Willys-Overland

OWNER'S MANUAL

☆

Model 2-WD 4700 Lbs. Gross Weight
Model 4-WD 5300 Lbs. Gross Weight

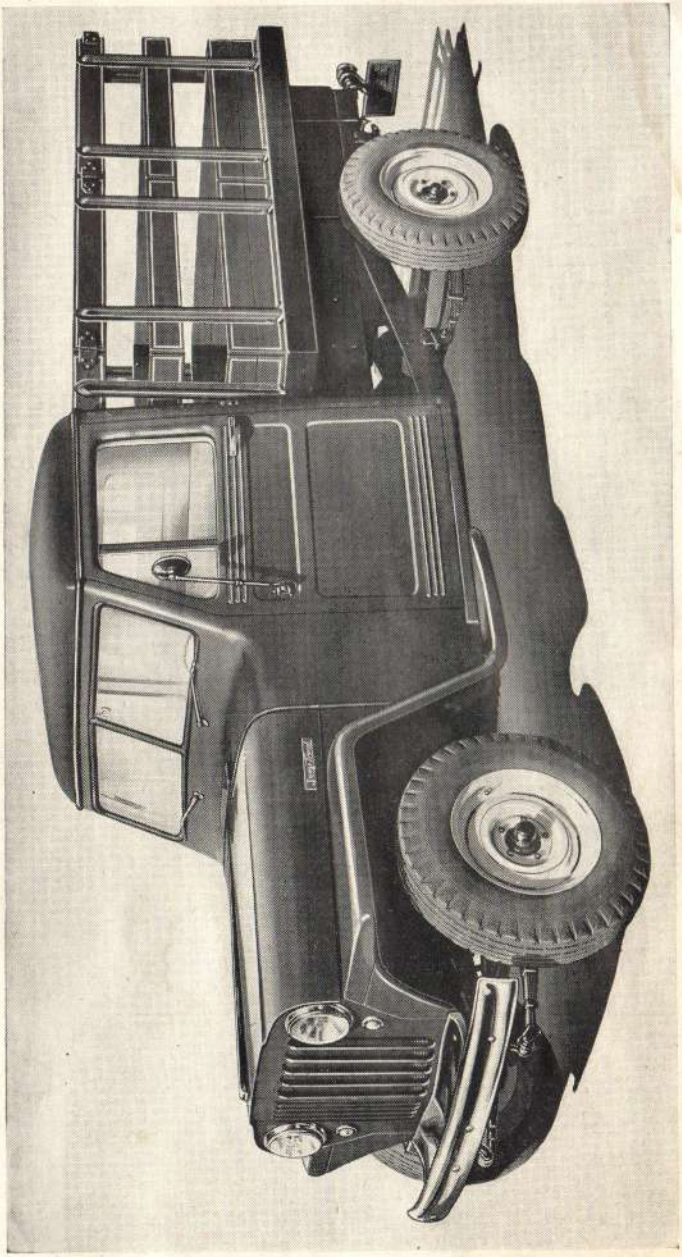
☆

FOURTH EDITION

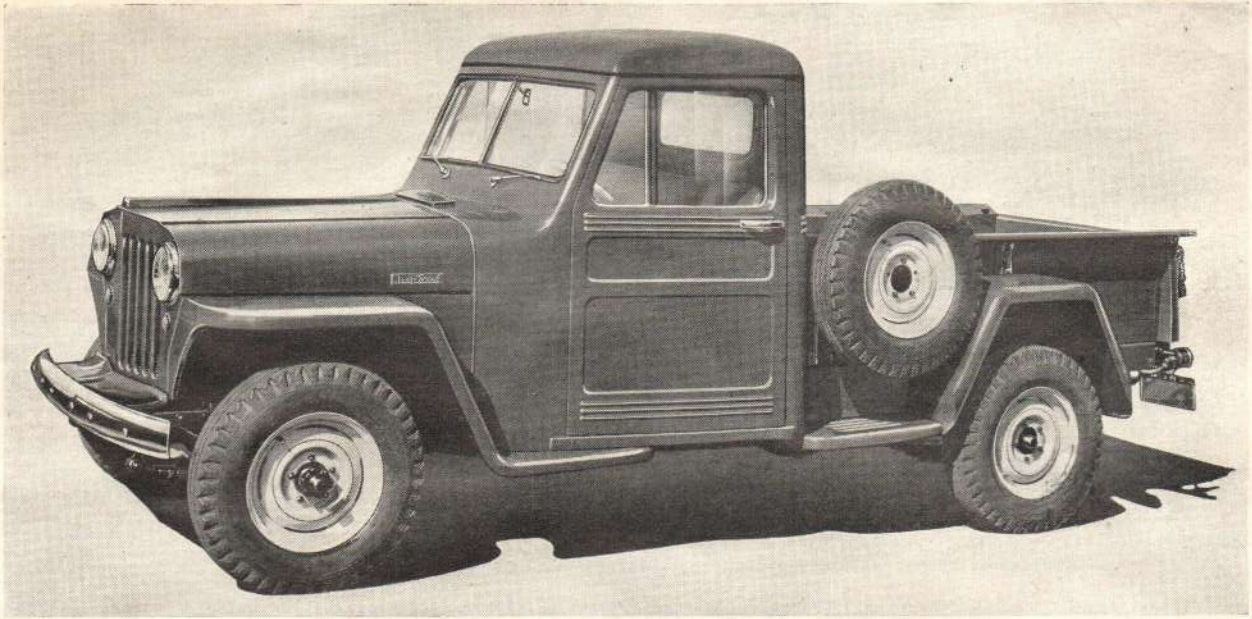
☆

Willys-Overland Motors

Willys-Overland Export Corporation
Toledo, Ohio, U. S. A.



JEEP TRUCK with STAKE BODY



JEEP TRUCK with PICK-UP BODY

Foreword

IN YOUR possession is a motor vehicle that has been thoroughly tested and inspected. Like any other piece of machinery, to maintain it in first class condition, you should lubricate it at the time prescribed with the proper grade of oil and lubricant and keep all the working parts and oil holes clean and free from dirt and grit. You should also periodically have it systematically inspected at an authorized Willys-Overland Service Station.

In the following pages we have set forth the knowledge every owner should have of his vehicle, that he may know how to take the best care of it and handle it in such a way that he will receive maximum service. Information is also made available covering external adjustments and emergency repairs. Read and follow these instructions carefully; we are sure that you will then enjoy the satisfactory operation that you rightfully anticipate.

Should adjustment or repair seem necessary beyond your ability, don't experiment; have the work done by a competent repair man. It will always prove best and cheapest in the end to have the work done by the Dealer from whom you purchased your car. Willys-Overland Dealers have factory trained mechanics and all are familiar with the construction and adjustments through the cooperation of the manufacturer.

Do not attempt any adjustments as long as the vehicle is operating satisfactorily.

Be sure to obtain the Owner Service Policy provided by your Dealer on delivery of your new vehicle.

Caution

Accept and use only Genuine Factory Parts. Imitation parts are usually of inferior quality and can do serious damage to other mechanical parts of your vehicle. Genuine parts are sold by all authorized Willys-Overland Dealers. Be sure none other than genuine parts are placed in your vehicle.

