

1938  
**PACKARD**

SUPER EIGHT & TWELVE



**OWNER'S MANUAL**

**DRIVING, CARE, ADJUSTMENT  
AND EMERGENCY DATA**

FOR SUPER EIGHT BEGINNING ENGINE NO. A-500001  
FOR TWELVE BEGINNING ENGINE NO. A-600001

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**A Shop Manual containing complete maintenance  
data is available gratis on request**

**First Edition-1603-9-37**

# PACKARD SUPER EIGHT

Models 1603, 1604 and 1605

# PACKARD TWELVE

Models 1607 and 1608

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## Ready Reference Data

### Capacities

	Super Eight	Twelve
Cooling system.....	20 quarts	40 quarts
Crankcase oil.....	8 quarts	10 quarts
Gas tank.....	24 gallons	30 gallons
Rear axle oil.....	6.5 pints	6.0 pints
Transmission.....	4.5 pints	4.5 pints

### License Data

Car serial number location—Transfer at front of dash  
 Engine number location—Super Eight—Stamped crankcase left side. Twelve—Block above generator  
 Engine bore and stroke—Super Eight— $3\frac{3}{16}$ " x 5"; Twelve  $3\frac{7}{16}$ " x  $4\frac{1}{4}$ "  
 Engine horsepower A.M.A.—Super Eight—32.5; Twelve 56.7  
 Engine piston displacement—Super Eight—320 cu. in.; Twelve 473 cu. in.  
 Wheelbase 127"—1603, 134"—1604 and 1607, 139"—1605 and 1608

### Shipping Weights

	1603	1604	1605	1607	1608
Formal Sedan.....	—	4795	—	5550	—
Touring Sedan.....	4530	4670	—	5525	—
7-Pass. Touring Sedan.....	—	—	4700	—	5600
7-Pass. Touring Limo.....	—	—	4815	—	5660
5-Pass. Club Sedan.....	—	4600	—	5520	—
5-Pass. Coupe.....	—	4595	—	5415	—
2-4-Pass. Coupe.....	—	4585	—	5255	—
2-4-Pass. Convertible Coupe..	—	4580	—	5255	—
5-Pass. Victoria.....	—	4650	—	5345	—
Convertible Sedan.....	—	—	4945	—	5680

If weight of car ready for the road is desired, add 245 lbs. Super Eight, 315 lbs. Twelve, to cover fuel, water and spare tire.

### Miscellaneous

	Super Eight	Twelve
Tire size.....	16 x 7.50—6 ply	16 x 8.25—6 ply
Tire pressure—front.....	24 lbs. cold	26 lbs. cold
Tire pressure—rear, Sedans..	27 lbs. cold	27 lbs. cold
	1605 is 29 lbs.	7-Pass. is 29 lbs.
Tire pressure—rear, Coupes..	25 lbs. cold	27 lbs. cold
Spark plugs.....	10mm.—AC103	or Champion Y4
Fuses and relays.....	See page 35	See page 35
Ignition timing.....	See page 38	See page 38
Camber.....	$1^{\circ}$ +or- $\frac{1}{4}^{\circ}$	$1^{\circ}$ +or- $\frac{1}{4}^{\circ}$
Caster.....	$2\frac{1}{2}^{\circ}$ +or- $\frac{1}{2}^{\circ}$	Zero+0- $\frac{1}{2}^{\circ}$
*Over-all length.....	$216\frac{7}{16}$ "—1603, $223\frac{7}{16}$ "—1604 and 1607 $228\frac{7}{16}$ "—1605 and 1608	

\*Add  $2\frac{7}{16}$ " for cars with trunk rack. Cold = atmospheric temperature.

## **As Soon as You Take Delivery, Please Make Sure**

1. Is the transfer, located on the forward side of the dash, stamped in the space marked Delivered by—City—Date—? If not ask the dealer to take care of this at once. You will not receive the benefits of the Owner's Service Policy unless this transfer is stamped.
2. Have you received your Packard Owner's Service Card? This card should be made out by the seller of the car. It enables you to obtain the service described in the Owner's Service Policy, should you require this at other than the service station delivering your car.
3. Has your dealer reported your purchase to the factory by means of the postal card supplied for this purpose?
4. Have you read the starting instructions for this particular car on page 16, and are you familiar with the "breaking in" information? This is on the next page.

The occasion may arise where your car must be serviced by other than a Packard dealer. In such cases, this book should be handed the shop proprietor so that it may serve as a guide, enabling him to maintain correct adjustment.

## **When Parking, Lock Your Car**

Locking is part of parking. Lock whenever you park. The greater the number of cars stolen the higher insurance rate you pay.

**Make a record of the key numbers.**

## **New Car "Break-in"**

The Manner in Which Any New Car is Driven for

### **THE FIRST 250 MILES**

has a very pronounced effect upon its subsequent operation and this applies to the brakes, gears, rear axle and other units, as well as to the engine.

All friction surfaces will burnish themselves to that high surface polish so essential to quietness, smoothness and durability, if not too highly stressed or loaded during the "break-in" period.

The best procedure is to refrain from even momentary wide-open throttle operation. Unless emergency demands it, do not fully open the throttle for acceleration or hill climbing and limit speed to 50 miles per hour until at least 250 miles have been driven. Observance of this advice will pay big dividends in ultimate satisfaction.

## **Packard Warranty**

*Packard Motor Car Company has warranted that for a period of ninety days from the date of original delivery to the purchaser of each new Packard car or before such car has been driven 4,000 miles, whichever event shall first occur, it will replace, free of charge, any part or parts thereof, including all equipment or trade accessories, except tires, supplied by it as standard equipment, claimed within that period to be defective and found by the Company upon examination to be so, provided such part or parts are returned to the Company within that period for credit or replacement. Such free replacement does not include transportation charges to or from the Packard factory.*



## Service to Packard Owners

### by Distributers and Dealers

It is intended that every owner of a Packard motor car shall receive fair and satisfactory treatment. Should any owner not receive it, we will appreciate being advised.

The original purchaser of a new Packard car will be entitled to the following services:

1. **Parts and Labor:** For 90 days after the original delivery of such motor car to the owner, provided the car has not been driven to exceed 4,000 miles, any parts, including all standard equipment, except tires, that may be adjudged by Packard Motor Car Company to be defective under its warranty will be replaced or repaired by any Packard dealer or distributor in the United States and Canada without charge to the owner for material or labor.

2. **Adjustment:** The owner is entitled during this period to receive two inspections and two necessary adjustments of his new car at any Packard Service Station, provided such

adjustments are not made necessary by accident, neglect or misuse.

3. **Inspections:** Throughout the life of the car, the owner is entitled to have it tested and inspected without charge every 30 days or 1,000 miles by an authorized Packard Service Station, provided such inspection requires no removal or dismantling of parts or units.

4. **Owner's Service Card:** At the time of delivery, the owner is provided with an Owner's Service Card which will introduce him to any authorized Packard Service Station and entitle him to receive service in accordance with this policy. The owner should carry the card with him at all times so he can present it when necessary.

5. **Tourist Privileges:** When touring, the owner is entitled, upon presentation of the Owner's Service Card, to all of the benefits of this policy during the warranty period at any authorized Packard Service Station in the United States and Canada, provided the date of delivery and name of the dealer from whom the car was purchased are stamped on the transfer provided for that purpose on the front face of the dash.

6. **Change of Residence:** In case the owner changes his residence from one location to another before the warranty period has expired, the Packard Service Station serving the locality into which the owner moves will, upon presentation of the Owner's Service Card, render any no-charge service to which the owner may be entitled.

7. **Service Charges:** Every authorized Packard Service Station is provided with a Manual containing the correct charges for service work. In order that maintenance costs may be kept as low as possible, these rates are based on careful studies of the shortest times for doing the service operations consistent with proper workmanship. Guaranteed Packard Parts are sold through authorized Packard Service Stations in the United States at the published list.



# Courtesy + Skill = Safety

Automobile engineering has always been devoted to safety and tremendous advances have been made. The modern motor car is, in itself an amazingly safe machine—ininitely more safe than cars of a few years back and yet, in spite of this, automobile accidents continue to reach shocking totals. A moral seems to be pointed in the fact that in nearly all parts of the civilized world educational campaigns are being conducted to make the public—both motoring and pedestrian—safety conscious.

Undoubtedly there are many drivers who need improvement. In most cases, fortunately, driving skill can be cultivated if there is any desire to become proficient. Deliberate indifference is an unfortunate attitude. Driving can be and **is** a lot of fun for those who do it well. Think of driving as a game—such as golf or tennis—and approach it with the same enthusiasm and expectancy. The ability to handle a motor car adroitly will give as much pleasure as does ability in any other sport.

A list of items considered essential in respect to skill, safety and comfort will be briefly discussed in the following paragraphs. We sincerely hope they will be helpful.

## Smooth Driving

Car operation can be smooth and graceful or it can be harsh and jerky. Acceleration and deceleration can be smooth even though rapid. Smooth operation is the mark of a finished driver.

## Anticipation

Ability to “anticipate” what “the other fellow” is going to do may sound like a fanciful illusion but it can be developed to a remarkable degree and is valuable in promoting safety and smooth driving. It proceeds, of course, from the practiced habit of being highly alert for indications of what is likely to occur.

## Speed

Modern cars perform so smoothly and quietly that there is no distinct sensation or impression of speed. Even at high speeds they seem to be “floating.” It is advisable to glance at—and be guided by—the speedometer.

## Negotiating Curves

Inexpert drivers apparently consider it advantageous to maintain speed right up to the entrance, close the throttle, apply the brakes and “man-handle” the car through the curve. This method involves the danger of complete loss of control and does not save any time. A more skillful driver approaches and enters the curve at reduced speed. When the car is safely in the turn, a slight throttle opening will give a stabilizing

effect. From about the middle of the turn, the throttle opening can be gradually increased to give maximum acceleration out of the turn. The latter method is decidedly more safe, easier on tires and also faster.

### **Passing Overtaken Cars**

Many accidents proceed from errors in judgment of speed and distance. It is thought that many drivers make but **one** observation of the respective distances between their own car, the car to be passed and the oncoming car. **One** observation is not enough. Develop the habit of making **numerous careful appraisals** of the gap (think of it in terms of feet or yards) between your car and the car to be passed and the gap between the car to be passed and the on-coming car. **Repeated** observations of the **two** gaps will tell you reliably whether you have room to pass. Persistence in this method will develop a fine sense of "pace and distance" that will add to the safety and pleasure of driving.

### **Mountains and Hills**

Safety in mountainous or hilly country **demands** keeping always to the right side of the road. Do not "cut" curves and **never** pass a car at or near the brow of a hill. To attempt to do so is wantonly criminal.

### **Low or Soft Shoulders**

Concrete highways having low or soft shoulders present very definite hazards to fast drivers. To bring a car from such a shoulder back onto the pavement involves—in effect—**climbing a curb stone** and this cannot be done safely at speed. Under such conditions, cars are not responsive to light steering effort and the thoughtless driver who turns the steering wheel sharply in an effort to retain the pavement without first slowing down is courting serious disaster. Remember, too, that on such roads safety for passengers burdens the driver with the responsibility of being alert for any indication of a dangerous maneuver on the part of an oncoming driver.

### **Skidding**

Turn the front wheels in the direction of the skid, i. e., if the rear wheels are skidding to the right—turn the front wheels toward the right. To avoid a second though less violent skid in the opposite direction, the front wheels should be turned back gradually, as the speed of the rear wheel skid is diminishing, so that at the instant the rear wheels stop sliding, the front wheels will have been returned to the straight ahead position.

### **Over-Steering**

A fault common to nearly all drivers is a marked tendency to over-steer. Under certain conditions, over-steering is decidedly disadvantageous to say the least. The technique in skidding has been explained but most drivers seem unable to bring themselves to carry out the execution

accurately. In the case of skidding, failure to bring the front wheels back as indicated usually results in a greater reverse skid than is necessary. A sharp turn of the wheel in climbing from a low or soft shoulder at speed is difficult to correct rapidly enough and may send the car directly across the highway. Steering has been made slower to compensate for the tendency to oversteer but other difficulties are encountered if it is made too slow.

### **Tire Blow-Out**

Perhaps the best advice that can be given is to urge that nothing whatever be done until the necessity arises. The reason for this is that in many cases a blow-out produces nothing more than a mild tendency to skid and should be handled accordingly, but many persons suffer under the delusion that a blow-out demands heroic measures and proceed to make a harmless situation serious, or even dangerous. It is not possible to predict exactly what will happen in the event of tire failure because it depends entirely upon the conditions that exist at the time. Ordinarily, a blow-out results in skidding that may be mild or severe. If the car is intelligently handled, a blow-out is not apt to cause serious trouble.

### **Applying Brakes**

Violent braking is never advisable unless emergency demands it. It imposes terrific strains on all parts of the car including brakes and tires. Where slippery pavement, skidding or tire blow-out are involved, brake application should be **very cautiously** made.

### **Dusty Road Ventilation**

When driving over very dusty roads, the admission of dust to the front and rear compartments may be quite effectively prevented by closing all the windows and opening the cowl ventilator.

### **Starting the Car on Ice**

Getting the car under way on icy pavement can be more readily accomplished if care is taken not to spin the wheels. Use second or even high gear and open the throttle only slightly.

### **Starting in Mud or Sand**

In getting out of mud or sand, spinning of the wheels should be avoided to prevent them from "digging in." First speed may be necessary but don't open the throttle more than is necessary.

### **Safety First**

Public officials who shoulder the responsibility of motor car regulation quite logically look to the better class of drivers to set an example for others. May we, in the interest of all concerned, sincerely request that Packard owners "Always Drive Safely."

# Washing and Polishing

Fine lacquers applied under ideal conditions give Packard cars a beautiful finish of high luster that can be maintained indefinitely if given proper attention.

## Washing

Periodic cleaning is, of course, necessary. Fine dust may be safely removed by dusting with a soft clean cloth but "scrubbing" a dirty car with dry cloths is almost certain to scratch the highly polished surfaces.

Ordinarily, it is better practice to clean the car by washing with plenty of cold or lukewarm water. Soak the dirt off as much as possible and rinse sponges frequently to remove grit and dirt. Dry with a clean chamois. The use of an ordinary garden hose nozzle—adjusted to give a high velocity stream—will be very useful in removing dirt from the under side of the car and the inside of the wheels. A stiff brush may also be necessary. Avoid washing the car in the direct rays of hot summer sun or at any time when the lacquered surfaces are hot. Never wash the car with hot water.

In sections where salt, calcium chloride or similar chemicals are used on the roads, frequent washing of the car is necessary to preserve the finish. Where cars are to be exposed to freezing temperatures immediately after washing, all water must be removed from the edges of the adjustable windows to prevent them from becoming inoperative due to the formation of ice.

## Polishing

Natural weathering and an accumulation of traffic film will, in time, produce a dull appearance that washing will not correct. The original high luster can be fully restored by a thorough cleaning with Packard Body Polish or any other properly formulated body polish. The presence of color on the rubbing cloths simply indicates the removal of chalked or dead surface pigment loosened by exposure. All body striping is applied on top of the lacquer and requires careful treatment. Prolonged, vigorous rubbing will damage or may even remove the striping.

Oil or grease spots may also be removed with body polish. With a clean cloth, apply polish to the area of the spot only and polish out with a dry soft clean cloth. Special preparations are available that will remove tar or road oil without damage to the lacquer. Hardened lumps of tar can be more readily removed if first softened with lard or butter. If tar remover dulls the finish, use body polish to bring back the luster. Lacquer is resistant to many chemicals but alcohol will cause serious damage if allowed to remain. Any lacquered surface upon which alcohol solutions have been spilled should immediately be flushed with water.

## Care of Glass

Although a relatively hard material, plate glass can quite easily be scratched. Cleaning a dirty windshield when dry by operation of the wiper blade or with dry cloths is apt to cause minute surface scratches that will increase eye strain. Wet or moisten glass before cleaning.

## Care of Chromium Plating

Owners of modern cars are aware of the advantages of chromium plating but the very ability of chromium to withstand exposure has created the impression that it requires no service attention. Actually, the finest chromium plating is subject to deterioration if neglected.

Among the more common elements that attack chromium plating are: sulphur dioxide present in the air, especially in large industrial centers, calcium chloride used on city streets to melt ice and on dirt roads to prevent dust, also the salt air of coastal territories. When plating is scratched or scuffed to the base metal, ordinary moisture becomes a damaging agent. Rust, originating at the root of a scratch will continue to spread **underneath** the plating unless attended to when it first appears.

Chromium plating is very easy to clean and frequent cleaning is all that is necessary to keep it in first-class condition. First, go over all plated surfaces with a clean cloth moistened with kerosene, follow this with a clean cloth wet with clear water and then rub dry with a soft clean cloth. The rough treatment given car bumpers is apt to damage the plating. Should rust appear, use a mild scouring compound to remove every trace of rust and prevent further oxidation by applying a coat of wax, varnish or clear lacquer over the damaged area.

