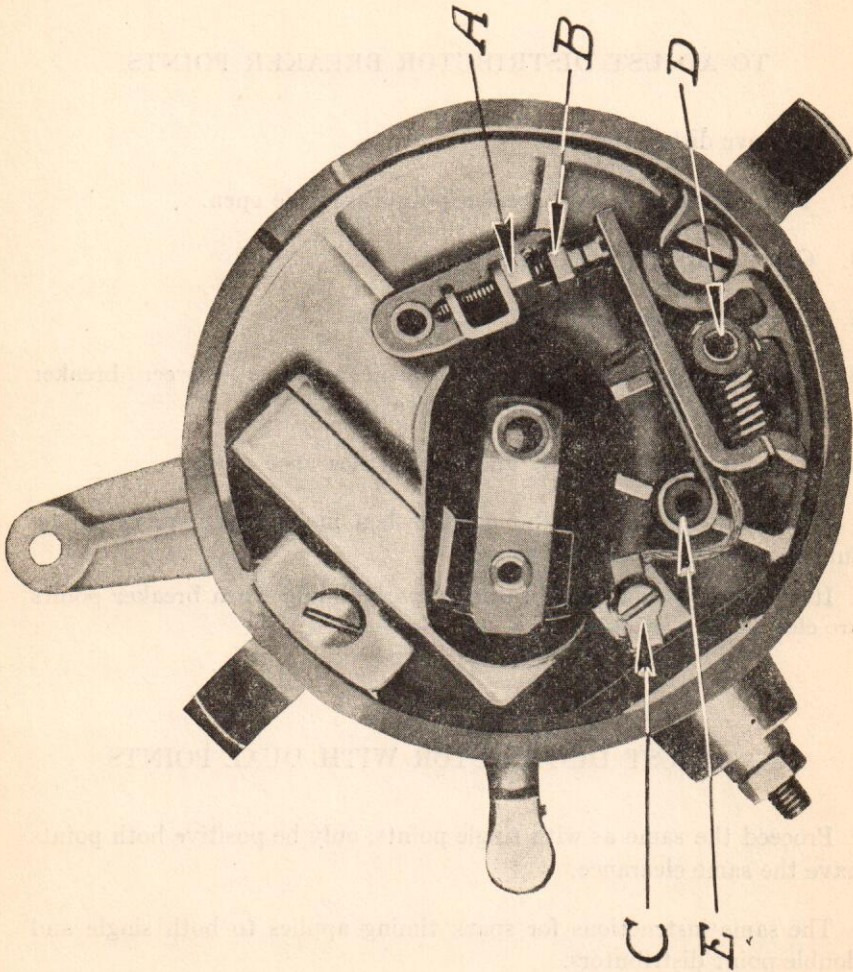
NOTE—Engine timing range: Automatic 22°  
Manual 20°

## SET SPARK TIMING

1. Proceed as in preceding operation.
  2. Remove any slackness from timing chain.
  3. Loosen distributor screw clamp screw.
  4. Place keys are directly beneath 10 o'clock on cap.
  5. Note—If spark is only from distributor to the left until breaker points open and close then turn to the right until breaker points just open. If spark is late turn distributor to the right until breaker points just start to open. Hold thumb against cover arm when making this adjustment so there will be no backlash.
  6. Tighten distributor clamp screw, be sure to hold distributor head in correct position with rotor arm while doing this.
  7. Check timing and reinstall distributor cap.
- Note—The firing order of this engine, 1-4-3-2-1 is stamped on the distributor cap—rotation counter clockwise.
- Note—Engine timing marks, Automatic 22.  
Manual 20.



## ADJUST BREAKER POINTS



See instructions on reverse side of sheet.

## TO ADJUST DISTRIBUTOR BREAKER POINTS

1. Remove distributor cap.
2. Turn engine over until breaker points are wide open.
3. Check spark gap with feeler gauge.
4. Loosen lock nut "A" as in cut.
5. Turn adjustable contact "B" until clearance between breaker points is not less than .015 or to exceed .020.
6. Tighten locking nut "B" and recheck clearance of gap.

NOTE—Always inspect the points when making adjustment to be sure they are clean and not pitted.

It is always advisable to recheck spark timing when breaker points are cleaned and adjusted.

## TO ADJUST DISTRIBUTOR WITH DUAL POINTS

Proceed the same as with single points, only be positive both points have the same clearance.

The same instructions for spark timing applies to both single and double point distributors.



## TO INSTALL NEW SET OF BREAKER POINTS

1. Remove distributor cap.
2. Disconnect breaker arm by removing screw "C".
3. Slip spring up off insulating bushing "D".
4. Lift breaker arm out.
5. Loosen lock nut "A".
6. Remove adjustable contact screw "B".
7. Thread lock nut "A" on new adjustable contact screw.
8. Re-install adjustable contact screw "B" in bracket.
9. Slip spring on lug of new breaker arm, slide the other end over insulating bushing "D" and at the same time work breaker arm down on pivot.

NOTE—Be sure bushing "E" in pivot stud is in place.

10. Re-connect pig tail by replacing screw "C".
11. Adjust breaker points as given in "To adjust breaker points".

**TO REPLACE CAM OR AUTOMATIC ADVANCE SPRING**

1. Remove distributor cap.
2. Remove cap screws.
3. Remove breaker box.
4. Slip springs off from distributor camshaft arm and governor weight studs.
5. Remove camshaft.
6. Replace new camshaft.

NOTE—A camshaft arm should be between the two studs on the advance weight.

7. Replace springs.
8. Replace breaker box and screws.
9. Replace distributor cap.

NOTE—If necessary to install new advance weight, the coupling on the shaft will have to be removed.

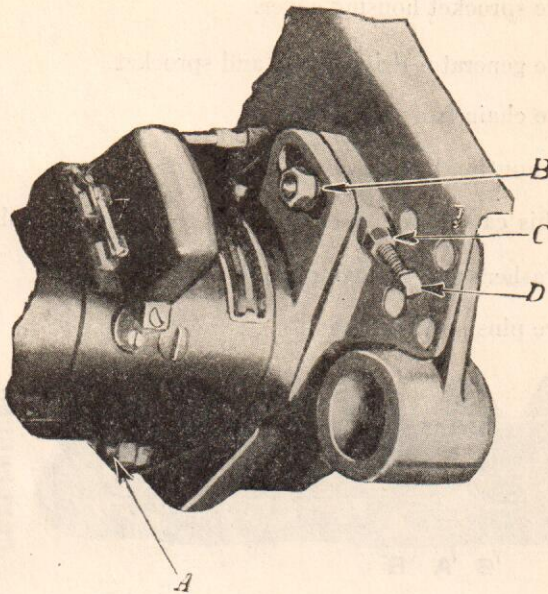
**REMOVE AND REPLACE DISTRIBUTOR ASSEMBLY FROM ENGINE**

1. Disconnect spark control rod from advance lever.
2. Disconnect spark plug leads.
3. Loosen cap screw in distributor housing casting.
4. Lift out distributor.
5. Replace distributor.
6. Tighten cap screw in distributor housing.
7. Re-connect spark plug leads and be sure leads are connected according to firing order which is 1-5-3-6-2-4.

NOTE—Slot on distributor shaft is placed off center making it impossible to assemble it incorrectly.



## TO ADJUST TIMING CHAIN



1. Loosen generator support bolt nuts "A" and "B" 1-1/2 turns.
2. Loosen lock nut "C".
3. Turn adjusting screw "D" to right which will move generator flange outward until chain slightly hums by engine running at moderate speed.
4. Back out adjusting screw "D" until quietness has been obtained.
5. Tighten lock nut "C" and generator supports bolt nuts "A" and "B".

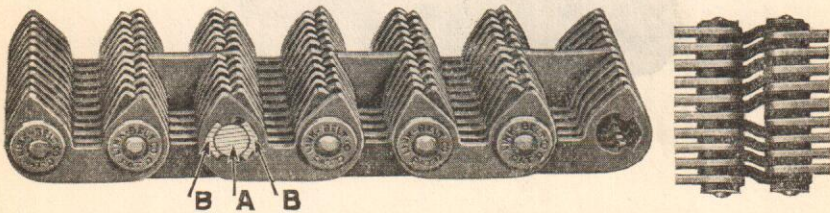
## TO REMOVE HUNTING LINK OR SHORTEN CHAIN

If all slackness is not removed from timing chain by the moving of the generator sprocket, the chain may be shortened by removing the hunting link.

1. Remove sprocket housing cover.
2. Remove generator drive flange and sprocket.
3. Remove chain from sprockets.
4. Locate hunting link on chain.

NOTE—This can be found by locating the offset link shown in cut.

5. Split washers and remove pins.
6. Remove pins and bushings.



7. Bring end of chain together, lapping links in regular order.
8. Insert pin "A" and bushings "BB".

NOTE—Chain travels in either direction.

9. Replace old washers, pins and bushings with new.
10. Replace chain on sprockets.
11. Readjust position of generator sprocket, proceeding as in operations on adjusting timing chain.

NOTE—The chain and the crankshaft, camshaft and generator sprockets all turn to the right.

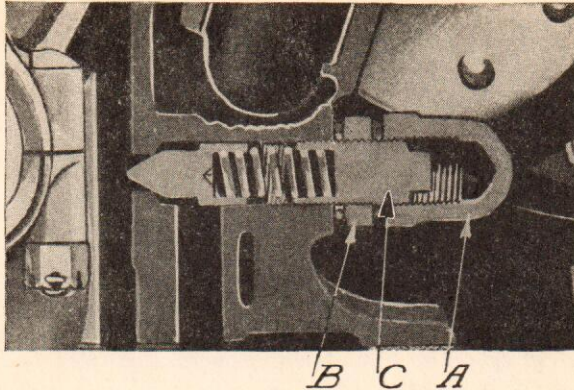
12. Insert spring and bearing pin for generator sprocket driving flange and replace sprocket housing cover.

NOTE—Reverse operations to re-assemble.

Camshaft setting should always be checked after removing chain. Refer to page BA12.



## ADJUST OIL PRESSURE



The following are conditions which should be checked before any adjustment of oil pressure is made.

Use of too light oil.

Oil dilution.

Loose bearings.

Leaky or broken oil tube.

Clogged oil screen.

Defective pump.

Defective oil pressure gauge.

Maximum 40 lbs. at 40 miles per hour.

Minimum at idling speed 4 lbs. or more.

When making this adjustment motor must be thoroughly warm.

1. Remove acorn nut "A".
2. Loosen lock nut "B".
3. Turn regulating screw "C" until a maximum pressure is obtained with wide open throttle. (Caution: motor should be run only momentarily at this speed.)
4. When maximum pressure has been obtained hold adjusting screw "C" and tighten locking nut "B".

