Proper Maintenance

NEVER RUN ENGINE IN CLOSED GARAGE

Due to the presence of carbon monoxide (a poisonous gas in the exhaust of the engine) never run the engine for any length of time while the vehicle is in a small closed *garage. Opening the doors and windows will* lessen *the danger considerably, but it is safest if adjustments are being made that require the operation of the engine, to run the vehicle out-of-doors.*

INSPECTION.

The old adage "An ounce of prevention is worth a pound of cure" was never more true than when applied to any motor vehicle. The importance of regular systematic inspection cannot be over-emphasized. Small and seemingly unimportant faults, if neglected, may grow into expensive major repairs. Regular inspections and prompt correction of small faults will go far toward holding down maintenance expense, eliminating delays in productive operations and upholding the high standard of reliability and performance built into your "Jeep" at the factory.

In the following paragraphs are methods of making minor adjustments and preventive maintenance suggestions. Should major repair work be necessary, consult your Willys-Overland Dealer.

ENGINE TUNE-UP.

For best performance and dependability the engine should have a periodic tune-up twice yearly, preferably in the Spring and Fall.

Remove the spark plugs, clean them thoroughly and space the electrodes to .030" (0.76 mm.) gap.

Clean and tighten the battery cable terminals, the battery ground connection and the ground strap, Fig. 10, on the right side of the engine at the front engine support.

Remove the distributor cap and inspect the contact points. Adjust the points to .020" (0.51 mm.) gap. See Fig. 7, No. 5.

Check the ignition timing.

Check the valve tappet clearance. Adjust to .016" (0.406 mm.) clearance with engine hot or cold.

Clean the fuel pump filter screen and check fuel line connections. Remove the ventilator valve, Fig. 12, and clean.

Start the engine and allow it to run until thoroughly warm then set the carburetor idle screw so the engine will idle at 600 rpm (vehicle speed of approximately 6 mph (9.6 Km./h.).

Adjust the carburetor low speed idle screw No. 15, Fig. 14, so that the engine will idle smoothly.

NOTE: Should the engine fail to perform satisfactorily and the trouble is definitely traced to the carburetor, consult your Willys-Overland Dealer. Carburetor service is specialized and should not be undertaken unless the unit is thoroughly understood.

VALVE AND IGNITION TIMING.

	Piston Measurements From Top Center	
Inlet opens 9 degrees before top center	039”	(0.991 mm.)
Inlet closes 50 degrees after bottom center	3.772”	(95.81 mm.)
Exhaust opens 47 degrees before bottom center. ..	.3.799”	(96.49 mm.)
Exhaust closes 12 degrees after top center	054”	(1.37 mm.)
Ignition Timing	5° BTC	

Spark set top center with automatic spark controls at rest, when using low octane fuel.

Firing Order	1-3-4-2
Tappet setting for valve timing	020” (0.51 mm.)
Number of flywheel teeth	124

CHECKING VALVE TIMING.

To check the valve timing, adjust the inlet valve tappet No. 1 cylinder to .020” (0.51 mm.). Use care in making this adjustment that the measurement is accurate with feeler gauges and that the tappet is resting against the lowest surface of the camshaft cam. Rotate crankshaft clockwise until piston in No. 1 cylinder is ready for the intake stroke. (The intake valve opens at 9° before top center. The flywheel is marked at top center and 5° before top center. Estimate the 9° position, as viewed through the timing hole opening, Fig. 6, in the flywheel housing on the right side of the engine, by noting distance between the top center mark and the 5° mark.) With the crankshaft in this position, valve timing is correct if No. 1 intake valve tappet is just tight against the end of the valve stem. After checking, adjust all of the tappets .0 16” (0.406 mm.). The correct alignment of the timing gear marks when setting valve timing is indicated in Fig. 8.
Should the timing be incorrect it is advisable to consult your Willys-Overland Dealer.

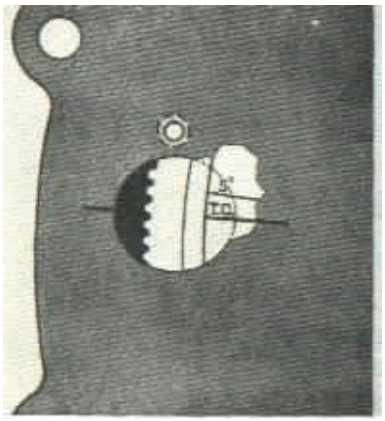


FIG. 6—FLYWHEEL TIMING MARKS

IGNITION TIMING.

The breaker points should be cleaned and adjusted to .020" (0.51 mm.) opening. Remove all the spark plugs except No. 1. Rotate the crankshaft until No. 1 piston is coming up on the compression stroke which can be determined by the resistance in the cylinder. Remove the spark plug and continue to turn the engine slowly until the mark ~ on the flywheel is in the center of the timing hole in the flywheel housing at the right rear. This places the piston in the correct position to set the ignition.

Loosen the distributor clamp and rotate the distributor assembly until the distributor rotor arm points to No. 1 terminal in the distributor cap and the distributor points just start to break. To advance the timing, turn the distributor in a clockwise direction; to retard it, turn in a counterclockwise direction. Tighten the clamp screw firmly but do not over-tighten it.

The engine firing order is 1-3-4-2.

After setting the timing, revolve the crankshaft two complete turns, to make sure all backlash is eliminated, and check the timing to the flywheel 5° mark.

Ignition timing must be accurately set to obtain maximum efficiency given only to enable the operator to place the vehicle back in service should trouble develop. At the first opportunity, have your Willys-Overland Dealer check the setting with a neon timing lamp which can also be used to check the automatic spark advance operation, by accelerating the engine.

FIG. 7—DISTRIBUTOR

1—Condenser
2—Lubricating Wick
3—Breaker Arm Pivot
4—Breaker Cam
5—Distributor Points
6—Oiler
7—Adjustment Lock Screw
8—Adjusting Screw

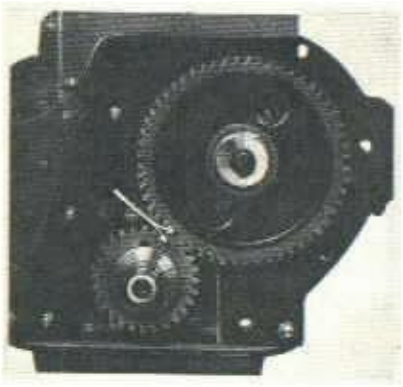


FIG. 8—TIMING GEAR MARKS

ENGINE FAILS TO START.

Should the engine suddenly stop or fail to start, check the cause as follows. Also see “Emergency Chart” Page 54.

1. Make sure there is gasoline getting to the carburetor (Note: Should the trouble be traced to the gasoline supply see “Fuel System” Page 28) and that the ignition switch is “ON”.

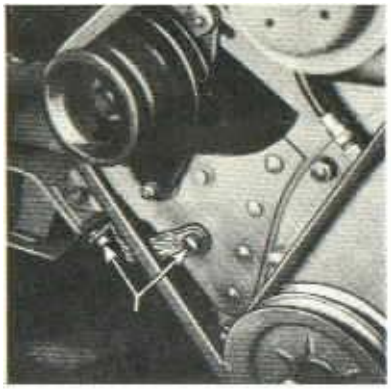
2. Check ignition circuit wiring connections to be sure they are tight and clean.

3. Be sure that the distributor breaker points are smooth, have a flat contact with each other and are set to the proper gap (.020”) (0.51 mm.). If the points are rough, replace them or temporarily smooth them with a breaker point file.

4. Inspect the distributor cap and rotor for cracks carbon runners or burned places. If they are found replace the part.

5. See that current is reaching the distributor breaker points. To make this test, turn on the ignition switch, remove the distributor cap and turn the engine until the breaker points are open, then holding one end of a piece of wire on the breaker arm, strike the other end on a clean, unpainted surface of the engine. No flash indicates a poor or open connection between the switch and distributor or an open circuit in the coil. If the wire and connections leading to the coil are in good condition, then an open primary in the coil is apparent and a new coil will be necessary.

If a flash occurs when testing the primary, as outlined above, it indicates that the primary circuit is all right and the trouble is elsewhere so the secondary coil circuit should be tested as follows:



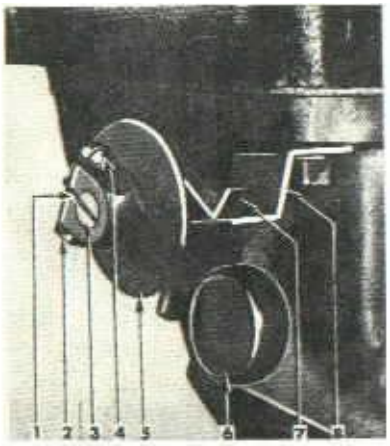


FIG. 9—HEAT CONTROL VALVE FIG. FIG 10—ENGINE GROUND STRAP AND CONNECTIONS

1—Heat Control Valve Lever Key

2—Heat Control Valve Lever Clamp Bolt Nut

3—Heat Control Valve Shaft

4—Heat Control Valve Lever Clamp Screw

5—Heat Control Valve Hi-Metal Spring Washer

6—Heat Control Valve Counterweight Lever

7—Heat Control Valve Hi-Metal Spring

8—Heat Control Valve Bi-Metal Spring Stop

6. To test the secondary coil circuit, remove the distributor cap and turn the engine until the breaker points are making contact. Turn “ON” the ignition switch and remove the high tension wire (center wire) from the distributor cap. Hold this wire about one-eighth of an inch from a clean, unpainted surface of the engine, then open and close the breaker points with the finger, giving them a short, snappy break. A fat, flame-colored spark indicates the coil is in good condition. No spark indicates the secondary winding of the coil is open, while a thin, stringy spark indicates an internally shorted coil or a loose or inoperative condenser. Condenser trouble will also be indicated by badly burned breaker points. Should the test show a thin stringy spark, check the condenser first. Be sure that the mounting screw is tight and is making a good ground connection to the distributor body and also that the connecting wire to the distributor points is not broken or the connection loose. Should no trouble be found in the condenser mounting or connection, install a new condenser which will localize the difficulty in either the coil or the condenser. No repairs can be made to either the condenser or coil, it being necessary to replace them if inoperative.

MANIFOLD HEAT CONTROL.

The manifolding is designed to utilize the exhaust gases of the engine to provide a quick means of heating the inlet manifold, thereby reducing the length of time the choke must be used after starting a cold engine and making the engine more flexible during the warm up period. The heat control valve, Fig. 9, which controls the amount of exhaust gases by-passed around the intake manifold insures more complete vaporization of the fuel. This control is fully automatic.

The valve shaft should turn freely in the manifold at all times. Note that the thermostatic spring No. 7 should be assembled above the metal stop No. 8.

ENGINE MOUNTINGS.

The rubber engine mountings, which are attached to the frame side rail brackets and to the support plate, prevent fore-and-aft motion of the engine, yet allow free sidewise and vertical oscillation which neutralizes vibration at the source. Keep the mountings tight. A loose engine may cause vibration, clutch chatter or high fuel level in the carburetor.

The rubber surface of the mountings partially insulates the engine from the frame. To assure a positive electrical connection between the engine and frame, a ground strap is provided at the right front engine support under the generator. See Fig. 10. The two attaching screws must be kept tight and the connections clean. A loose or poor connection may result in hard engine starting, low charging rate of the generator or sluggish operation of the starting motor.