## Interior

A clean car unquestionably adds to the enjoyment of motoring. In respect to personal comfort, it is particularly important that the inside of the car be kept clean. At least occasionally, the whole interior should be given a thorough vacuum cleaning.

## Cleaning Upholstery

Where the use of cleaning fluid is indicated, use Packard Fabric Cleaner or a cleaning fluid in which carbon tetrachloride is the principal ingredient. To avoid rings, work from the outside toward the center.

## Battery Acids

Battery acids will destroy upholstery if allowed to remain. Neutralize the acids as soon as possible by pouring enough household ammonia water directly on the spot to saturate the fabric as far as the acid extends. Give the ammonia water a full minute to neutralize the acid and then rinse the fabric with a wet clean cloth. Use cold water.

## **Blood Stains**

Rub the stain with a clean cloth wet with cold water.

## **Candy or Fruit Stains**

Candy stains that do not contain chocolate and all fruit stains should be rubbed with a clean cloth wet with very hot water. If chocolate is present, use lukewarm water. After drying, sponge with a clean cloth wet with cleaning fluid.

## **Chewing Gum**

Moisten gum with cleaning fluid and remove with a dull knife.

## **Ice Cream**

Rub with a clean cloth wet with very hot water. If this is not satisfactory, use a cloth wet with warm soap suds and rinse with a cloth wet with cold water. After drying, sponge with cleaning fluid.

## **Lipstick**

Pour cleaning fluid directly on spot and immediately after hold a clean blotter on the stain. Repeat until clean.

## **Shoe Polish**

For black or tan polish, use a cloth wet with cleaning fluid. If white polish cannot be brushed off, wet with cold water, allow it to dry and then brush off.

## **Grease or Oil**

Spots should be rubbed with a cloth wet with cleaning fluid. If a considerable amount of grease or oil is present, pour cleaning fluid on stained area and blot with clean blotters.

## **Tar**

Moisten with cleaning fluid and remove with dull knife. Sponge with cloth wet with cleaning fluid.

## **Paints and Lacquers**

Rub with a cloth wet with turpentine and then sponge with a cloth wet with cold water.

## **Water Spots**

Sponge the entire panel with a cloth dampened with cold water and then sponge the spots with a cloth moistened with cleaning fluid.

# Instruments and Controls

Familiarize yourself with the operation of controls and learn how to interpret the instrument readings before driving your car. The following paragraphs will help you:

**The ignition lock** is located at the lower center of the instrument board as in Fig. 1. Make it a habit to withdraw key when leaving car.

**The starter button** is of the remote control type and is located to the left of the ignition lock.

**The foot accelerator** is of the treadle type, rubber covered and "soft" in action. The mechanical linkage has been designed to give a modulated opening of the throttle that promotes smooth operation and ease of control. Depressing the accelerator once or twice may assist in **cold** starting but will interfere seriously with **hot** starting. **Hold** accelerator in wide open position when starting a hot engine but **do not pump** the treadle.

**The light control switch** is located at the lower left below the speedometer. It is of the push-pull type having three positions. Pulling out to the first notch provides parking lights, second notch city or country driving lights and third notch country driving or passing lights. There is also a foot control switch located on the toe-board to the left of the clutch pedal. With the light switch in second notch, depressing the toe-board switch raises both beams to "Country Drive" while a subsequent depression tilts both beams for city driving. In a similar manner, with the light switch in third notch, successive movements of the toe-board switch alternately tilt the left hand beam for country passing or raise it for country driving. Illuminated tell-tale lights at each end of the center panel indicate which beam is in use.

**Instrument illumination** can be regulated in small steps by turning the rheostat knob located on the lower flange of the panel near the clock reset knob.

**The map reading light** is controlled by a toggle switch located on the lower flange of the panel to the left and below the main light switch.

**The oil pressure gauge** is mounted with the gasoline gauge at the extreme right end of the center panel. This gauge does **not** indicate the quantity of oil in the engine. Normal reading, 50 to 55 pounds at 50 miles per hour, 5 pounds minimum idling with warm oil. **CAUTION**—Failure of the gauge to show pressure while engine is running indicates either a lack of oil or some derangement that should be corrected immediately to avoid serious damage to the engine.

**The gasoline gauge** located with the oil pressure gauge at the right end of the panel, indicates the quantity of fuel in the supply tank. The gauge is electrically operated and will register only when the ignition switch is "On."

**The ammeter**, located at the extreme left of the center panel with the water temperature gauge, indicates whether the battery is being charged or discharged. The generator regulator is so designed that the ammeter will be nearly at zero when battery is fully charged. To deter-

mine whether generator is charging, turn on the headlights with engine stopped. Now run engine at a speed equivalent to 30 miles per hour. If the ammeter hand now moves to "Charge" side of dial, the generator is charging.

**The water temperature gauge** is at the extreme left of the center panel with the ammeter. Most efficient operating temperature is between 150 and 185 degrees. Water boils at 212 degrees at sea level.

**A 100-mile speedometer** is located to the left of the central Packard emblem plate. Fuel consumption at 60 miles per hour is approximately 50 per cent greater than at 20 miles per hour.

**The windshield wiper control** is mounted on the top of the panel just above the ash tray. Turn the knob to start wiper and regulate its speed. Do **not** pull up on the knob.

**The electric clock** is protected against electrical overload by a thermostatic relay on the main lighting switch.

**The rear view mirror** is eccentrically mounted on a friction type ball and socket swivel and may be adjusted for height or angle.

**Seat adjustment** on all body models having the undivided front seats (except the Limousine) is controlled by pulling up a latch located at the left end of the seat. Nine separate positions are available. Moving the seat forward elevates the cushion and decreases the seat-back inclination to provide greater comfort and better vision for persons of small stature.

**Sun visors** are swiveled in such a manner that they can be moved to shade either the windshield or the front doors.

**Ventilating windows** of the pivot type built into the front doors of all closed body types are operated by a convenient crank. Rear quarter windows in the Sedan and Touring Sedan are also of the pivot type.

**Duplicate sets of keys** are provided with each car. One set fits the ignition and right front door locks, the other set fits the package compartment and rear trunk locks. For greater protection against car theft, lock-cylinders are not numbered. **A record of key numbers** should be made by every owner to facilitate purchase of duplicate keys from Packard dealers in event original keys are lost.

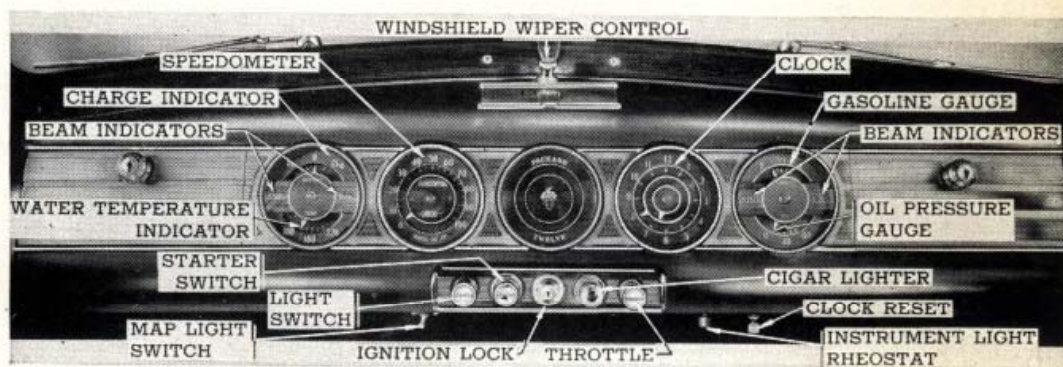


Fig. 1—Front View of Instrument Board



# Starting the Engine

All Packard cars are equipped with automatic carburetor chokes which provide proper mixture for starting and warm-up in cold weather and prevent unnecessary choking when warm. For completely satisfactory cold weather operation, Packard's lubrication recommendations must be followed:

For cold weather starting:

1. Turn on ignition switch.
2. Depress accelerator pedal once and allow it to return to the closed position. This engages the low-temperature idle control.
3. Depress clutch pedal fully.
4. Press starter button located on the instrument panel.

**NOTE:** In cold starting, should excessive choking result from failure to turn on ignition—or from any other cause—hold the accelerator pedal in the wide-open position until engine starts, but do not allow cold engine to race.

**When hot**, engines with down-draft carburetors start more readily with fully opened throttle. **Hold** accelerator in wide-open position until engine starts. **Do not pump** accelerator pedal.

## Carbon Monoxide Gas

Open garage doors wide before starting the engine. Poisonous carbon monoxide gas is present in the exhaust of all gasoline engines. Don't take chances—provide lots of fresh air.

## Owner's Maintenance Schedule

Adherence to this chronological maintenance schedule will be found very helpful in securing uninterrupted and pleasurable use of your car. Although not listed here, owner should have the chassis lubricated every 5,000 miles.

### *Every Week*

#### **Tires**

Check air pressure and inflate to specifications. Page 3.

### *Once a Month or Every 2,000 Miles*

#### **Battery**

In the case of HiLevel batteries, distilled water (rain water in an emergency) should be added to each cell until the star disappears.

## **Carburetor Air Cleaner**

Should be cleaned and oiled at intervals of not more than 3,000 miles. Page No. 28.

## **Engine Lubrication**

Refer to "When Should Oil be Changed" on next page.

### *Twice a Year*

## **Cooling System**

The cooling system should be reverse flushed twice a year. Page No. 26.

## **Shock Absorbers**

Check for proper oil level and refill, if necessary, with Packard Lovejoy Shock Absorber Fluid. Other fluids may change the ride characteristics.

## **Brakes**

Master cylinder fluid level should be checked twice a year at least, or whenever pedal goes all the way to the floor. Use Packard Special Brake Fluid or, if not available, Lockheed No. 5 Fluid. Page 50.

## **Engine Tune-Up**

In the spring and fall, the engine should be completely tuned which will include a check of the carburetor and ignition system.

## **General Tightening**

The car should be given a "general tightening" occasionally, especially if driven over rough roads, to keep it free of rattles.

### *Once a Year*

## **Rear Axle**

Lubricant must be changed in advance of cold weather. Use only Packard Approved Lubricants. **This is important.**

## **Transmission**

The lubricant should be changed in the spring. Page No. 20.

## **Front Wheel Alignment**

Check to assure easy steering and long tire life. Page No. 44.

## **Engine Oil Pan and Filter**

Remove and thoroughly clean pan and oil pump strainer screen. External filter should be renewed every 8,000 miles.

## **Steering Gear**

The lubricant should be renewed in the spring.

# General Lubrication

The subject of lubrication of the complete automobile should be given careful attention. It is important that the lubrication schedule be followed and that the proper lubricant be used if the car is to give quiet and efficient performance. The use of high grade lubricants will prolong the life of the wearing parts and prove most economical in the long run.

It is now common practice of oil companies to designate their oil by the S. A. E. classification, instead of the old method of designation as light, medium or heavy. The application of the S. A. E. viscosity number to a lubricant is intended only to indicate the body or fluidity of the oil and has no bearing on the quality of the product. Only high quality oils furnished by reputable companies should be used and for accuracy they should be ordered by S. A. E. numbers.

It is essential to add oil, as required, to maintain the correct oil level.

## Engine Oil Viscosity

Choose the proper viscosity from the following table in accordance with the lowest temperature expected to be encountered:

Below minus 10°F.....	10-W plus 10% kerosene
Minus 10°F.....	10-W
Plus 10°F.....	20-W
32°F.....	S. A. E. 30
90°F. average daylight temperature.....	S. A. E. 40

The best performance of the engine will be obtained by using the correct body (S. A. E. number) of engine oil in the engine crankcase as specified in the above table. The oil should be of a low S. A. E. number in cold weather to provide proper starting and a higher number in warm weather to provide economical consumption.

## When Should Oil Be Changed

Engine oil should be changed in accordance with temperature variations rather than according to seasons. In some localities variations in temperature are so extreme that several grades may be required during the course of the year.

Low maintenance costs, long engine life and best performance will be insured by changing the crankcase oil when it becomes contaminated. Driving over dusty roads or through dust storms without air cleaners or with dirt-clogged air cleaners, introduces abrasive material in the crankcase. If this is not removed immediately by draining the crankcase, harmful engine wear may result.

Hard driving in warm weather causes chemical changes in the oil. Accumulation of the products of these changes is undesirable and may prove harmful to the engine.

In winter, water accumulates in the crankcase from condensation of moisture produced by the burning of the fuel and may freeze and interfere with proper oil circulation. It also promotes rusting and causes

clogging of oil screens and passages. While on long continuous drives this water may be removed by the crankcase ventilator, draining is a safer procedure. Light oils should be used for easy starting but very hard driving may thicken them and cause starting trouble.

Obviously the time between crankcase drains depends entirely upon the driving conditions. In considering the above factors as to when to change the oil it should be kept in mind that good lubrication is low priced insurance against high maintenance costs.

The first change should be made at low mileage, thereafter, 2,000 to 3,000 mile changes are recommended as that most closely approximating average conditions, but the changes should be controlled by the driving conditions pointed out above.

### **Engine Oil Pan and Filter**

A generous size basket type screen at the pump intake serves to filter out dirt and foreign substances that would tend to injure the bearings. To prevent the accumulation of sludge, which is injurious to the engine, the lower oil pan and screen should be removed and cleaned at least once a year. The external oil filter should be renewed every 8,000 miles.

### **Clutch Shifter Thrust Bearing**

The clutch shifter thrust bearing is packed with lubricant and sealed and should not require attention.

### **Clutch and Brake Pedals**

**Super Eight** clutch and brake pedal bearings have wick oilers. These can be reached with a long nozzle oiler through holes in the floor board. Pedals on the Twelve are mounted in roller bearings and require no lubrication during the life of the car.

### **Universal Joints**

Although the Twelve is provided with pressure gun fittings the universal joint journals on either model do not require lubrication for at least 40,000 miles. Lubricate universal slip yoke spline with pressure gun each 5,000 miles.

### **Rear Axle**

The oil level in the rear axle should be checked at every 5,000 mile greasing operation. Oil should be changed in the fall. A special rear axle gear oil is necessary for hypoid gears and the use of alternate lubricants may ruin the gear set. See Packard Dealer for approved lubricant.

### **Rear Wheel Bearings**

Unless a leak develops at the oil seals, bearings will not require lubrication for at least 40,000 miles. At this mileage the shafts should be removed and the bearings packed with a fibrous wheel bearing grease. Renew any leaking seals.

## Steering Gear and Transmission

The oil level in the transmission should be checked at every 5,000 mile greasing operation to make certain oil level is up to filler opening. Use S. A. E. 160 oil. Dilute with kerosene or change to S. A. E. 90 for winter if desired. Change oil in spring. Capacity 4½ pints.

Follow same directions on steering gear.

## Distributor

**On Super Eight** refill grease cup every 5,000 miles. Apply a few drops of engine oil to the wick under the distributor rotor.

**On the Twelve** fill the two flip top oilers every 5,000 miles but do **not** lubricate the specially treated pad that bears on the cam.

## Lubrication Schedule

### 5,000 Miles

Knuckle pins	Pressure gun grease	2 lubrication connections
Steering connecting rod	Pressure gun grease	2 lubrication connections
Steering cross tubes	Pressure gun grease	4 lubrication connections
Rear spring shackles	Pressure gun grease	2 lubrication connections
Universal yoke spline	Pressure gun grease	1 lubrication connection
Water pump shaft	S. A. E. 30 or 20-W	1 oiler
Generator	S. A. E. 30 or 20-W	2 oilers
Starter motor	S. A. E. 30 or 20-W	2 oilers Super 8 only
Distributor	No. 3 cup grease on Super.	Oilers on 12
Clutch and brake pedal	S. A. E. 30 or 20-W	Saturate wick. Super only

Add a few drops of light oil to the clevis pins, door hinges, dovetails and locks. Grease hood lacing and hinges as needed.

Crankcase—See "When Should Oil be Changed" on page 18.

### 10,000 Miles

Support arm outer pin	Pressure gun grease	2 lubrication connections
Front wheel bearings	No. 3 fibre grease	(2) Repack
Transmission	S. A. E. 160—Dilute with kerosene or use S. A. E. 90 for winter if desired.	Fill to level
Steering gear	Same as transmission.	Fill to level
Rear axle	See note below	Drain and refill

NOTE: Rear axle gears require a special lubricant, see Packard dealer.