# WARNING

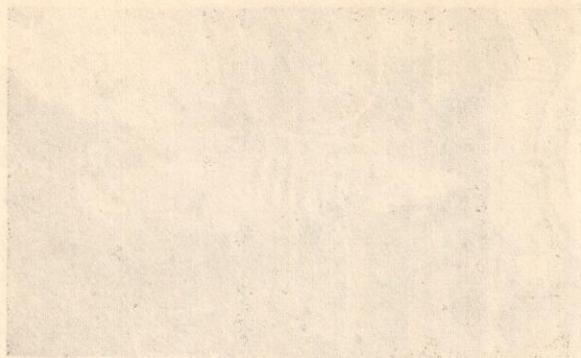


FIG. 1

The following are conditions which should be observed when using the instrument in oil pressure is required.

The oil should be:

Oil should be:

Free from water.

Free from dirt.

Free from sludge.

Free from scale.

Free from rust.

Free from any other foreign matter.

Minimum oil level should be maintained at all times.

When making this adjustment make sure the instrument is clean.

1. Before use, the "A" scale should be set to zero.

2. Before use, the "B" scale should be set to zero.

3. When the instrument is used, the oil pressure should be maintained at a constant level. The oil pressure should be maintained at a constant level. The oil pressure should be maintained at a constant level.

4. When the instrument is used, the oil pressure should be maintained at a constant level. The oil pressure should be maintained at a constant level. The oil pressure should be maintained at a constant level.



ADJUSTMENT OF SCHEBLER MODEL "S"  
CARBURETOR

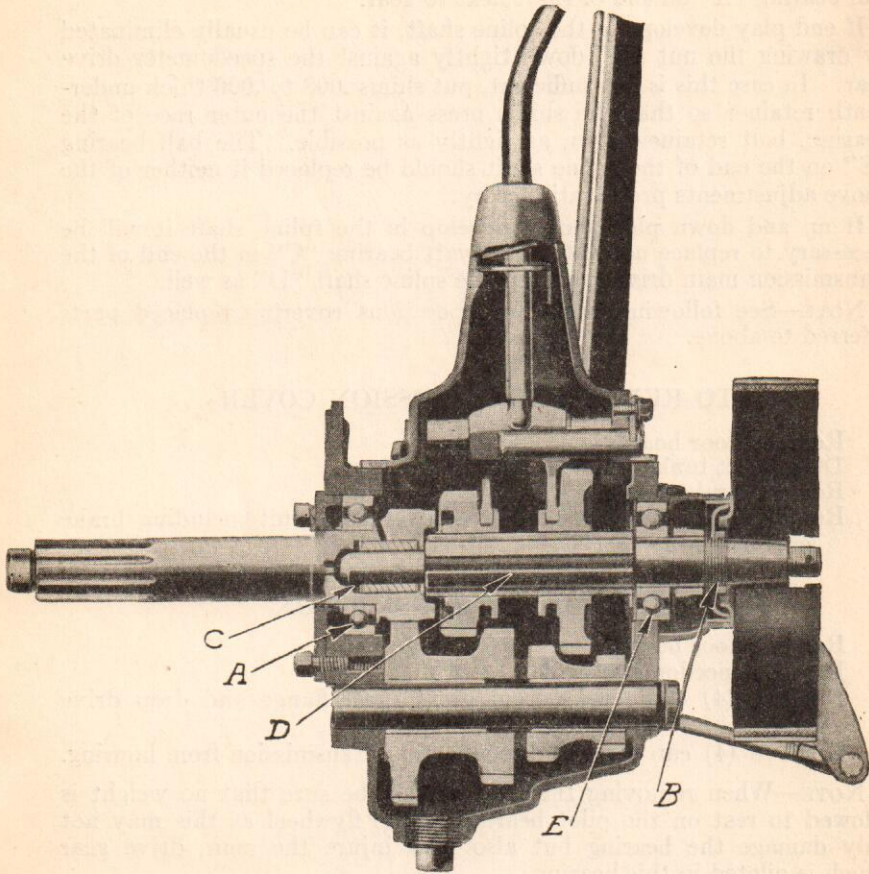
Refer to  
Instructions  
on Pages  
AA23-24

ADJUSTMENT OF SCHEMATIC MODEL  
CARBURETOR

Refer to  
Instructions  
on Pages  
A-13-24



## TRANSMISSION ADJUSTMENTS



See Instructions on reverse side of sheet.

### TRANSMISSION ADJUSTMENT

The transmission is so designed that there are no adjustments for either up or down play or end play in units other than the shim adjustment on the spline shaft.

If play develops in main drive gear it can be eliminated by replacing ball bearing "A" on end of shaft next to gear.

If end play develops in the spline shaft, it can be usually eliminated by drawing the nut "B" down tightly against the speedometer drive gear. In case this is not sufficient, put shims .003 to .006 thick underneath retainer so that the shims press against the outer race of the bearing, bolt retainer down as tightly as possible. The ball bearing "E" on the end of the spline shaft should be replaced if neither of the above adjustments prove satisfactory.

If up and down play should develop in the spline shaft it will be necessary to replace not only the Hyatt bearing "C" in the end of the transmission main drive gear, but the spline shaft "D" as well.

NOTE—See following pages for operations covering replaced parts referred to above.

### TO REMOVE TRANSMISSION COVER

1. Remove floor boards.
2. Disconnect brake pull rod from brake lever.
3. Remove brake sector.
4. Remove (4) cap screws, remove cover as a unit including brake lever assembly.

### TO REMOVE TRANSMISSION

1. Remove floor boards.
2. Remove speedometer cable.
3. Remove (4) cap screws from drive shaft flange and drop drive shaft.
4. Remove (4) cap screws, disconnecting transmission from housing.

NOTE—When removing the transmission be sure that no weight is allowed to rest on the pilot bearing in the flywheel as this may not only damage the bearing but also may injure the main drive gear which is piloted in this bearing.

5. Reverse operations to re-assemble.

### TO REMOVE MAIN DRIVE GEAR

1. Remove transmission.
2. Remove transmission cover.
3. Remove (4) bolts, nuts and lock washers.
4. Remove front bearing cap.
5. Remove gear from case by tapping lightly with hammer and brass punch.

NOTE—Be careful Hyatt bearing does not fall in case and be sure it is in place when gear is re-assembled.



### TO REMOVE BALL BEARING FROM DRIVE GEAR

1. Remove snap ring.
2. Remove bearing retaining washer, being careful not to bend it.
3. Remove bearing and replace with new bearing when necessary.
4. Reverse operations for re-assembling.

NOTE—To remove bearing pound pilot end on lead block, this will not injure the bearing. Do not press on outer race to remove as this will injure the bearing. When pressing on bearing, press against inner race only.

### TO REMOVE SPLINE SHAFT

1. Remove floor boards.
2. Remove speedometer cable.
3. Disconnect propeller shaft and drop it down.
4. Disconnect hand emergency brake from brake pull rod.
5. Remove transmission cover assembly.
6. Remove (4) bolts and lock washers.
7. Remove bearing cap.
8. Tap ball bearing on end of spline shaft lightly with brass punch and hammer and remove shaft from transmission.

NOTE—When spline shaft is removed care must be taken not to allow the Hyatt bearing in the main drive gear or the spacer ring on the pilot of the spline shaft to fall in the case. When replacing spline shaft, reverse operations. As the sliding gears are a selective fit on the shaft, keep turning gears until the best fit is secured.

### TO REPLACE NEW BALL BEARING ON END OF SPLINE SHAFT

1. Remove spline shaft.
2. Press off ball bearing or pound tapered end on lead block.
3. Replace with new ball bearing and re-assemble, reversing operations. When pressing on new bearing, press on inner race, never on outer race.

### COUNTERSHAFT

The countershaft and reverse idler gear shaft are stationary and are locked in place by a lock bar and cap screw which screws in rear of transmission case. The countershaft gears are machined as one unit with bushings (which are interchangeable) pressed and reamed in place with an allowance of .003 to .0045.

If any play develops in countershaft gears, it can be eliminated by replacing front and rear bushings.

The reverse idler gear is assembled with bushing reamed in place to a .002 running clearance and revolves on idler shaft which is locked in place with countershaft.

If play develops in idler gear install new bushing.

### TO REMOVE TRANSMISSION COUNTERSHAFT CLUSTER GEARS

1. Remove transmission from chassis.
2. Remove spline shaft.



3. Remove main drive gear.
4. Remove countershaft and idler shaft lock plate by removing cap screw in center of plate.
5. Remove countershaft.
6. Remove countershaft cluster gears.

#### TO INSTALL NEW BUSHINGS IN COUNTERSHAFT

1. Remove countershaft cluster gear.
2. Remove bushing from each end of countershaft.
3. Replace with new bushing.
4. When replacing countershaft reverse operations.

NOTE—Bushings must have a .003 to .0045 running clearance.

#### TO REMOVE IDLER GEAR FROM TRANSMISSION

1. Remove spline shaft from transmission.
2. Remove cap screw and lock plate, holding countershaft and idler shaft in position.
3. Remove idler shaft and gear from transmission case.
4. Install new bushing and re-assemble.

NOTE—When re-assembling reverse operations.

#### DIS-ASSEMBLING TRANSMISSION COVER

1. Remove brake lever assembly from its Fulcrum Pin.
2. Remove cap screw that holds shift rod lock plate.
3. Remove shift rod lock plate.
4. Drive shift rod through forks, use tool T-381 to hold spring and ball in place.
5. When one fork is out be sure and remove the 2 interlock steel balls.

NOTE—There are 2 interlock steel balls and 2 poppet steel balls, 1 in each fork. All 4 balls are 3/8" dia.

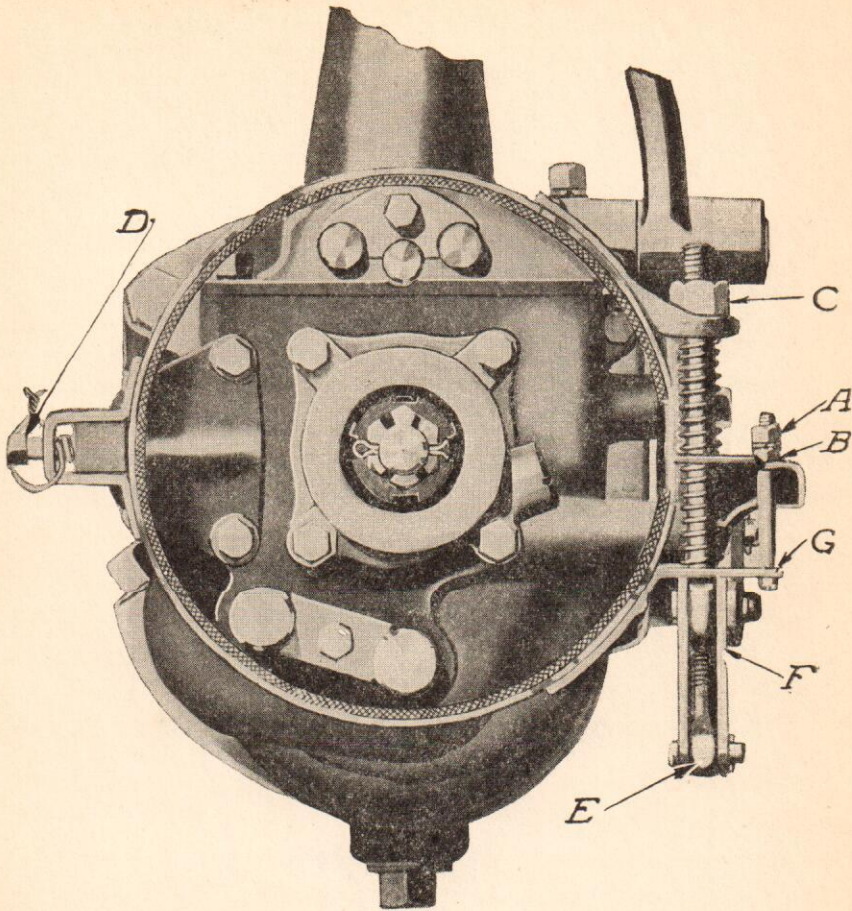
6. Drive shift rod out.
7. Drive remaining shift rod out.