Presence of parts other than those furnished by Willys-Overland will void the manufacturer's warranty.

NOTE: Parts replaced under the terms of the Warranty (Page 6) must be left with the Willys-Overland Dealer who makes the replacement, if full credit is expected.

This is important for owners to know when traveling outside the territory in which their vehicle was originally purchased, particularly when credit for old parts cannot be established to the satisfaction of the Dealer.

In this connection, a forwarding address should be given by the owner in order to insure the credit reaching him.

Standard Warranty

THE only Warranty under which new Willys-Overland motor vehicles are sold is that of the manufacturer, being the Standard Warranty recommended by the Automobile Manufacturers' Association and is as follows:

> This is to certify that we, Willys-Overland Motors, Inc., Toledo, Ohio, U. S. A. warrant each new passenger automobile and truck or other motor vehicle manufactured by us, to be free from defects in material and workmanship under normal use and service, our obligation under this warranty being limited to making good at our factory any part of parts thereof, including all equipment or trade accessories (except tires) supplied by the car manufacturer, which shall within ninety (90) days after making delivery of such vehicle to the original purchaser or before such vehicle has been driven 4000 miles (6500 Km.), whichever event shall first occur, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on our part, and we neither assume nor authorize any other person to assume for us any other liability in connection with the sale of our vehicles.
>
> This warranty shall not apply to any vehicle which shall have been repaired or altered outside of an authorized Willys-Overland Service Station in any way so as, in the judgment of the manufacturer, to affect its stability or reliability, nor which has been subject to misuse, negligence or accident."

The manufacturer makes no warranty against, nor assumes any liability for any defect in metal or other material in any part, device or trade accessory which cannot be discovered by ordinary factory inspection.

Willys-Overland Motors, Inc.

NOTE: Willys-Overland Motors, Inc., reserves the right at any time or times to revise, modify, discontinue or change any models of its vehicles, or any part or parts thereof, without notice; and without it or the Seller, incurring any liability or obligation to the Purchaser.

General Data

Engine—	
Number of Cylinders	4
Bore	3 1/8"
Stroke	4 3/8"
Piston Displacement	134.2 cu. in.
Compression Ratio	6.48 to 1
Horsepower—SAE	15.6
Horsepower—Actual at 4000 RPM	63
Torque—Maximum at 2000 RPM	105 lbs. ft.
Wheelbase	118"
Tread—Front	56"
Tread—Rear	63 1/2"
Road Clearance	8 1/8"

	Length	Width	Height
Pick-up Box Dimensions	80"	48 1/2"	14"
Platform Dimensions	81 1/2"	73"	

VEHICLE WEIGHTS

	Shipping Weight		Curb Weight		Gross Weight	
Model 2-WD	Pounds	Kilogram	Pounds	Kilogram	Pounds	Kilogram
Chassis	1867	847	1978	897		
Chassis and Cab	2677	1214	2763	1253	4700	2132
*Platform	3113	1412	3224	1462	4700	2132
†Pick-up	2995	1359	3182	1443	4700	2132
Model 4-WD						
Chassis	1974	895	2120	961		
Chassis and Cab	2809	1274	2937	1332	5300	2404
*Platform	3245	1472	3356	1522	5300	2404
†Pick-up	3129	1419	3314	1503	5300	2404

*If equipped with a stake rack add 186 lbs.-84.351 kilograms.
†If equipped with a canopy top add 120 lbs.-54.430 kilograms.

	U. S.	Imperial	Metric
Capacity—Fuel tank	15 gals.	12.50 gals.	56.78 liters
Cooling System	11 qts.	9.16 qts.	10.41 liters

LAMP BULBS

Head Lamp (7-inch Sealed Beam Type)	35-45 Watts
Parking Lamp Bulb	2 cp. Mazda No. 55
Beam Indicator Lamp Bulb	1 cp. Mazda No. 51
Tail Lamp Bulb	21-3 cp. Mazda No. 1158
Instrument Lamp Bulb	2 cp. Mazda No. 55
Fuse (Thermal Type) on Light Switch	30-Amperes

Location of Serial Number:—Plate on dash under hood by steering tube. **Engine Number:**—Stamped on top of cylinder block water pump boss.

Inspection—Adjustment

Your car was carefully lubricated and inspected at the factory and again thoroughly serviced by the Selling Dealer.

After your truck has been operated 1,000 miles (1600 Km.) and again at 2000 miles (3200 Km.), return it to your Dealer for the regular inspections and adjustments in accordance with Factory Service Policy. These inspections are free with the exception of engine oil and anti-freeze solution used.

1000-2000 Mile (1600-3200 Km.) Inspections

Check steering system and front wheel alignment.
Check spring clip nuts and spring shackles.
Check rear axle for oil level and possible leaks.
Adjust the body bolts.
Test foot and hand brakes—inflate the tires.
Check cooling system for leaks and the fan belt adjustment—check anti-freeze solution.
Adjust clutch pedal.
Check operation of transmission—check oil level and for possible leaks.
Check battery, generator output, headlamps and horn.
Tighten universal joint companion flange bolts.
Check operation of ammeter, heat indicator, fuel and oil gauges.
Tighten cylinder head nuts—check ignition timing and distributor points.
Set spark plugs—adjust carburetor—check throttle controls.
Check engine for possible oil leaks—check fuel line connections.
Adjust valve tappets, if required.
Change engine oil (Charge for oil)—lubricate vehicle.
Clean and refill air cleaner.
Clean fuel pump sump and strainer.

Model 4-WD Inspection Points Not Common To Both Vehicles

Check operation of transfer case—check oil level and for possible leaks.
Tighten front drive universal joint companion flange bolts.
Check front axle for oil level and possible leaks.
Check axle shaft universal joint housing oil seals.
Check oil level in the axle shaft universal joint housing and for possible oil leaks.
Check end float of front axle shaft and universal joint assemblies.
Check governor operation—check oil level and for possible leaks.
Check operation of power take-off and pulley drive—check oil level and for possible leaks.
Check power take-off propeller shaft and universal joints.

FILL IN FOR YOUR REFERENCE

Vehicle Serial Number.....
Engine Serial Number.....
Ignition Key Number.....
Door Key Number.....
Fuel Tank Cap Key Number.....
Date Purchased.....

Proper Operation

DRIVING A NEW TRUCK

Do not run your truck faster than 40 miles (64 Km./h.) an hour for the first 500 miles (800 Km.) and if it is a four-wheel drive vehicle use care when pulling heavy loads in the lower gear ratios. If the vehicle is operated at high speed, while new or used for heavy pulling for long periods, the closely fitted parts might possibly become overheated, resulting in scored pistons, cylinders and burned bearings. During its entire life, never race the engine while making adjustments or when the vehicle is standing idle. If the vehicle is not properly lubricated, our warranty is null and void. Be sure to have your Willys-Overland Dealer inspect your truck at the end of 1,000 miles (1600 Km.) or equivalent and again at 2000 miles (3200 Km.) usage and every 2,500 miles (4000 Km.) thereafter.