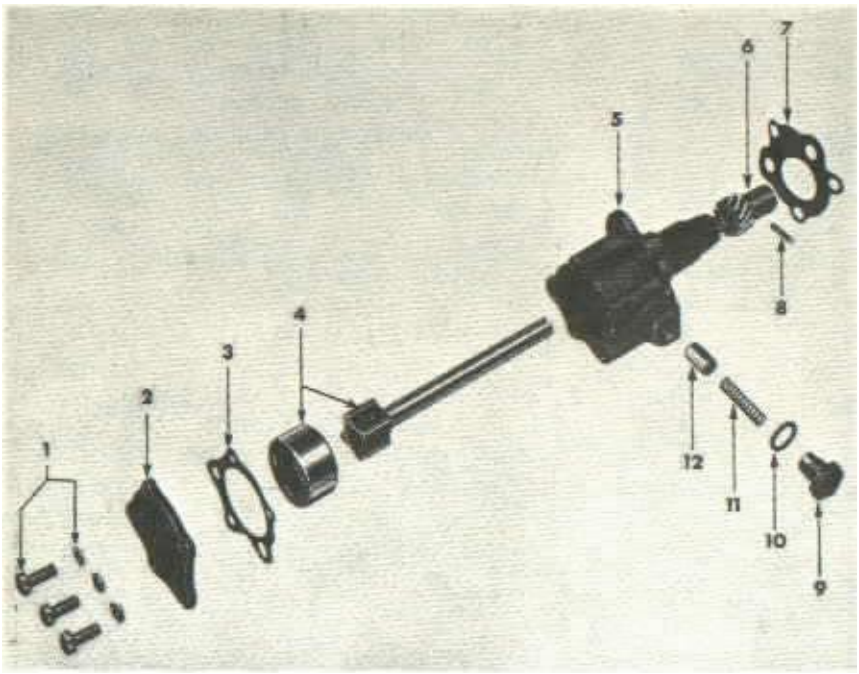


FIG. 11—OIL PUMP
1—Cover Screw
2—Cover
3—Cover Gasket
4—Outer Rotor
5—Shaft and Rotor
6—Body
7—Driven Gear
8—Gasket
9—Gear Retaining Pin
10—Relief Valve Retainer
11—Relief Valve Retainer. Gasket
12—Relief Valve Spring
13—Relief Valve Plunger

OIL PUMP ASSEMBLY.

The oil pump assembly is provided with a pressure relief valve which controls the maximum oil pressure at all speeds.

The standard controlled pressure is approximately 30 to 35 lbs. (5.355 to 6.247 Kg./cm.) at 30 mph (48 Km./h.) and 5 to 10 lbs. (.892 to 1.785 Kg. /cm.) at the idle speed of 600 rpm as registered by the dash gauge. Pressure may be adjusted by installing or removing shims between the relief plunger spring and the spring retainer. Add shims to increase the pressure or remove to decrease.

The oil pump drive shaft drives both the pump and the distributor assembly. See Fig. 4. Should it be necessary to remove the oil pump assembly, first remove the distributor cap and carefully note the position of the rotor to allow reinstallation without disturbing the ignition timing. When the pump is installed, use care that the driving key on the end of the distributor shaft is correctly meshed with the slot on the end of the pump shaft. To make the installation without disturbing ignition timing, the

pump gear must be correctly meshed with the camshaft gear to allow mesh of the distributor driving key and slot with the distributor rotor in the original position. Should it be necessary to reset the ignition timing refer to Page 21

FLOATING OIL INTAKE.

The floating oil intake (No. 26, Fig. 4) is attached to the crankcase with two screws. The construction of the float and screen cause it to remain on top of the oil, preventing the circulation of water and dirt.
Once each year remove the float, screen and tube and clean thoroughly with a suitable cleaning fluid. When replacing, be sure to install a new gasket between the float support and the engine crankcase. A leak at this point will allow air to enter the oil suction line seriously affecting oil pressure.

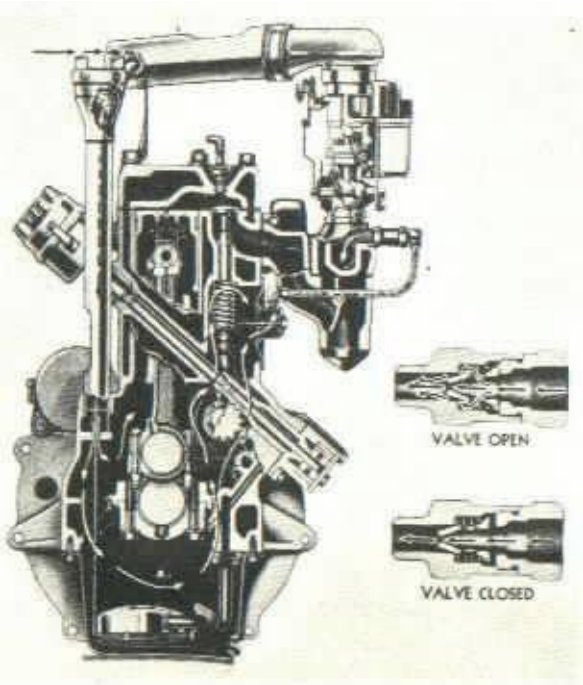


FIG. 12—CRANKCASE VENTILATING SYSTEM

CRANKCASE VENTILATOR.

The crankcase ventilating system provides thorough, positive ventilation which reduces to a minimum the formation of sludge.

In operation (see Fig. 12) clean air flows from the air cleaner through the short connecting tube to the oil filler tube and then through the crankcase and valve compartment to the intake manifold. Any vapors in the crankcase are carried into the manifold and burned. Positive air circulation reduces oil temperatures and the formation of moisture due to condensation. Air flow is controlled at the manifold by the control valve.

Be sure there are no air leaks at tube connection between the air cleaner and oil filler tube, and that the oil filler tube cap gasket is in good condition. Always keep the cap locked securely in place.

When tuning the engine or grinding valves, remove the control valve and clean it thoroughly. If this valve is blocked with carbon, the ventilating system will not operate and should the valve fail to seat, it will be impossible to make the engine idle satisfactorily.

GENERATOR.

The generator is a 35-ampere, two-brush unit which does not require adjustment to increase or decrease output. Output control is accomplished by the regulator which limits the current generated to that which is required by the battery. The generator charging rate, as shown by the ammeter, will be low when the battery is well charged and correspondingly higher as charging is required.

As a general rule it will not pay an owner, not equipped with specialized test equipment, to undertake generator repairs. There are some adjustments which may be made without this equipment and which are covered below. Should the generator stop charging, examine all connections in the charging line to be sure they are clean and tight. Also note the condition of the commutator and brushes.

If the commutator is dirty and discolored, it can be cleaned by holding a piece of No. 00 sand-paper against it with the engine running at idle speed. Do not use emery or carborundum cloth.

The brushes must slide freely in their holders and should they be badly worn or oil soaked, they should be replaced. Excessive arcing between the commutator and brushes usually indicates incorrect seating of the brushes against the commutator or high mica insulation between the commutator segments. Incorrect seating may be corrected by drawing a piece of No. 00 sand-paper around the commutator with the sanded side against the brush. After sanding, blow the carbon dust and sand from the generator.

Should the above attention fail to make the unit operate satisfactorily, consult your Willys-Overland Dealer.

VOLTAGE REGULATOR.

The regulator must be adjusted with great accuracy; heat as well as voltage and amperage must be considered when adjusting it. Should trouble develop in the regulator either install a new one or consult a Willys-Overland Dealer.

DISTRIBUTOR ASSEMBLY.

The distributor delivers the spark to the right cylinder at the right time. The mechanical breaker, built in the distributor, opens and closes the primary circuit at the exact time for ignition. See Fig. 7.

The distributor cap should be kept clean for efficient operation. It should be inspected periodically for cracks, carbon runners, evidence of arcing and badly corroded high tension terminals. If any of these conditions exist, the cap should be replaced.

Inspect the distributor rotor for cracks or evidences of excessive burning at the end of the metal strip. After a rotor has had normal use, the end of the metal strip will become burned. If burning is found on top of the rotor, it indicates the rotor is too short and should be replaced. Usually when this condition is found, the distributor cap segment will be burned on the horizontal face and the cap should also be replaced.

The distributor contact points should be kept clean and not burned or pitted. The contact gap should be set at .020" (0.51 mm.). When making adjustments, be sure that the fibre block in the breaker arm rests on one of the high points of the cam. Adjust the points by loosening the lock screw and turning the eccentric head screw. Recheck the gap after tightening the lock screw.

Should new contact points be installed they should be aligned so as to make at the center of the contact surfaces. Bend the stationary contact bracket to secure correct alignment and then recheck the gap.

SPARK PLUGS.

Keep spark plug porcelains clean. Dirty porcelains will cause hard engine starting and poor operation especially in damp weather. The spark plug electrode gap should be set at .030" (0.76 mm.). Too wide gap will cause misfiring, especially at high speeds and when operating with open throttle, while a small gap causes poor idling. Uniform gap setting assures smooth engine operation.

It is recommended that spark plugs be replaced at intervals of each 10,000 miles (16,000 Km.) of service for, because of erosion, the spark loses intensity.

STARTING MOTOR.

The starting motor requires little attention except regular lubrication. It is a standard three-bushing type motor with over-running clutch flywheel engagement.

In operation the starting motor pinion is manually engaged with the flywheel gear by the starting switch control arm, before the electrical connection is made at the starting switch. When the engine starts, the flywheel drives the pinion faster than the starting motor armature bringing the over-running clutch into action to disengage the pinion and prevent the engine from driving the armature at excessive speeds.

FUEL SYSTEM.

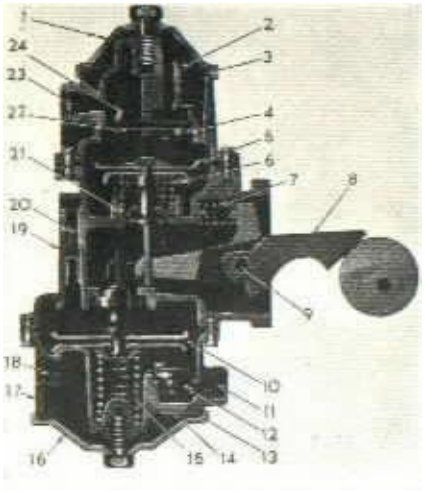


FIG. 13—FUEL AND VACUUM PUMP

1—Fuel Pump Bowl
2—Fuel Pump Filtering Screen
3—Fuel Pump Bowl Gasket
4—Fuel Pump Inlet Valve Assembly
5—Fuel Pump Diaphragm Assembly
6—Fuel Pump Diaphragm Spring
7 —Fuel Pump Rocker Arm Spring
8—Fuel Pump Rocker Arm Assembly
9—Fuel Pump Rocker Arm Pin
10—Vacuum Pump Diaphragm Assembly
11—Vacuum Pump Inlet
12—Vacuum Pump Valve Assembly
13—Vacuum Pump Bottom Cover Gasket
14—Vacuum Pump Screen
15—Vacuum Pump Diaphragm Spring
16—Vacuum Pump Bottom Cover
17—Vacuum Pump Lower Housing
16— Vacuum Pump Outlet
19—Pump Housing
20—Vacuum Pump Air Passage Filter
21—Fuel Pump Diaphragm Pull Rod Sea
22—Fuel Pump Valve Retainer
23—Fuel Pump Outlet
24—Fuel Pump Outlet Valve Assembly

The fuel system consists of the fuel tank, fuel lines, fuel pump, carburetor and air cleaner.

The most important maintenance attention is to keep the system clean and free of water, also periodically inspect for leaks.

Should the vehicle be stored for an extended period, the fuel system should be completely drained and the engine started and allowed to run until the carburetor is emptied. This will avoid oxidation of the fuel, resulting in the formation of gum in the units of the system.

Gum formation is similar to hard varnish and may cause trouble in the fuel pump valves or the carburetor float valve may become stuck or the filter screen blocked. Gum formation can be dissolved by acetone, obtainable in most drug stores. In extreme cases, it will be necessary to disassemble and clean the fuel system, however, often one pint of acetone placed in the fuel tank with about one gallon of gasoline will dissolve any deposits as it passes through the system with the gasoline.

CARBURETOR.

The Carter carburetor, Model W.O. 636-SA is a precision instrument designed to deliver the proper fuel and air mixtures at all engine speeds. Carburetor parts wear little; the chief cause of faulty carburetor is the accumulation of dirt and water. More often than not the carburetor is blamed for poor engine performance when the trouble is elsewhere (See Emergency Chart Page 54). Do not disturb the carburetor until it is proven that the trouble is not elsewhere. Should it be determined that the carburetor is at fault consult your Willys-Overland Dealer.