NOTE—The shift rods are not interchangeable therefore they should be marked as removed to be sure they are replaced correctly.

8. Remove hand ball at top of control lever.
9. Remove spring from inside of shift fork.
10. Remove control lever.
11. Reverse operations to re-assemble.



## HAND EMERGENCY BRAKE ADJUSTMENT



To take up brake:

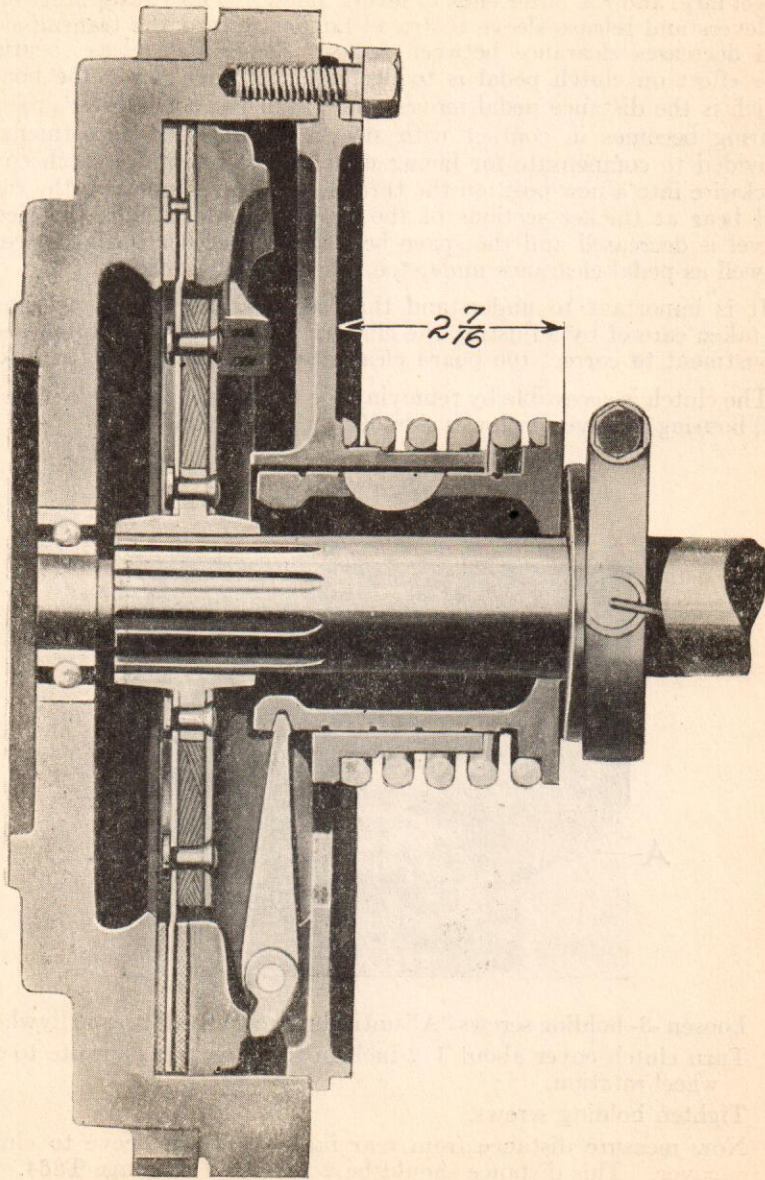
1. Loosen nut "A".
2. Tighten nut "B" until there is  $1/16$ " clearance between the lower half of the brake band and the lining.
3. Tighten nut "C".
4. Tighten bolt "D" until the entire lining clears the drum  $1/16$ ".

NOTE—Do not attempt to adjust the brake by changing the length of the pull rod "E". This rod length should be such that the cam lever "F" surfaces rest flatly against the lower brake band brake "G" when the brake lever is in released position.





## CLUTCH ADJUSTMENT



See Instructions on reverse side of sheet.



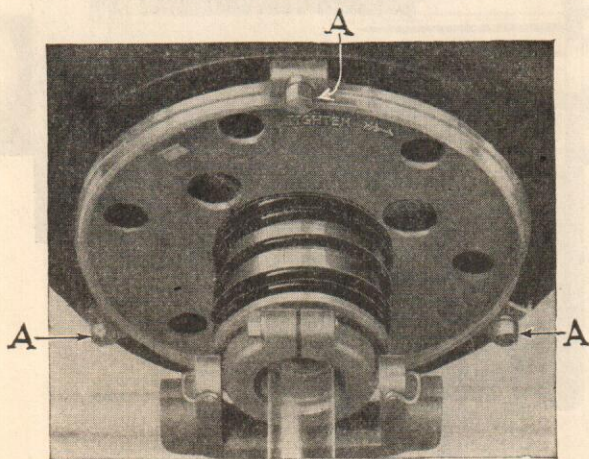
## CLUTCH ADJUSTMENT

As the clutch facings wear, the pressure plate moves close to flywheel face, and the outer ends of levers follow. This causes inner ends of levers and release sleeve to travel farther toward the transmission, and decreases clearance between face of sleeve and release bearing. The effect on clutch pedal is to decrease clearance under toe board, which is the distance pedal moves away from toe board before release bearing becomes in contact with sleeve. The clutch adjustment is provided to compensate for facing wear, and by turning clutch cover clockwise into a new position the three levers move higher on the cams and bear at thicker sections of the pressure plate. Thus the sleeve travel is decreased and the space between release bearing and sleeve, as well as pedal clearance under toe board, is increased.

It is important to understand that compensation for wear should be taken care of by adjusting the clutch. Do not change clutch pedal adjustment to correct toe board clearance except as instructed below.

The clutch is accessible by removing toe board and hand hole plate on bell housing or cover on lower side of flywheel housing.

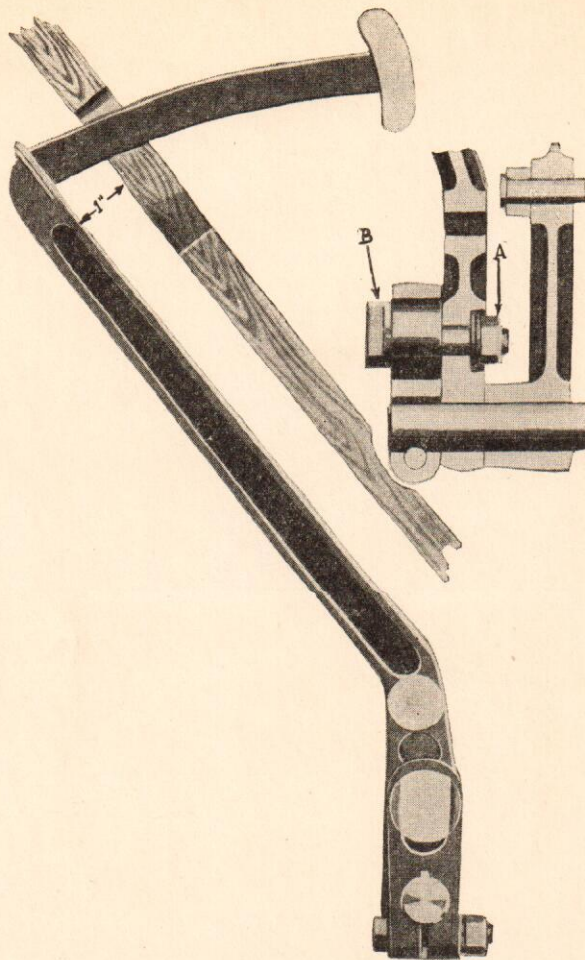
## TO ADJUST CLUTCH



1. Loosen -3- holding screws "A" until clutch cover will turn in flywheel.
2. Turn clutch cover about 1/2 inch in the direction opposite to flywheel rotation.
3. Tighten holding screws.
4. Now measure distance from rear face of release sleeve to clutch cover. This distance should be  $2 \frac{7}{16}$ ". Use gauge T364.
5. If this space is more than  $2 \frac{7}{16}$  inches, loosen holding screws as above and turn in the same direction. If less than  $2 \frac{7}{16}$  inches, turn cover in the direction of flywheel rotation. After correct setting has been obtained, be sure holding screws are tightened. This completes clutch adjustment.



## CLUTCH PEDAL

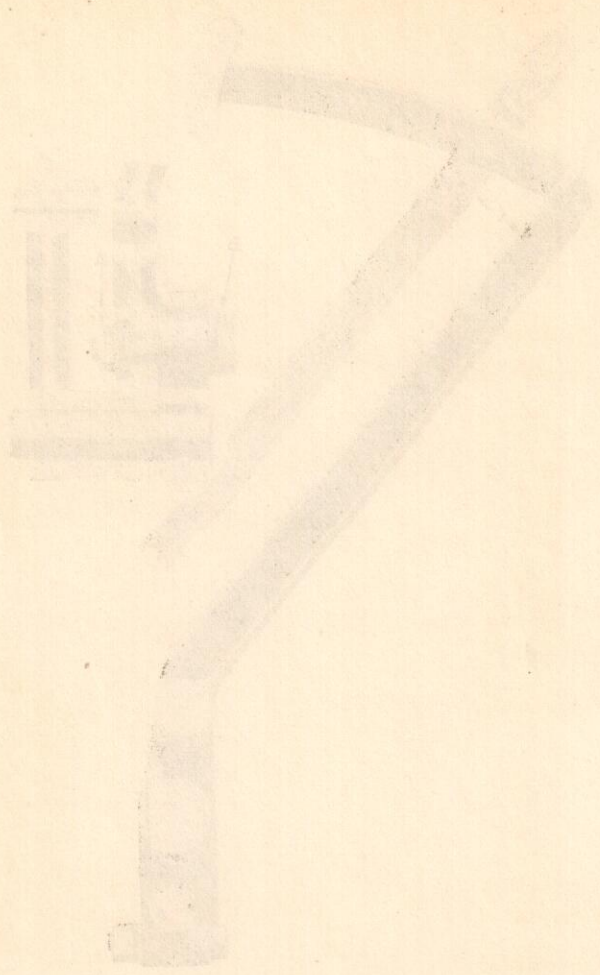


6. Clutch pedal is correctly set at the factory and should not require changing. However, if necessary to correct setting proceed as follows:
7. Clutch pedal is in proper position when the shoulder on clutch pedal arm is one inch from lower side of toe board as shown in cut above. If this dimension is more than one inch raise the pedal, if less than one inch, lower the pedal.