### 40,000 Miles

Rear wheel bearings	No. 3 fibre grease	(2) Repack
Universal joints	S. A. E. 160	(8) Repack Super
Universal joints	S. A. E. 160	2 connections Twelve

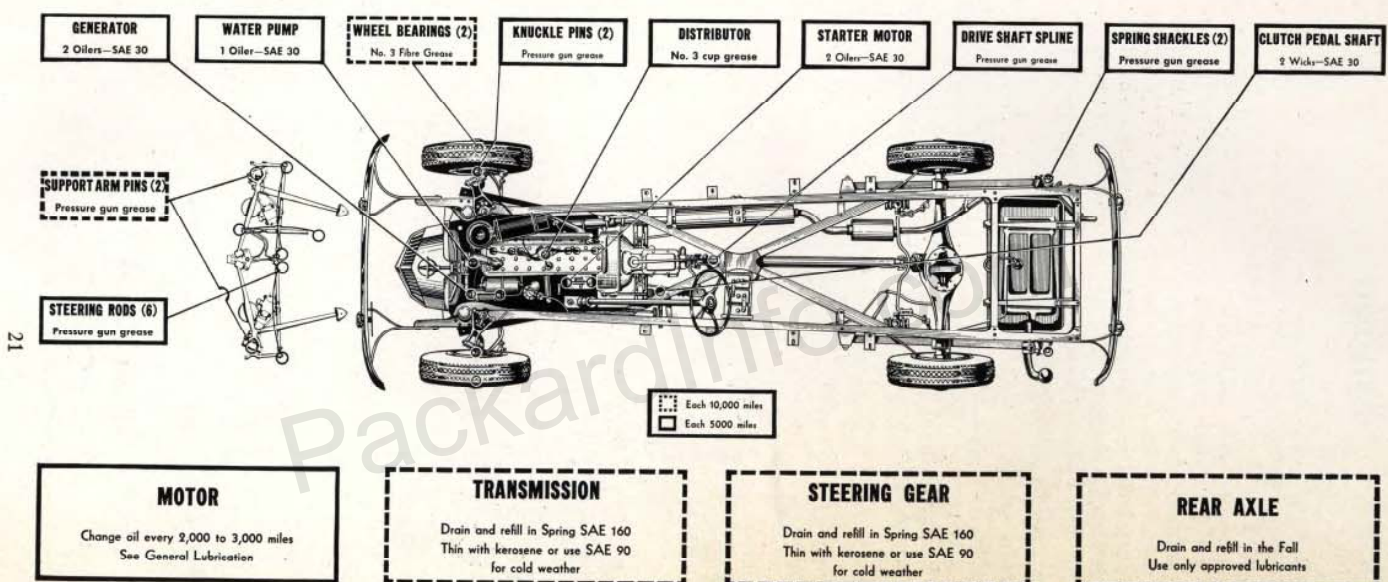


Fig. 2—Chassis Lubrication Chart for the Super Eight Showing Points to Lubricate and Type of Lubricant Needed. On the Twelve, the Clutch Pedal Shaft and Starter Armature are Carried in Bearings Which Require No Lubrication During the Life of the Car. With These Exceptions This Chart Applies Also to the Twelve

# Engine

**The Twelve engine** cylinders are cast integral with the upper crankcase. Included angle between the two banks of cylinders is 67 degrees. Cylinder heads are of heat treated aluminum. Crankshaft main journals and crankpins are induction case hardened. The fully counterbalanced crankshaft is carried in 4 main bearings. The oil pan is cast aluminum. Roller bearing equipped rocker levers mounted in three cluster brackets operate the horizontally disposed valves with zero tappet clearance. Zero tappet clearance is made possible by a hydraulically operated silencer mechanism for each rocker lever. Camshaft is driven by a non-adjustable two sprocket silent chain at the forward end of the engine. Compression ratio standard 6.4, optional 6.0 and 7.0.

**The Super Eight engine** differs from the Twelve in that the cylinder block is detachable from the aluminum crankcase—the crankshaft is carried on 9 main bearings—and the valves are actuated by cylindrical lifters through the medium of pressure lubricated rocker levers interposed between lifters and camshaft. Compression ratio standard 6.5, optional 7.05.

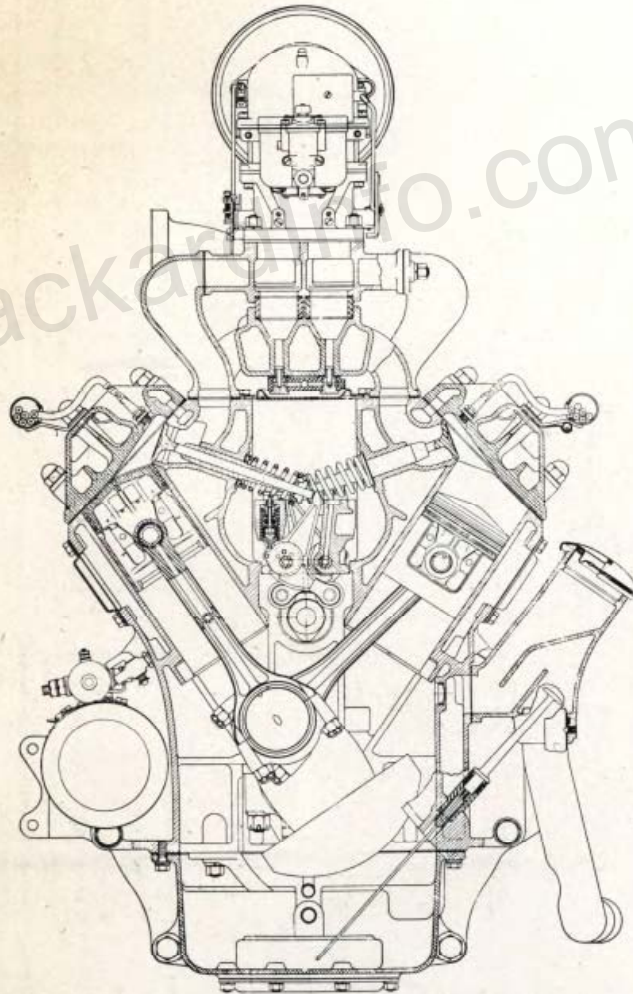


Fig. 3—End Section of Twelve Engine Showing Valve Action

## Bearings

The camshaft, crankshaft and connecting rod bearings are all of the shimless steel backed type and are not adjustable. Connecting rod lower bearing shells are lined with an alloy of copper and lead.

## Pistons and Rods

Piston and connecting rod assemblies are removed by first removing the oil pan and cylinder head. Detach caps from lower rod bearings and push assemblies up, then remove the piston pins. *Removal will be greatly facilitated if done while engine is warm.* The pistons may now be withdrawn from top of engine and the connecting rods from below. Slots on all pistons should face towards the camshaft. Oil holes in all rods of the Twelve should face the starter motor. On the Super they should face the camshaft.

## Valve Tappets

**Super Eight** valve stem to tappet clearance is .006" for the inlet and .008" for the exhaust with engine warm and running.

**On the Twelve** the non-adjustable tappets operate at zero clearance.

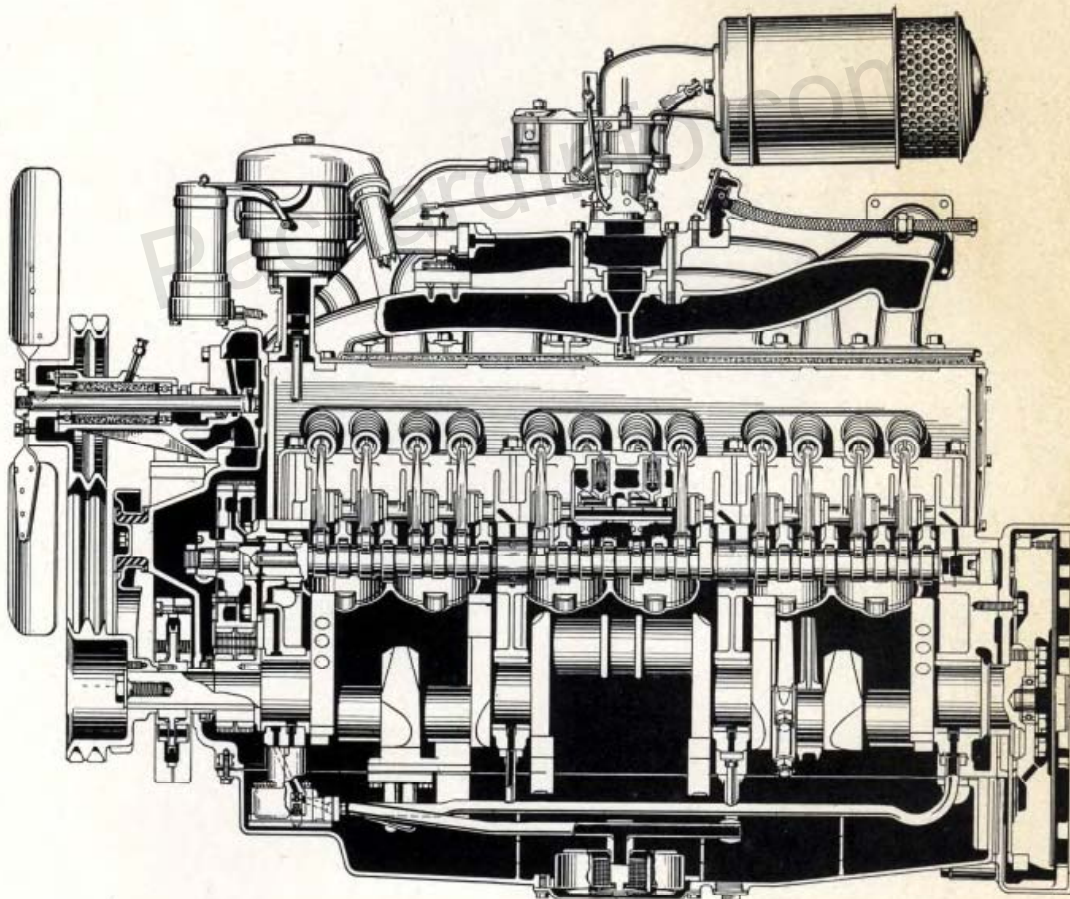


Fig. 4—Side Section of Twelve Engine Showing Accessibility of Oil Pump Screen



Valve action noise that may persist for several minutes after the engine is started is due to oil seepage from the silencers and should not be mistaken as an engine derangement.

### Oil Relief Valve, Filter and Cooler

Adjustment of the pressure relief valve is accomplished by turning the slotted adjustment screw after removing the acorn nut on oil filter side of engine. See page 14 for recommended pressure.

A series type oil filter removes from the oil, carbon and dirt particles that are too small to be caught by the pump screen. The filter cartridge should be replaced about every 8,000 miles.

An oil temperature regulator or cooler is mounted below the oil filter. The cooler unit requires no attention.

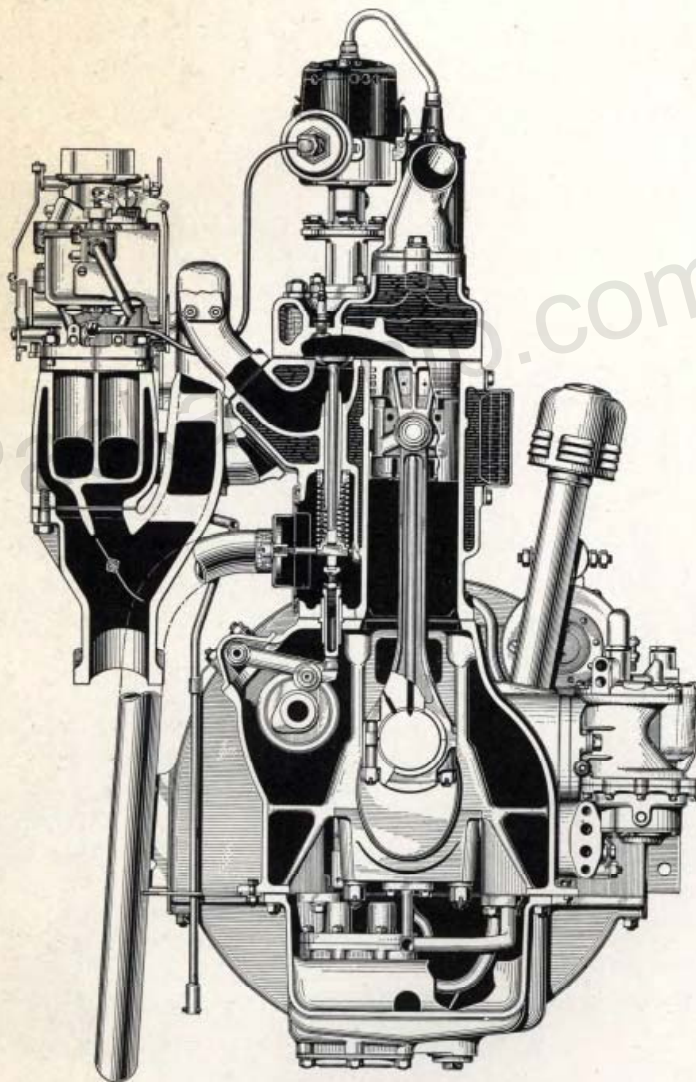


Fig. 5—The Super Eight Engine Showing Valve Mechanism and Other Internal Details

## Notes for the Mechanic

**Super Eight** cylinder head should be tightened cold with 550 inch pounds of torque, that is 55 pounds pull on wrench handle 10 inches from center of socket. Retighten when warm to 725 to 750 inch pounds or 72.5 to 75 pounds pull on a 10 inch leverage. This is important. Coat both sides of gasket with a good grade of gasket paste before installing.

**Twelve Valve System**—Tappet noises persisting after several minutes of running indicate dirt in silencer units. Dirt is usually removable by flushing with kerosene or half and half solution of benzol and alcohol. Remove valve cover plate. Noisy rockers will be the ones showing free travel when pressure is exerted on valve end of rocker. Fill port at top of noisy silencer unit with cleaning fluid, then depress and release valve stem "14" Fig. 5A ten to 20 times, adding fluid as needed. Turn engine until silencer units are filled from engine oiling system, then check tappet clearance of all rockers. If any show free travel, repeat the flushing procedure. In rare cases it may be necessary to remove the assemblies to eliminate all dirt.

When lapping engine valves to block, hold silencer valves "14" in "down" (open) position with a 4 inch piece of one inch cold rolled bar stock laid on end over them. Before reinstalling valve springs, check amount of take-up reserve of each silencer unit by measuring tappet clearance of each valve as follows: Locate low side of cam by turning crankshaft one revolution past point where valve is wide open. With engine valve held against its seat, and valve "14" open, push rocker away from engine valve stem and insert feeler. If clearance is less than .030 or more than .055 inch, carefully grind end of engine valve stem until .030 inch minimum is obtained. A dial gauge may also be used to check silencer take-up reserve.

Valve springs on the Twelve must be installed with painted end nearest rocker lever. Springs should show a pressure of 65 to 75 lbs., at  $2\frac{7}{32}$ " and 140 to 150 lbs., at  $1\frac{29}{32}$  inches. To restore spring pressure lost as the result of several reseating operations and to prevent interference, stem keeper keys  $\frac{1}{32}$ " higher than standard are available.

**Super Eight** valve springs should show pressure of 68 to 78 lbs. at  $3\frac{1}{16}$ " overall, 154 to 164 lbs. valve fully open.

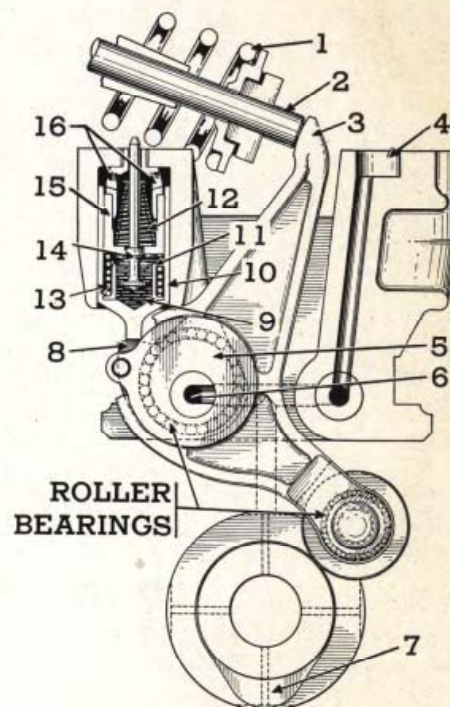


Fig. 5A—Valve Silencer Mechanism

# Cooling System

**The Super Eight** system is drained by turning the valve at rear face of the oil cooler housing on left side of engine and the valve in radiator lower outlet casting.

**The Twelve** cooling system is drained by turning the valves at bottom of water jacket on each bank of cylinders, in the radiator lower outlet casting and at the bottom of condenser tank under the right front fender.

The cooling system should be reverse flushed each spring and fall and always before adding anti-freeze. If soluble oil is added after flushing it will delay subsequent accumulation of rust.

**Caution:** Never use caustic alkali radiator cleaning preparations as they have a definitely detrimental effect on the aluminum cylinder head.

## Anti-Freeze Solutions

Anti-freeze solutions of alcohol and water, ethylene glycol and water or glycerine and water may be used. While alcohol solutions possess a lower boiling point than water, are injurious to lacquer and are subject to evaporation, they have less tendency to spark knock. When alcohol solutions are used, 10 ounces of soluble oil (17 on Twelve) should be added as a rust inhibitor. Ethylene glycol (Prestone) and glycerine (G. P. A.) contain soluble oil and therefore none need be added. It is advisable to shellac the inside of the hose connections when ethylene glycol or glycerine is used. Do not save Prestone or glycerine solutions from one winter to the next. Use new materials each winter.