The carburetor is provided with an external adjustment to secure smooth engine idle. Fig. 14, No. 15. To set this adjustment, proceed as follows:

Make sure that the choke is in a fully open position. Close the idle adjustment by turning it to the right or in against the seat; then open it one and one-quarter turns. Start the engine and run it until operating temperature is obtained, then turn the adjustment in or out slightly until the engine

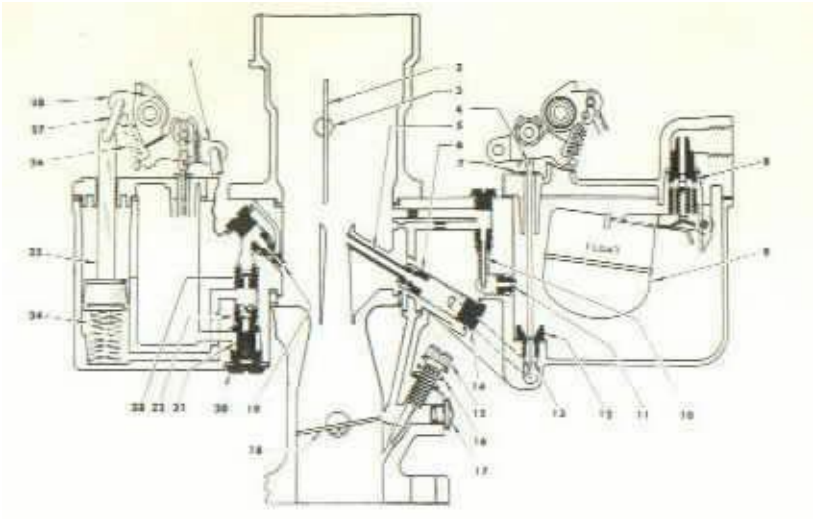


FIG. 14—CARBURETOR

I—Pump Operating Lever Assembly
2—Choke Valve Assembly
3—Choke Shaft and Lever Assembly
4—Metering Rod Spring
S—Nozzle
6—Nozzle, Retaining Plug
7—Metering Rod Disc
8—Needle, Pin, Spring and Seat Assembly
9—Float and Lever Assembly
10—Low Speed Jet Assembly
11—Idle Well Jet
12—Metering Rod Jet and Gasket Assembly
13—Metering Rod
14—Nozzle Passage Plug and Gasket Assembly
15—Idle Adjustment Screw
16—Idle Adjustment Screw Spring
17—Idle Port Rivet Plug
18—Throttle Valve
19—Pump Jet
20—Pump Jet Strainer Nut
21—Pump Jet Strainer
22—Intake Ball Check Assembly
23—Discharge Disc Check Assembly
24-'—Pump Plunger Spring
25—Pump Plunger and Rod Assembly
26—Pump Arm Spring
27—Pump Connecting Link
28—Pump Arm and Collar Assembly

fires evenly. Open the throttle for a few seconds allowing the engine to clean the manifold. Recheck the adjustment, then set the throttle stop screw at an idle speed of 600 rpm or approximately 8 miles per hour (12.8 Km./h.) in high gear.

FUEL DIFFUSER.

The engine is equipped with a fuel diffuser built as part of a thick insulating gasket which is installed between the carburetor and the intake manifold. In operation the diffuser causes intense swirling of the fuel and air in the manifold. Under some operating conditions this results in a drier and more satisfactory fuel mixture.

FUEL PUMP.

The combination fuel and vacuum pump is of the diaphragm type attached to the left side of the crankcase and operated from an eccentric on the camshaft, Fig. 13.

The pump draws gasoline from the fuel tank, through a filtering screen mounted in the pump sediment chamber and forces it to the carburetor. The pump pressure is 3-3/4 lbs. (.26 Kg./sq. cm.) at 16" (.41 m.) above the outlet at 1800 rpm engine speed.

The principle trouble experienced with the fuel pump is caused by the accumulation of dirt and water in the sediment chamber and filtering screen. Regular cleaning of the screen and sediment chamber twice yearly will prevent annoying delays due to a blocked screen or water freezing.

The sediment chamber may be opened for cleaning by removing the cover retaining screw. The chamber and cover should be washed and wiped dry and the screen dried and then cleaned with a stiff brush. When reinstalling the cover, make certain that the cork gasket is not broken; reverse it and position it flat on the seat then install the cover and tighten the retaining screw securely. After cleaning, start the engine and make a careful inspection to guard against leakage.
Lack of gasoline in the carburetor may be caused by the following conditions:
1. Gasoline tank empty.
2. Leaking tubing or connections.
3. Bent or kinked tubing.
4. Clogged fuel lines—(or frozen).
5. Sediment chamber cover on fuel pump loose.
6. Dirty screen.
7.Carburetor inlet valve stuck shut.
Should the carburetor flood (too much gasoline), check the unit to make certain that the needle valve Fig. 14, No. 8, is seating properly and that the float No. 9 is not stuck.
CAUTION: Do not attempt repairs which require disassembling of the fuel and vacuum pump other than cleaning as special care is required. It is recommended that all fuel pump trouble be taken up with your WillysOverland Dealer.

FUEL SUPPLY TANK.
The capacity of the fuel tank is 10-1/2 gal. (U.S.) (39.7 liters).
When filling the tank, care should be used that no foreign matter or water enters the tank. Once each season, at a time when the fuel supply is low in the tank, remove the drain plug in the bottom to drain out sediment and water which may have accumulated.

COOLING SYSTEM.
The practice of checking the condition of the cooling system of your Jeep while lubricating it will guard against costly delays in service. Inspecting the condition of the radiator and heater hoses; also the fan belt and water pump will eliminate the possibility of an overheated engine due to a water leak or loose fan belt.

RADIATOR ASSEMBLY.
The radiator is designed to cool the water under all operating conditions however, the core must be kept free from corrosion and scale and the air passages free of chaff, dust and mud.
At least twice a year flush out the cooling system. A good way to do this is to remove the drain cock at the bottom of the radiator and that in the cylinder block under the generator. Place a hose in the radiator filler opening and adjust the flow of water to equal that draining from the two openings. Start the engine and allow it to run until the cooling system is thoroughly flushed. After flushing it is advisable to install a corrosion inhibitor in the system to prevent the formation of rust and scale. This may be obtained from your Willys-Overland Dealer.
Should the air passages become clogged, do not use a metal tool of any kind to clean them. Use compressed air or water pressure and clean from the rear, forcing the dirt out through the front of the radiator.

RADIATOR FILLER CAP.
This cap is of the pressure type, which prevents evaporation and loss of cooling solution. A pressure up to 4-1/2 pounds (.25 Kg./sq. cm.) makes the engine more efficient by permitting a slightly higher operating temperature. Vacuum in the radiator is relieved by a valve in the cap which opens at 1/2 to 1 pound (.035 to .070 Kg./sq. cm.) vacuum.

DRAINING COOLING SYSTEM.
To completely drain the cooling system, open both drain cocks; that at the bottom of the radiator and *also in the cylinder block under the denera tor*. Remove the radiator cap to break any vacuum which might prevent thorough draining.

THERMOSTAT.
A 145° F. (62.8~ C.) to 155° F. (68.30 C.) thermostat, Fig. 2, No. 8,is used to provide quick warming and to prevent overcooling during normal vehicle operation. The temperature at which this unit operates is set by the Manufacturer and can not be altered. Should sudden heating occur the thermostat should be checked first as failure of this unit to operate will nearly block the water circulation. As a check, remove the thermostat and if the overheating is eliminated, install a new one.

HEAT INDICATOR.
The heat indicator is of the hydrostatic type and is connected to a bulb, mounted in the water chamber of the cylinder head, by a capillary tube. Should this unit fail to operate, it should be replaced as it is not practical to either repair or adjust it.

WATER PUMP.
The water pump assembly Fig. 15 is a centrifugal impeller type, of large capacity to circulate the water in the entire cooling system.
The sealed type double-row ball bearing is integral with the shaft and is packed at the time of assembly with a special high melting point grease, so requires no lubrication.
The pump is designed to give maximum service without adjustments. Should trouble develop, consult your Willys-Overland Dealer.

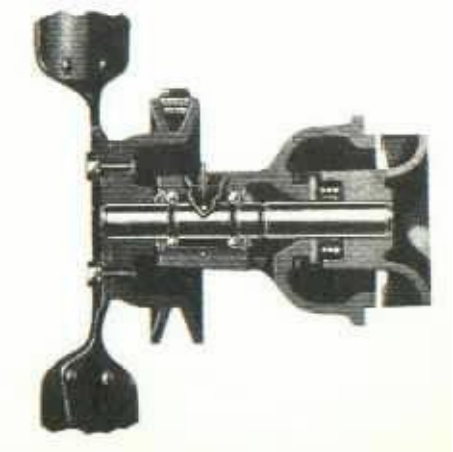
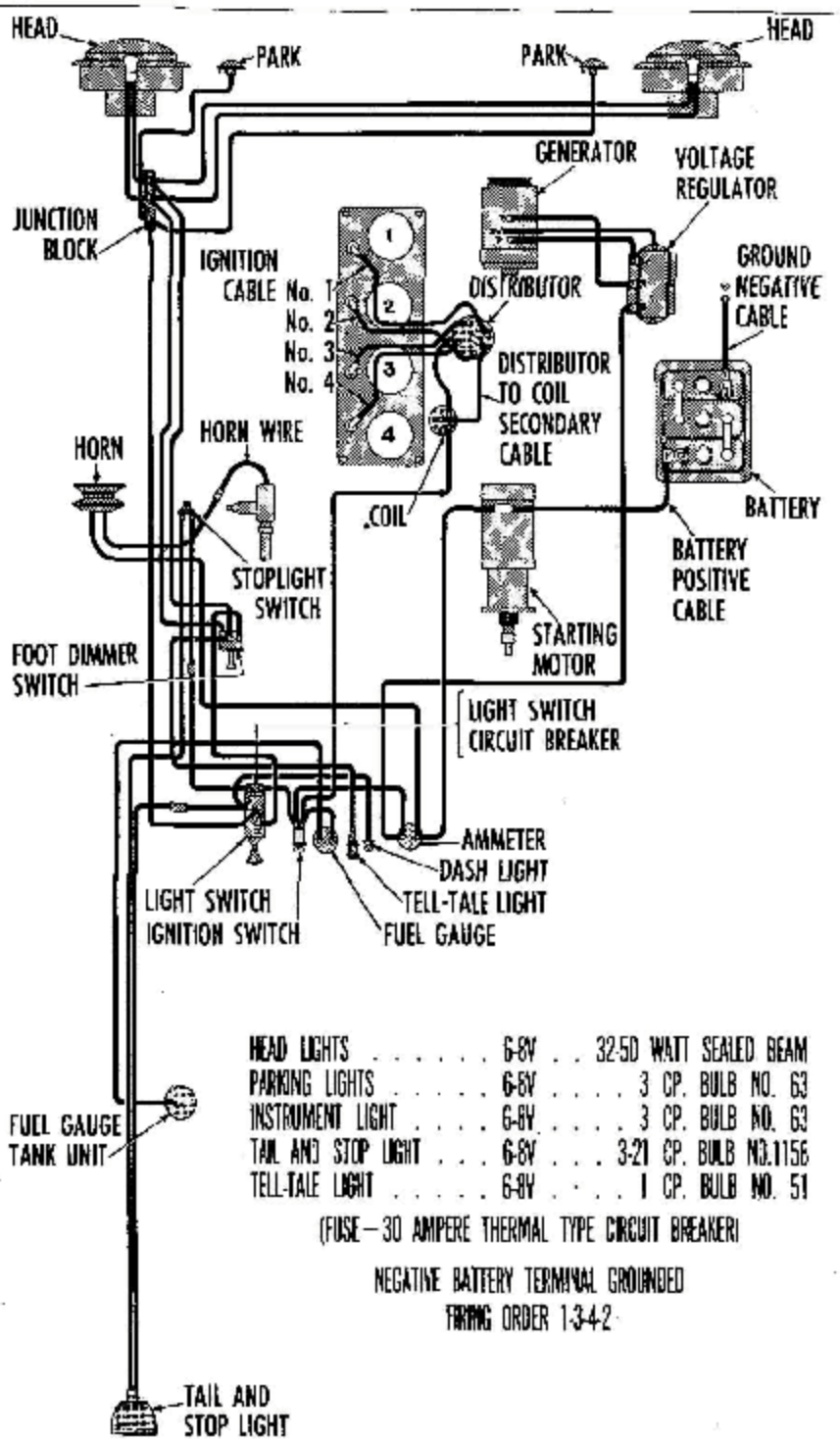


FIG. 15 —WATER PUMP ASSEMBLY

FAN BELT.
The fan and generator are driven by a “V”-type belt. The drive is on the sides of the belt, therefore it is not necessary to adjust it tight, which might cause excessive wear on the water pump and generator bearings. Adjust the belt by swinging the generator away from the engine until the belt can be depressed 1” (25 mm.) by thumb pressure midway between the pulleys.