## ADJUST CLUTCH PEDAL

8. Loosen nut "A" shown in cut.
9. Turn cam "B" to right or left as the case may be until the dimensions given in paragraph (7) have been obtained.
10. Hold cam "B" in proper position and tighten nut "A".

LETTER FROM



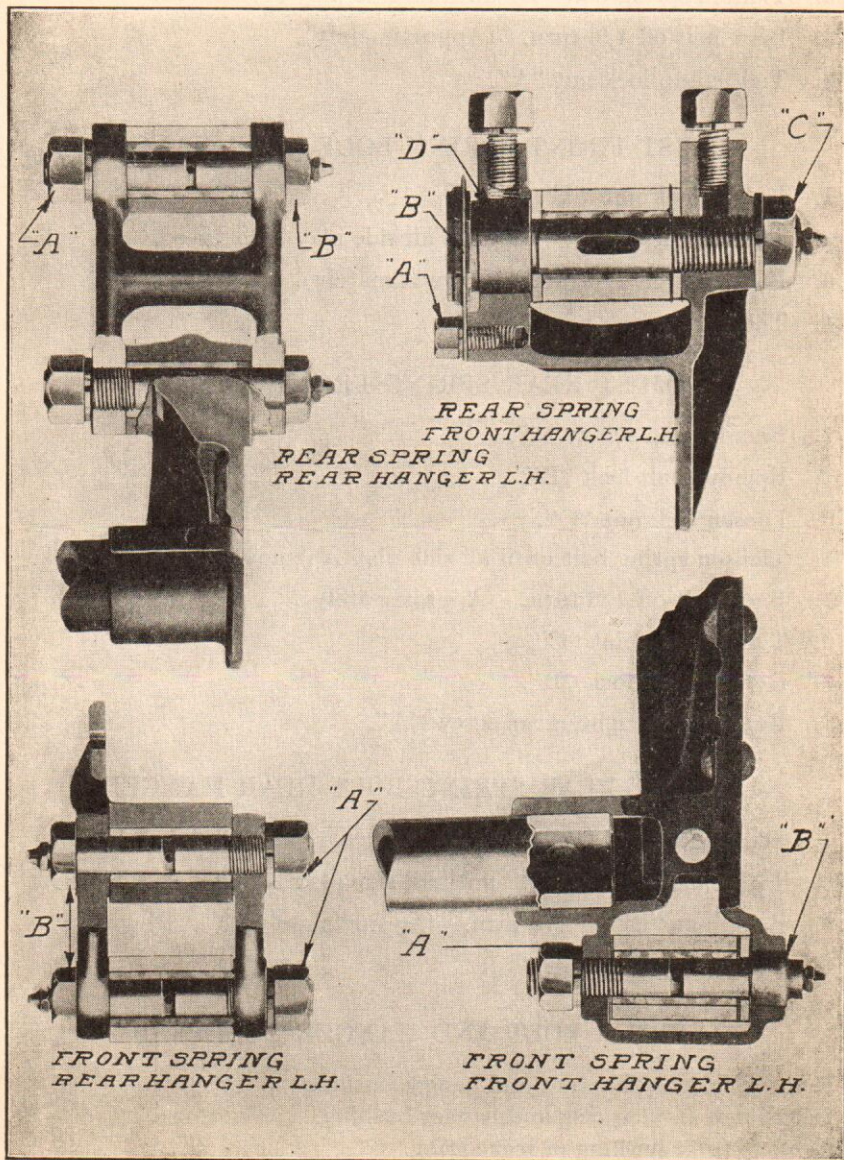
8. This is a copy of the letter from the Secretary of the  
Board of Directors of the American Association of  
University Professors, dated June 1, 1940, to the  
President of the American Association of University  
Professors, dated June 1, 1940, and to the  
President of the American Association of University  
Professors, dated June 1, 1940.

LETTER FROM

9. This is a copy of the letter from the Secretary of the  
Board of Directors of the American Association of  
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Professors, dated June 1, 1940, and to the  
President of the American Association of University  
Professors, dated June 1, 1940.



## ADJUST SPRING BOLTS AND HANGERS



See Instructions on reverse side of sheet.



**ADJUST FRONT SPRING BOLT FRONT HANGER**

1. Loosen lock nut "A".
2. Tighten spring bolt "B" until all side play is removed.
3. Back bolt off 1/6 turn. (Approximately).
4. Tighten up lock nut "A".

**ADJUST FRONT SPRING BOLT REAR HANGER**

1. Loosen lock nut "A".
2. Tighten spring bolt "B" until all side play is removed.
3. Back bolt off 1/6 turn. (Approximately).
4. Tighten up lock nut.

**ADJUST REAR SPRING FRONT HANGER**

1. Remove cap screw "A".
2. Remove bolt lock "B".
3. Loosen lock nut "C".
4. Tighten spring bolt until all side play is removed.
5. Back bolt off 1/6 turn. (Approximately).
6. Tighten lock nut "C".
7. Replace bolt lock "B".
8. Replace and tighten cap screw "A".

**ADJUST REAR SPRING BOLT REAR HANGER**

1. Loosen lock nut "A".
2. Tighten spring bolt "B" until all side play is removed.
3. Back bolt "B" off 1/6 turn. (Approximately).
4. Tighten up lock nut.

**SPRING BOLT AND HANGER BUSHINGS**

Remove front spring bolt and hanger bushing.

Install new front spring and hanger bushing.

Remove front bushing of rear spring.

Install new front bushing of rear spring.

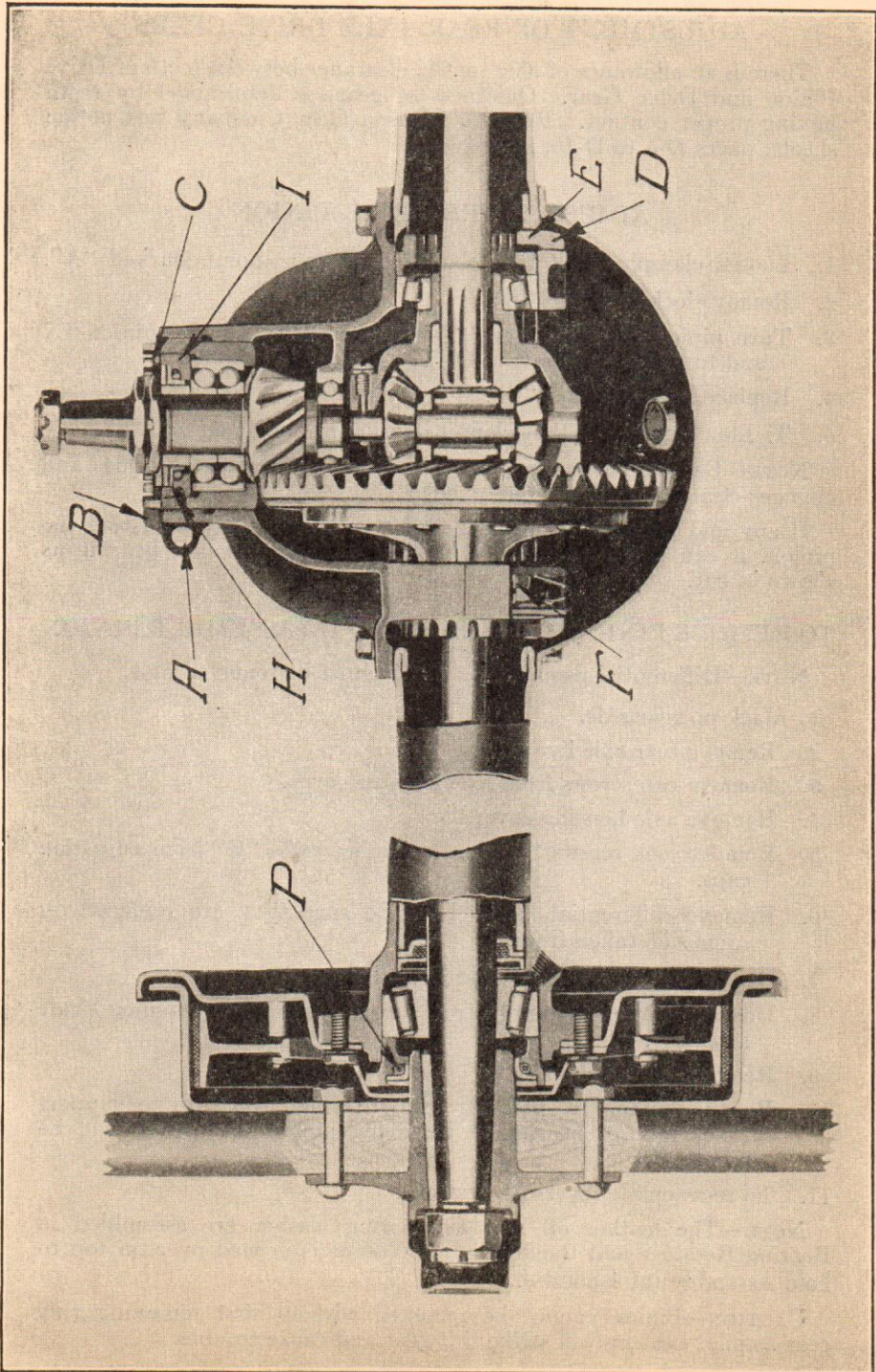
Remove rear spring bolt and hanger bushings.

Install new rear spring and hanger bushing.

Use tool T-320 bushing press with adapters.



## REAR AXLE ADJUSTMENT



See Instructions on reverse side of sheet.



### ADJUSTMENT OF REAR AXLE DRIVE GEARS

There is an allowance of .002 to .012 clearance between teeth of Drive Pinion and Drive Gear. Quietness of gears is determined by teeth having proper contact. Refer to Gleason Gear Company instruction sheets, pages D-5 to D-10, inclusive.

### ADJUST BEVEL DRIVE PINION

1. Loosen clamping bolt that clamps housing at point marked "A".
2. Remove locking finger "B".
3. Turn pinion adjusting cage "C" to the right to move pinion IN and to the left to move it OUT. Use wrench T-366.
4. Replace locking finger "B".
5. Tighten clamp bolt that clamps housing at point marked "A".

NOTE—Each notch moves pinion in or out approximately .004" and changes clearance approximately .0015.

If any end play develops that cannot be removed by adjusting the pinion, it can be eliminated by replacing the double ball bearing as shown in cut.

### TO REMOVE PINION ASSEMBLY AND DISASSEMBLE PINION

NOTE—Differential assembly as a unit must be removed first.