Trade marked anti-freezes are often sold mixed with water and rust inhibitors. When these are used, follow directions on the containers.

The table below indicates quantity, in quarts, of anti-freeze required for protection at various temperatures. Quantities shown are based on a system capacity of 20 quarts for Super, 40 quarts for the Twelve.

<i>Pure Methyl Alcohol</i>		<i>Denatured Alcohol</i>		<i>Prestone (E. Glycol)</i>		<i>Radiator Glycerine</i>		<i>Freezing Point Approximate</i>
Super	Twelve	Super	Twelve	Super	Twelve	Super	Twelve	
2.5	5.0	3.5	7.0	3.5	6.5	7.5	15.0	20° F. Above Zero
4.0	8.0	5.0	10.5	5.0	10.0	11.0	22.0	10° F. Above Zero
5.5	11.0	7.0	13.5	6.5	13.0	14.0	28.0	Zero
6.5	13.0	8.0	16.0	8.0	15.5	16.0	32.5	10° F. Below Zero
7.5	15.0	9.0	18.5	9.0	17.5	18.5	37.0	20° F. Below Zero
8.0	16.0	10.5	21.5	9.5	19.0	20.0	40.0	30° F. Below Zero

**NOTE:** During cold weather months have the radiator solution tested occasionally with an hydrometer especially prior to an expected drop in temperature. This practice may avoid expensive repairs.

**Caution:** Do not use a calcium chloride solution or an alkaline solution or any anti-freeze compounded from these materials.

## Fan Belt Adjustment

Adherence to recommended tension specifications is important. Premature failure of either the belt or the pump and generator bearings results from too little or too much belt tension. Adjust the belts by first loosening the hinge bolt "B" and lock bolt "A," Fig. 6. Twist a piece of wire around the generator then hook a spring scale to the wire and pull horizontally until scale pointer registers 40 pounds on Super Eight or 70 to 80 on the Twelve. Holding this position, tighten the bolts. If a scale is not available adjust tension to provide  $\frac{1}{2}$  to  $\frac{3}{4}$  inch thumb pressure deflection of belt when tested between generator and water pump pulleys. Twelve belts should be renewed in matched pairs.

## Water Pump

A special continuous ring packing is used in the water pump, illustrated in Fig. 7. When the packing nut is at the end of its travel, back off the nut and add a service type split packing ring. Service packing is installed without removing the pump.

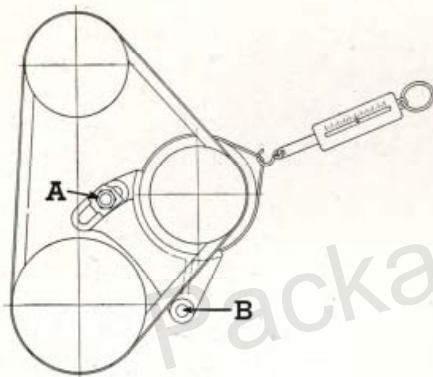


Fig. 6—Belt Tension Should be Adjusted to 70 to 80 lbs. Scale Pull on Twelve, 35 to 45 on Super

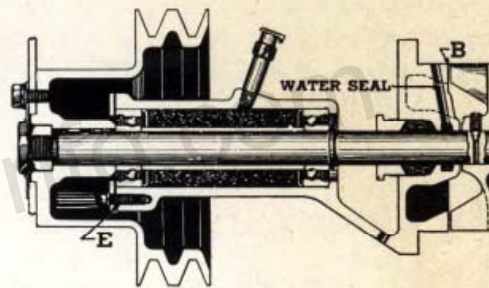


Fig. 7—Pump for Twelve. Super Eight Unit is Substantially the Same

## Shutters

Engine temperature is automatically controlled by thermostatically actuated shutters in front of the radiator core. The thermostat is designed to start shutters opening at 165° Fahrenheit.

## Notes for the Mechanic

Clearance between face of impeller and water pump body at "B," Fig. 7, should be within limits of .010" to .034" on Super and .025" to .042" on Twelve with impeller pushed forward. This clearance is controlled by the impeller set screw and hole in shaft. Shaft end play should be within limits of .005 to .010 inch. Secure this specification by shimming with gaskets at "E" if necessary. Coat gasket with good grade of gasket paste when assembling. Felt packing between pump bearings should be saturated with S. A. E. 50 oil when reassembling.

# Fuel System

Except for details of the rocker lever the Super Eight pump is similar to the Twelve. The vacuum pump unit in the lower portion of the assembly acts as a stabilizing booster for the windshield wipers by providing sufficient vacuum to operate the wiper blades under all driving conditions. Owner care should be confined to cleaning of the filter assembly by removal of the glass bowl and screen element. Any trouble should be referred to a Packard or AC service station.

**NOTE:** Excessive engine oil consumption is frequently traceable to a leaky vacuum pump diaphragm permitting oil to be sucked from the crankcase into inlet manifold. To determine if defective vacuum diaphragm is causing high oil consumption, disconnect the manifold to vacuum pump line at the pump end. If inside of line is oily or if oil vapor is ejected from pump opening with engine running at high speed, diaphragm is defective and should be replaced.

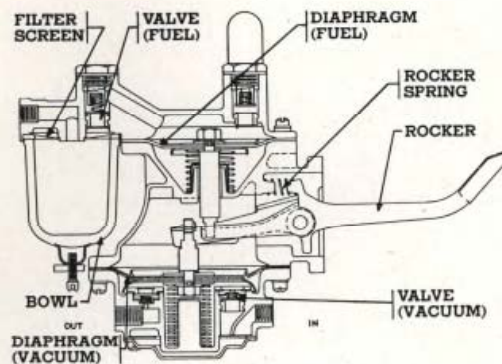


Fig. 8—Fuel and Vacuum Pump

## Air Cleaner and Silencer

Under ordinary conditions, the cleaner unit should be cleaned every 3,000 miles or as often as every day where all of the driving is done on extremely dusty roads. Definite mileage intervals cannot be stated due to the natural variation in conditions. The safe procedure in very dusty territory is to check the unit daily and clean if necessary.

Procedure for cleaning the Super Eight unit is to first dismount the assembly from the carburetor, then remove the filter element and the oil reservoir. Wash the filter element by plunging it up and down several times in a vessel of clean gasoline or kerosene until thoroughly clean. Empty the oil reservoir and clean thoroughly, then refill to level with a pint of S. A. E. 50 engine oil in summer or S. A. E. 30 in winter. Reassemble and reinstall on engine. Procedure for cleaning the Twelve unit is the same as Super Eight except that the Twelve does not have an oil reservoir.

## Crankcase Ventilation (Super Eight Only)

The cap of the oil filler tube is fitted with a copper mesh type of air cleaner to prevent dust from entering the crankcase. The cap filter element should be cleaned every 2,000 miles or oftener by plunging up and down in a container of clean gasoline or kerosene.

# Carburetor and Choke

The Packard Stromberg carburetor is of the duplex plain tube type with fixed main metering orifices and a mechanically controlled power mixture or economizer valve. Cut-away views of the Super Eight unit are shown in Fig. 9. Due to use of fixed metering orifices, only the idle mixture is manually adjustable.

## Warm Idle and Pump Adjustment

Idle mixture adjustment is controlled by the two knurled needle valves "10" located near the base of the carburetor. One of these needles controls the quantity of idle mixture delivered to the center four cylinders. The other one controls cylinders 1, 2, 7 and 8. To adjust the idle, first set the throttle stop screw to 6 M. P. H. car speed with engine warm. Turn one of the needles "10" in, until engine runs irregularly, then out until engine begins to "roll" (due to richness) then in again slowly until smoothest running is obtained. Do the same with the other needle. Now readjust the throttle stop screw if necessary.

Two holes are provided in the throttle lever for the accelerating pump link. Under ordinary conditions the link should be placed in the hole providing longest stroke. Use other hole only in extremely warm weather or with very volatile fuel.

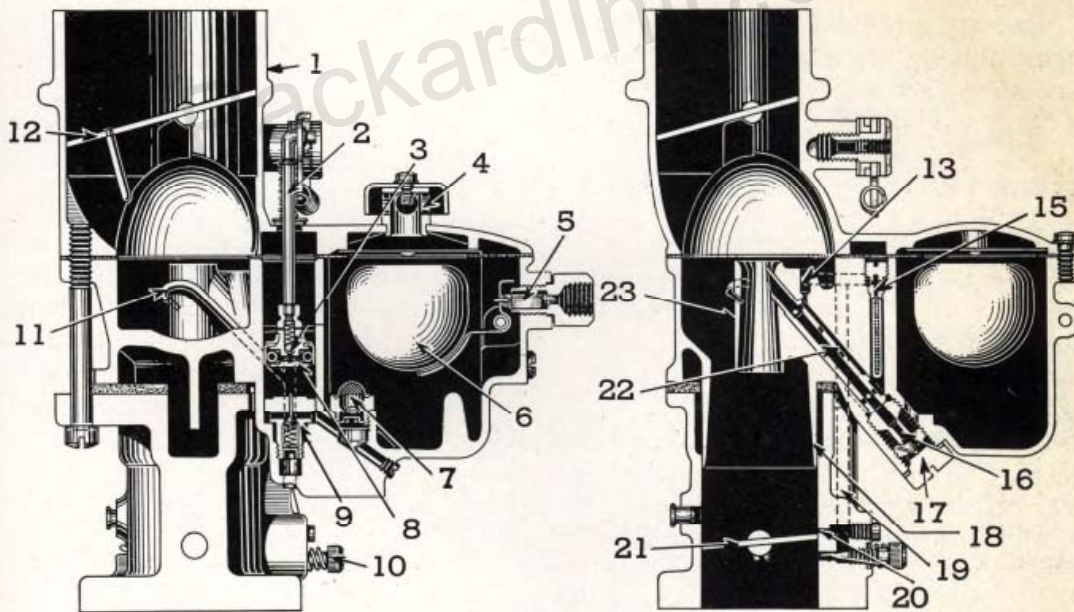


Fig. 9—Schematic Views of Packard Stromberg Carburetor

- 1—Air Horn
- 2—Pump Piston Link
- 3—Pump Relief Valve
- 4—Bowl Vent
- 5—Float Needle
- 6—Float
- 7—Pump Check Valve
- 8—Pump Piston

- 9—Economizer Valve
- 10—Idle Adjustment
- 11—Pump Nozzle
- 12—Choke Valve
- 13—High Speed Bleeder
- 15—Idle Tube
- 16—Main Metering Jet
- 17—Metering Jet Cap

- 18—Main Venturi
- 19—Idle Passage
- 20—Idle Discharge Ports
- 21—Throttle Valve
- 22—Main Discharge Jet or nozzle
- 23—Auxiliary Venturi

## Cold Idle Adjustment

The cold idle adjustment controls the idling speed of the engine during the warm-up period. Adjustment should be executed with engine either warm or cold but not running. First close the choke manually to bring cold idle cam "Y" under cold idle stop screw "Z" as shown in Fig. 10. Back off cold idle stop screw "Z" until it just breaks contact with cold idle cam. Now turn cold idle stop screw in opposite or clockwise direction  $2\frac{1}{2}$  to  $2\frac{3}{4}$  turns. Fewer turns clockwise decreases the cold idle speed.

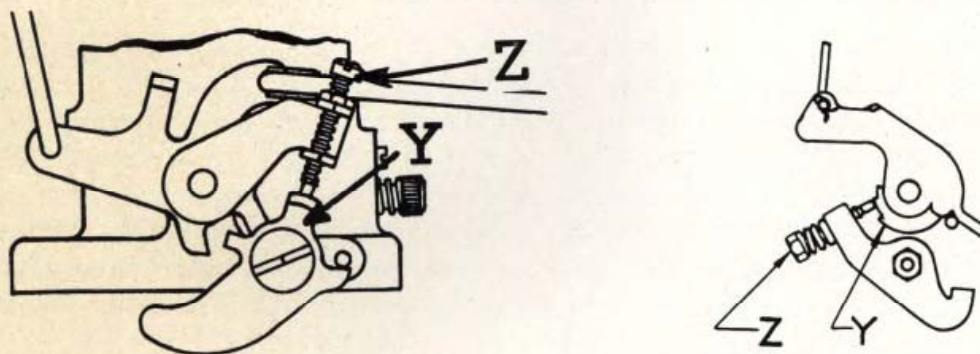


Fig. 10—Cold Idle Mechanism Showing "Y" Cold Idle Cam and "Z" the Adjustable Stop Screw. See Text for Adjustment Instructions

## Fuel Level

Recommended fuel level is  $\frac{5}{8}$ " for Super Eight,  $\frac{9}{16}$ " for Twelve (plus or minus  $\frac{1}{32}$ " ) below machined top surface of float bowl with  $2\frac{1}{2}$  to 3 lbs. pressure on fuel.

## Heat Control (Super Eight Only)

Amount of heat applied to the inlet manifold is automatically controlled by a counter-weighted valve and a thermostatic spring on the outside of the manifold heat riser. Valve should move freely when turned by hand.

## Automatic Choke (Super Eight)

The automatic carburetor choke is of the built-in type comprising a vacuum piston unit built into carburetor lower body and a small thermostatic control spring set into the exhaust manifold. It incorporates a cold idle control that increases the initial idling speed thereby reducing the stalling tendencies of a cold engine.

If a check of the warm-up behavior shows definitely that the carburetor mixture is either too lean or too rich during this period, proceed step by step as follows:

1. Disconnect link "G," Fig. 11, and test operation of choke valve. When closed by hand, it should drop open freely without the slightest

lag. If it does not drop freely, remove choke valve and shaft and clean with alcohol or crocus cloth. Make sure that fly (disk) does not bind in air horn. **Caution:** Do not oil any part of the choke linkage.

2. Remove thermostat unit assembly from exhaust manifold and check the adjustment of the thermostat spring. Factory adjustment is when the arrow on prong plate is aligned with the eleventh or punch marked graduation (in the "rich" direction) from the "O" or zero mark on main plate, as shown. If arrow is not aligned with punch mark, loosen screw "M" to secure this position.

Correct any bearing friction in movement of thermostat lever "L" and reinstall assembly to manifold.

3. Lever "L" should be  $\frac{1}{16}$ " to  $\frac{1}{32}$ " away from stop lug "N" when choke is fully closed as shown in right hand view in Fig. 11. If this clearance does not exist adjust position of stop lug by turning screw "S" until clearance is obtained.

4. If mixture is still too rich or too lean during warm-up period, remove thermostat assembly and decrease or increase the spring tension one graduation at a time. Satisfactory results should be obtained by changing the adjustment not more than 5 graduations from the original setting of 11 graduations rich. If results are not obtained within these limits, the thermostat has been distorted and should be renewed.

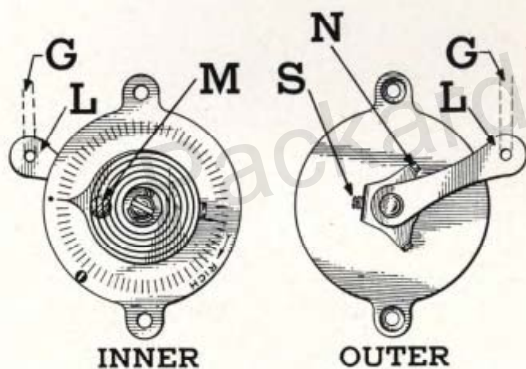


Fig. 11—Right Hand View Shows Super Eight Thermostat Assembly as it Appears When Installed. Left View Shows Inner Face of the Unit With Thermostat Spring Adjusted to Factory Setting

## Automatic Choke (Twelve)

The automatic choke is a self-contained type with the vacuum piston and thermostatic control spring mounted as a single unit. The unit is bolted to the inlet manifold but the thermostatic spring receives its heat by reason of direct contact of the thermostat housing with a metal plate screwed to the exhaust manifold. If a check of the starting and warm-up behavior shows definitely that the carburetor mixture is either too rich or too lean during this period, proceed step by step as follows:

1. Disconnect link "G," Fig. 12, and test operation of the choke valve. When fully closed by hand, it should drop open freely without the slightest lag. The weighted lever at one end of the choke valve shaft will assist the opening if properly positioned. If choke valve does not drop open freely, remove the choke valve and shaft and clean with alcohol and



crocus cloth. Reinstall the valve, making sure that it does not bind in the carburetor air horn. **Caution:** Do not oil any part of the automatic choke unit or its linkage.