TO MAKE TRUCK READY

Fill the radiator with clean, soft water.

Put gasoline in the tank.

Fill the oil reservoir through the filler pipe at the right side of the engine until the oil indicator stick registers "Full." (See "Engine Lubrication," Page 16).

Supply all parts requiring lubrication with oil or other lubricant. (See "Lubrication Chart", Pages 38 through 40.

See that the tires have proper pressure. (See "Tire Pressure", Page 59).

Adjust the rear view mirror to the correct position for the driver. The mirror may be adjusted by means of the ball and socket mounting.

CONTROLS AND SWITCHES

The position of all controls and switches is shown in Fig. 1.

The main light switch No. 18 controlling both the head and tail lamps is conveniently located on the instrument panel at the center. It is of the plunger type—pull all the way out for the "full on" position, half-way out for the parking lights and all the way in is the "off" position.

In addition to the main light switch, the high and low beams of the head lamps are controlled by a selector foot switch, No. 29, located on the toe board to the left of the clutch pedal. Pressing and releasing the switch button, with the left foot, alternately changes the beam from high to low and vice versa.

The instrument light switch No. 17 is located along the lower edge of the instrument panel to the right of the main light switch.

The hood retaining lock is located directly back of the radiator grille. Press the latch to unlock the hood after which pull the lower end of the safety latch forward to open hood.

TO START ENGINE

Put the transmission gearshift lever, Fig. 23, in neutral. (NOTE: When operating the Model 4-WD place the transfer case low and high shift lever, the right hand lever, in high gear or in the rear position, Fig. 2 and disengage the front axle drive by placing the left hand transfer case shift lever in the forward position).

Pull the choke control button No. 7 one-fourth of the way out which also opens the throttle slightly.

Place the key in the ignition lock No. 27 and turn it to the right, closing the ignition circuit.

Disengage the clutch by depressing pedal No. 28.

Depress the foot starting control button No. 21.

Should the engine fail to start at once, pull the choke all the way out and again press the starting control lever. When the engine starts, push the choke in about one-third of the way.

Set the choke control at the best operating position and as the engine warms up, push the choke all the way in. Do not run with the choke out as fuel is wasted and the engine fouled.

Should the engine fail to start, refer to the "Emergency Chart," Page 63.

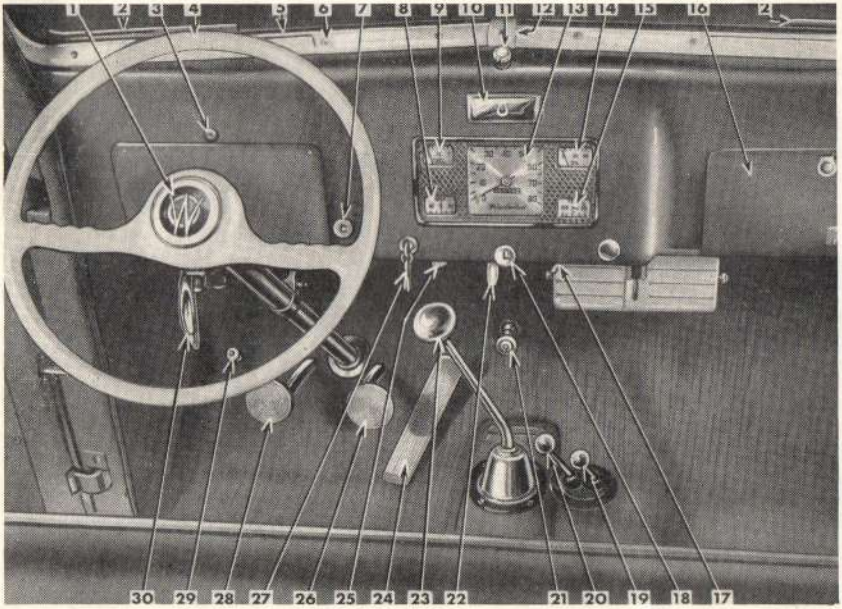


FIG. 1—VEHICLE CONTROLS

1—Horn Button
2—Windshield Wiper Blade
3—Tell Tale Light
4—Steering Wheel
5—Defroster Outlet
6—Windshield Garnish Moulding
7—Choke Control
8—Ammeter
9—Fuel Gauge
10—Ash Receiver
11—Windshield Wiper Control
12—Windshield Garnish Moulding Cover Plate
13—Speedometer
14—Oil Gauge
15—Temperature Gauge
16—Glove Compartment
17—Instrument and Dome Light Switch
18—Main Light Switch
19—Underdrive Shift Lever—4WD
20—Front Axle Drive Shift Lever—4WD
21—Foot Starter Control
22—Cowl Ventilator Control
23—Gear Shift Lever
24—Accelerator
25—Heater Switch
26—Brake Pedal
27—Ignition Switch
28—Clutch Pedal
29—Foot Dimmer Switch
30—Hand Brake Control

TO START THE TRUCK

Release the brake, if set.

Depress the clutch pedal.

Move the transmission gearshift lever to the first speed position, Fig. 2. When the Model 4-WD is driven on the highway in rear wheel drive, the front axle and transfer case shift levers are not used.

Depress the foot accelerator pedal gradually and at the same time, slowly release the clutch pedal.

Allow the truck to gain momentum (two or three truck lengths), then release the accelerator and depress the clutch pedal at the same moment.

Move the shift lever promptly to the second speed position.

Depress the foot accelerator pedal gradually and at the same time, slowly release the clutch pedal.

Shift to third or "high" speed in the same way at approximately 18 to 20 mph. (29-32 Km./h.), releasing the accelerator and depressing the clutch pedal before moving the shift lever.

The synchronizing mechanism in the transmission makes gear shifting silent and easy. This device synchronizes the speeds of the two gears to be engaged and prevents "clashing."

TO CHANGE TO LOWER SPEED

(CAUTION: Never attempt to shift to a lower gear with the vehicle traveling at a high rate of speed.)

Depress the clutch pedal.

Move the gearshift lever quickly to next lower speed, increase the engine speed slightly, if travelling on level road and release the clutch pedal.

It will be found advisable to make this change when the engine is placed under heavy pull, or when dropping down to a very low speed as when travelling up a steep grade, in sand or in congested traffic.

TO STOP THE TRUCK

Release the foot accelerator.

Apply the foot brake until the truck is nearly at a standstill and then depress the clutch pedal. The practice of applying the brakes intermittently rather than with constant pressure will result in reduced brake lining wear as less heat is generated.

When stopped, move the gearshift lever into neutral.

Set the hand brake and release the clutch and brake pedals.

TO REVERSE THE TRUCK

With the truck at a standstill, depress the clutch pedal.

Move the gearshift lever into the reverse position, Fig. 2, and slowly release the clutch pedal and regulate the truck speed with the foot accelerator.

TO USE THE ENGINE AS A BRAKE

The most effective brake for holding the truck back on a steep grade is the engine. To use the engine as a brake, shift into one of the lower speeds before starting to descend. Keep the clutch engaged, the throttle closed and the ignition "ON." Low gear will hold any vehicle effectively on any hill it can climb.