1. Jack up rear axle.
2. Remove rear axle live shafts.
3. Remove cap screws from axle housing cover.
4. Remove axle housing cover.
5. Remove lock screws "D" and retaining locks "E" from adjusting caps.
6. Remove differential caps "F". Be sure they are replaced on same side taken from.
7. Remove clamp bolt "A" and locking finger "B".
8. Unscrew pinion assembly from carrier and remove pinion shaft assembly.
9. Remove nuts and washers.
10. Remove pinion by pressing from bearing. Be sure to support inner race of bearing in removing pinion or bearing will be damaged.
11. To re-assemble reverse operations.

NOTE—The leather oil seal and spring washer are assembled in Bearing Retainer and the Retaining Washer is peened over on top to hold Assembly (at 4 points).

CAUTION—Pinion cannot be removed without first removing ring gear as pilot bearing will strike this gear and cause trouble.



### TO DISASSEMBLE BEARING CAGE ASSEMBLY IF NECESSARY

1. Remove dog point screw (H). This permits unscrewing bearing retainer (I).
  2. Remove double row ball bearing.
- To reassemble reverse operations.

### TO REMOVE INNER BALL BEARING

1. Remove inner ball bearing from pinion shaft. Be sure to support bearing inner race when pressing off so as not to damage bearing.

NOTE—The end of pinion shaft is annealed, allowing it to be peened over (at 4 points) on inner race of ball bearing.

### TO ADJUST REAR AXLE DRIVE GEAR

If any excessive clearance develops between Drive Gear and Pinion Gear it can be eliminated by adjustment of Drive Gear.

1. Jack up rear wheels and drain lubricant by removal of bottom plug.
2. Remove cap screws from Axle Housing Cover.
3. Remove Axle Housing Cover.
4. Remove cotter pin and retaining lock "E" from adjusting caps.
5. Loosen differential support caps.
6. Turn right hand adjusting cap to the left, using tool T-368. (Away from differential gear case.)
7. Turn left hand adjusting cap to right, using tool T-368. (Toward differential gear case.)
8. Tighten differential support caps "F".
9. Try out axle for noise and repeat above operations until quietness is obtained.

NOTE—These adjustments should be made by having wheels on a jack off the floor and running the car in high gear at various speeds before taking out for road test.

10. Replace Retaining Lock and Cotter Pin on Adjusting Caps.
11. Replace new Gasket on Axle Housing Cover if necessary and replace Cover with oil filler Plug in proper position.
12. Replace Cap Screws on Cover.

NOTE—See pages D-5 to D-10.

### TO ADJUST REAR AXLE SHAFT BEARINGS

1. Jack up rear wheels.
2. Remove Hub Caps.
3. Remove Cotter Pin.
4. Remove Nut from Axle Shaft.
5. Pull wheel using puller T-379.
6. Remove Locking Finger and Bolt.
7. Tighten up adjusting Cap "P" until all end play is removed, using Tool T-367.
8. Back off Adjusting Cap two notches.
9. Replace Locking Finger and Bolts.

## TO DISASSEMBLE BEARING CASE ASSEMBLY IN REVERSE

1. Remove cap screw (11). This permits unscrewing bearing cap (12).
2. Remove roller ball bearing.
3. To reassemble reverse operations.

## TO REMOVE INNER BALL BEARING

1. Remove inner ball bearing from pinion shaft. Be sure to support bearing inner race when pressing off so as not to damage bearing.
- Note--The end of pinion shaft is chamfered, allowing it to be pressed over (at 1 point) on inner race of ball bearing.

## TO ADJUST REAR AXLE DRIVE GEAR

If any excessive clearance develops between Drive Gear and Taper Gear it can be eliminated by adjustment of Drive Gear.

1. Jack up rear wheels and drain lubricant by removal of bottom plug.
2. Remove cap screws from 2-1/2 Housing Cover.
3. Remove Axle Housing Cover.
4. Remove roller pin and retaining lock "W" from adjusting caps.
5. Loosen differential support caps.
6. Turn right hand adjusting cap to the left, using tool T-300.
7. Turn left hand adjusting cap to right, using tool T-300. (Toward differential gear case).
8. Tighten differential support caps "T".
9. Try out axle for noise and repeat above operation at equal distances as obtained.

Note--These adjustments should be made by driving wheels on a jack up the floor and running the car in high gear at various speeds before taking out for road test.

10. Replace Retaining Locks and Roller Pin on Adjusting Caps.
11. Replace new gaskets on Axle Housing Cover if necessary and re-place Cover with oil filler plug in proper position.
12. Tighten Cap Screws on Cover.

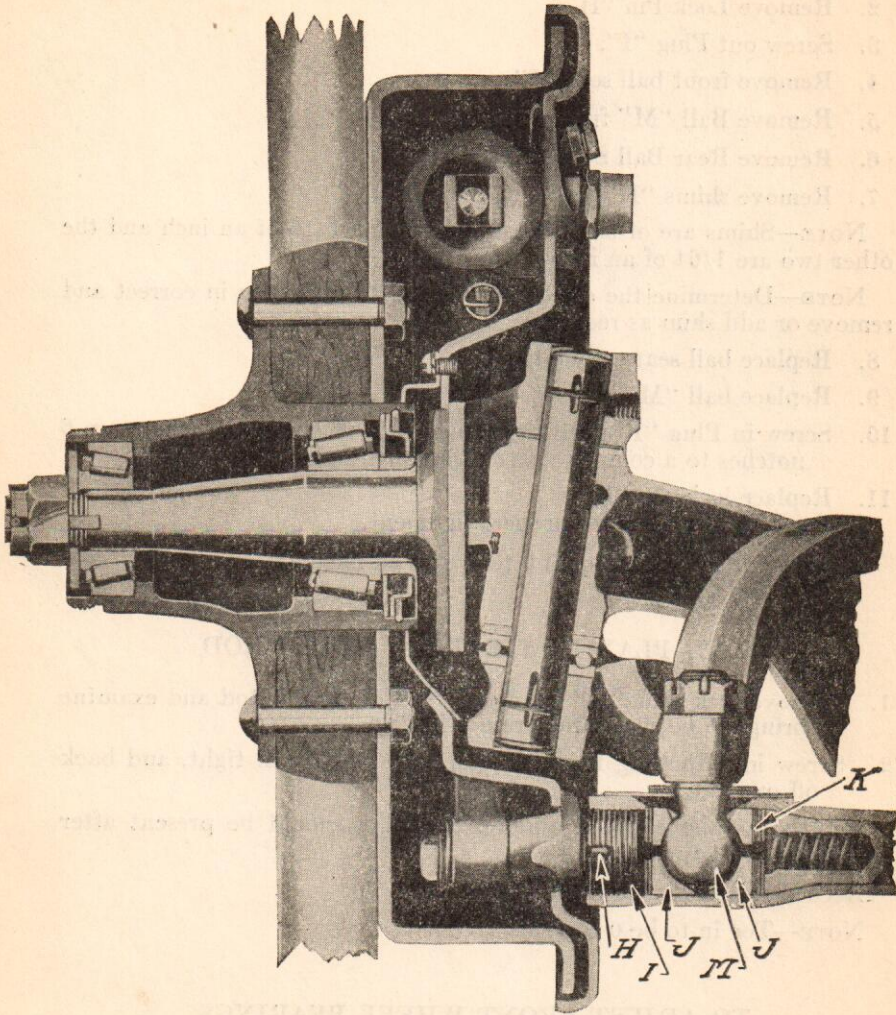
Note--See pages 11-12 to 11-13.

## TO ADJUST REAR AXLE SHAFT BEARINGS

1. Jack up rear wheels.
2. Remove Drive Shaft.
3. Remove Cap Screw.
4. Remove Nut from Axle Shaft.
5. Roll wheel away using T-310.
6. Remove 1-1/2 inch 1/2 inch and ball.
7. Tighten differential cap "T" until all end play is taken out using Tool T-300.
8. Back off Adjusting caps for backlash.
9. Reinstall locking pin and roller.



## ADJUST FRONT WHEELS



See Instructions on reverse side of sheet.



## TO ADJUST REACH ROD FOR TOE IN ON FRONT WHEELS

1. Jack up front wheels.
2. Remove Lock Pin "H".
3. Screw out Plug "I".
4. Remove front ball seat "J".
5. Remove Ball "M" from slot.
6. Remove Rear Ball Seat "J".
7. Remove shims "K".

NOTE—Shims are of two dimensions: one is  $\frac{1}{16}$  of an inch and the other two are  $\frac{1}{64}$  of an inch.

NOTE—Determine the dimension needed to make toe in correct and remove or add shim as required.

8. Replace ball seat at points "J".
9. Replace ball "M".
10. Screw in Plug "I" until tight and back off one notch (there are 6 notches to a complete revolution of the plug).
11. Replace lock pin "H".

Recheck front wheels for proper alignment.

NOTE—Toe in should equal 0 to  $\frac{1}{8}$  of an inch.

## END PLAY IN STEERING REACH ROD

1. Remove lock pins "H" from each end of Reach Rod and examine springs to be sure same are not broken.
2. Screw in Adjusting Plug "I" (on each end) until tight, and back off one notch.

Replace as above noted and no end play should be present after making above adjustment.

Recheck alignment of front wheels.

NOTE—Toe in to be 0 to  $\frac{1}{8}$ .

## TO ADJUST FRONT WHEEL BEARINGS

1. Jack up front wheels.
2. Remove hub cap.
3. Remove cotter pin.
4. Draw up adjusting nut until all play is eliminated.

NOTE—Spin wheel to see if it has proper running clearance. If it is too tight, back off Nut until wheel turns freely.

NOTE—Both wheel nuts are right hand thread.