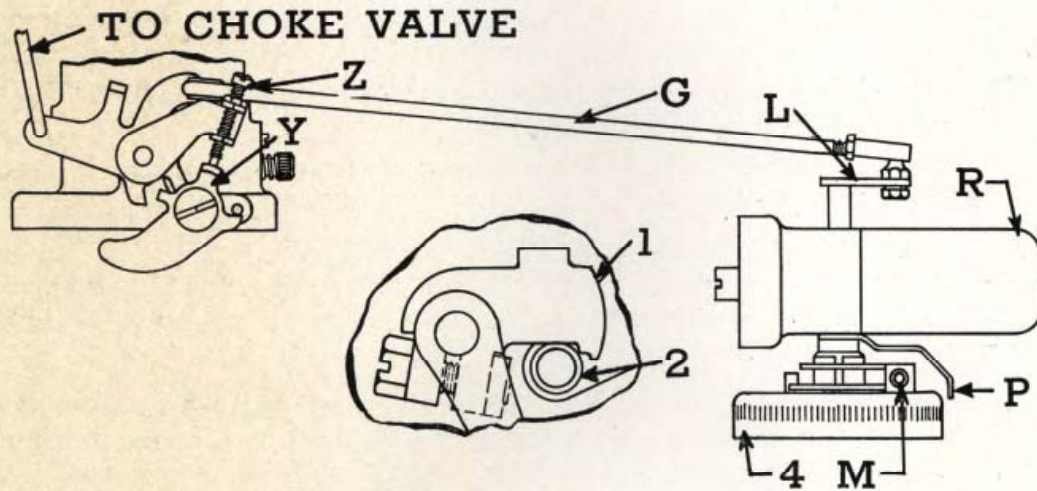


Fig. 12—Linkage Hookup of Automatic Choke on Twelve. Standard Setting is 16 Graduations on Housing "4" in the "Rich" Direction

2. Loosen clamp bolt at carburetor choke valve lever just enough to permit lever to be rotated on choke valve shaft with finger pressure. Remove cover "R" from automatic choke unit. Place cold idle screw "Z" on cold idle cam "Y." Insert a piece of writing paper or newspaper  $\frac{1}{2}$ " wide between air horn and carburetor choke valve and close valve tightly against paper.

3. With choke valve held in this closed position, move the thermostat lever "L" toward rear of car until roller "2" engages first notch of thermostat cam "1" as shown at the center view in Fig. 12. Now without moving roller out of notch in cam and with choke valve closed against paper, tighten the choke valve lever clamp bolt securely.

4. Check the adjustment of the thermostat spring. Factory setting is when the pointer "P" is aligned with the punch marked graduation on thermostat housing. The punch mark is 16 graduations (in the "rich" direction) from the zero mark. If pointer is not aligned with punch mark, secure this position by means of the clamp bolt "M" then start engine and recheck the warm-up behavior. If mixture is still too rich or too lean during the warm-up period, decrease or increase the thermostat spring tension one graduation at a time. Satisfactory results should be obtained by changing the adjustment not more than 4 graduations either way from the original setting of 16 graduations rich. If results are not obtained within these limits, either the thermostat is defective and should be renewed or the cam and levers within the unit require a major adjustment which should be performed by a Packard or Stromberg dealer.

# Electrical System

The electrical system is of the single wire or grounded return type. The positive battery cable is grounded to the frame and the negative wire connects the battery with the starter motor. All terminals and binding post nuts should be kept tight and free from dirt and oil.

The battery is located in a protected cradle under the front seat and can be serviced easily by removing the front seat cushion and battery cover plate in the floor. The electro-lite in the battery should always be maintained at the proper level. Distilled water or, if not available, rain water, should be added to each battery cell until the star in filler opening disappears. Never add acid to the solution. Use a hydrometer to gauge the condition of the battery. A fully charged HiLevel battery should register 1.250 specific gravity. It is important that the battery be kept firmly anchored in its cradle; if it works loose, broken cells and loose connections result.

## Generator

The generators on both cars are the shunt wound, fan ventilated type having both current and voltage regulated externally. The Super Eight unit is capable of delivering a safe maximum output of 28 amperes and the Twelve 30 amperes. The generator is hinge-mounted to the engine and is driven by means of a V-type belt from the engine crankshaft pulley. The fan, which is on the armature shaft at the drive end of the generator, provides forced ventilation through the armature and field coil windings while the machine is in operation. **Caution:** Generator must not be tested on open circuit.

The commutator should be kept clean, smooth and dry. If it appears dirty or rough, clean with 00 sandpaper, not emery cloth.

Super Eight generator is Auto-Lite GCO-4803-A, Twelve is GCE-4803-A.

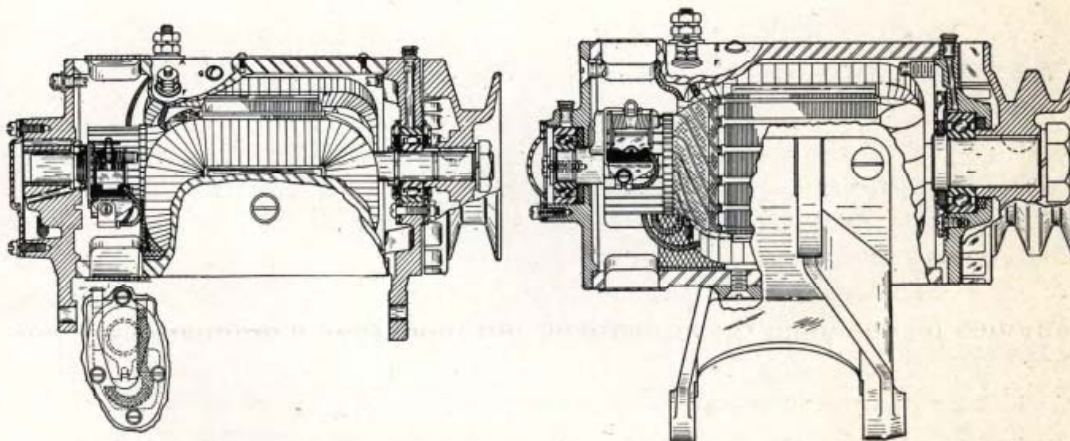


Fig. 13—Generators are Shunt Wound with External Regulation of Both Voltage and Current. Super Eight at Left

## Starting Motor

The starting motor shown in Fig. 14 is fitted to the front face of the flywheel housing. It is controlled by a magnetic relay switch on top of the motor housing operated by a remote button on the instrument board. The starter is equipped with a Bendix shifting mechanism, the pinion of which engages with a steel ring gear shrunk on the flywheel. Oilless bushings are used in the Twelve and require no lubrication while the armature shaft bushings on the Super are provided with oil cups. Super Eight starter is Auto-Lite MAX-4014, Twelve is Auto-Lite DN-1389.

The starting motor should be inspected about every 10,000 miles for loose connections or possible commutator or brush wear. If the commutator is rough or worn excessively it should be turned in a lathe to true it. If brushes are badly worn they should be replaced.

## Starter Drive

Proper cleaning and lubrication of the Bendix drive is important. If the screw shaft becomes gummy, clean with kerosene and lubricate the threads with light engine oil. Do not use gasoline for cleaning as it is very likely to destroy the special packed-in lubricant. A light film of graphite grease should be applied to the Bendix shaft where the pinion travels. In case of failure of this mechanism on the road, it is recommended that a complete new Bendix drive unit be installed.

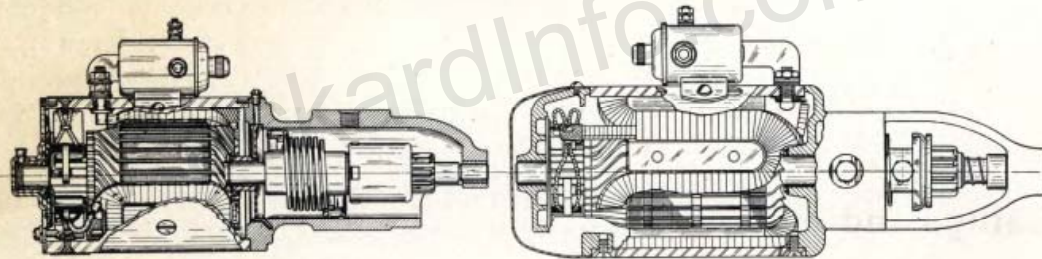


Fig. 14—The Starter May be Operated from Engine Side of Dash by Pressing the Plunger in Magnetic Switch at Top of Starting Motor. Super Eight on Left

## Manual Control of Starter Switch

In case the remote control on the instrument board fails to operate the starter, due to a broken switch or defective contacts, the main switch contact can be made by pressing the plunger in the rear end of the magnetic switch atop the starter. This is also a convenient method for turning the engine over when adjusting in the shop.

## Horns

The horns are mounted on the engine and are operated from the button through a relay which assures long life to the horn button contacts. To remove the horn button, press down, rotate either to the right or left and lift out. Total current draw of both horns is 22 to 25 amperes.

## Fuses and Circuit Breakers

Two thermostatic type overload circuit breakers are attached to the lighting switch shown in Fig. 15. One of the relays protects the headlamp wiring in case of overload or short circuit, the other protects the dome light, cigar lighter and other body wiring. A 20 ampere fuse mounted in a socket near the light switch protects the tail light circuit and a similar fuse enclosed in a socket near the light switch acts as a safeguard for the stop light circuit. If the tail lamp fuse blows, the instrument light is extinguished.

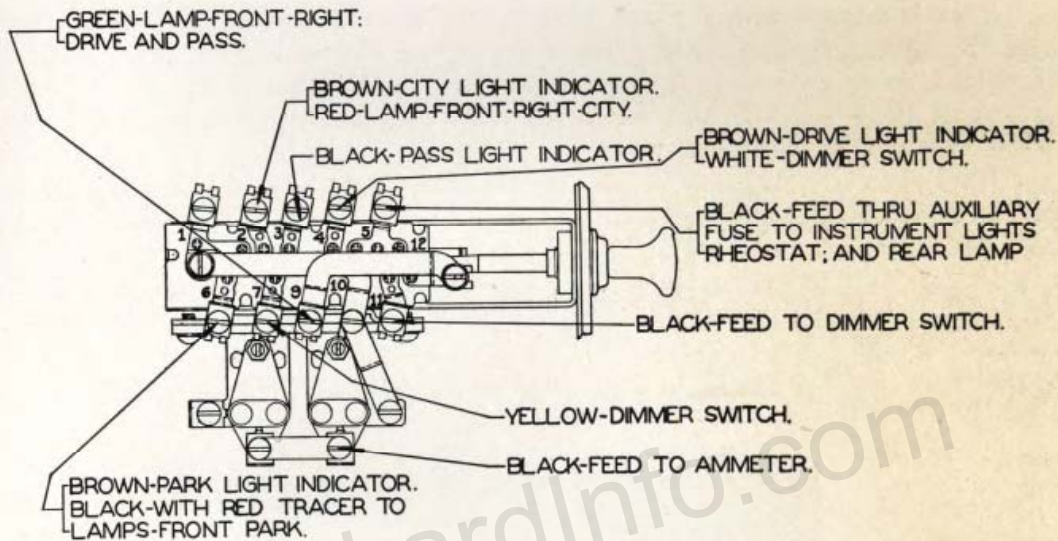


Fig. 15—Lighting Switch on which is Mounted the Overload Relays

## Lamps and Reflectors

The Flex-beam headlamps shown in Fig. 16 have prefocused main bulbs. The lens are marked right and left and if removed for any reason should be reinstalled as indicated.

To clean lamp reflectors, use lamp-black and polish from the center to the edge. Do **not** use a circular motion.

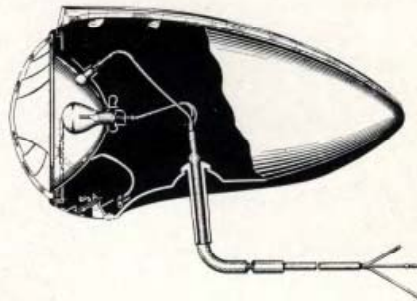


Fig. 16—Side Section of Headlamp Assembly

## Lamp Beam Adjustment

With car fully loaded and tires inflated, place it on to a level floor within twenty-five feet of a white screen or wall.

Measure the height of lamp centers above floor level and stretch a ribbon across the screen at this height. By sighting through the exact center of the rear window, and the radiator cap, determine a point on the screen corresponding to the center line of the car. Measure the distance between the centers of the lamps and place vertical markers at half this distance on either side of the center line. A typical screen layout with the ribbons indicated by the one horizontal and three vertical lines is shown in Fig. 17.

Cover the right lamp, place switch on "country drive" position, then aim the spot of high intensity "H. I. L." view 1 from the left lamp so that it centers on the corresponding lamp center marker with its upper cutoff falling at the horizontal marker as shown. Tighten mounting nut securely while lamp is in this position.

Now cover the left lamp and aim the right lamp until the left margin of the spot of high intensity "H. I. R." falls on the right center marker and the upper cutoff on the horizontal ribbon as shown in view 1. With headlamps tightened in these positions the "country passing" and "city driving" beams will automatically fall in their proper places as indicated in views 2 and 3 respectively. If the lighting in "country passing" position appears to be too blinding for oncoming traffic, turn right hand lamp slightly toward the curb.

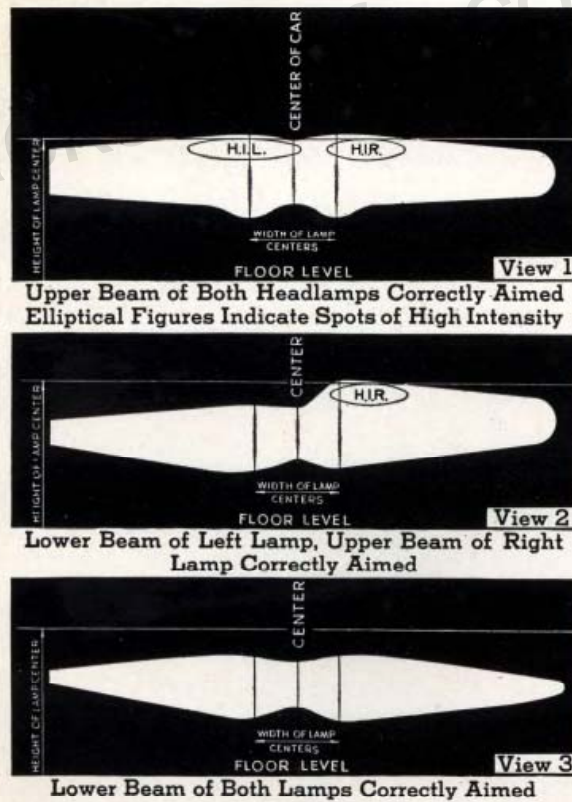


Fig. 17—Headlight Patterns Secured at Various Switch Positions

## Light Bulbs

<i>Location</i>	<i>Candle-power</i>	<i>Mazda No.</i>
Front lamp—right.....	32-32	2330-L
Front lamp—left.....	32-21	1104
Courtesy lamp.....	6.0	81
Defroster and heater light.....	0.8	51
Front parking and front fender lamps....	1½	55
Instrument panel and reading lights.....	1½	55
Instrument board signal light.....	0.8	51
Radio control and clock lights.....	1½	55
Rear stop lamp.....	15	87
Rear tail lamp.....	3.0	63

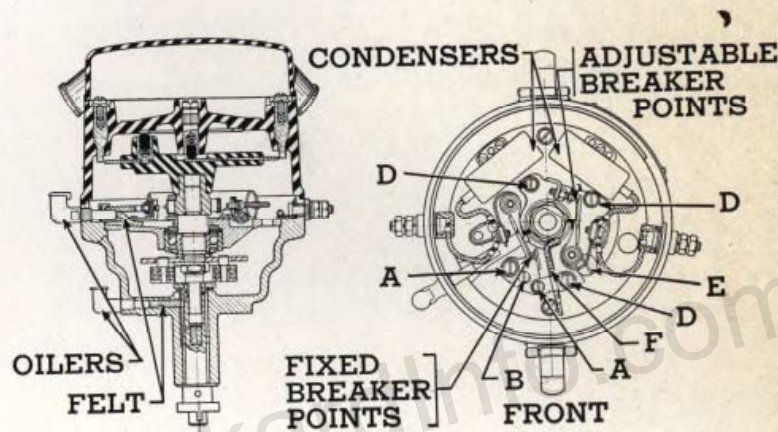


Fig. 18—Twelve Distributor Showing Felt Brush "F" which is Treated with a Special Lubricant. Do not Oil the Felt Brush. Renew It if Dry

### Ignition Distributor (Super Eight)

This Auto-Lite IGT-4006 distributor is of the full automatic advance single breaker type employing a centrifugal governor and manifold vacuum for timing control. The centrifugal governor advances the spark as the speed of the engine is increased. The vacuum advance mechanism being connected to the inlet manifold at the carburetor throttle advances the spark according to the power load imposed on the engine. The vacuum advance is additional to that provided by the governor thereby reducing fuel consumption at part throttle operation.