Never engage the clutch suddenly when the vehicle is coasting with clutch released and the transmission gears in mesh, as damage to the driving mechanism may result.

STARTING TRUCK ON UPGRADE

In starting on an upgrade, hold the vehicle with the hand brake, disengage the clutch and shift the transmission into low gear, then accelerate the engine with the foot accelerator in the regular way while simultaneously releasing the hand brake and engaging the clutch.

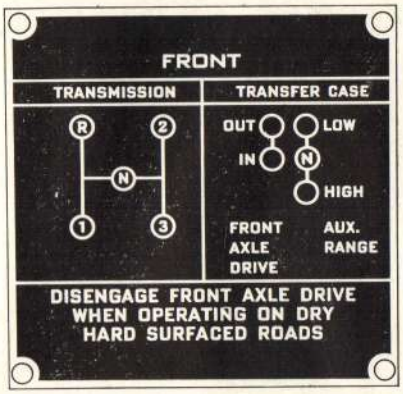


FIG. 2—TRANSMISSION AND TRANSFER CASE SHIFT

FOUR-WHEEL DRIVE—MODEL 4-WD

The four-wheel drive of the 4-WD is accomplished through the medium of the transfer case which provides a means of connecting the engine power to the front axle. The transfer case is an auxiliary two-speed transmission attached to the rear of the standard transmission and provides a low and direct gear in four-wheel drive.

Control of the transfer case is through the two shift levers, Fig. 1 No. 19 and No. 20. The left lever No. 20 is used to connect and disconnect the power to the front axle. The right lever No. 19 is used to shift the transfer case to secure either "High" (direct drive) or a very low gear ratio for heavy pulling requirements.

Instructions for shifting gears in the transfer case and engagement of the front axle drive are as follows: See Fig. 2.

1. To engage the front axle drive, depress the clutch pedal, release the accelerator and move the left hand shift lever (No. 20) to the rear position.

2. With the front axle drive engaged, the right hand lever, No. 19 may be shifted to the rear into "High" (direct) or forward into "Low." The "Neutral" position midway between "High" and "Low" is provided for use when the power take-off belt drive is used. This "Neutral" position enables the operator to shift through all transmission gear ratios to obtain the desired belt pulley speed and power, with the vehicle standing. The truck cannot be driven when this lever is in the "Neutral" position.

3. To disengage the front axle drive, release the accelerator, depress the clutch pedal and shift the left lever to the forward position. NOTE: **The transfer case can be operated only in "High" or direct drive when the front axle drive is not used.**

4. Shifting down from high to low transfer case gear should not be attempted except when the vehicle is practically at a standstill. The front axle drive must be engaged for this shift. Release the accelerator and depress the clutch pedal—move the left hand shift lever to the rear position to engage the front wheel drive, then move the right hand lever to the forward or low gear position.

5. Shifting from low to high transfer case gear may be accomplished at any time, regardless of vehicle speed. Release the accelerator and depress the clutch pedal to shift the right hand lever into the rear position.

USE OF FOUR-WHEEL DRIVE—MODEL 4-WD

The Model 4-WD truck is equipped with four-wheel drive and transfer case to provide increased tractive power and a lower gear ratio for use on difficult terrain and to provide low speed pulling power for industrial and agricultural use. Four-wheel drive should be used only when greater traction and power are required than that provided by the standard transmission low gear.

Tire maintenance is of utmost importance when using four-wheel drive. Slight difference in the overall diameter of the front and rear wheels will result in hard shifting. 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. Keep tires inflated to recommended pressure (Page 59) especially when operating the vehicle with maximum load.

Avoid the use of four wheel drive on hard-surfaced highways. The increased tractive power is not required and this practice will result in rapid tire wear and hard shifting of the transfer case gears. Should hard shifting occur, disengage the clutch, start the engine, shift the transmission into reverse gear, back the truck a few feet and disengage the clutch. If the transfer case is in low range, shift into direct drive, then disengage the front axle drive (left lever forward).

STEERING KNUCKLE OIL SEAL—MODEL 4-WD

When parking during cold, wet weather, swing the front wheels from right to left to wipe away moisture adhering to the front axle universal joint housings and oil seal, Fig. 3. This will prevent freezing with resulting damage to the oil seals. When the truck is stored for any period, the outer surfaces of the front axle universal joint housings should be coated with light grease to prevent rusting.

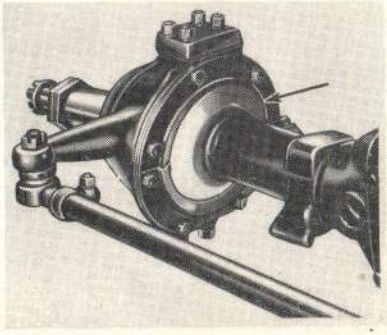


FIG. 3—KNUCKLE OIL SEAL

How to Save Gasoline

1. In cold weather economical starting of the engine is easily accomplished by pressing down on the accelerator pedal once or twice, then depress the clutch pedal and start the engine using the choke sparingly. Do not use the choke when starting a warm engine.

2. Do not use the choke excessively while the engine is warming up and never leave it out longer than necessary.

3. Accelerate gently. Tramping on the accelerator pumps more gasoline into the cylinders than can be effectively used.

4. Holding the truck in second gear until you get up to high speeds may easily double the gasoline you should use in getting under way. Shift into high gear at about 20 miles per hour (32 Km./h.).

5. Fast driving uses more gasoline. Travel at moderate speeds if you want gasoline economy.

6. Decelerate to a gradual stop. Sudden stops, like rapid starts, are wasteful of gasoline.

7. Park your truck in the shade if possible; hot sun evaporates gasoline. A well filled tank reduces evaporation and condensation.

8. Don't drive your tires with less that the proper air pressure. Under inflated tires mean more road friction, more work for the engine to do and therefore more gasoline consumed. See "Tire Pressure" Page 59.

9. Keep the battery charged in good condition. It helps starting and provides good ignition thereby reducing loss of gasoline.

10. Letting the engine idle for long periods wastes gasoline.

11. Be sure that the carburetor is in proper condition for maximum mileage and power.

12. One faulty or dirty spark plug may waste as much as 10% of your gasoline. Have the spark plugs tested occasionally.

13. Keep your truck well lubricated at all times, and carefully follow the instructions for "Lubrication."

14. Keep the radiator filled to the proper level as your engine will remain at a more constant temperature. An overheated engine uses more gasoline.

15. Check the operation of the automatic heat control on the exhaust manifold. The purpose of this heater is to warm the mixture of air and gasoline as it leaves the carburetor, in order to give better vaporization. (See Manifold Heat Control, Page 29.)

16. It will pay to have a complete engine tune-up and the fuel system checked for leaks every 6,000 miles (9600 Km.), or at least twice a year—in the Fall when preparing for Winter and again in the Spring. The Owner Service Policy entitles you to an adjustment and complete inspection without charge at the end of the first 1,000 miles (1600 Km.) and again at 2000 miles (3200 Km.).