**BRAKE ADJUSTMENT**  
will be found on pages  
AD11 to AD22 inclusive

ADDITIONAL TO ADJUST INCLUSIVE  
WILL BE FOUND ON PAGES  
BRIDGE ADJUSTMENT



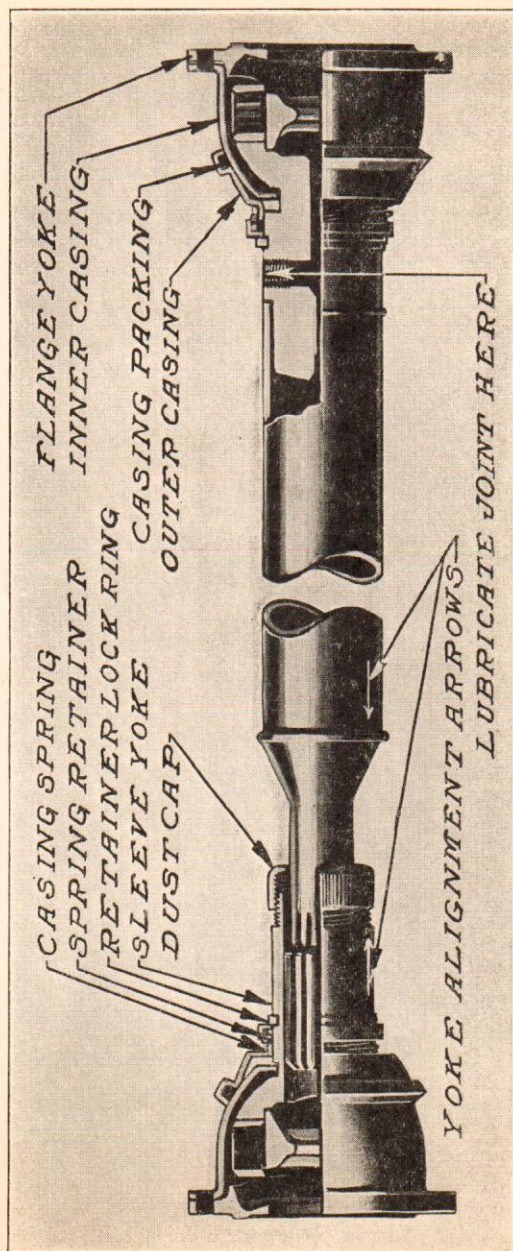
## DRIVE SHAFT—B—BA

1. When removing the propellor shaft from the car or truck do not let either end fall. The shaft should not be permitted to swing from one joint, as its weight will damage the mouth of the inner casing, which in turn will rapidly destroy the casing packing.
2. To disassemble, unscrew the dust cap from the sleeve yoke, then remove the spring retainer lock, which can be done with a screw driver. The outside and inside covers can then be removed but care should be taken not to dent or distort them.
3. To disassemble the yokes and journals, it is necessary to remove the bushings from the flange yokes. To do this, remove the bushing lock-rings with a screw driver or similar tool. Then remove the bushing. This may be done with a flat nose punch and hammer, tapping first one side and then the other. This leaves the flange yoke free. The bushings in the sleeve yoke and ball yoke are removed in a similar manner. Before reassembling the joint see that all the parts are clean and that the bearing surfaces are oiled, as grease may not reach the moving parts of the joint for the first few revolutions and the oil helps the grease work in rapidly.
4. The journal must be inserted in the sleeve, ball or flange yoke, making sure that the journal shoulders do not project above the yoke lugs. This permits the joints to operate at the maximum angle for which they are designed. The bushings are then driven into their respective places, but it should be kept in mind that when removing and replacing bushings, they should be coaxied rather than forced into place. Be sure to keep the bushings lined up with the journal lug. After each pair of bushings is in position, test the movement of the journal to make sure that it moves freely and does not bind in any way.
5. When replacing the inner casing be sure to get the grease plug opposite the space between the yokes so that grease can be inserted without difficulty.
6. Do not paint the spherical part of the inner casing. If the packing of the outside casing is forced to ride over a ridge of paint it will wear rapidly.

7. When replacing the slip joint on the tubular shaft, line up the arrow stamped on the sleeve yoke with the arrow stamped on the tubular shaft; this insures having the yokes in their correct relation to each other.