### Ignition Distributor (Twelve)

The Auto-Lite IGO-4002A or IGO-4001A distributor shown in Fig. 18 is of the full automatic advance double breaker type employing only a centrifugal governor for timing control. Two ignition coils are used, one for each set of breaker points. The right hand set of points is fixed and fires the right hand bank of cylinders. The left hand, or adjustable set, fires the left bank of cylinders. Because the breaker cam has 6 lobes the two sets of breaker points must be synchronized.

## Ignition Timing (Super Eight)

Adjust breaker points to .015" gap before retiming. With fuel compensator on base of unit set at zero, spark should occur in No. 1 cylinder 6 to 8 degrees before top center or when the 6th to 8th graduation on the vibration damper ahead of "UDC1" aligns with the pointer on left front face of timing chain case cover. The firing order is 1-6-2-5-8-3-7-4.

NOTE: Seven to one heads should be timed 4° to 6° before top center.

## Synchronizing and Timing (Twelve)

Both sets of points should be adjusted to .020" gap before synchronizing. The movable points should be synchronized to open 33½ distributor degrees after the fixed set. If movable points do not open 33½ degrees (plus or minus ¾ of a degree) after fixed set, loosen the screws "D," Fig. 18, and turn the screw "E" until this specification is obtained.

Adjust both sets of points to .020" gap before retiming. Timing specifications for standard and low compression heads are as follows: With the carbon brush end of rotor aligned under cap terminal marked "1R" as shown in Fig. 19 the fixed set of points should just open 7 degrees or graduations on the vibration damper before top center. Stated in other words the fixed points should just open when the seventh graduation ahead of the "1RUDC" graduation aligns with pointer on left front face of timing chain case cover as shown in Fig. 20.

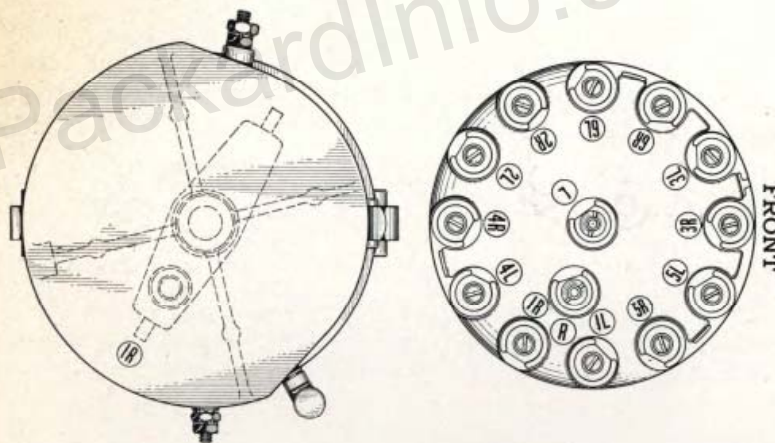


Fig. 19—Rotor Position for Timing No. 1-R Cylinder is Shown at Left. Distributor Cap Wiring Order is Shown in Right View

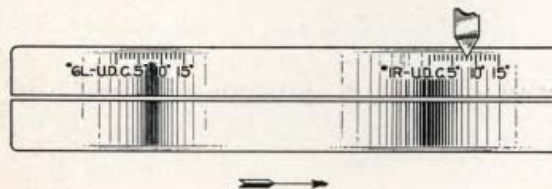


Fig. 20 (Right)—Marks Shown at Pointer are for Timing Fixed Breaker Points. Movable Points are Timed to Marks at Left

Movable points should open a similar number of graduations ahead of the damper mark "6LUDC."

Cylinders are numbered 1 to 6 on each bank No. 1 in each case being the front cylinder. Firing order is 1R, 6L, 5R, 2L, 3R, 4L, 6R, 1L, 2R, 5L, 4R, 3L. NOTE: It should be remembered that the double ended rotor fires at alternate ends as will be seen by reference to the distributor cap wiring order in Fig. 19.

NOTE: Seven to one heads should be timed 4 to 6 degrees before top center.

## Ignition Coils

The ignition switch is mounted on the instrument board and connected to the coils by a cable encased in a metal conduit. When the switch is turned "off" the circuit is broken through the coils, grounding the latter and making it impossible to start the engine by wiring around the switch. The switch is protected by a cylindrical type lock for which two keys are supplied. Amperage draw of each coil is  $2\frac{1}{2}$  amperes engine stopped.

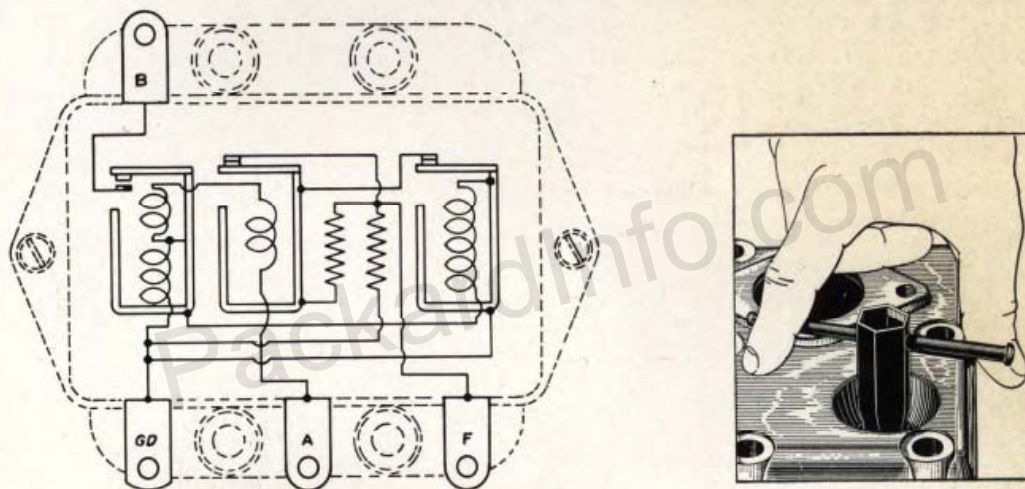


Fig. 20A (Left)—Generator Regulator Internal Circuits.  
Center Unit is the Current Regulator.

Fig. 21—10 mm. Spark Plug Tightening Torque Should Not Exceed 50 Inch Pounds

## Spark Plugs

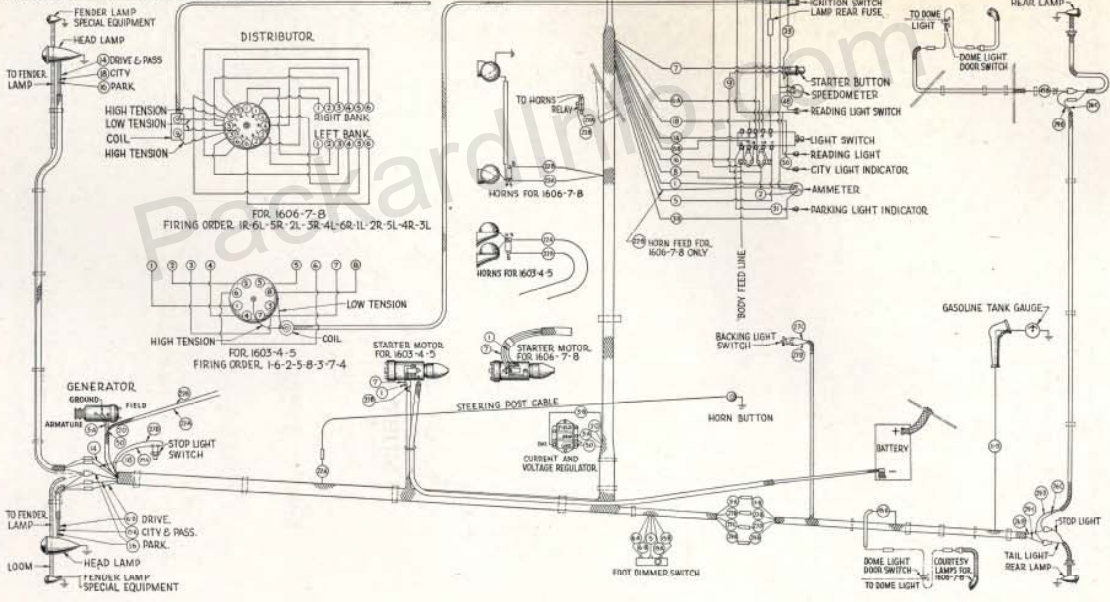
Spark plugs are 10 mm. size, AC model 103 or Champion Y-4. IMPORTANT: To prevent damage to the plugs they should be installed using the wrench provided in the tool kit, as shown in Fig. 21. Only one hand should be used on the wrench when tightening. If the regular tool kit wrench is not available, the leverage used should be limited to that obtainable with one hand on a wrench handle  $\frac{1}{4}$ " diameter—not more than  $4\frac{1}{2}$ " long overall. Stated in another manner, the leverage should not exceed 50 inch lbs., that is, not more than 10 lbs. pull on a wrench handle of 5 inches effective length.

The spark plug gap should be .028 inch, plus or minus .002", for all cars. In readjusting the gap, bend the side electrode—never bend the center electrode as this may crack or break the insulator.



Fig. 22—Chassis Wiring Diagram. Does not Include Body Wiring

NO. GA.	COLOR.	LOCATION	NO. GA.	COLOR.	LOCATION
1	RED	FROM STARTER MOTOR SWITCH TO AMMETER.	73	GREEN	FROM IGNITION SWITCH TO BACKLAMP TO STOP LIGHT FEED
2	BLACK	LIGHT SWITCH FEED	74	GREEN	STOP LIGHT TO SPILICE B
3	RED	CURRENT REGULATOR TO GENERATOR.	75	GREEN	REAR LIGHT JUNCTION TO STOP LIGHT REAR RIGHT
4	BLACK	AMMETER	77	GREEN	STOP FEED TO SPILICE A
5	BLACK	LIGHTING SWITCH TO DIMMER SWITCH	78	GREEN	FEED TO SPILICE A
6	BLACK	DIMMER	79	GREEN	FEED TO SPILICE A
10	WHITE	LAMP FRONT LEFT	80	GREEN	FEED TO SPILICE A
7	BLACK	STARTER BUTTON TO STARTER MOTOR SWITCH	81	GREEN	REAR BARNES JUNCTION TO SPILICE A
8	RED	CIGAR LIGHTER TO CIGAR LIGHTER FEED	82	GREEN	BACKING LIGHT SWITCH TO SPILICE B
9	BLACK	STARTER BUTTON TO LIGHT SWITCH FEED	83	BLACK	REAR BARNES JUNCTION TO SPILICE A
10	BLACK	STARTER BUTTON TO GASOLINE GAUGE	84	BLACK	REAR BARNES JUNCTION TO SPILICE A
11	RED	REAR ADDRESS JUNCTION TO GASOLINE GAUGE	85	BLACK	TAIL LIGHT TO SPILICE C
12	RED	REAR ADDRESS JUNCTION TO GASOLINE GAUGE	86	BLACK	JUNCTION TO LAMP REAR RIGHT
13	RED	REAR ADDRESS JUNCTION TO GASOLINE GAUGE	87	BLACK	LIGHTING SWITCH TO CITY LIGHT MIDDLE SIDE
14	GREEN	LIGHTING SWITCH TO LAMP FRONT RIGHT	88	BLACK	LIGHTING SWITCH TO CITY LIGHT MIDDLE SIDE
15	YELLOW	DIMMER	89	BROWN	LIGHTING SWITCH TO CITY LIGHT MIDDLE SIDE
16	BLACK	LIGHTING SWITCH	90	BROWN	LIGHTING SWITCH TO CITY LIGHT MIDDLE SIDE
17	BLACK	LAMP FRONT (LAMP)	91	BROWN	LIGHTING SWITCH TO CITY LIGHT MIDDLE SIDE
18	RED	LAMP FRONT (LAMP)	92	BROWN	LIGHTING SWITCH TO CITY LIGHT MIDDLE SIDE
19	BLACK	LAMP FRONT (LAMP)	93	BROWN	LIGHTING SWITCH TO CITY LIGHT MIDDLE SIDE
20	BROWN	CURRENT REGULATOR TO GENERATOR	94	BLACK	RIGHT POOL SWITCH FEED TO SPILICE C
21	BLACK	STEERING POST HORN BUTTON TO HORN RELAY	95	BLACK	RIGHT POOL SWITCH FEED TO SPILICE C
22	BLACK	STARTER MOTOR SWITCH TO HORN RELAY	96	BLACK	STARTER SWITCH TO BRAKING LIGHT SWITCH
23	BLACK	AMMETER TO HORN RELAY	97	GREEN	CURRENT REGULATOR GROUND TO UNIFORM DISC
24	BLACK	STARTER BUTTON TO IGNITION SWITCH			
25	BLACK	PANEL RHEDSTAY TO TAIL LIGHT FEED			



# Clutch

The **Super Eight** clutch is adjustable only at the pedal linkage as shown in Fig. 23. Pedal free play should be  $1\frac{1}{2}$  inches measured between pedal pad and floorboard.

The **Twelve** clutch is power operated by means of a vacuum cylinder as shown in Fig. 24. Adjustment procedure is as follows:

1. With engine shut off, move clutch pedal in and out about 10 times to completely empty the vacuum storage tank. This is important. Remove floor boards.
2. Make sure that pedal is up against toe-board spring. Loosen lock screw "1," Fig. 24. Pull rearward on the bottom of lever "2" and forward on bottom of lever "5" until all clearance at the top end is on the forward side of the pedal shaft and at the bottom end on the forward side of the pin "4" as shown in lower view. Holding levers in this position, tighten the lock screw "1" securely.

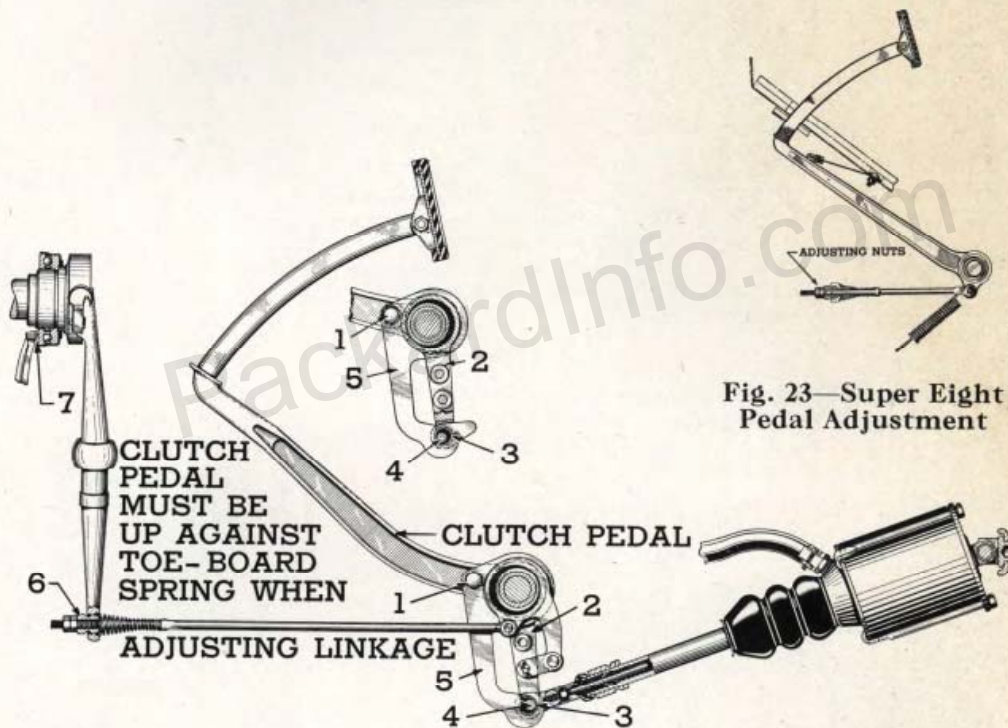


Fig. 24—Layout of Power Operated Clutch. Repeated View Shows Position of Levers as Power Unit Valve Opens

3. Pedal should have  $1\frac{3}{16}$ " free travel before shifter bearing contacts the clutch release fingers. To secure this specification, move pedal pad downward  $1\frac{3}{16}$ " then, holding this position, adjust pedal rod nuts "6" until all clearance "7" is removed between shifter bearing and clutch fingers. If linkage is correctly adjusted, the power cylinder valve will open simultaneously with the contact of release fingers against shifter bearing and of pin "4" against forward wall of bushing "3" as shown at repeated view in Fig. 24.

# Transmission and Rear Axle

Internal details of the 3-speed, synchro mesh helical gear transmission are shown in Fig. 25. The required pause at shifting is provided by dash-pot elements acting on the shifter forks.

## Axle Shaft Bearing Adjustment

Desirable end play at each axle shaft is  $.003''$  plus or minus  $.001''$ . This clearance is adjusted by means of shims as shown in Fig. 27 after removing the axle shaft and inner race. Adjust each shaft independently. Apply a coating of good grade gasket paste to inner face of bearing cap.