General Lubrication

The use of high grade lubricants and regular application is essential when operating any truck because of the heavy duty service it performs. The amount of trouble-free service received will be in direct proportion to the care given. The most common cause of rapid wear or damage is due to lack of lubrication, however, it is possible to overdo it. Too much lubricant in the differential housing or wheel bearings might result in the brake linings becoming saturated, necessitating replacement. Electrical units such as the generator, starting motor and distributor may be over-lubricated and cause trouble.

Because of the importance of correct lubrication, listed in the following paragraphs will be found:

1. Lubrication capacity chart.
2. Lubrication specification chart.
3. Detailed lubrication recommendations for each unit.
4. Illustrations of the chassis (Fig. 17 and Fig. 18) showing all points requiring lubrication.

Model 2-WD	Capacity		
Unit	U. S.	Imperial	Metric
Engine	4 qts.	3⅓ pts.	3.78 liters
Transmission	3 pts.	2½ pts.	1.40 liters
Steering Gear Housing	¾ pt.	⅝ pt.	0.36 liters
Differential	3 pts.	2½ pts.	1.40 liters
Oil Bath Air Cleaner	1¼ pts.	1 pt.	0.71 liters
Hydraulic Brakes	¾ pt.	⅝ pt.	0.36 liters

Model 4-WD	Capacity		
	U. S.	Imperial	Metric
Engine	4 qts.	3⅓ pts.	3.78 liters
Transmission Transfer Case	6½ pts.	5½ pts.	3.07 liters
Differential—Front	2½ pts.	2 pts.	1.18 liters
Differential—Rear	3 pts.	2½ pts.	1.40 liters
Universal Joint—Front Axle—Each	¾ pt.	⅝ pt.	0.36 liters
Steering Gear Housing	¾ pt.	⅝ pt.	0.36 liters
Oil Bath Air Cleaner	1¼ pts.	1 pt.	0.71 liters
Hydraulic Brakes	¾ pt.	⅝ pt.	0.36 liters
Power Take-off Rear	1 pt.	¾ pt.	0.47 liters
Pulley Drive Unit	¾ pt.	⅝ pt.	0.36 liters

Lubrication Specifications

	Type	Winter	Summer
Chassis Lubrication	Chassis	No. 0	No. 1
Transmission	Gear Oil	SAE 80	SAE 90
Transfer Case	Gear Oil	SAE 80	SAE 90
Differentials	Hypoid Gear Oil	SAE 90	SAE 90
Steering Gear	Steering Gear	SAE 140	SAE 140
Wheel Bearings	Wheel Bearing	No. 2	No. 2
Universal Joints (Front Axle Shaft)	Universal J. Grease or Chassis Grease	No. 0	No. 1
Universal Joints (Propeller Shaft)	Universal J. Grease	No. 0	No. 1
Power Take-off Housings	Hypoid Gear Oil	No. 80	No. 80
Oil Bath Air Cleaner	Engine Oil	Same grade used in engine	
Governor (Variable Speed)	Engine Oil	Same grade used in engine	
Engine	Engine Oil	See Below	

Above 90 Deg. F.	Not Lower than 32 Deg. F.	As Low as +10 Deg. F.	As Low as −10 Deg. F.
SAE 30	SAE 20 or 30	SAE 20W	SAE 10W

For temperatures below −10 degrees F. use SAE 5W or 10W plus 10% Kerosene.

ENGINE LUBRICATION—MODELS 2-WD and 4-WD

Lubrication of the engine is accomplished by means of a force feed continuous circulating system. This is effected by means of a gear type pump, located externally on the left side of the engine, and driven by a spiral gear on the camshaft.

The oil is drawn into the circulating system through a floating oil intake. The floating type intake does not permit water or dirt, which may have accumulated in the bottom of the oil pan to circulate, because the oil is drawn horizontally from near the top surface.

An oil pressure gauge is mounted in the instrument panel which indicates the pressure being applied to the circulating system. Failure of the gauge to register may indicate absence of oil or a fault in the lubricating system and the engine should be stopped immediately. If there is plenty of oil in the reservoir the mechanical fault must be corrected before starting the engine. When the oil level is below the "Full" mark, pour sufficient oil into the oil filler pipe to bring the level to this mark.

When the truck leaves the factory the crankcase is filled to the correct level with oil of the proper viscosity for the "break-in" period. Completely drain the oil at 500 miles (800 Km.), and at 1,000 miles (1600 Km.), then every 2,000 miles (3200 Km.) thereafter, by removing the drain plug in the lower left side of the oil pan.

To secure maximum engine life, watch the condition of the oil closely and should it become contaminated, due to the conditions under which the truck is being operated, change it immediately.

Always drain the oil when the engine is warm. The benefit of draining is, to a large extent, lost if the crankcase is drained when the engine is cold, as some of the foreign matter will remain in the bottom of the oil pan.

At least once a year, preferably in the Spring, remove the oil pan and floating oil intake and wash thoroughly with cleaning solution.

Detailed Lubrication—Model 2-WD

In the following paragraphs will be found detailed lubrication information covering all the units of the Model 2-WD which require lubrication. For complete information of the amount and type of lubricant to use, refer to the charts on Pages 15 and 16.

CHASSIS

When lubricating the chassis refer to the Lubrication Chart on Page 40. Clean and lubricate with a compressor, points indicated by No. 1, each 1,000 miles (1600 Km.). The importance of using a good quality chassis lubricant cannot be exaggerated, for the cost will be more than repaid by longer wear and good service.

TRANSMISSION

The transmission housing is filled with the proper lubricant at the factory. The level in the housing should be checked each 1,000 miles (1600 Km.) or at each vehicle lubrication to maintain the lubricant at filler plug level. Drain and refill each 6,000 miles (9600 Km.) of service.

DIFFERENTIAL

The differential and drive gears require extreme pressure lubricant which is suitable for the hypoid gear type axle. Check at each 1,000 miles (1600 Km.) or at each lubrication to maintain the lubricant at filler plug level. **Do not mix different types of hypoid lubricants.** Drain and refill the housing each 6,000 miles (9600 km.) or twice yearly. Use a light engine or flushing oil to clean out the housing.

SAE 90 gear oil is recommended for both winter and summer. It may be that this oil is too heavy for satisfactory lubrication in extremely cold localities. In this case use SAE 80 gear oil.

NOTE: Do not use water, steam, kerosene or gasoline for flushing. If the oil is decomposed, dismantling is necessary.

WHEEL BEARINGS

Front wheel bearings should be removed, thoroughly cleaned, checked and repacked with lubricant twice yearly or every 6,000 miles (9600 Km.).

The rear wheel bearings are equipped with hydraulic lubricators. Lubricate them sparingly to guard against surplus oil saturating the brake lining.

STEERING GEAR

Check the level of the lubricant in the steering gear housing every 1,000 miles (1600 Km.). Avoid the use of cup grease, graphite, white lead or heavy solidified oil. Remove the plug from the steering gear housing and use a hand gun to fill the housing slowly to filler plug level.

OIL FILTER

If the vehicle is equipped with an oil filter the unit should be dismantled, cleaned and the filter element replaced at the end of the first 2,000 miles (3200 Km.). Drain the filter at each change to prevent old oil contained in the filter, from mixing with and contaminating the new oil.