HEAD LIGHTS	6-8V	32-50 WATT SEALED BEAM
PARKING LIGHTS	6-8V	3 CP. BULB NO. 63
INSTRUMENT LIGHT	6-8V	3 CP. BULB NO. 63
TAIL AND STOP LIGHT	6-8V	3-21 CP. BULB NO.1156
TELL-TALE LIGHT	6-8V	1 CP. BULB NO. 51

(FUSE—30 AMPERE THERMAL TYPE CIRCUIT BREAKER)

NEGATIVE BATTERY TERMINAL GROUNDED

FIRING ORDER 1-3-4-2

FIG. 16—WIRING DIAGRAM

ELECTRICAL SYSTEM.

The wiring diagram Fig. 16 shows the general arrangement of all the electrical circuits, together with all the units in correct relation to the position in which they are found.

Regular inspection of all electrical connections avoids failures in the electrical system. When tracing any one particular circuit, note that the wires have different colored tracers to identify each individual wire.

BATTERY.

The battery is of 6-volt, 15-plate, 100-ampere hour capacity. It is located under the hood on a bracket attached to the right hand side rail of the frame and held firmly on the base with a hold-down frame and two studs and wing nuts.

Check the battery once a week with a hydrometer and at the same time check the electrolyte level in each cell; add distilled water to maintain the solution level 3/8" (9.52 mm.) above the plates. Avoid overfilling and do not fail to replace the filler caps and tighten securely. If the plates are exposed for any length of time, they can be seriously damaged, therefore, it is important to add enough water to keep the plates covered.

A hydrometer reading of 1.285 to 1.300 indicates that the battery is fully charged. Should the reading fall below 1.225, it will be necessary to recharge the battery or else use the lights and battery sparingly until the battery has had an opportunity to build itself up again.

Coating the battery terminals with light grease will protect them from corrosion. The battery must be held securely in place, otherwise it may shift, resulting in loose connections, broken cells or other trouble. Should a sufficiently charged battery fail to crank the engine, it is probably due to loose or corroded terminals or ground connections. The terminal connections should be removed and all corrosion cleaned from them, as well as the posts, to insure proper contact. Also clean and tighten the battery ground connection. A strong solution of baking soda and water may best be used for removal of the corrosion.

Clean and tighten the engine ground strap located on the right side of the engine as shown in Fig. 10. This strap is necessary because of the rubber engine mountings.

FUEL GAUGE.

The fuel gauge circuit is composed of the indicating unit, mounted on the instrument panel, and the fuel tank unit, connected by a single wire through the ignition switch.

Should the gauge fail to register, check all wire connections to be sure they are tight and clean; also be sure both units are well grounded. If, after this check, the gauge does not indicate properly, remove the wire from the tank unit and connect it to a new tank unit which must be grounded to the tank or frame for test. Turn the ignition switch “ON” and move the float arm through its range of travel, watching the dash unit to determine if it indicates correctly. If it fails to do so the trouble is probably in the dash unit and it should be replaced.

Should a new tank unit be unavailable for this test, disconnect tank unit wire at the instrument panel gauge. Connect one lead of a 6 V, 1 CP test light to the instrument panel unit terminal and with the ignition switch “ON” ground the other lead. If the unit is operating correctly the pointer will move approximately three-quarters across the dial.

Do not attempt to repair either unit; replacement is the only procedure.

LIGHTING SYSTEM.
The wiring of the lighting system is shown in Fig. 16. The lighting circuit is protected by an overload circuit breaker mounted on the back of the main light switch and no replaceable fuse is required. It clicks off and on in the event of a short circuit in the wiring.
The upper and lower headlight beams are cohtrolled by a foot switch located on the toe board at the left of the clutch pedal.

MAIN LIGHT SWITCH.
The main light switch Fig. 17 has three positions. When the switch control knob is all the way in, all lights are turned off. Pulling it out to the first position turns on the parking lights; out to the second position, the driving lights.
Should it be necessary to install a new light switch, refer to the wiring diagram, which indicates the correct wires to install on the several terminals.
To remove the switch, loosen the setscrew in the side of the switch control knob and remove the knob by unscrewing. The retaining nut may then be removed and the switch removed through the rear of the instrument panel.

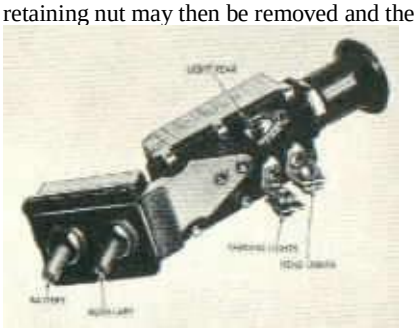


FIG. 17-MAIN LIGHT SWITCH

STOPLIGHT SWITCH.
The stoplight switch is of the diaphragm type and is located in the front end of the brake master cylinder. When the switch becomes inoperative, it is necessary to install a new one.

HEADLAMP AIMING.
Headlarnps may be aimed correctly by using an aiming screen or wall, Fig. 18, providing a clear, level space of 25 feet (7.62 m.) from the front of the headlights to the screen or wall is available.

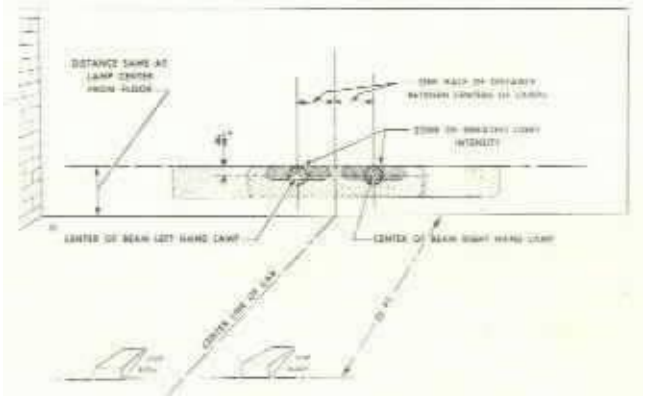


FIG. 18 HEADLIGHT AIMING CHART

The screen should be made of light colored material and should have a black center line for use in centering the screen with the vehicle. The screen should also have two vertical black lines, one on each side of the center line at a distance equal to the lamp centers.

Place the vehicle on the floor with the tires inflated to the recommended pressure for highway use. Set the vehicle 25 feet (7.62 in.) from the front of the screen or wall, so that the center line of the vehicle is in line with the center line on the screen. To position the vehicle, stand at the rear and sight through the windshield down across the cowl and hood.

Measure from the floor to the center of the headlamp and mark a horizontal line on the screen 4½ inches (114.30 mm.) less.

Turn on the headlamp upper beam, cover one lamp and check the location of the beam on the screen. The center of the “hot spot” should be centered on the intersection of the vertical and horizontal lines.

If the aim is incorrect, remove the headlamp door screw and remove the door, then adjust the two screws in the mounting ring to move the headlamp unit until the beam is correctly aimed, then tighten.

Cover the headlamp aimed and adjust the other in the same manner.

CLUTCH.

The clutch is of the single, dry plate type consisting of a pressure plate assembly, having three pressure springs, three release levers; and a spring cushioned, faced driving plate mounted on a hardened steel, splined hub. Clutch release is accomplished by moving the release bearing toward the flywheel. The three springs located in the clutch bracket provide the driving pressure, thus, when the foot pressure is removed from the pedal, the springs force the pressure plate forward against the driven plate, gradually and smoothly applying power to the wheels.

As the clutch facings wear, the clearance between the release levers and the release bearing is decreased. The effect on the clutch pedal is to decrease the free travel, which is the distance the pedal moves away from the toe board before the release bearing comes into contact with the release levers. Adjusting the length of the clutch control cable to increase the free travel of the clutch pedal, restores the proper clearance between the release levers and the release bearing. See Fig. 19. The release bearing and clutch pedal must be in their proper positions. No adjustment of the clutch proper is required to compensate for wear of the facings, but a clearance of approximately 1/8” (3.17 mm.) should be maintained between the release levers Fig. 21 No. 14 and the release bearing No. 7. To obtain this clearance, adjust the length of the clutch control cable No. 18, so that the pedal has 1-1/4” (31.75 mm.) free movement from the fully engaged position before any resistance can be felt.

FIG. 19CLUTCH PEDAL ADJUSTMENT

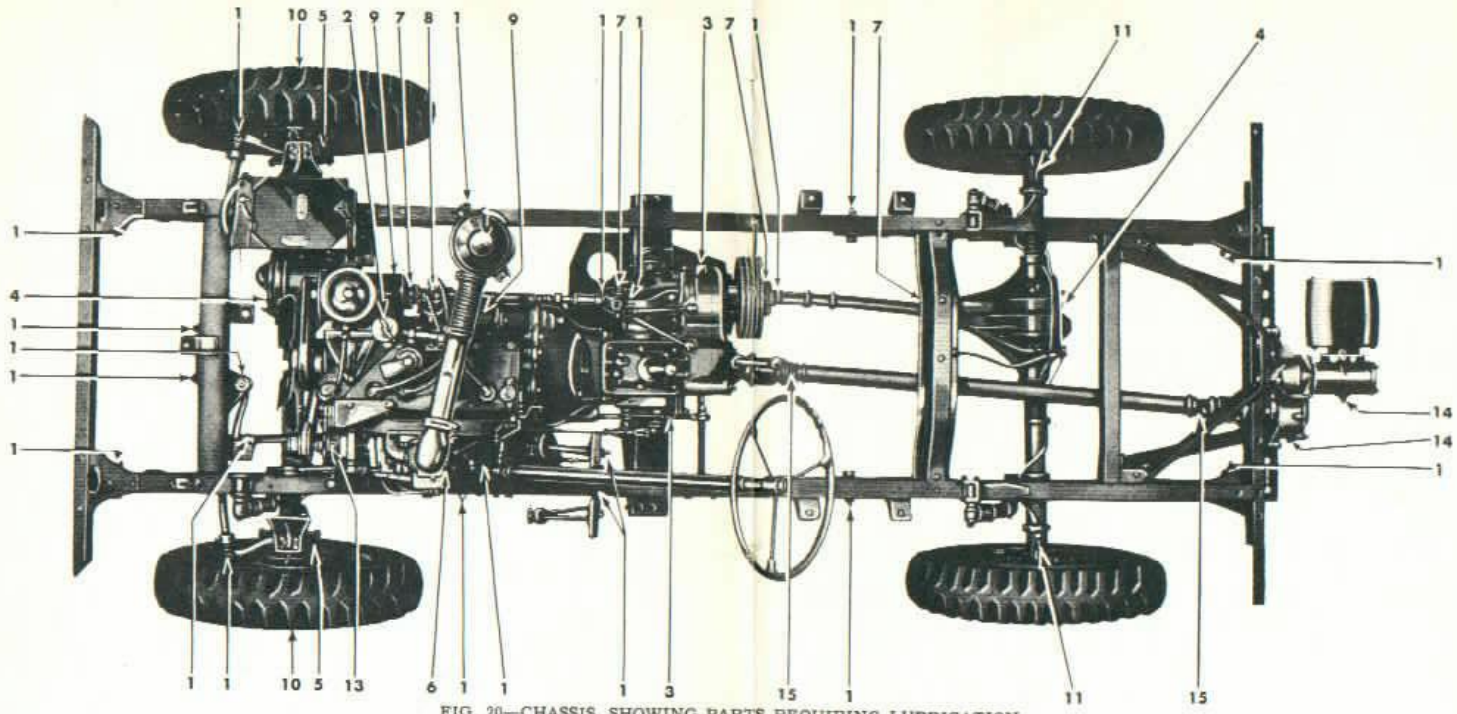


FIG. 20—CHASSIS, SHOWING PARTS REQUIRING LUBRICATION
See "Lubrication Specification" and "Capacity" Charts, Pages 15 and 16

No. 1, Chassis Bearings—Clean and lubricate each 1000 miles (1600 Km.) of road service. Make certain that each bearing surface is properly lubricated and oil all clevis pins, yokes, hood hooks and the upper end of the hand brake conduit. Lubricate these parts DAILY when using the vehicle for field work as the new lubricant will force the old from the bearings with the grit and dirt which may have accumulated.