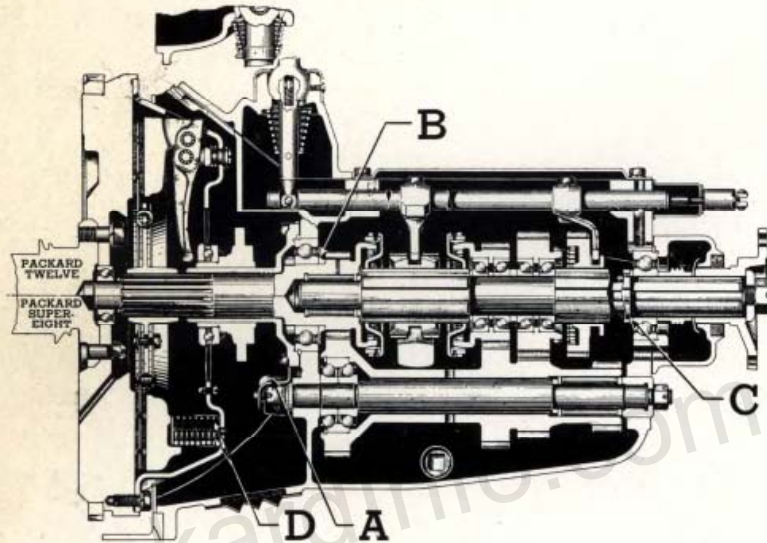


Fig. 25—(Above) Synchronizer Yoke Travel is Controlled by Shims at "B" and "C"

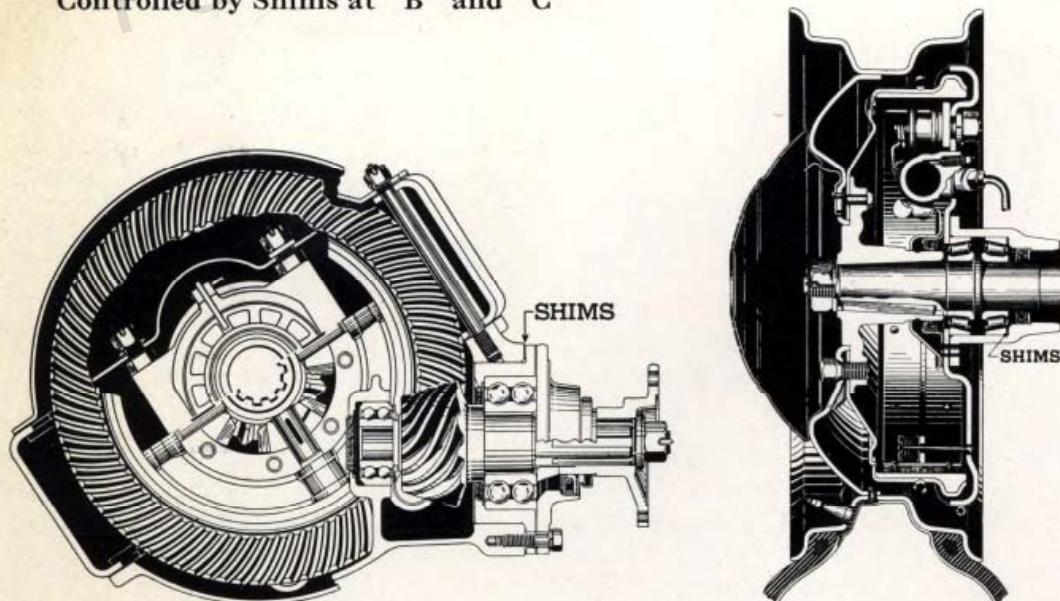


Fig. 26—(Above, Left) Pinion Mesh is Controlled by Shims

Fig. 27—(Above, Right) Shaft End-Play is Shim Controlled

## Notes for the Mechanic

If gears do not shift smoothly and quietly, check synchronizer yoke travel. Movement of the synchronizer yoke after a second or high speed shift should be not less than .140" and not more than .160", measured with a dial gauge mounted on cover face of housing and contacting the rear face of that part of the synchronizer yoke containing the coil springs. If not within these limits, remove or add spacer washers in front of the main shaft rear bearing as shown at "C," Fig. 25 or behind the clutch shaft bearing as at "B" in Fig. 25. A change in washer thickness of .006" will change the yoke travel approximately .040 inch. Correct yoke travel of .140 to .160 inch will automatically produce the desired .018 inch clearance between drum and steel shoe of the two synchronizing brakes.

Countershaft cluster should have .003 to .004" backlash at the 19 and 29 teeth gears. Adjustment is controlled by "A" which is available in several angles. The "L" on flat at front end of countershaft must face towards the reverse idler gear.

**Differential side bearings** should be adjusted to a preload representing a .015" spread of the bearing support pedestals. Procedure is as follows: Loosen each of the four bearing cap nuts about  $\frac{3}{4}$  of a turn and remove the locks. Back off the right hand (viewed from rear) bearing adjusting nut until ring gear mount is loose in bearings. Make sure that left hand adjusting nut is backed out far enough to provide some backlash between gears.

Using a large outside caliper and a .015" feeler blade, caliper from one cap lock boss to the other with the feeler blade interposed between one of the bosses and the caliper. Lock the caliper at this setting. Now tighten the right hand bearing adjusting nut until the previously adjusted caliper (minus the .015" feeler) will just slide over both bearing cap lock bosses. This gives the desired .015" spread.

Now check backlash between pinion and ring gear teeth. If lash is more than .005" back off the right hand adjusting nut and tighten the left hand nut exactly the same amount until lash is within the .003" to .005" limit. By turning each nut exactly the same amount backlash may be adjusted without disturbing the previously adjusted preload spread. Tighten both caps securely and lock the adjusting nuts.

Pinion shaft splines should be coated with Lubriplate or equivalent when assembling.

**IMPORTANT:** If axle universal joint flange is removed for any reason, be sure to refill the oil reservoir, Fig. 26 with  $1\frac{1}{4}$  ounces of S. A. E. 50 oil. Insert the oil after assembling the spacer and before installing the joint flange.

The counterbore of front pinion bearing cap where it contacts the front oil seal should be coated with a good grade of gasket paste whenever the universal flange is removed.

# Chassis Suspension

If the front tires show irregular wear or if the car does not "handle" correctly, the toe-in, camber and caster should be checked and corrected as outlined in the following paragraphs.

## Toe-in

Recommended toe-in is  $\frac{1}{32}$ " to  $\frac{1}{8}$ " measured at or as near hub height as possible.

1. Inflate all tires to recommended pressure. Adjust front wheel bearings. Center the steering worm on "high spot," steering crank on center line of car and front wheels straight ahead, before measuring. The adjustable connecting rod (drag link) permits exact centering of the steering crank. Dimension "X," Fig. 28, from brake backing plate to frame at first rivet back of bumper should be same as "Y" on opposite side. If they differ more than  $\frac{1}{8}$  inch, lengthen cross tube on short side until both wheels are centered.

Adjust toe-in by turning each cross tube (tie-rod) same amount until "A" is  $\frac{1}{32}$  to  $\frac{1}{8}$  inch longer than "B."

## Camber

Desired camber angle is one degree but a minimum of  $\frac{3}{4}$  and a maximum of  $1\frac{1}{4}$  degrees is permissible. Angle should be checked with car loaded as indicated in note on next page. Four wheels must be resting on level floor or rack. Height from floor to bottom of frame side rail measured with front tires inflated to same pressure must be same on each side within  $\frac{1}{4}$  inch. If not within this limit, replace the short spring.

Adjust by installing proper Packard offset pilot thimbles at shock absorber bolt "B," Fig. 29 on the **Super Eight** or by removing or installing Packard split washers "B", Fig. 30, on the **Twelve**. Pilots of zero,  $\frac{1}{16}$ "  $\frac{1}{8}$ " and  $\frac{3}{16}$ " offset and split washers of  $\frac{1}{8}$ ",  $\frac{3}{16}$ ",  $\frac{1}{4}$ " and  $\frac{5}{16}$ " thickness are available. A change of  $\frac{1}{16}$ " in offset of pilot or thickness of washer changes the camber angle  $\frac{1}{3}$  of a degree.

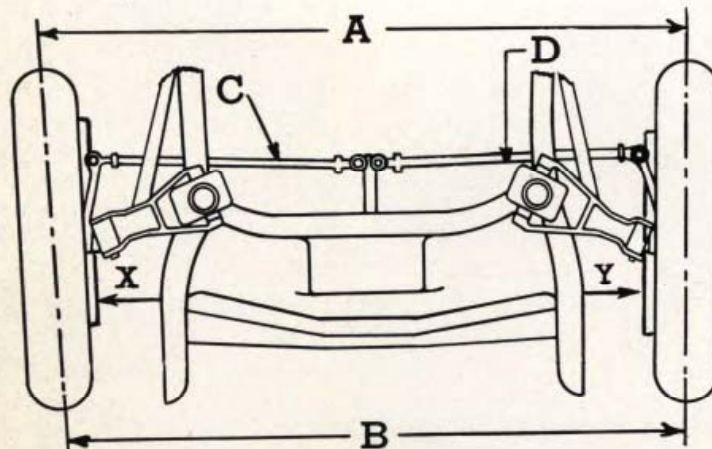


Fig. 28—Toe-in is Correct when Distance "B" is  $\frac{1}{32}$ " to  $\frac{1}{8}$ " Shorter than "A"

NOTE: Caster and camber angles should be measured with car loaded to its rated passenger capacity at front and rear seats on the basis of 150 pounds per passenger.

## Caster

**Super Eight** recommended caster angle is  $2\frac{1}{2}$  degrees but a minimum of 2 and a maximum of 3 degrees is permissible.

**Twelve**, **caster** is zero degrees but reverse caster of  $\frac{1}{2}$  degree is permissible. Angle should be checked with wheels resting on level floor or rack, extra tires in place and car loaded as per note above.

Adjust caster by installing the proper Packard taper shim between torque arm and wheel support arm at "C." Shims of  $\frac{1}{2}$  and one degree are available.

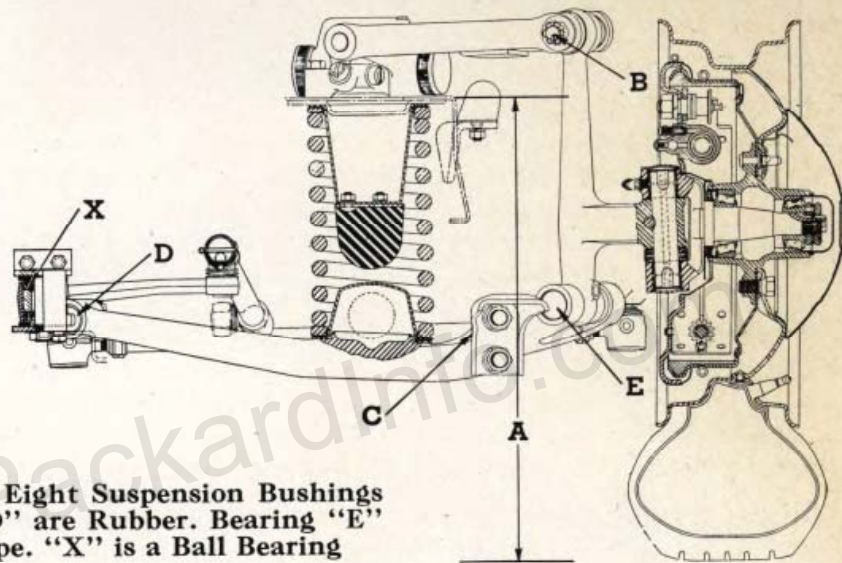


Fig. 29—Super Eight Suspension Bushings at "B" and "D" are Rubber. Bearing "E" is Roller Type. "X" is a Ball Bearing

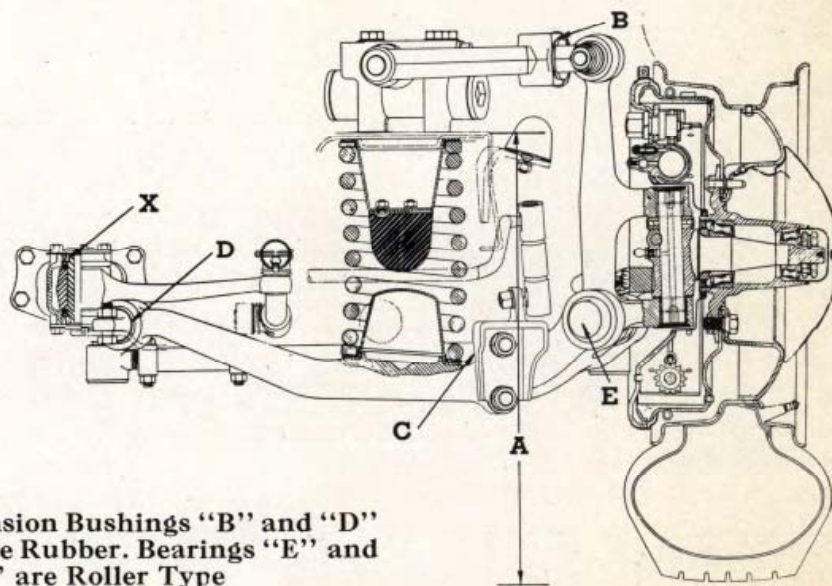


Fig. 30—Suspension Bushings "B" and "D" of the Twelve are Rubber. Bearings "E" and "X" are Roller Type

## Rear Springs

The rear suspension is by means of low rate semi-elliptic springs. The front ends of the rear springs are mounted in rubber bushings. The rear ends of the rear springs are hinged to the frame by means of shackles which are rubber bushed at the top while the lower bolt rides in a threaded type metallic bushing.

## Shock Absorbers

Double acting hydraulic shock absorbers are used front and rear. **Caution:** Use only Packard, or Delco Lovejoy fluid for refilling.

## Notes for the Mechanic

If troubled by wheel fight or improper road handling, first check the steering geometry and the steering gear and adjust to specifications then check the riding height, front and rear, as follows:

With car on level floor or rack, the distance "A," Figs. 29 and 30 from floor to top of frame should be  $20\frac{1}{8}$  inches plus or minus  $\frac{1}{4}$  inch on the Super Eight, and  $20\frac{1}{2}$  inches plus or minus  $\frac{1}{4}$  inch on the Twelve. On the Super the distance from top of rear axle to bottom of frame should be  $4\frac{3}{4}$  inches and on the Twelve  $4\frac{1}{4}$  inches plus or minus  $\frac{1}{4}$  inch. Renew or shim the springs if riding height is not within the limits. Riding height should be measured with car loaded as follows:

Body	Load, Front	Load, Rear
5-Pass.	300 lbs.	375 lbs.
Coupes	300 lbs.	225 lbs.
7-Pass.	300 lbs.	675 lbs.

Steering crank pivot bearing "X" Figs. 29 and 30 should be adjusted to a preload of  $3\frac{1}{2}$  to  $4\frac{1}{2}$  lbs., measured with a spring scale on the steering connecting rod (drag link) ball stud with tie-rods disconnected.

## Steering Gear

Preparatory to adjusting the gear, the front road wheels should be jacked up and the steering connecting rod (drag link) disconnected at the crank or forward end. Check freedom of the system by swinging the wheels through their normal turning arc. There should be no tight spots and not more than 45 lbs. pull applied at the steering crank ball stud should move the wheels in either direction. If pull of more than 45 lbs. is required, locate and free up the tight bearing.

The gear should also be checked for misalignment before proceeding to the actual adjustment. Loosen steering gear to frame bolts enough to permit gear to align itself to the angle determined by height setting of instrument board bracket then retighten the frame bolts securely. Next loosen bracket at instrument board so that gear will align itself to the angle determined by the frame bracket, then tighten the board bracket. Perform the actual adjustments in the following order.

## Steering Column Up and Down Play

1. Turn steering wheel to either stop then back up  $\frac{1}{8}$  turn. Loosen the worm cover screws at bottom of housing, Fig. 31 and remove one thin gasket, being careful not to mutilate the others.

2. Tighten the cover screws and check adjustment by hooking a spring scale to steering wheel with **drag link disconnected**. When properly adjusted a pull of not less than  $1\frac{1}{2}$  and not more than  $2\frac{1}{4}$  lbs. (measured at rim end of wheel spoke) should be required to move the steering wheel. Remember that an increase in pull will be encountered as wheel is turned through the "high spot". The  $1\frac{1}{2}$  to  $2\frac{1}{4}$  lbs. specification applies only when the gear is **off** the high spot.

## Roller Mesh

3. Turn steering wheel to the exact "high spot" or mid-position. If steering crank is not now on lengthwise centerline of car adjust the drag link until centered. Remove cap nut from cross shaft adjusting screw and disengage special lockwasher from housing boss. Using an Allen wrench turn adjusting screw in clockwise direction until a light but noticeable drag is secured when steering wheel is turned through the mid-position. Adjustment is correct when the pull required to move steering wheel through mid-position is not less than 3 and not more than  $4\frac{1}{2}$  pounds. Check this specification with an accurate spring scale at rim end of wheel spoke with drag link disconnected.