After the initial change, replace the element at each 8,000 miles (12800 Km.) of highway travel.

AIR CLEANER—Dry Type

At each vehicle lubrication wash the element in a suitable solvent and dry lightly with an air hose. Re-oil the element before reinstalling.

AIR CLEANER—Oil Bath

Some vehicles are equipped with an oil bath type air cleaner. Care of this type cleaner is IMPORTANT—especially when the truck is used under dusty conditions.

Clean the air cleaner reservoir and refill to the level mark with oil of the same grade used in the engine at each engine oil change or more often when used under dusty conditions.

UNIVERSAL JOINTS

At assembly the universal joints are packed with the correct grade of lubricant which is retained by the dust covers.

At each vehicle lubrication inspect the dust covers for leakage and be sure that the flange attaching screws are tight.

Disassemble and repack these joints each 20,000 miles (32000 Km.), however, guard against overloading them. Do not use over one ounce (1 oz.—28.34 grams) of universal joint lubricant in each joint.

The center universal joint is carried on a rubber supported ball bearing, mounted in a bracket attached to the frame cross member. This bearing is prelubricated and sealed at assembly, requiring no additional lubrication for its life.

IGNITION DISTRIBUTOR

The oiler on the distributor Fig. 8, No. 5, should be lubricated every 1,000 miles (1600 Km.) with several drops of engine oil. Also place one drop of light engine oil on the wick, No. 1 located in the top of the shaft, which is accessible by removing the rotor arm, and sparingly apply soft grease on the breaker arm cam No. 4 and a drop of oil on breaker arm pivot, No. 2.

GENERATOR

Two oilers are provided, one at each end; three to five drops of engine oil is recommended every 1,000 miles (1600 Km.). Be sure to slip the commutator end hole cover back in place.

STARTING MOTOR

The oil hole cover at the commutator (front) end slips to one side; put three to five drops of engine oil in this hole every 1,000 miles (1600 Km.). Be sure to slip the cover back in place.

SPEEDOMETER DRIVE

Remove the drive shaft from the tube once each year, clean it thoroughly and lubricate with a good quality light graphite grease.

WATER PUMP—CLUTCH

Both the water pump and the clutch release bearings are prelubricated and sealed at assembly and the lubricant lasts for the life of the bearings.

WINDSHIELD WIPER CABLES AND PULLEYS

Twice each year or each 6,000 miles (9600 Km.), coat the windshield wiper cables with light grease and oil the pulley bearings with engine oil.

Detailed Lubrication—Model 4-WD

In the following paragraphs will be found detailed lubrication information covering all the units of the Model 4-WD which require lubrication. For complete information of the amount and type of lubricant to use, refer to the charts on Page 15 and 16.

CHASSIS LUBRICATION

When lubricating the chassis refer to the Lubrication Chart shown on Page 38. Clean the hydraulic fittings and use a compressor to lubricate all the points indicated by No. 1. Use a good quality chassis lubricant for the cost will be more than repaid by longer wear and good service. IMPORTANT—Should the truck be used for dusty field work, the chassis bearings should be lubricated DAILY as dirt and grit which has accumulated in the bearings will cause rapid wear unless forced out by the new lubricant.

TRANSMISSION—TRANSFER CASE

Check the oil level in both the transmission and transfer case each 1,000 miles (1600 Km.), or at each lubrication, to maintain the lubricant at filler plug level. Drain and refill at each 6,000 miles (9600 Km.) or 300 hours of field work.

While these two assemblies are drained and filled as separate units, drilled passages are provided between the two housings for circulation of the lubricating oil to provide unit lubrication. The capacities of the housings are small for economy and it is *important* that the lubricant be changed regularly.

AXLE DIFFERENTIALS

Both the front and rear axle differential gears require extreme pressure lubricant which is suitable for the hypoid gear type axle. Check the oil level at each 1,000 miles (1600 Km.) or at each lubrication to maintain the lubricant at filler plug level. Drain and refill the housings each 6,000 miles (9600 Km.) or twice yearly.

Do not mix different types of hypoid lubricants. Use a light engine or flushing oil to clean out the housings.

NOTE: Do not use water, steam, kerosene or gasoline for flushing. If the oil is decomposed, dismantling is necessary.

SAE 90 gear oil is recommended for both winter and summer. It may be that this oil is too heavy for satisfactory lubrication in extremely cold localities. In this case use SAE 80 gear oil.

FRONT AXLE UNIVERSAL JOINTS—SPINDLE PIVOT BEARINGS

The front axle shaft universal joints and both upper and lower king pin bearings are enclosed in the steering knuckle housings, Fig. 29, which are filled with lubricant so require no attention other than checking each 1,000 miles (1600 Km.) or at each lubrication to be sure the housings are filled to the filler plug level.

Once each year or approximately every 300 hours of heavy industrial or field work the axle shaft and universal joint assemblies should be removed, thoroughly cleaned and the housings filled with new lubricant. See Front Axle, Page 49.

STEERING GEAR HOUSING

Check the level of the lubricant in the steering gear housing each 1,000 miles (1600 Km.). Avoid the use of cup grease, graphite, white lead or heavy solidified oil. Remove the plug in the steering gear housing and use a hand gun to fill the housing slowly to filler plug level.

UNIVERSAL JOINTS—PROPELLER SHAFT

The propeller shaft universal joints, both front and rear, are equipped with hydraulic fittings. Use a hand compressor to lubricate the trunnion bearings each 1,000 miles (1600 Km.).

WHEEL BEARINGS

The front wheel bearings should be removed, thoroughly cleaned, checked and repacked with lubricant twice yearly or every 6,000 miles (9600 Km.).

The rear wheel bearings are equipped with hydraulic lubricators. Lubricate them sparingly to guard against surplus oil saturating the brake lining.

OIL FILTER

If the vehicle is equipped with an oil filter, the unit should be dismantled and cleaned and the filter element replaced at the end of the first 2,000 miles (3200 Km) or 100 hours of industrial or field work. After the initial change, install a new filtering element at each 8,000 miles (12800 Km.) of highway travel or 200 hours of industrial or field work.

Always drain the filter at each engine oil change to prevent the old oil contained in the filter, from mixing with and contaminating the new oil.

OIL BATH AIR CLEANER

Care of the air cleaner is EXTREMELY IMPORTANT, especially when the truck is used for dusty field or industrial work.

When the truck is used for road work, clean the air cleaner reservoir and refill to the level mark with oil of the same grade used in the engine, each time the engine oil is changed. When used for dusty field work, clean the reservoir and change the oil DAILY or under extremely dusty conditions TWICE DAILY.

IGNITION DISTRIBUTOR

The oiler on the distributor Fig. 8, No. 5, should be lubricated every 1,000 miles (1600 Km.) with several drops of engine oil. Also place one drop of light engine oil on the wick, No. 1 located in the top of the shaft, which is accessible by removing the rotor arm, and sparingly apply soft grease on the breaker arm cam No. 4 and a drop of oil on the breaker arm pivot, No. 2.