No. 2, Engine Crankcase—Drain engine oil when hot and refill with fresh oil each 2000 miles (3200 Km.) of road service. For power take-off and field operation change the oil at each 50 hours. Watch the condition of the oil closely and should it be contaminated due to conditions of operation, change it immediately. When changing oil, always drain oil filter to prevent dirty oil in filter from mixing with new.

No. 3, Transmission and Transfer Case—Check the level in the housings each 1000 miles (1600 Km.). Change oil at each 6000 miles (9600 Km.) of road service or 300 hours of field work. See Page 18.

No. 4, Front and Rear Differentials—Check level at each 1000 miles (1600 Km.) and change the oil each 6000 miles (9600 Km.) of road service and 300 hours of field work. Use hypoid type lubricant. Page 18.

No. 5, Front Axle King Pin Bearings and Universal Joints—Check oil level each 1000 miles (1600 Km.). Change the lubricant at each 12,000 miles (19,200 Km.) of road service. See Page 18.

No. 6, Steering Gear—Check lubricant level each 1000 miles (1600 Km.). When level is low use a hand gun to fill the housing slowly. See Page 17.

No. 7, Universal Joints (Propeller Shaft)—Lubricate with a compressor each 1000 miles (1600 Km.).

No. 8, Ignition Distributor—Lubricate each 1000 miles (1600 Km.) or equivalent in field service. Place several drops of engine oil in oiler at side of housing; also place a drop of light oil on wick in shaft under the rotor and sparingly apply soft grease on the breaker arm cam and a drop of oil on breaker arm pivot.

No. 9, Generator and Starting Motor—Place three to five drops of oil in the oilers each 1000 miles (1600 Km.). Do not overlubricate.

No. 10, Front Wheel Bearings—Remove the front wheel bearings and clean them thoroughly each 6000 miles (9600 Km.) of road service or 300 hours of industrial service after which repack them with wheel bearing lubricant.

No. 11, Rear Wheel Bearings—Lubricate the rear wheel bearings sparingly with a compressor. See "Wheel Bearings" Pages 18 and 50.

No. 13, Governor—At each lubrication check the level in the housing. Note that three plugs are provided, drain plug, level plug and filler plug. Fill the housing to the level plug level with the same grade oil used in the engine. Avoid overfilling.

No. 14, Power Take-Off and Belt Pulley Housings—Check the lubricant level each time the vehicle is lubricated. Should the units be used frequently change the lubricant each 300 hours. See Page 18.

No. 15, Power Take-Off Universal Joints—For average service the original factory lubrication will last the life of the vehicle. If the power take-off is used often for continuous operation, disassemble and repack once each year.

Air Cleaner—For normal operation clean the air cleaner and replace the oil each 2000 miles (3200 Km.) using the same grade used in the engine. Clean this unit and change oil in accordance with conditions of operation—twice daily when the vehicle is used in extremely dusty field service.

NOTE—The water pump and clutch release bearings are prelubricated and the lubricant lasts for the life of the bearings.

CAUTION—Do not lubricate the shock absorber rubber mounting connections.

CAUTION: Avoid the practice of resting the foot continuously on the clutch pedal while driving and do not slip the clutch excessively instead of shifting gears. Slipping the clutch causes excessive heat, with the result that the clutch is finally made inoperative.

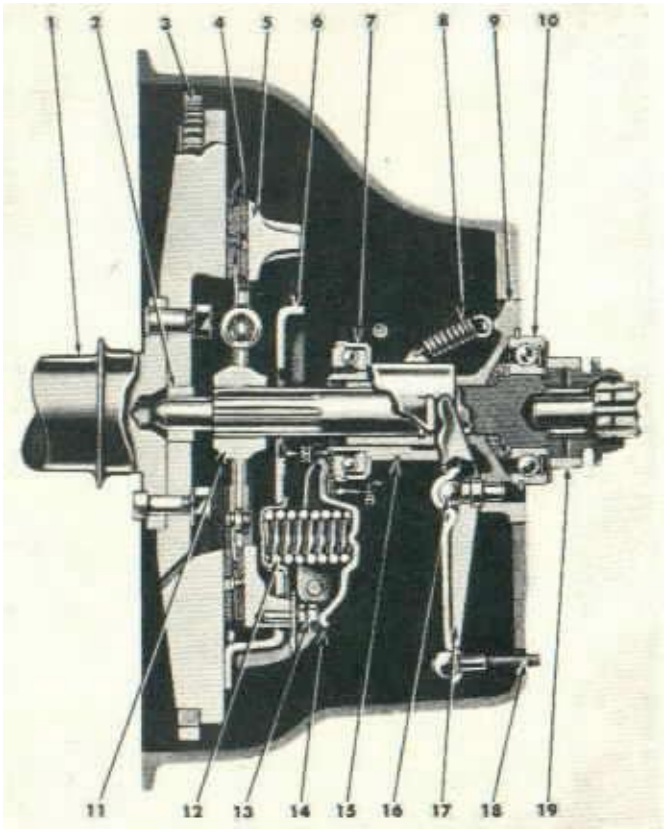


FIG. 21 CLUTCH ASSEMBLY
1—Crankshaft
2—Clutch Shaft Bushing
3—Flywheel Ring Gear
4—Clutch Facings
5—Clutch Pressure Plate
6—Clutch Pressure Plate Bracket
7—Clutch Release Bearing
8—Clutch Release Bearing Spring
9—Transmission Main Drive Gear Bearing Retainer
10—Transmission Main Drive Gear Bearing
11—Clutch Driven Plate and Hub
12—Clutch Pressure Spring
13—Clutch Adjusting Screw
14—Clutch Lever
15—Clutch Release Bearing Carrier
16—Clutch Control Lever Fulcrum
17 —Clutch Control Lever
18—Clutch Control Lever Cable
19—Transmission Main Drive Gear

TRANSMISSION ASSEMBLY.
The transmission, Fig. 22, is a heavy duty, three speed synchro-mesh type unit with cane type shift. It is attached to the rear face of the flywheel bell housing and is supported on a rubber insulator at the frame center cross member which forms the rear engine support.

Shift is smooth and positive through a cane type control lever mounted in a shift housing at the top of the assembly. Poppet balls and springs retain the gears in mesh and an interlock prevents shifting into two gears at one time. Should any trouble be experienced with the transmission assembly, consult your Willys-Overland Dealer.

TRANSFER CASE ASSEMBLY.

The transfer case Fig. 23 is an auxiliary unit located at the rear of the transmission. It is essentially a two speed transmission, which provides a low and direct gear, also a means of connecting the drive to the front axle.

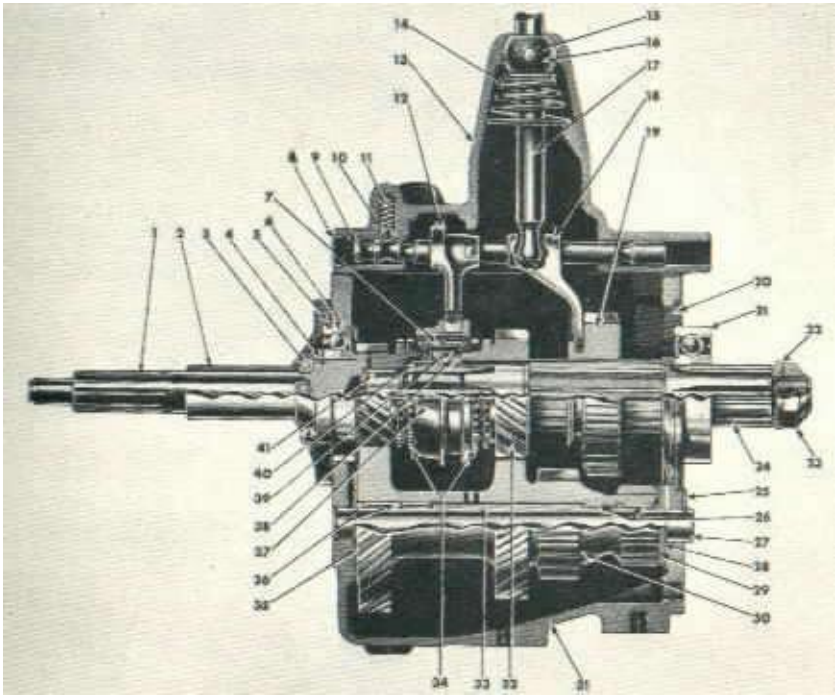


FIG. 22—TRANSMISSION

1—Main Drive Gear
2——Main Drive Gear Bearing Retainer
3—Main Drive Gear Bearing Retainer Oil Seal
4—Main Drive Gear Snap Ring
5—Main Drive Gear Bearing Snap Ring
6—Main Drive Gear Bearing
7—Synchronizer Shifting Plate
8—Shift Rail Cap
9—Shift Rail—High and Intermediate
10—Shift Rail Poppet Ball
11—Shift Rail Poppet Spring
12—Shift Fork—High and Intermediate
13—Control Housing
14—Control Lever Support Spring
15—Control Lever Housing Pin
16—Control Lever Fulcrum Ball
17—Gear Shift Lever
18—Shift Fork—Low and Reverse
19—Sliding Gear—Low and Reverse
20—Main Shaft Bearing Adapter
21—Main Shaft Bearing
22—Main Shaft Washer
23—Main Shaft Nut
24—Main Shaft
25—Idler and Countershaft Lock Plate
26—Countershaft Gear Bearing Rollers
27—Countershaft Thrust Washer Rear—Steel
28—Countershaft
29—Countershaft Thrust Washer Rear—Bronze
30—Countershaft Gears
31—Transmission Case
32—Main Shaft Second Speed Gear
33—Countershaft Bearing Spacer
34—Synchronizer Blocking Ring
35—Countgrshaft Thrust Washer Front— Bronze
36—Countershaft Bearing Washer
37—-Intermediate and High Speed Clutch Sleeve
38—Intermediate and High Clutch Hub
39—Synchronizer Spring
40—Intermediate and High Clutch Hub Snap Ring
41—Main Shaft Pilot Bearing Roller

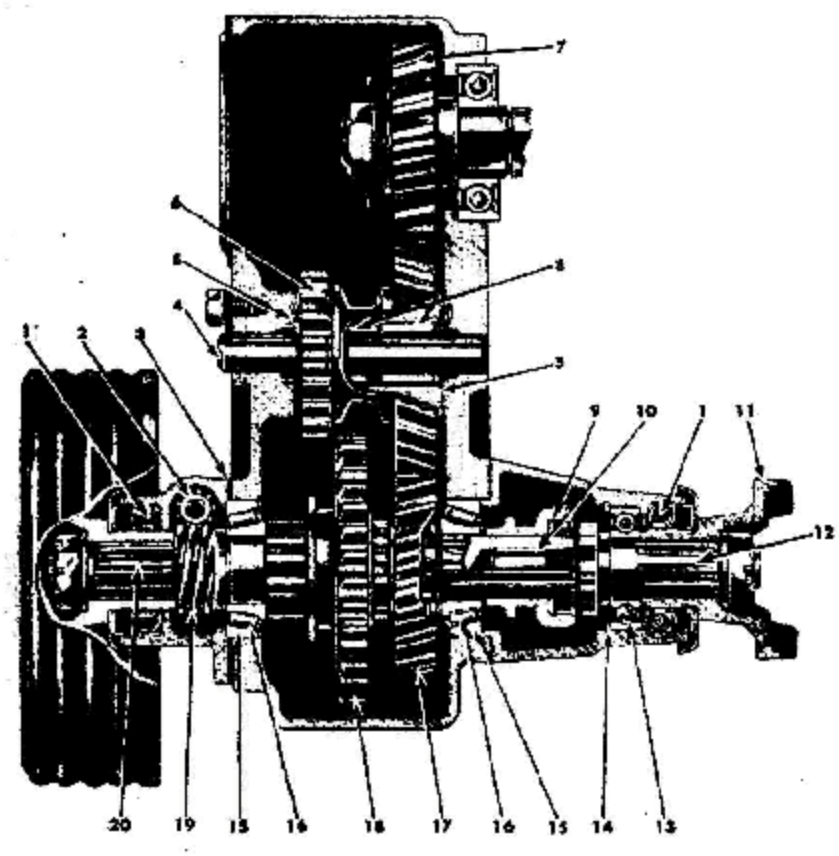


FIG. 23—TRANSFER CASE

1—Output Shaft Oil Seal
2—Speedometer Driven Pinion
3—Output Shaft Bearing Shims
4—Intermediate Shaft
5—Intermediate Gear Thrust Washer
6—Intermediate Gear
7—Main Shaft Gear
8—Intermediate Gear Bearing
9—Output Shaft Clutch Gear
10—Output Clutch Shaft Pilot Bushing
11—Companion Flange Assembly—Front
12—Output Clutch Shaft
13—Output Clutch Shaft Bearing
14—Output Clutch Shaft Bearing Snap Ring
15—Output Shaft Bearing Cup
16—Output Shaft Bearing Cone and Roller
17—Output Shaft Gear
18—Output Shaft Sliding Gear
19—Speedometer Drive Gear
20—Output Shaft

The shifting mechanism is located on the transfer case for engaging and disengaging the drive to the front axle, also for shifting the gears.