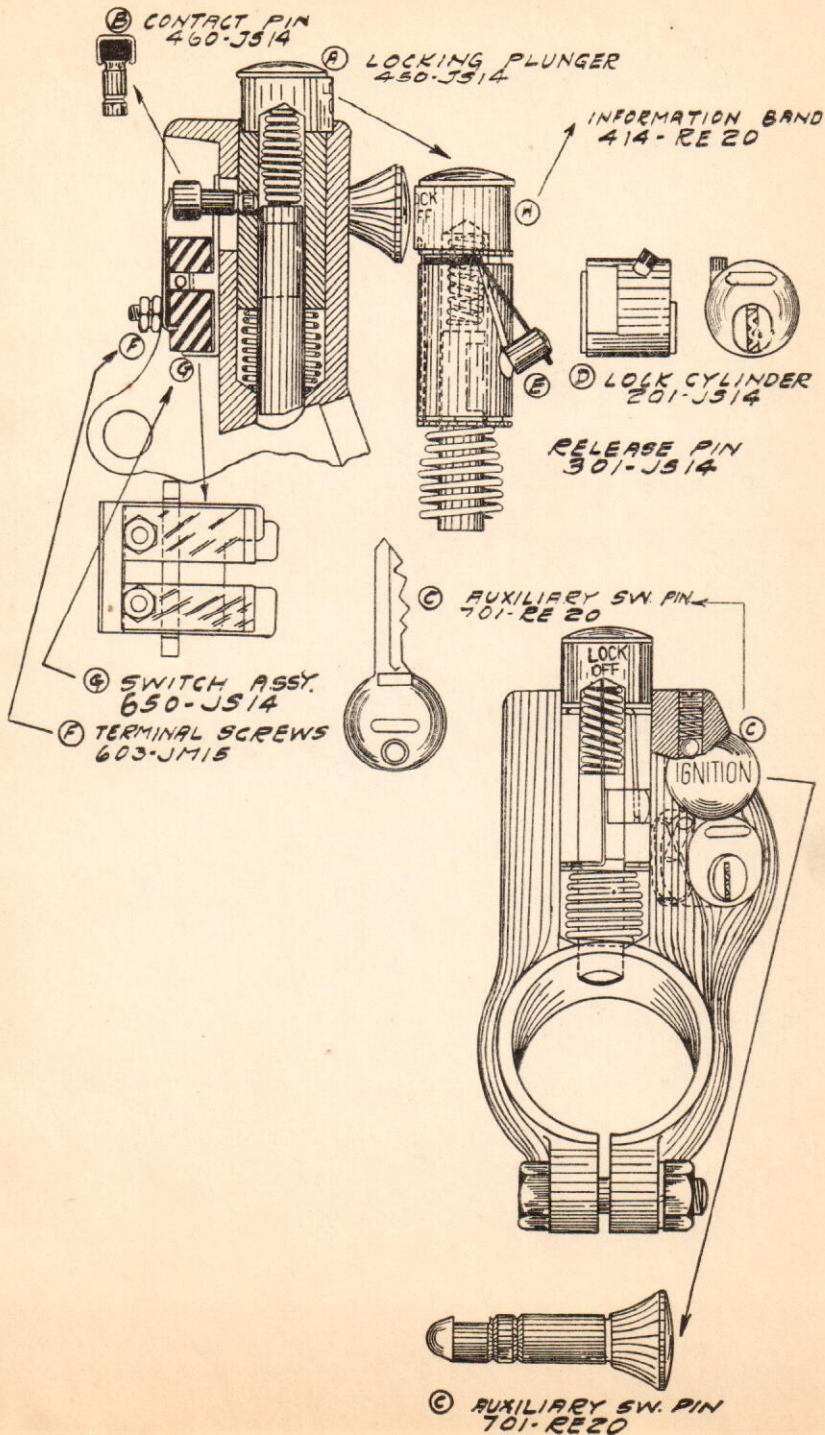
## DRIVE SHAFT—B—BA



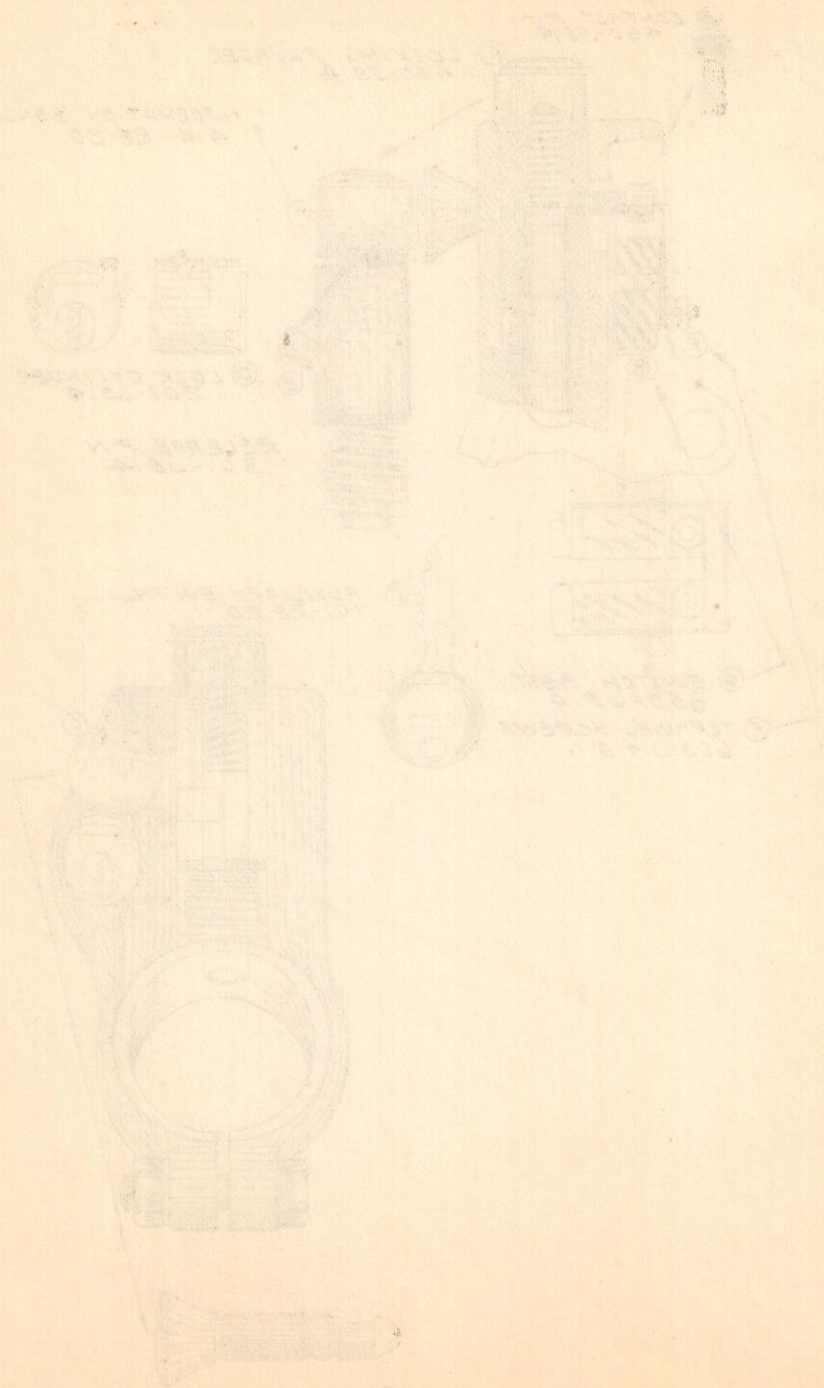




## COINCIDENTAL LOCK

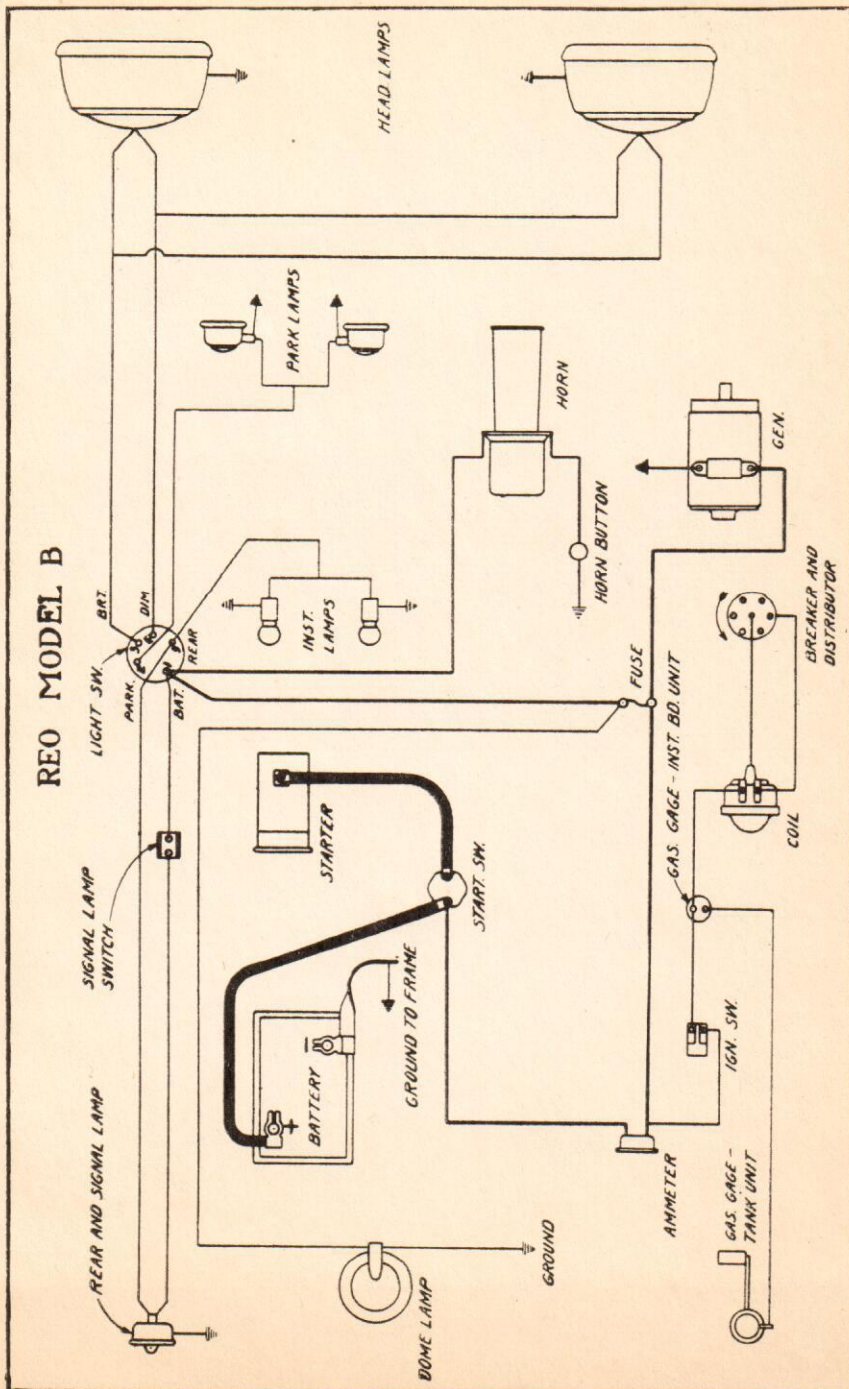


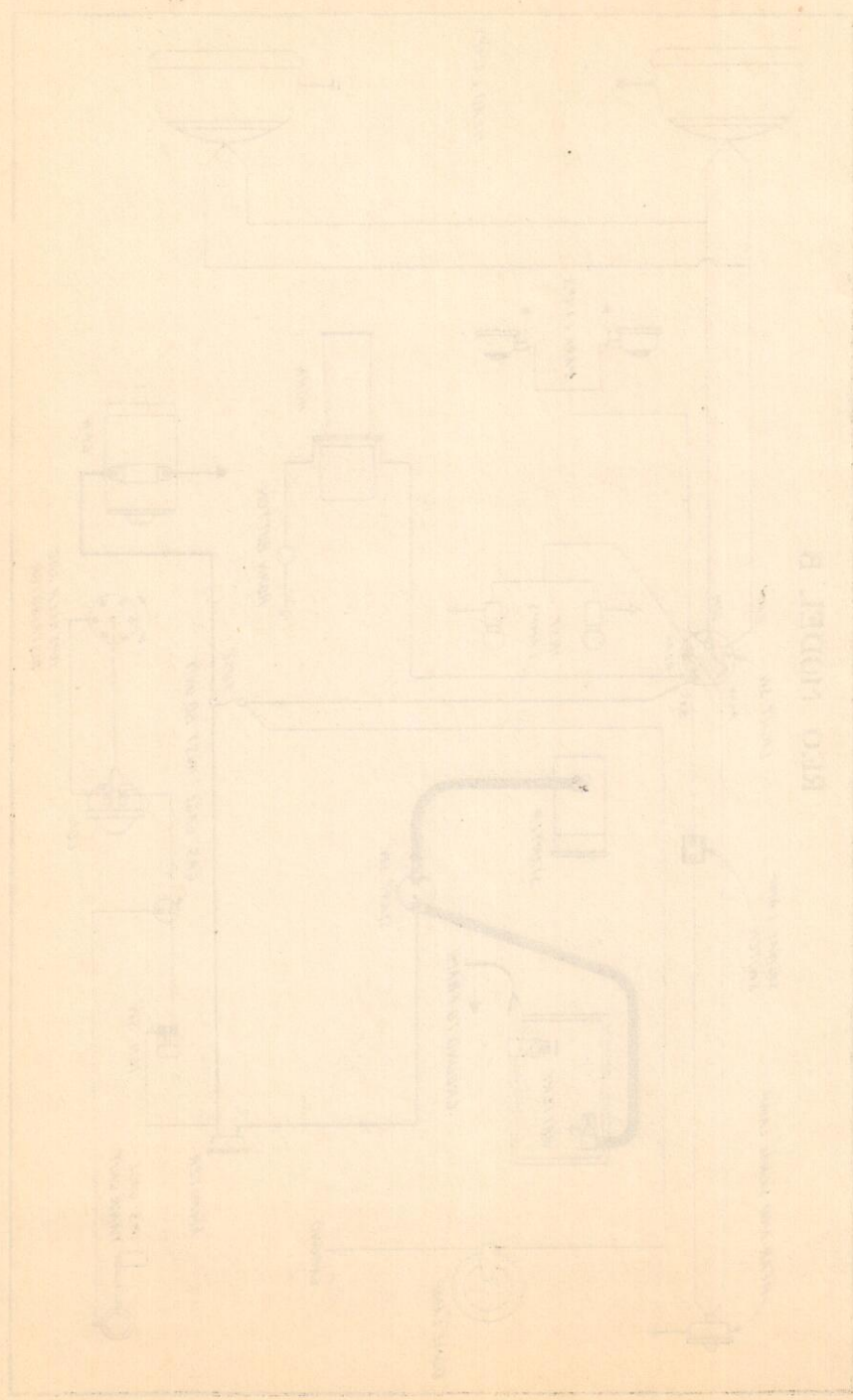
# CONTINENTAL LOCK





## WIRING DIAGRAM

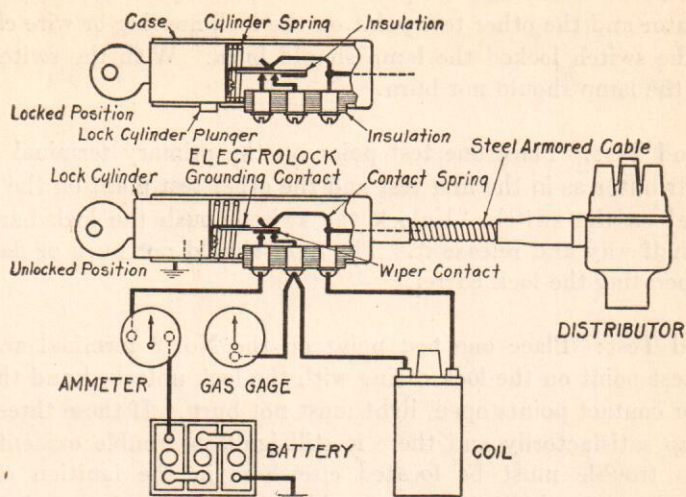




KTO MODEL B



## OPERATION AND SERVICING OF ELECTROLOCK



The Electrolock is classified as the Underwriters' Group One Co-incidental Lock.

A quarter turn of the key releases the lock plunger and allows the plunger to spring out closing the ignition circuit. The key is not required to lock the car and *should be removed* after the operation of unlocking is completed. In order to break the ignition circuit and lock the car the plunger should be pushed completely in. The action of breaking the ignition circuit not only protects the car against theft by a mechanical protection of the primary circuit but grounds the ignition circuit in two places and also locks the lock itself to the car. The mechanical protection is accomplished by means of a steel cable protecting the primary circuit between the switch and the distributor, said cable being attached to the distributor in such a way as not easily being removed. The grounding of the circuit takes place both through the lock casing and through the attachment at the distributor.

In servicing should ignition trouble develop to ascertain whether or not such trouble exists in the Electrolock switch the following tests should be applied. **FIRST** the wires should be disconnected from all the terminals on the lock case. This should always be done as an attempt to remove the cylinder from the lock switch without first disconnecting these wires will short circuit and burn the distributor insulation. The switch may then be tested in the following manner by



using a six volt battery and lamp or a lamp in series with a one hundred and ten volt circuit and the conventional insulated handle test points:

**First Test:** Place one test point on the primary terminal inside the distributor and the other test point on the lock housing or wire circuit. With the switch locked the lamp should burn. With the switch unlocked the lamp should not burn.

**Second Test:** Place one test point on the primary terminal inside the distributor as in the first test and the other test point on the No. 2 terminal on the switch. Unlock the switch, push the lock barrel in about half way and release it. The light should not burn or flash in, thus operating the lock barrel.

**Third Test:** Place one test point on the No. 3 terminal and the other test point on the lock casing with the lock unlocked and the distributor contact points open, light must not burn. If these three tests show up satisfactorily and there is still ignition trouble evident, this ignition trouble must be located elsewhere in the ignition circuit. Should the above indicate some trouble in the Electrolock switch, the lock should then be unlocked and removed from the mounting. All wires should then be disconnected from the terminals. The lock cylinder then can be removed by taking out the small set screw on the side of the lock casing. Remove the coil spring which is directly behind the lock cylinder and pull out the metal wedge which holds the bakelite terminal block in position. With the terminal screws removed, that part of the bakelite piece in which the terminal screws are located can be pushed into the lock casing and the lock casing can then be slid back on the cable allowing the switch to be inspected. Any trouble with the switch due to broken parts will then be readily discovered and necessary parts for repairs are in the hands of all service stations.

In order to make distributor repairs which cannot be accomplished on the car, the lock can be unlocked, removed from the mounting, and the distributor taken to the bench with the lock and the cable attached.