GENERATOR

Two oilers are provided, one at each end; three to five drops of engine oil is recommended every 1,000 miles (1600 Km.). Be sure to slip the commutator end hole cover back in place.

STARTING MOTOR

The oil hole cover at the commutator (front) end slips to one side; put three to five drops of engine oil in this hole every 1,000 miles (1600 Km.). Be sure to slip the cover back in place.

SPEEDOMETER DRIVE

Remove the drive shaft from the flexible housing once each year, clean it thoroughly and relubricate with a good quality light graphite grease.

GOVERNOR—VARIABLE SPEED

At each lubrication, check the oil level in the governor housing. Use oil of the same grade used in the engine to maintain the lubricant at the level indicator plug level; (open cock to test level when servicing the Monarch governor). Some Novi governors have no level indicator plugs. The capacity of these governors is 2 ounces (.059 liters). Drain and refill the housing at each engine oil change. Guard against over filling.

The NOVI type governor oil filler plug is also a vent. When this plug is removed to fill the governor, clean it thoroughly to guard against the vent becoming clogged.

POWER TAKE-OFF SHAFT AND PULLEY DRIVE

Check the oil level in both housings at each lubrication to maintain the oil at filler plug level. Should the power take-off be used frequently, change the oil at each 300 hours of operation.

POWER TAKE-OFF DRIVE SHAFT UNIVERSAL JOINTS

The power take-off and belt pulley drive shaft universal joints are prelubricated at assembly. The lubricant is retained in the joints by covers. For average service, the original lubrication will last for the life of the vehicle, however, should the power take-off unit be often used for continuous operation, it is advisable to disassemble the joints and repack them once each year. Examine the covers periodically to guard against leakage of the lubricant.

The ball bearing supporting the ends of the two shafts at the rear intermediate frame cross member was prelubricated and sealed at assembly and the lubricant will last the life of the bearing.

PINTLE HOOK

Should the vehicle be equipped with a pintle hook, place a few drops of engine oil on both the latch and the latch lock pivots at each vehicle lubrication.

WATER PUMP AND CLUTCH RELEASE BEARINGS

Both the water pump bearing and the clutch release bearing are prelubricated at assembly. This initial lubrication will last the life of these bearings so they require no attention.

SHOCK ABSORBERS

Do not place oil on the shock absorber rubber mounting bushings to eliminate squeaks. See "Shock Absorbers" Page 61.

WINDSHIELD WIPER CABLES AND PULLEYS

Twice each year or each 6,000 miles (9600 Km.) coat the windshield wiper cables with light grease and oil the pulley bearings with engine oil.

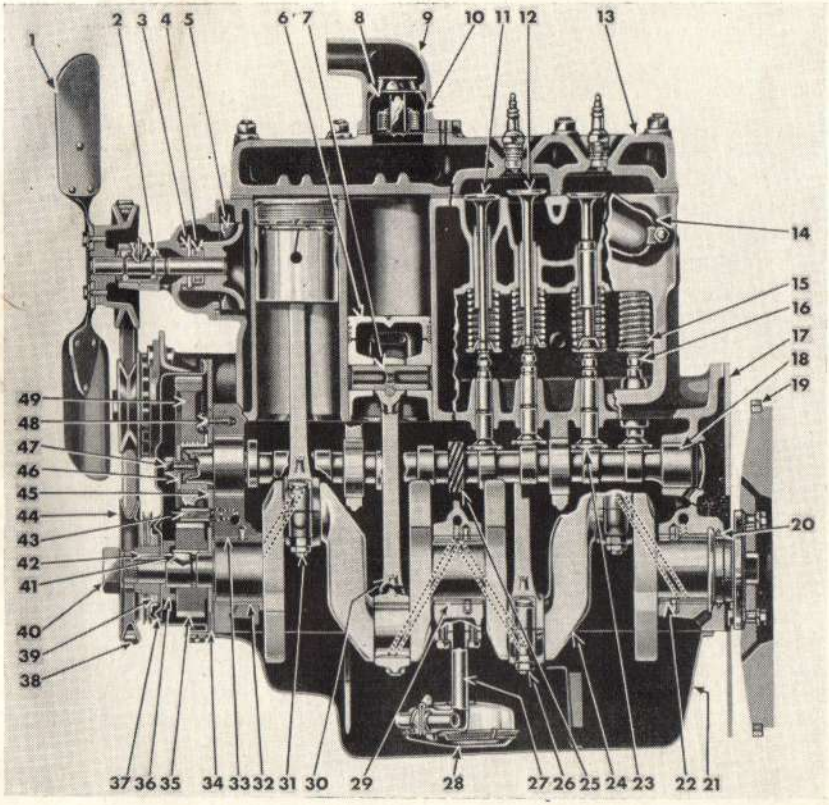


FIG. 4—SIDE SECTIONAL VIEW OF ENGINE

1—Fan Assembly
2—Water Pump Bearing and Shaft Assy.
3—Water Pump Seal Washer
4—Water Pump Seal Assembly
5—Water Pump Impeller
6—Piston
7—Piston Pin
8—Thermostat Assembly
9—Water Outlet Elbow
10—Thermostat Retainer
11—Exhaust Valve
12—Inlet Valve
13—Cylinder Head
14—Exhaust Manifold Assembly
15—Valve Spring
16—Valve Tappet Self-Locking Adjusting Screw
17—Engine Plate—Rear
18—Camshaft
19—Flywheel Ring Gear
20—Crankshaft Packing—Rear
21—Engine Oil Pan
22—Crankshaft Bearing Rear Lower
23—Valve Tappet
24—Crankshaft
25—Oil Pump and Distributor Drive Gear
26—Connecting Rod Cap Bolt
27—Oil Float Support
28—Oil Float Assembly
29—Crankshaft Bearing Center—Lower
30—Connecting Rod Assembly No. 2
31—Connecting Rod Bolt Nut
32—Crankshaft Bearing Front—Lower
33—Crankshaft Bearing Front—Upper
34—Engine Plate—Front
35—Crankshaft Gear
36—Crankshaft Gear Spacer
37—Crankshaft Oil Slinger
38—Fan Belt
39—Crankshaft Packing—Front End
40—Crankshaft Nut
41—Crankshaft Gear Key
42—Fan and Generator Drive Pulley Key
43—Timing Gear Oil Jet
44—Fan and Generator Pulley
45—Camshaft Thrust Plate
46—Camshaft Gear Washer
47—Camshaft Gear Screw
48—Camshaft Thrust Plate Screw
49—Camshaft Gear

Proper Maintenance

NEVER RUN ENGINE IN CLOSED GARAGE

Do 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

Proper maintenance of your truck demands that it be given a thorough service inspection at each 1,000 miles (1600 Km.) of operation. Such an inspection consists of a careful road test and examination by a competent mechanic to locate and analyze any small faults that may have developed. The prompt correction of minor faults thus discovered will go far toward holding down maintenance expense and costly delays in operation.

Your Willys-Overland Dealer is vitally interested in your truck and it will pay you to have him regularly inspect it. Many dealers' mechanics are factory trained men and all have the advantage of complete factory specifications covering the vehicle as well as bulletins which are sent out by the factory.