On hard surface and level roads, disengage the front axle drive by placing the transfer case left shift lever in the forward position. See Fig. 3. The right hand lever controls the gear ratio; low and high. The low gear can only be engaged when the left hand lever is in the engaged (rear) position for front drive. Proper position for disengaging axles to use the power takeoff with the vehicle standing is shown as "N" in Fig. 3 of "Drivers Instructions."

Both the transmission and the transfer case are precision built units. No external adjustments are possible and should attention be necessary, it is advisable to consult your Willys-Overland Dealer.

IMPORTANT: Check the units at each lubrication to guard against lubricant leakage. For economy the capacity is small change the lubricant in accordance with instructions on Page 18.

PROPELLER SHAFT.

The drive from the transfer case to the front and rear axles is completed through two propeller shafts each equipped with two universal joints. The splined slip joints at the transfer case end of each shaft allows for variations in distance between the transfer case and the axles, due to spring action.

Examine both propeller shafts periodically for foreign matter which may become wrapped around them. Check for dents or a bent shaft and make sure that the universal joints attaching bolts are tight at all times.

The universal joints have needle type bearings and are so designed that correct assembly is very simple. No hand fitting or special tools are required.

The journal trunnion and needle bearing assemblies are the only parts subject to wear, and when it becomes necessary to replace these parts, the propeller shafts must be removed from the vehicle to make replacement.

When reinstalling, note that the slip joints are marked with arrows, Fig. 24, at the spline and the sleeve yoke. Align the arrows so the yokes of the universal joints at the front and rear of each shaft are in the same plane, when assembled, to avoid vibration. The "U" type attaching bolt nuts should be tightened evenly with approximately the same pressure on each nut.

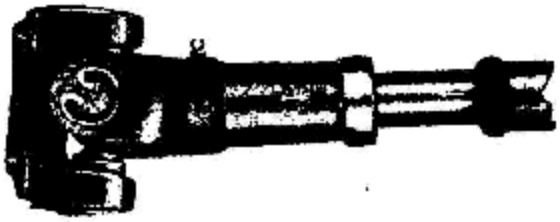


FIG. 24—ARROW MARKING

FRONT AXLE.

The front axle is a live driving unit with hypoid drive gears, Fig. 26, and spherical steering knuckles, Fig. 25, containing constant velocity type axle shaft universal joints.

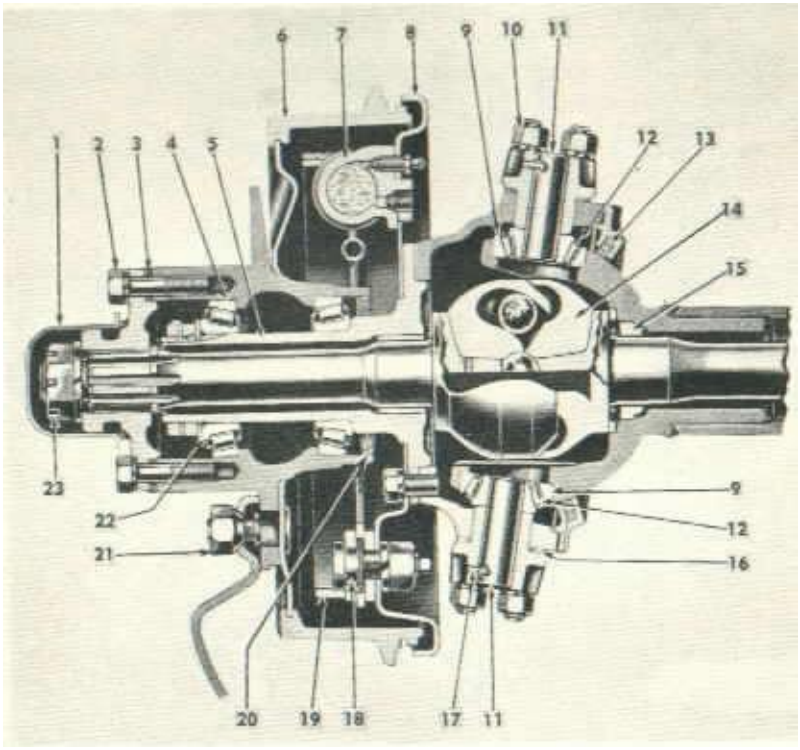


FIG. 25 FRONT STEERING KNUCKLE

1—Wheel Hub Cap
2—Driving Flange Cap Screw
3—Axle Shaft Universal Joint Adjusting Shims
4—Wheel Bearing Cup
5—Front Wheel Spindle
6—Brake Drum
7—Front Brake Cylinder
8—Brake Backing Plate
9—Pivot Pin Bearing Cap
10 —Pivot Pin Bearing Cap Nut
l1—Pivot Pin
12— Pivot Pin Cone and Rollers
13— Steering Knuckle Oil Seal
14—Front Axle Universal Joint
15 —Axle Shaft Bushing
16 —Pivot Bearing Adjusting Shims
17 —Pivot Pin Locking Pin
18—Brake Shoe Anchor Pin
19— Brake Shoe and Lining
20—Hub Oil Seal
21 —Wheel Huh Bolt Nut
22—Wheel Bearing Cone and Rollers
23— Axle Shaft Nut

The differential is mounted in a housing similar to that used in the rear axle, except that the drive pinion shaft is toward the rear of the front and to the right of the center of the axle. This design allows placing the front propeller shaft along the right side of the engine oil pan without reducing

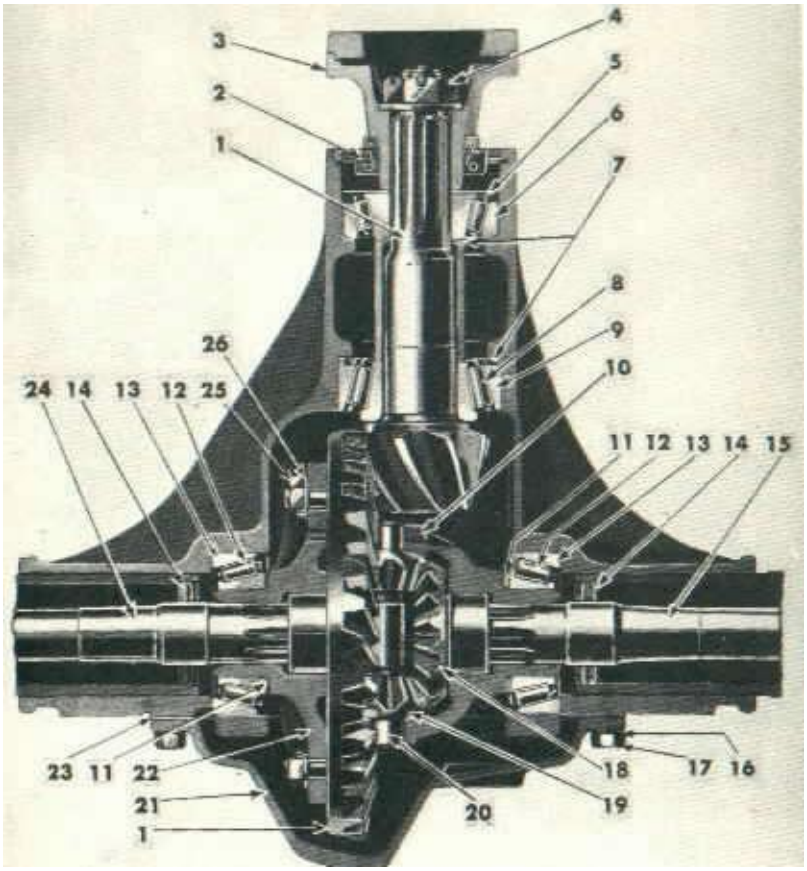


FIG. 26—FRONT AXLE

DIFFERENTIAL

1—Hypoid Bevel Drive Gear and Pinion Set (Matched)
2—Drive Pinion Oil Seal
3—Universal Joint End Yoke Assembly
4—Drive Pinion Nut
5—Pinion Shaft Bearing Cone and Rollers (Outer)
6—Pinion Shaft Bearing Cup
7—Pinion Bearing Adjusting Shims (Front and Rear)
8—Drive Pinion Bearing Cone and Rollers (Rear)
9—Drive Pinion Bearing Cup (Rear)
10—Differential Bevel Pinion Mate Shaft Lock Pin
11—Differential Adjusting Shims
12—Differential Bearing Cone and Rollers
13—Differential Bearing Cup
14—Oil Seal Differential End
15—Axle Shaft (Left)
16—Gear Cover Screw Lockwasher
17—Gear Cover Screw
18—Differential Bevel Side Gear
19—Differential Pinion Mate
20—Differential Bevel Pinion Mate Shaft
21—Gear Carrier Cover
22—Differential Case
23—Gear Carrier Cover Gasket
24—Axle Shaft (Right)
25—Hypoid Bevel Drive Gear Screw
26—Drive Gear Screw Locking Strap

the road clearance under the engine. The axle is of the full floating type and the axle shafts can be removed without dismantling the steering knuckles.
Once each year have your Willys-Overland Dealer remove the front axle universal joint and shaft assemblies to thoroughly wash out the steering knuckle housings and check the shim adjustment of the universal joints. After checking, the universal joint housings must be refilled with good quality lubricant as specified in the "Lubrication Section".
The lubricant is retained in the steering knuckle housings by felt oil seals mounted in twin retainers attached to the inner face of the housing, Fig. 25, No. 13. These seals also prevent dirt and grit entering the housings. Inspect the seals regularly and replace them promptly if damaged.
Keep the spring loaded air vent or breather, mounted in the differential housing cover, free of dirt at all times.

REAR AXLE.

The rear axle is the semi-floating type, Fig. 27. End float of the axle shafts is adjusted by shims placed between the brake backing plate and the axle flange. See Fig. 27, No. 38.
To remove a shaft for reshimming or replacement, first remove the hub cap, the cotter pin and the shaft nut. Use a wheel puller to remove the wheel hub. Remove the bolts holding the brake dust shield, the grease and bearing retainer and the brake assembly. Also remove the shield and retainer. Pull out the shaft, using care not to lose the bearing adjusting shims. Should the end of a broken shaft be inside the axle housing tube, the broken end can usually be removed by making a loop in a piece of wire and working the loop over the end of the shaft using the wire to pull it from the housing. When the shaft is replaced, adjust the bearing with the shims to allow proper end play of the shaft. See "Rear Wheel Bearings", Page 50.

BRAKES.

The foot or service brakes are hydraulically actuated in all four wheels. The brakes are of the two shoe, double anchor type and have chrome-nickel alloy iron drums.

The hand brake is mechanically operated through a cable and conduit to an internal expanding type brake mounted on the propeller shaft at the rear of the transfer case.

FOOT BRAKES.

In operation, pressure is applied to the hydraulic liquid in the master cylinder through the foot pedal, forcing the liquid through the lines and into the wheel cylinders. The pressure forces the piston in each wheel outward, expanding the brake shoes against the drums. As the pedal is further depressed, higher pressure is built up within the hydraulic system, causing the brake shoes to exert greater force against the brake drums. As the brake pedal is released the brake shoe return springs pull the shoes together forcing the fluid out of the cylinders and back into the lines toward the master cylinder.