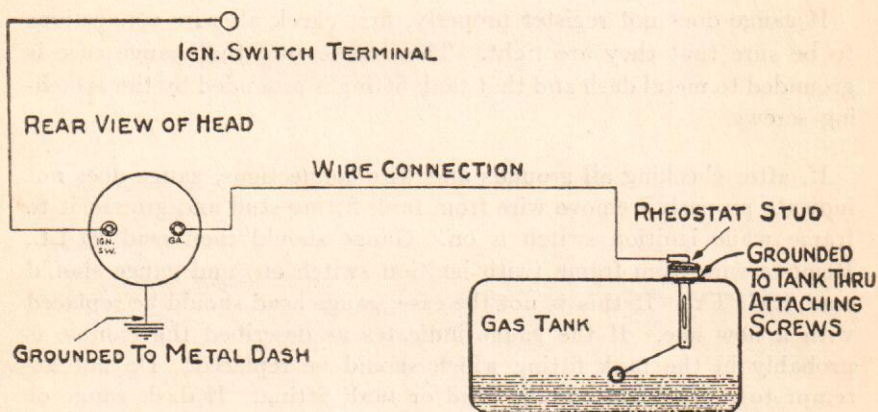
Should the lock plunger not work freely on account of dirt or foreign matter getting into the lock case, the cylinder should be removed and cleaned off so that it will work freely.

When a car is left either on the street or in a garage always be sure that the lock plunger is completely pushed in. If the switch is left open the battery will run down as in the case with any ignition switch.



## ELECTRIC GASOLINE GAUGE

The electric dash gasoline gauge consists of two principal parts, the indicating instrument, or gauge head, on the dash, and the actuating apparatus, or tank fitting, which is installed on the gasoline tank. These two parts are connected by a wire running along the frame of the car.



The gauge head is of the balanced coil type and has inherent characteristics which render it unaffected by variations in voltage, consequently the indications are not materially different when the battery is low or when it is being charged by the generator. The gauge is wired from one stud, or terminal (marked "Ign. Sw.") to the ignition switch. The gauge indicates only when the switch is turned on, and at other times the pointer will register EMPTY.

At the filling station, the height of the gasoline can be checked by turning on the ignition switch without starting the motor.

The second stud on the gauge head, (marked "Ga.") is connected by the wire which runs along the frame to the stud or terminal on the tank fitting. The gauge head is grounded through its case to the metal instrument board. When the instrument board is made of wood, it is necessary to run a special ground wire from the gauge case to the car frame.

The tank fitting consists of a rheostat, or variable resistance, and through the agency of a float and a series of gears, a sweep arm is moved across the face of the rheostat, thereby increasing or decreasing its resistance as the depth of the liquid in the tank is raised or lowered. As the resistance of the rheostat is varied, there results a proportionate variation of current in the indicating instrument or



gauge head, which is calibrated to accurately indicate the gasoline level in the tank. The tank fitting is grounded by means of the screws which attach it to the tank, thus completing the electrical circuit.

The tank fitting is equipped with a mercury seal which prevents gasoline or gasoline fumes from rising into the rheostat chamber.

### SERVICE

If gauge does not register properly, first check all wire connections to be sure that they are tight. Then make sure that gauge case is grounded to metal dash and that tank fitting is grounded by the attaching screws.

If, after checking all grounds and wire connections, gauge does not indicate properly, remove wire from tank fitting stud and ground it to frame while ignition switch is on. Gauge should then read FULL. Remove wire from frame (with ignition switch on) and gauge should read EMPTY. If this is not the case, gauge head should be replaced with a new one. If the gauge indicates as described the trouble is probably in the tank fitting which should be replaced. Do not attempt to repair either gauge head or tank fitting. If dash gauge or tank unit do not work return to National Gauge & Equipment Co.

The screw holes in the tank fitting and the tank are so spaced that the fitting can be installed in only one position, this being necessary to insure the proper movement of the float arm.

Be sure that rubber housing, which protects the connection between the tank fitting and the frame wire, is in place as a connection between the terminal and the tank would cause a ground which would make the gauge read FULL regardless of the position of the float.

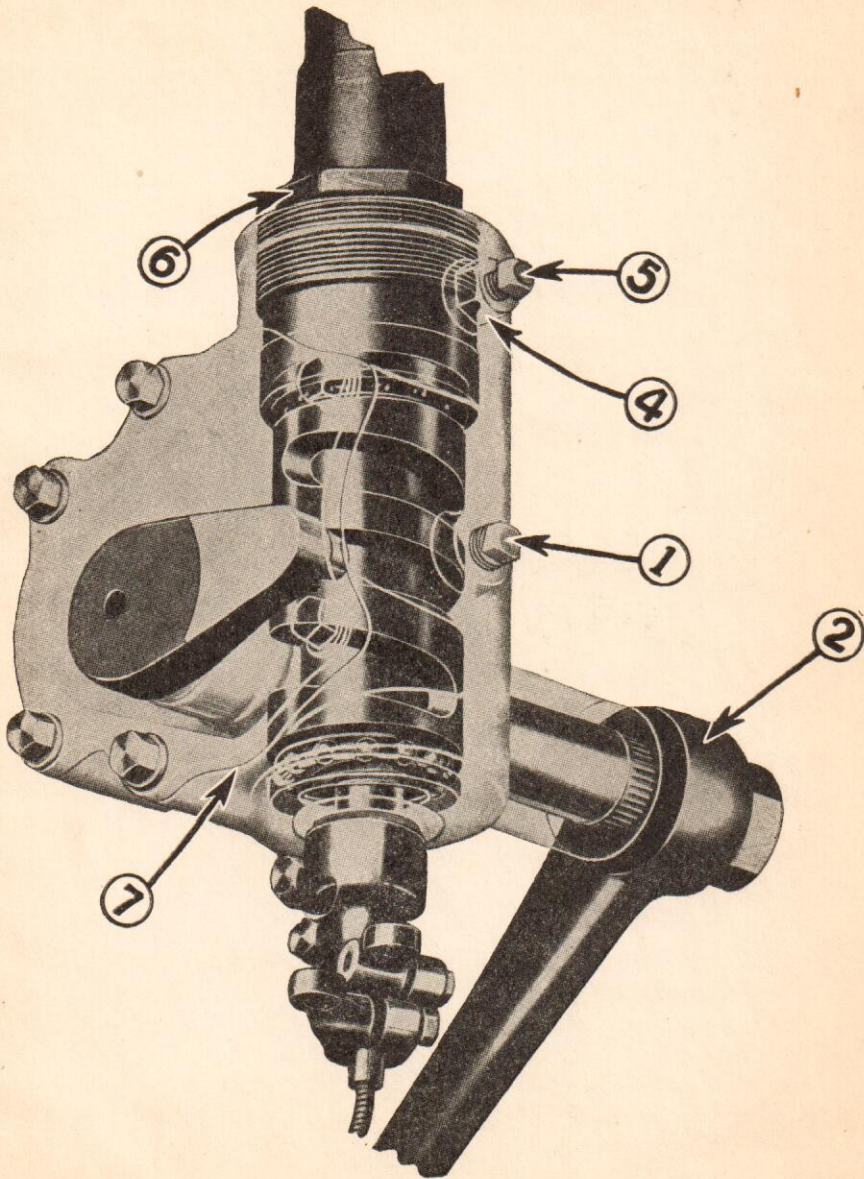
### CAUTION

If necessary to remove gauge head, disconnect battery terminal to prevent possible short circuits, which would be liable to damage other electrical equipment.

Do not remove or install tank fitting without first being sure that ignition switch is off so as to prevent danger of sparks near gasoline supply.

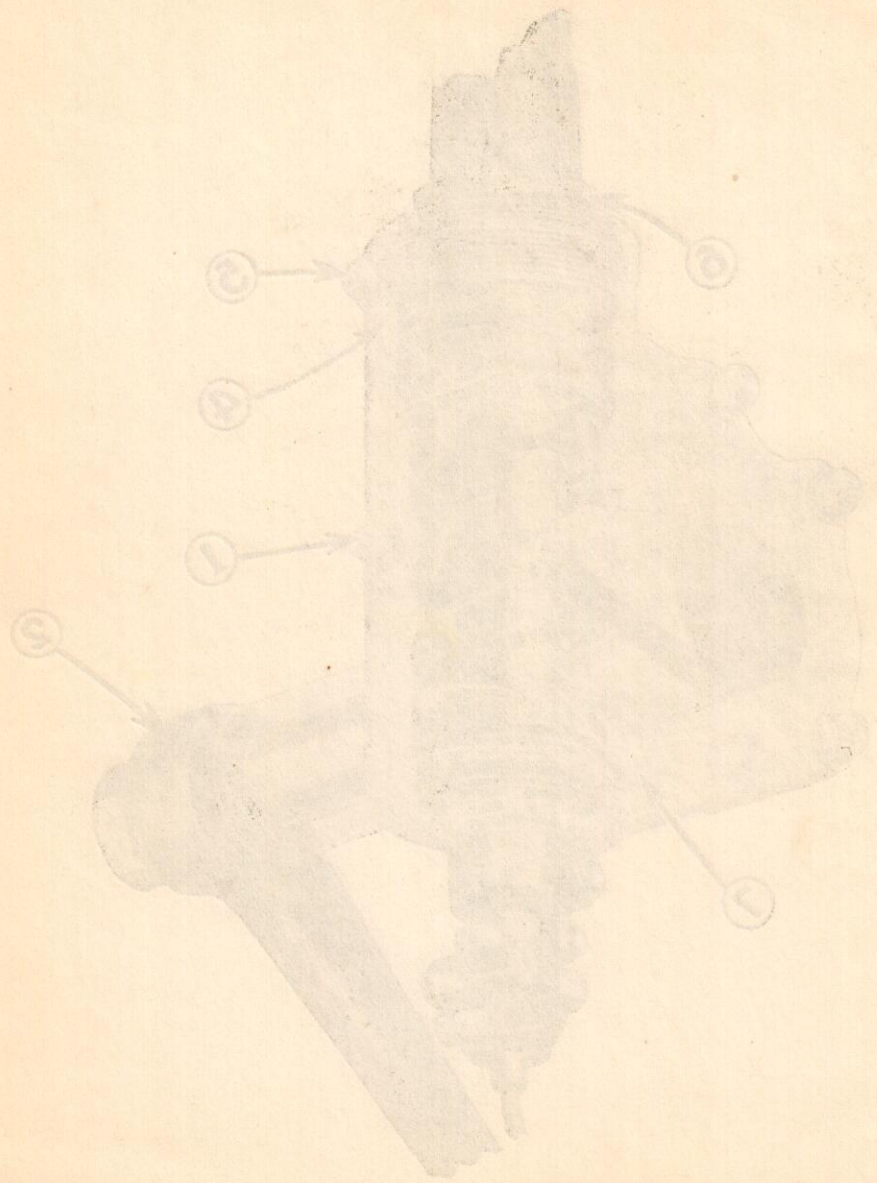


## ADJUST STEERING GEAR MECHANISM



See Instructions on pages AK 2-3-4.

ADJUST STEERING GEAR MECHANISM



See the diagram on page 172 for details.