4. Install lockwasher without changing position of adjusting screw and finally the cap nut.

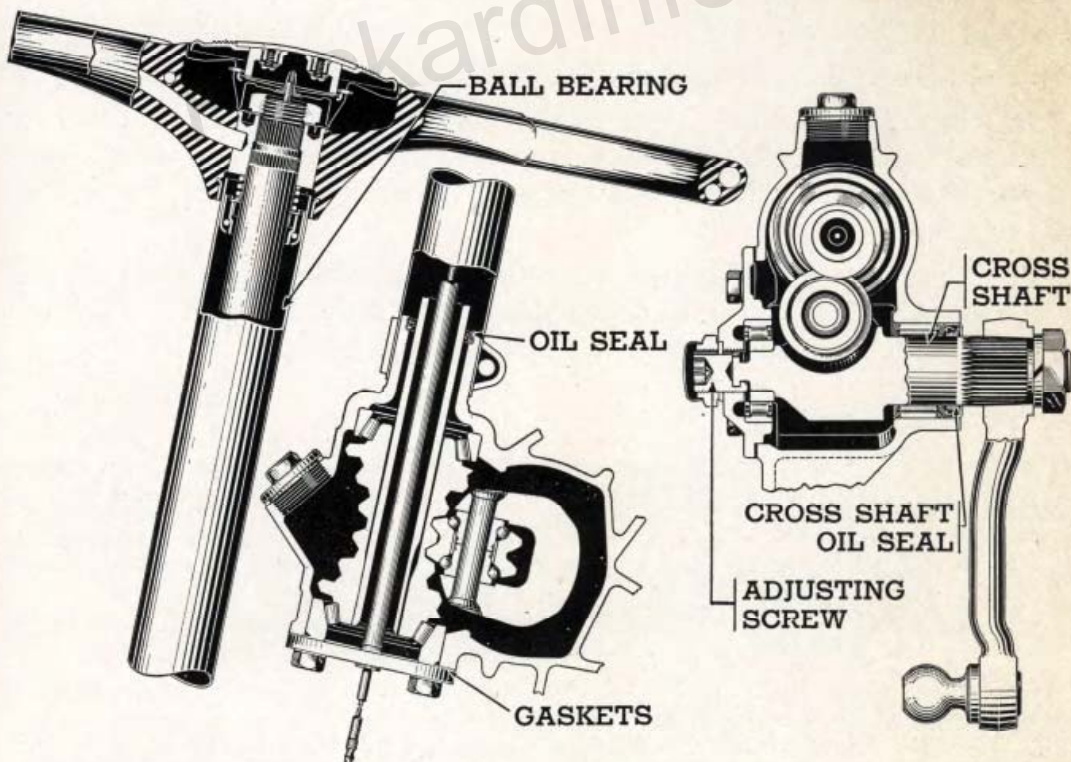


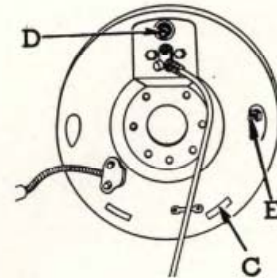
Fig. 31—The Worm and Roller Type Steering Gear Has Only Two Adjustments. Gaskets at Bottom of Housing Control Column Up and Down Play



# Brakes

Service brakes are of the single anchor, self-energized type, actuated hydraulically. Brake input effort on the Twelve is assisted or boosted by a vacuum power unit of the reaction type which provides "feel" at the pedal. The parking brake utilizes the rear wheel service shoes which are actuated mechanically by a hand lever through steel cables and an equalizer. The hand lever, equipped with a friction type ratchet mechanism, is attached to the cowl.

Fig. 32—Backing Plate Side of Right Rear Brake Showing Points of Adjustment



## Service Wear Adjustment

Adjustment to compensate for normal lining wear is accomplished as follows:

1. Jack up all 4 corners of car and remove wheels. Place hand brake lever in fully released position. If doubtful regarding full release of hand brake, remove the pin at either one of the hand brake cable clevises "A," Fig. 34. Remove adjusting hole covers "C" from backing plates.

2. Execute the following adjustments at each wheel.

A. Insert a .010 inch feeler blade between lining and drum at lower end of secondary shoe (rear shoe) and turn eccentric "E" towards front of car until feeler is just firmly gripped. Holding this position, tighten the lock nut on eccentric.

B. Turn star wheel adjuster nut by using a screw driver or special tool through port "C" until slight drag is felt then back off until drum is just free when turned. Reinstall all wheels and inspection covers.

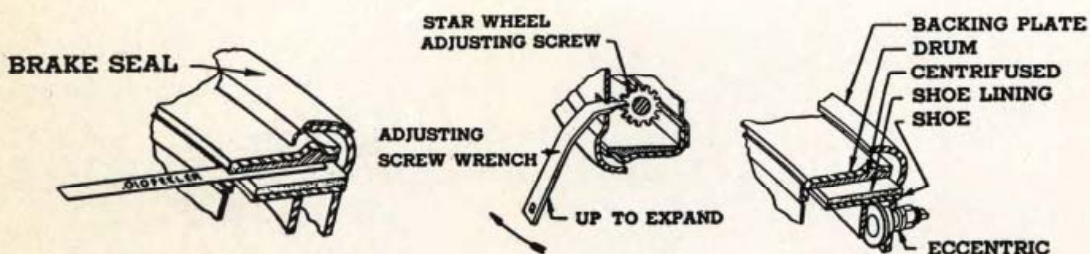


Fig. 33—Left View Shows Method of Checking Lining Clearance with .010" Feeler Blade. Center View Shows Star Wheel Clearance Adjuster Which May be Revolved with a Screw Driver. Right Hand View Shows Outer End of the Eccentric in Contact with Shoe

## Service Major Adjustment

Whenever the shoes are relined or whenever the "wear" adjustment fails to give satisfactory results, the major adjustment outlined below should be executed.

1. Jack up all 4 corners of car and remove wheels. Place hand brake lever in fully released position. If doubtful regarding full release of hand brake, remove either one of the clevis pins at "A," Fig. 34. Remove adjusting hole covers "C" from each backing plate and from each drum.

2. Execute the following adjustments at each wheel.

Insert a .010 inch feeler blade between lining and drum at lower end of secondary shoe (rear shoe) and turn eccentric "E," Fig. 34, towards front of car until feeler is just firmly gripped then tighten lock nut.

A. Loosen the lock nut on anchor "D" one turn. Insert a .010 inch feeler blade between lining and drum at the upper end of the rear (secondary) shoe and turn anchor in desired direction until .010 inch feeler is just firmly gripped. Holding this position tighten anchor lock nut securely with a wrench 12 to 16 inches long.

Clearance at both ends of secondary (rear) shoe should be .010".

B. Turn star wheel adjuster "B" until slight drag is felt then back off until drum is just free when turned. Reinstall wheels and covers.

## Hand Brake Adjustment

1. Jack up rear wheels. With equalizer against its stop and lever fully released, remove slack from lever to equalizer cable by turning the clevis at equalizer end of cable.

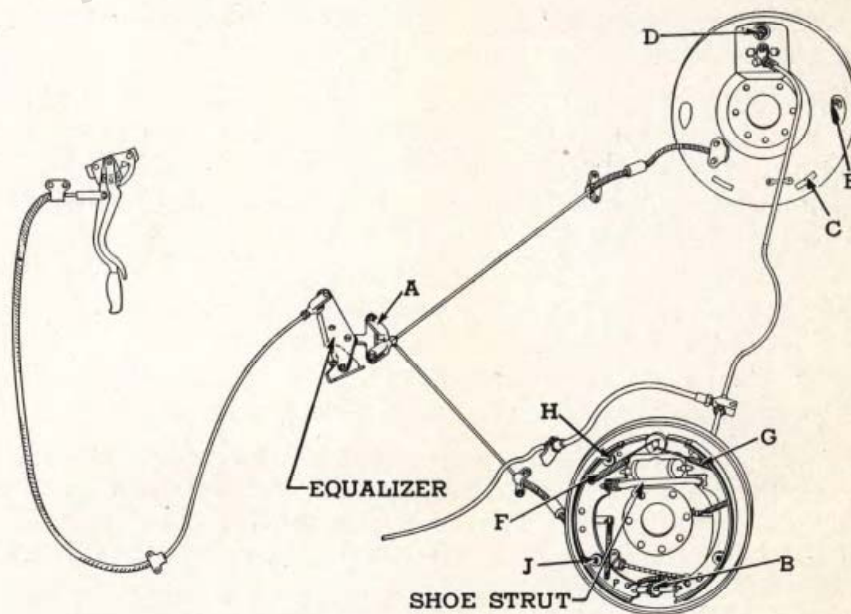


Fig. 34—Chassis Brake Diagram Showing Points of Adjustment. Brake Input Effort on the Twelve is Assisted by a Vacuum Power Unit Shown in Fig. 36

2. Remove clevis pin from equalizer end of each brake pull cable. Expand rear wheel shoes by turning star wheel adjuster until each rear wheel can just be turned with both hands.

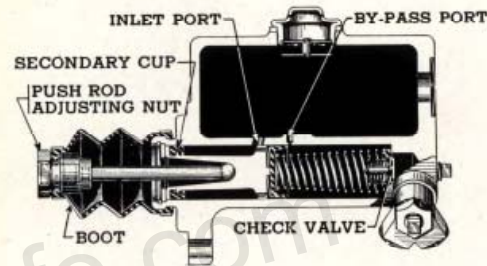
Set hand brake lever in first notch. Place equalizer bar in even pulling position at right angles to frame side rails. Adjust each pull cable clevis "A" so that clevis pins will just enter freely without moving the equalizer bar. Insert and cotter the clevis pins. Release hand lever. Back off star wheel adjuster until both rear wheels are just free of drag.

3. Get final equalization on testing machine or floor by backing off star wheel adjuster at "tight" wheel.

## Bleeding the Lines

Whenever the brakes have a "spongy" action or if the main outlet pipe from master cylinder has been disconnected the system must be bled at all 4 wheels. If a line is disconnected from any one wheel cylinder, only that cylinder must be bled. Procedure is as follows:

Fig. 35—Brake Pedal Must Have Some Free Travel so that Piston Cup Will Clear the By-pass Port as Shown



Remove screw from bleeder connection at backing plate side of wheel cylinder and attach bleeder tube. Place opposite end of tube below the liquid level in clean glass jar partially filled with brake fluid. Fill the master cylinder reservoir with genuine Packard fluid and keep reservoir at least half full during the bleeding operation. If Packard fluid is not available, use Lockheed No. 5 fluid.

Open bleeder valve  $\frac{3}{4}$  of a turn and depress the brake pedal slowly by hand. Allow pedal to return slowly to prevent entrance of air. A second person should observe the bleeder hose. Continue this action until fluid passing from hose shows no air bubbles, then tightly close the bleeder valve. Repeat this operation at other 3 wheels if necessary.

Fluid withdrawn in the bleeding operation should not be used again. Check fluid level in master cylinder reservoir after bleeding each cylinder and refill if less than half full.

## Pedal Free Movement (Super Eight)

The master cylinder primary cup must clear the by-pass port, Fig. 35 when the piston is in released position. If cup does not clear the by-pass port, the compensating action of the master cylinder will be destroyed and the brakes will drag after several applications. To prevent this trouble the brake pedal push rod should be adjusted to provide approximately  $\frac{1}{4}$ " free initial travel of the pedal. On the Twelve the push rod should just contact the master cylinder piston simultaneously with opening of the power unit valve as outlined in next paragraph.

## Power Unit Linkage (Twelve)

Adjustment of the power unit linkage is accomplished as follows:

1. Remove floor boards only. Move brake pedal in and out about 10 times to completely empty the vacuum storage tank. With pedal up against toe board loosen nut "A," Fig. 36, and pull rearward on bottom of lever "5" and forward on bottom of valve lever "8" until clearance at pedal shaft "9" and power unit valve pin "7" is all on the forward side as shown in the lower view at Fig. 36. Holding levers in position, tighten the nut "A" securely.

2. Remove clevis pin "4" and move pedal downward until the clearance in levers "5" and "8" is all on the rear side as shown in the upper view at Fig. 36. With someone holding the pedal in this position adjust the hydraulic master cylinder push rod nut "B" until push rod just contacts the master cylinder piston when the clevis pin "4" is inserted.

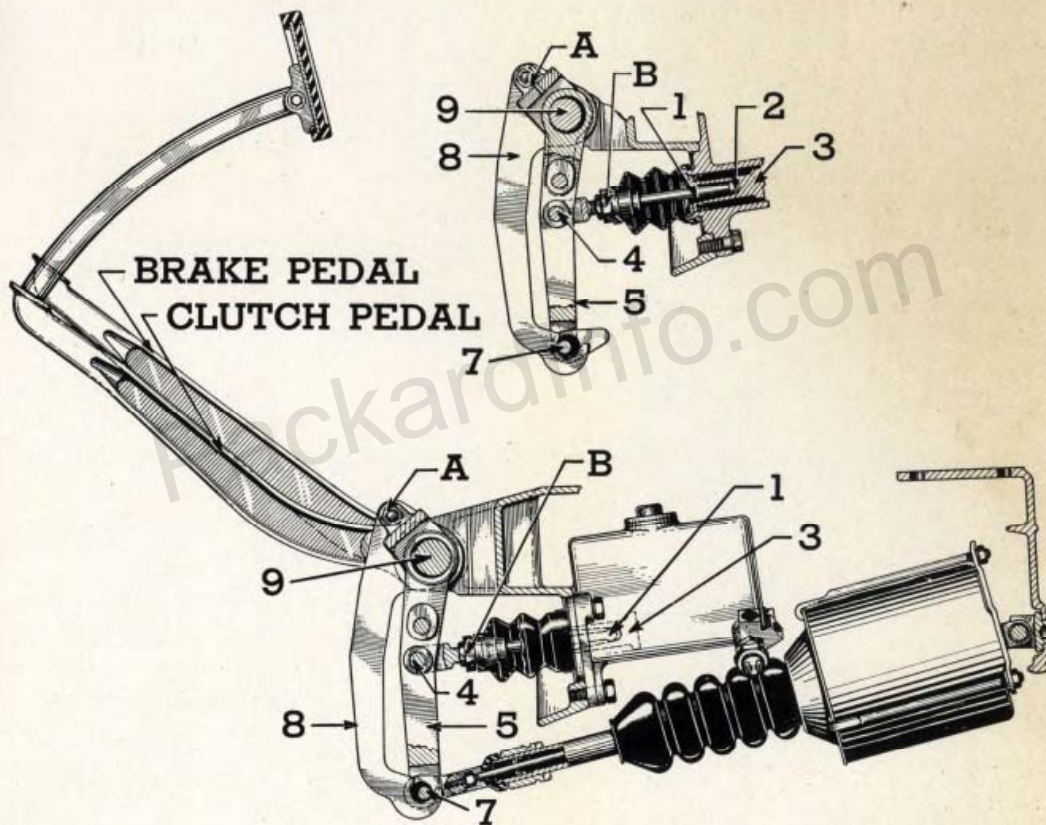


Fig. 36—Vacuum Power Unit Installation. Upper View Shows Position of Lever Clearances at the Instant Power Unit Valve Opens

## Tires

Tires are balanced and marked with a red dot to indicate the proper location for the valve stem of the inner tube to insure the best assembly balance. See page 3 for inflation pressure.

The spare wheels on 6 wheel models are carried in the front fenders. Each wheel is provided with a free wheeling type lock. The locked position is when the small hexagon revolves freely. Wheel assembly should be installed with valve stem at the top. The wheel support arm, which is clamped to the chromium plated tube, should contact the widest face of the wheel rim when tire is resting on rubber bumpers in fender.

## Number Information

**Engine Number**—Stamped on Super Eight upper center left side of crankcase, on Twelve left side block below distributor, above generator. The engine number is the principal identifying number and should always be used when ordering parts.

**Vehicle Number**—Stamped on transfer attached to front of dash. The vehicle number is stamped on the transfer before the car leaves the factory, but the delivery date, the name of the distributor or dealer making the delivery, and the city are stamped on the transfer at the time of delivery to customer.

The delivery date is of particular importance because it establishes the age of the car for insurance purposes. **Be sure that the delivery date is stamped on your car.**

**Body Serial Number**—Embossed in left front face of dash.

This is used as final reference where the other numbers have been altered. This is an additional protective measure.

## Ordering Parts

It is advisable to make all parts replacements with Packard Precision Built Parts which may be procured from authorized dealers.

**When ordering specify:** Shipping directions; engine number; vehicle number; complete description of part; color, if part is painted.

All quotations are subject to change without notice.

All parts should be ordered from the nearest Packard distributor or dealer. Orders sent direct to the factory will be shipped C. O. D., F. O. B. shipping point, unless accompanied by cash. Our responsibility ceases when goods are delivered in good condition to transportation company.