1—Wheel Hub Cap, Left or Right
2—Axle Shaft Nut
3—Wheel Hub
4—Brake Drum
5—Brake Cylinder Assembly, Rear
6—Backing Plate, Front and Rear Brake Assembly
7—Brake Cylinder Bleeder Screw
8—Brake Hose Connection
9—Axle Shaft Grease Retainer, Outer
10—Cone and Rollers, Axle Shaft Bearing
11—Axle Shaft, Left
12—Differential Bearing, Cone and Roller
13—Differential Bearing Adjusting Shims
14—Hypoid Bevel Drive Gear and Pinion Set (Matched)
15—Pinion Bearing Positioning Shims
16—Pinion Bearing Cone Shims
17—Drive Pinion Oil Seal
18—Universal End Yoke Assembly
19—Drive Pinion Bearing Oil Slinger
20—Drive Pinion Bearing Cone and Rollers, Front
21—Drive Pinion Bearing Cup, Front
22—Drive Pinion Bearing Cup, Rear
23—Drive Pinion Bearing Cone and Rollers, Rear
24—Differential Bevel Pinion Mate Shaft Lock Pin
25—Axle Shaft Right
26—Differential Bevel Side Gear
27—Differential Oil Filler Plug
28—Differential Bevel Pinion Mate
29—Differential Bevel Pinion Mate Shaft
30—Hypoid Bevel Drive Gear Screw
31—Drive Gear Screw Locking Strap
32—Differential Center Block
33—Differential Bearing Cup
34—Differential Gear Carrier Cover Gasket
35—Axle Shaft Grease Retainer, Inner
36—Axle Shaft Bearing Grease Connections
37—Axle Shaft Bearing, Cone and Roller
38—Wheel Bearing Adjusting Shims
39—Brake Shoe Anchor Pin
40—Brake Shoe and Lining Assembly

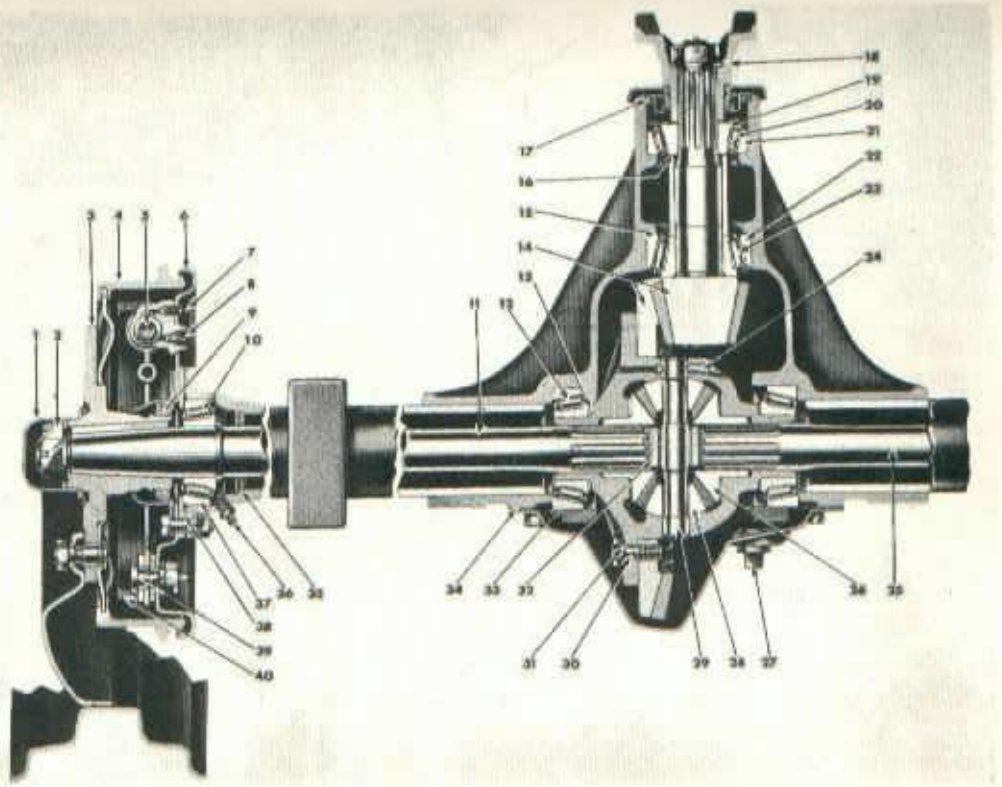


FIG. 27—REAR AXLE ASSEMBLY
(Semi-Floating Type)

The master cylinder may be reached by removing the five screws in the inspection cover on the toe board below the steering column. Keep the master cylinder reservoir full at all times. Use only genuine hydraulic brake fluid. Check the level each 1000 miles (1600 Km.) and use care, when removing the filler cap, that no dirt enters the reservoir. The fluid capacity is approximately 3/4 pt. (.325 it).

The hydraulic brake system must be bled whenever a fluid line is disconnected or air enters the system due to low fluid level in the master cylinder reservoir. A leak in the system will be indicated by a "spongy" pedal. Air trapped in the system is compressible and does not permit pressure, applied to the brake pedal, to be transmitted solidly to the brake shoes. Should bleeding be required, consult your Willys-Overland Dealer.

BRAKE SHOE ADJUSTMENT—-MINOR.

When the brake lining becomes worn the effective brake pedal travel is reduced. The effective travel may be restored by adjusting the brake shoes. First make sure that there is 2" (12.7 mm.) pedal travel, without moving the master cylinder piston, which is necessary to prevent the brakes from dragging due to expansion of the hydraulic liquid. Jack up the wheels to clear the floor. Adjusttrent is made by rotating the brake shoe eccentrics Fig. 28. Loosen the lock nut for the forward brake shoe and hold the nut while turning the eccentric toward the front of the car, with another wrench, until the shoe strikes the drum. Turn the wheel with one hand and release the eccentric until the wheel turns freely then hold the eccentric and tighten the lock nut. To adjust the reverse or rear shoe, repeat this operation except turn the eccentric toward the rear of the car. Do this on all brakes and check the fluid level in the master cylinder reservoir.

As pressure is equal in all parts of system, the brakes are self-equalizing.

FIG. 28—BRAKE ADJUSTMENTS

HAND BRAKE.

To adjust the hand brake the sequence below should be followed:

Make sure that the brake handle on the instrument panel is fully released. Give due attention to the cable and operating linkage to see that they do not bind. Should cable fail to slide freely in conduit, remove and lubricate it. Rotate the brake drum until one pair of the three sets of holes are opposite the two adjusting screw wheels in the brake. Use the edge of the holes as a fulcrum for a suitable adjusting tool or a screw driver, rotate each notched adjusting screw by moving the handle of the tool away from the center of the drive shaft until the shoes are snug in the drum. Back off *seven* notches on each adjusting screw wheel to secure the correct running clearance between the shoes and the drum.

Should either the foot or hand brakes require relining or should it be necessary to make a major adjustment, including resetting of the anchor pins, contact your Willys-Overland Dealer.

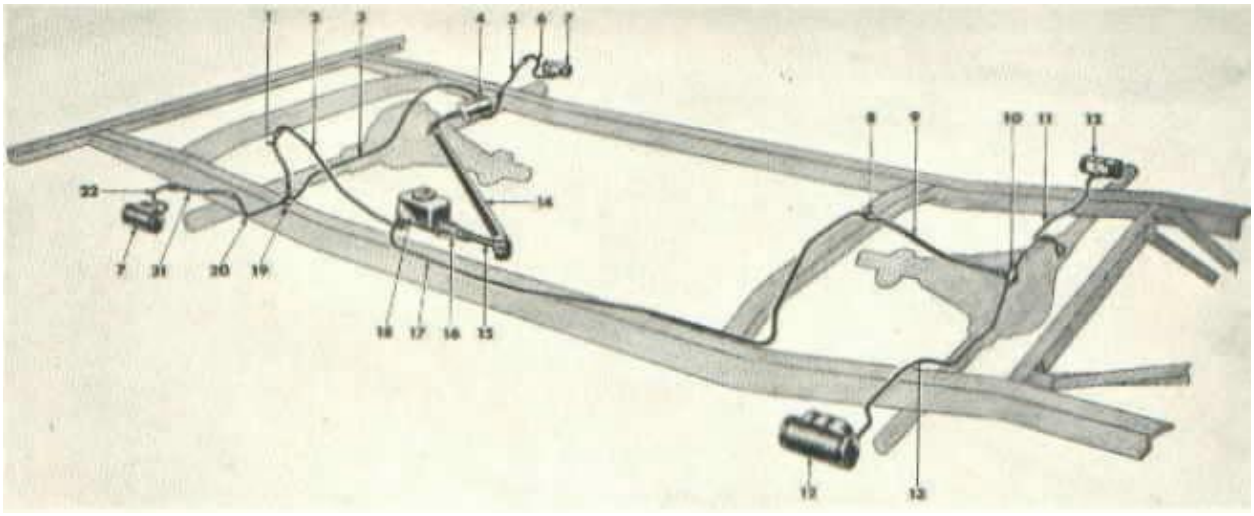


FIG. 29—HYDRAULIC BRAKE SYSTEM

1—Brake Hose—Front Axle to Frame
2—Brake Tube—Master Cylinder to Front Hose
3—Brake Tube—Tee to Frr,nt Brake Hose Right
4—Brake Pedal
5—Brake Hose—Front Axle
6—Brake Tube—Wheel Cylinder to Hose
7—Wheel Brake Cylinder—Front
8—Brake Hose Spring Lock Clip
9—Brake Hose Assembly
10—Rear Axle Tee
11— Brake Tube—Rear Axle Tee to Right Rear Brake
12—Wheel Brake Cylinder Rear
13—Brake Tube Rear A.~le Tee to Left Rear Brake
14—Brake Pedal Shaft
15—Master Cylinder Eye Bolt
16—Master Cylinder Boot
17—Brake Tube—Master Cylinder to Rear Hose
18—Brake Master Cylinder
19 —Front Axle Tee
20—Brake Tube—Tee to Left Front Brake Hose
21—Brake Hose—Front Axle
22—Brake Tube Wheel Cylinder to Hose

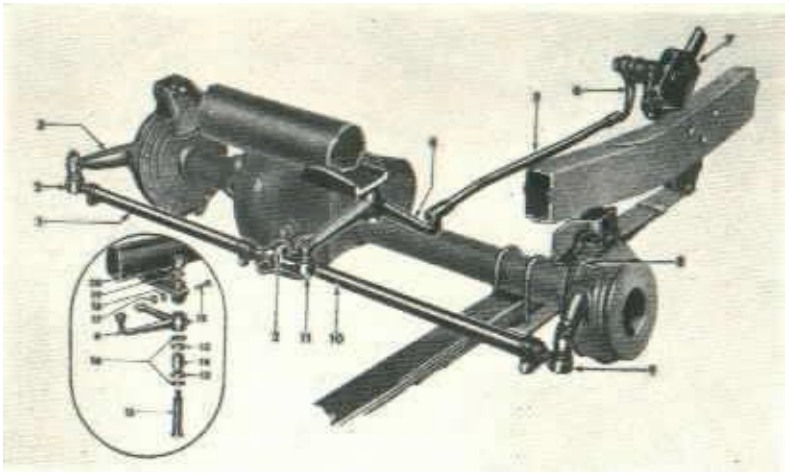


FIG. 30- STEERING SYSTEM

1—Tie Rod—Right
2—Tie Rod Socket—Right
3—Steering Knuckle and Arm—Right
4—Steering Bell Crank
S—Steering Connecting Rod
6—Steering Gear Arm
7—Steering Gear Housing
8—Steering Knuckle and Arm—Left
9—Tie Rod Socket—Left
10—Tie Rod—Left
11—Socket Assembly
12—Bell Crank Support Clamp Bolt
13—Bell Crank Bearing
14—Bell Crank Bearing Sleeve
15—Bell Crank Support Pin
16—Bell Crank Bearing Seals
17—Clamp Bolt Nut
18—Clamp Bolt Lockwasher
19—Support Pin Lockwasher
20—Support Pin Nut

STEERING SYSTEM.

The “Steering System” is illustrated in Fig. 30. It requires little attention other than proper lubrication and maintaining correct alignment.

Alignment may be thrown out by striking curbs or other obstructions. Looseness through the steering system will also affect alignment. It is impossible to satisfactorily align the front wheels without first adjusting the various connections, including the front wheel bearings.

The correct toe-in of the front wheels is 3/64 - 3/32 (1.19 mm.- 2.38 mm.) which must be accurately measured for satisfactory front tire wear and steering. The best method of checking wheel alignment is by the use of a wheel alignment device, which is available in most every well equipped shop.

Periodic inspection and adjustment of the steering parts will aid greatly in maintaining alignment. Keep the steering Connection rods and tie rod ball joints snug; they must operate freely without lost motion. Keep the steering gear arm No. 6 tight on the lever shaft and the steering housing bracket tight on the frame. For adjustment of the front wheel bearings see Page 49. The bell crank No. 4 is mounted on the frame front Cross tube and swivels on two needle bearings. The mounting shaft is removable from the frame bracket by removing the clamp bolt and nut. The bell crank tie-rod ball is replaceable.

Should the bell crank become bent or damaged, install a new part.

Do not tighten the steering gear to dampen out steering trouble. Should trouble develop, consult your Willys-Overland Dealer, as he has a definite procedure for the inspection and adjustment of the steering system.

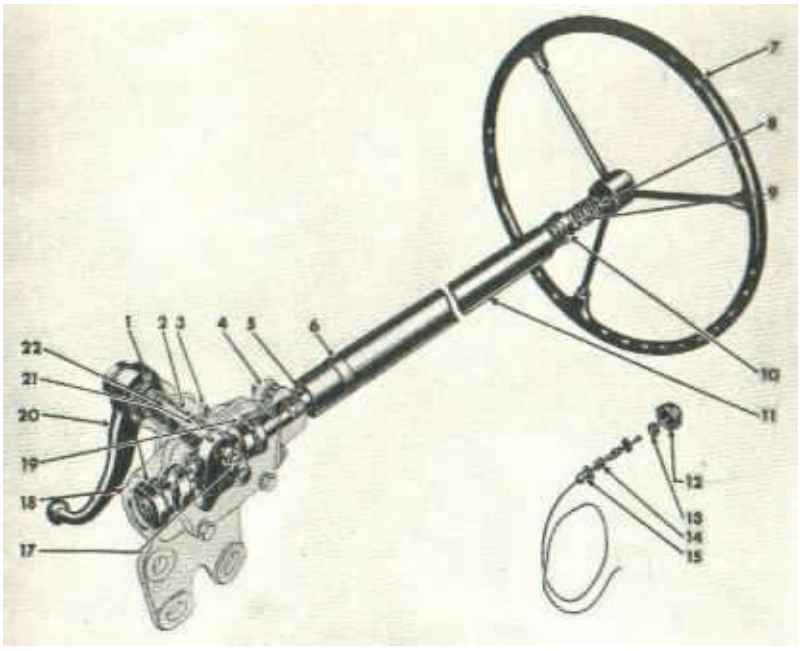


FIG. 31--STEERING GEAR

1—Housing Oil Seal
2—Lever Shaft Assembly
3—Housing Oil Filler Plug
4—Steering Column Clamp Assembly
5—Cam & Wheel Tube Assembly
6—Steering Column Oil Hole Cover
7—Steering Wheel
8—Steering Column Bearing Spring
9—Steering Column Bearing Spring Seat
10—Steering Column Bearing Assembly
11—Steering Column & Bearing Assembly
12—Steering Wheel & Horn Button Nut
13—Horn Button
14—Horn Button Spring
15—Horn Button Spring Cup
17—Side Adjusting Screw
18—Housing Assembly
19—Cam Bearing Balls
20—Steering Gear Arm
21—Housing Bushing—Inner
22—Housing Bushing—Outer

FRONT WHEEL BEARINGS.

The front wheels are mounted on two opposed tapered roller bearings. These bearings are adjustable for wear and their satisfactory operation and long life depends upon periodic attention and correct lubrication.

Loose front wheel bearings may cause excessive wear and will affect front wheel alignment. If the bearing adjustment is too tight, the rollers may break or become overheated.

To check the adjustment, first raise the front of the vehicle so that the tires clear the floor. Check the brakes to be sure they are free and fully released. With the hands, check sidewise shake of the wheel. If the bearings are correctly adjusted, shake of the wheel will be just perceptible and the wheel will turn freely with no drag.

Should the test indicate that adjustment is necessary, remove the hub cap, axle shaft nut and washer, driving flange and shims. See Fig. 25. Wheel bearing adjustment will then be accessible. Bend the lip of the nut locking washer so that the adjusting nut lock nut and washer can be

removed. Rotate the wheel and tighten the adjusting nut until the wheel binds slightly. Then back off the nut 1/6 turn, or more if necessary, making sure the wheel turns freely without sidewise shake. Replace the locking washer and lock nut and bend over the locking washer lip. Check the adjustment and reassemble the driving flange, nut and hub cap, being sure to replace the shims.

REAR WHEEL BEARINGS.

Each rear wheel is carried on a single tapered roller bearing which is adjusted by shims placed between the brake backing plate and the axle flange.

Check wheel bearing adjustment in the same manner as the front wheel. Should the check determine that adjustment is required, remove the hub cap; remove the cotter pin, the axle shaft nut and use a wheel puller to remove the wheel hub. Remove the bolts holding the brake dust shield, the grease and bearing retainer and the brake assembly. Remove or install shims, Fig. 32, No. 2 to adjust the bearing with .001" to .003" (.02 5 mm. to .075 mm.) end float which will be just perceptible when tested by hand. The shims available for this adjustment are .003" -.005" (.075 mm. -.125 mm.) and .030" thick (.75 mm.).

Examine the grease retainer to be sure it is serviceable—replace it if in doubt, and reassemble.

MAINTENANCE OF WHEEL BEARINGS.

When the vehicle is used for road work, lubricate and adjust the front wheel bearings once each year; if used in dusty field work, twice each year.

The bearings should be given more than casual cleaning. Use a clean stiff brush and suitable grease solvent to remove all particles of old lubricant from the bearings and hubs. After the bearings are thoroughly cleaned, inspect them for pitted races and rollers and check the hub oil seals.

Repack the bearing cones and rollers (see "Lubrication Section") and reassemble in the reverse order of dismantling. Adjust them as directed in the preceding paragraphs. Lubricate the rear wheel bearings sparingly. Oil forced from the oil relief hole No. 1, Fig. 32, indicates when the bearing is amply lubricated.

Should it be necessary to adjust the bearings, clean them thoroughly and repack them with the recommended lubricant.

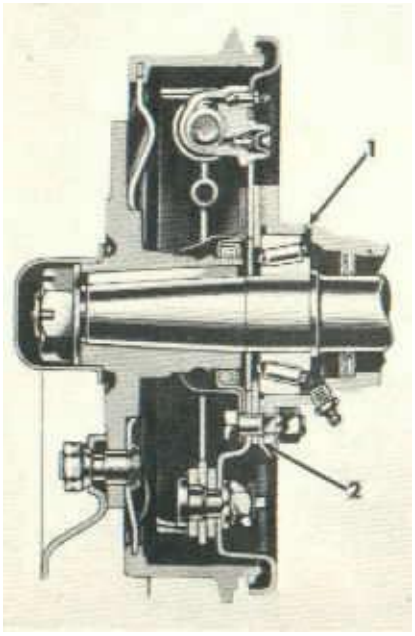


FIG. 32---REAR WHEEL HUB AND BEARING

MOUNTING AND DISMOUNTING WHEELS.

The wheel mounting nuts and studs on both left wheels have left hand threads to prevent them from being loosened by wheel action. The studs are identified by an "L" stamped on the end. The left hand threaded nuts are identified by a groove cut around the hexagonal faces.

To remove the left wheels, the nuts must be turned to the RIGHT, and to remove the right wheels, turned to the LEFT.

TIRES.

The recommended tire pressures are as follows:

6:00 x 16 Tires	26-28 lbs. (1.82 - 1.97 Kg./sq. cm.)
7:00 x 15 Tires	20-24 lbs. (1.41 - 1.68 Kg./sq. cm.)

The importance of correct tire inflation cannot be overemphasized. To secure maximum tire life and most efficient vehicle operation, it is imperative that these pressures be maintained for all normal vehicle operation.

When the vehicle is used with driver only doing agricultural work on very sandy or loose soil, increased flotation and wheel traction may be secured by decreasing the pressure of the 6:00x 16 tire to 20 lbs. (1.41 Kg./sq. cm.), and the 7:00 x 15 tire to 14 lbs. (.98 Kg./sq. cm.). Should unusual operating conditions require this reduction in pressure, use care that tires are inflated to recommended pressure immediately when normal operation is resumed.

To secure maximum tire wear, the wheels should be switched at least twice each year. The rear wheels should be moved to the opposite front positions and the right front wheel moved straight back to the right rear position. Place the spare on the left rear and use the left front as a spare.

Use judgment when switching the tires, however, as even a slight difference in the overall diameter of the front and rear wheels will result in hard shifting when operating in four-wheel drive. This difference may be caused by using a badly worn tire on one wheel and new tires on the others, or by operating the vehicle with one or more of the tires underinflated.

Balance tire wear between the front and rear wheels as closely as possible.

To remove a tire from a drop center rim, first deflate completely and then force the tire away from the rim throughout the entire circumference until the bead falls into the center of the wheel rim, then with a heavy screw driver or tire removing tool, used opposite the valve, remove one side of the tire at a time and remove the inner tube.

Installation of a tire is made in the same manner by first dropping one side of the tire into the center of the rim and with a tire tool, spring the bead over the wheel rim, using care not to damage the inner tube.

When mounting the wheel, alternately tighten opposite stud nuts to prevent wheel wobble. After the nuts have been tightened with the wheel jacked up, lower jack so wheel rests on the floor and retighten the nuts.

SPRINGS AND SHACKLES.

The springs should be periodically examined for broken or shifted leaves, loose or missing rebound clips, angle of the spring shackles and the position of the springs on the axle saddles. Springs with shifted leaves do not have their normal strength. Missing rebound clips may permit the leaves to fan

out or break on rebound. Broken leaves may make the vehicle hard to handle or permit the axle to shift out of line. Weakened springs may break causing difficult steering.

The front springs are interchangeable, as are the two rear.

The front ends of the front springs and the rear ends of the rear springs are shackled, using “U” type shackles with threaded bushings. The rear ends of the front springs and the front ends of the rear springs are bronze bushed and pivoted on bolts in the brackets mounted on the frame.

The spring shackle threaded bushings use right and left hand threads, depending upon where they are to be used. Six bushings are used with right hand threads and two with left hand threads. For identification the right hand threaded type have plain hexagon heads. The left hand have a groove cut around the heads.

The two left hand threaded shackles can be identified by a small forged boss on the lower shank of the shackle. They are used at the left front and the right rear springs with the left hand threaded end down at the spring eyes.

The bushings are anchored solidly in the frame brackets and spring eyes and the oscillation taken between the threads of the “U” shackle and the inner threads of the bushings. The lubrication of the shackle bushings is very important and should not be neglected, or excessive wear of the bushings and “U” shackles will occur.

When making installation of a new “U” shackle or bushing, follow the procedure below:

The shackles are installed with the bushing hexagon heads to the outside of the frame. Install the shackle grease seal and retainer over the threaded end of the shackle up to the shoulder. Insert the new shackle through the frame bracket and the eye of the spring. Hold the “U” shackle tightly against the frame bracket and start the upper bushing on the shackle, care being taken when it enters the thread in the frame, that it is not cross-threaded. Screw the bushings on the shackle about halfway, and then start the lower bushing, hold the shackle tightly against the spring eye and thread this bushing about halfway, then alternating from top bushing to lower bushing, turn them in until the head of the bushing is snug against the frame bracket and the bushing in the spring eye is 1/32” (.79 mm.) away from the spring measured from the inside of the hexagon head to the spring. Lubricate the bushings with high pressure lubricant and then try the flex of the shackle, which should be free. If the shackle is tight, it will cause spring breakage and it will be necessary to rethread the bushings on the shackle.

SHOCK ABSORBERS.

The shock absorbers are of the direct action type giving two-way control, however they are not adjustable. They dampen spring action, as the vehicle passes over irregularities in the road.

The shock absorbers are mounted on rubber bushings at both top and bottom. Should squeaks occur in the bushings, add a flat washer on the mounting pins to place the bushings under greater pressure and prevent movement between the rubber and metal parts.

DO NOT USE mineral oil to remove squeaks.