The following paragraphs outline methods of making minor adjustments and also suggestions covering preventive maintenance. 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 m. m.) gap.

Clean and tighten the battery cable terminals, the battery ground connection and the ground strap on the right side of the engine at the front engine support. (See Fig. 11.)

Remove the distributor cap and inspect the contact points. Adjust the points to .020″ (0.51 m. m.) gap. See Page 26.

Check the ignition timing. Check the valve tappet clearance.

Adjust all tappets to .016″ (0.406 mm.) clearance with the engine hot or cold.

Clean the fuel pump filter screen and check the fuel line connections.

Remove the ventilator valve shown in Fig. 12 and clean it thoroughly.

Start the engine and allow it to run until it reaches operating temperature after which adjust the carburetor low speed adjusting screw, Fig. 13, No. 2 so the engine will idle smoothly.

Set the carburetor idle stop screw No. 1, Fig. 13 so the engine will idle at approximately 600 r. p. m.

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.

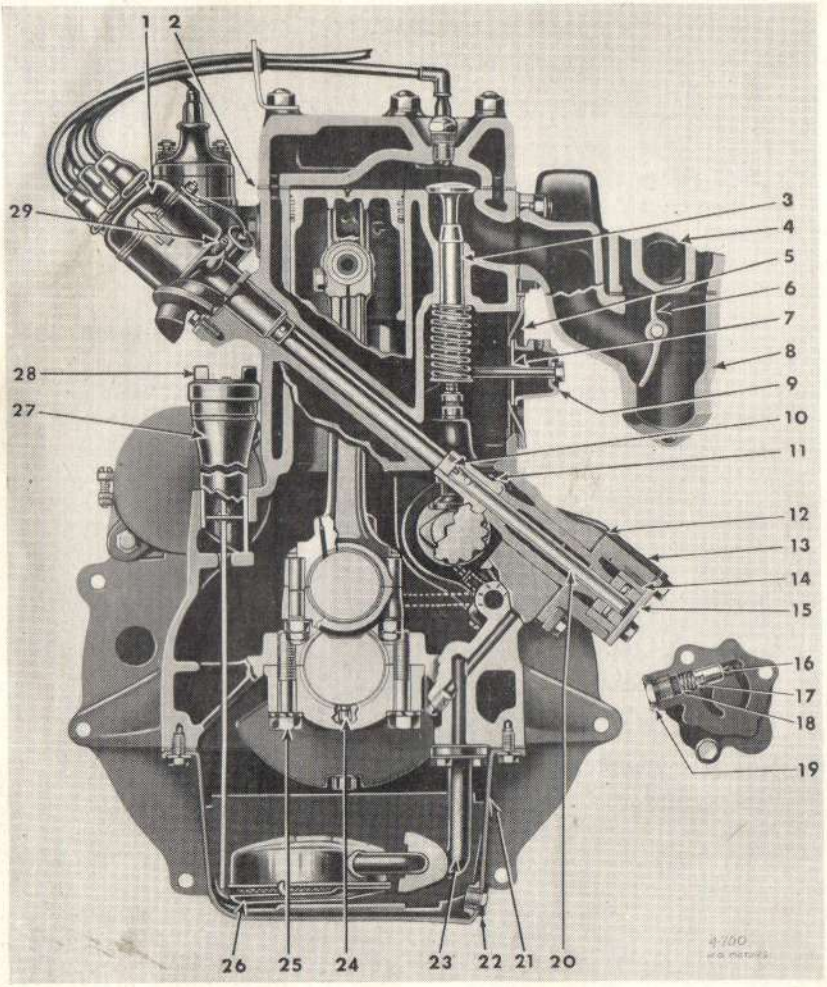


FIG. 5—FRONT SECTIONAL VIEW OF ENGINE

1—Ignition Distributor
2—Cylinder Head Gasket
3—Exhaust Valve Guide
4—Intake Manifold Assembly
5—Valve Spring Cover Assembly
6—Heat Control Valve
7—Crankcase Ventilator Baffle Gasket
8—Exhaust Manifold Assembly
9—Crankcase Ventilator Assembly
10—Distributor Shaft Friction Spring
11—Oil Pump Driven Gear
12—Oil Pump Gasket
13—Oil Pump Assembly
14—Oil Pump Rotor
15—Oil Pump Cover
16—Oil Relief Plunger
17—Oil Relief Plunger Spring
18—Oil Relief Valve Adjusting Shim
19—Oil Relief Plunger Spring Retainer
20—Oil Pump Shaft
21—Oil Pan Assembly
22—Oil Pan Drain Plug
23—Oil Float Support
24—Crankshaft Bearing Dowel
25—Crankshaft Bearing Cap to Crankcase Screw
26—Oil Float Assembly
27—Oil Filler Tube
28—Oil Filler Cap and Level Indicator
29—Distributor Oiler

Valve and Ignition Timing	Piston Measurement from Top Center	
Inlet opens 9 degrees before top center	.039″	(0.991 mm.)
Inlet closed 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.)
Tappet setting for valve timing	.020″	(0.51 mm.)
Number of flywheel teeth	124	
Firing order	1-3-4-2	
Ignition timing	"IGN" 5 degrees B.T.C.	

The ignition should be set at top center with the automatic spark control at rest, when using low octane fuel.

CHECKING VALVE TIMING

To check the valve timing, adjust the inlet valve tappet No. 1 cylinder to .020″ (0.508 mm.). Use care in making this adjustment that the measurement is made accurately with a feeler gauge and that the tappet is resting against the lowest surface of the camshaft cam. Rotate the crankshaft until the 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 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 tappets .016″ (0.406 mm.) with engine either hot or cold.

Should the timing be incorrect, consult your Willys-Overland Dealer.

IGNITION TIMING

Clean and adjust distributor breaker points to .020″ (0.508 mm.) opening. Remove 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 "5°" on the flywheel is in the center of the timing hole in the flywheel housing at the right rear, Fig. 7. This places the piston in the correct position to set the ignition.

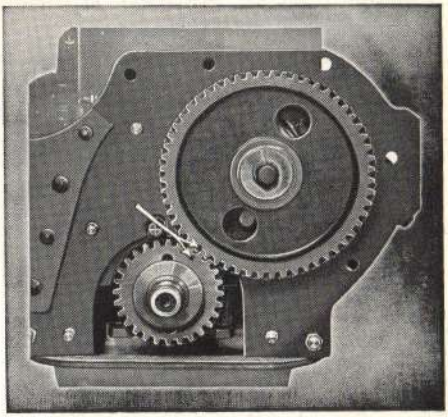


FIG. 6—TIMING GEAR MARKS

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 assembly in a clockwise direction; to retard it, turn in a counter-clockwise 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, then check the timing to the flywheel "5°" mark.

Ignition timing must be accurately set to obtain the maximum efficiency of the engine. Information above is given only to enable the operator to place the car 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.

DISTRIBUTOR

The distributor delivers the spark to the right cylinder at the correct time. The mechanical breaker, built in the distributor, opens and closes the primary circuit at the exact time for ignition. See Fig. 8.

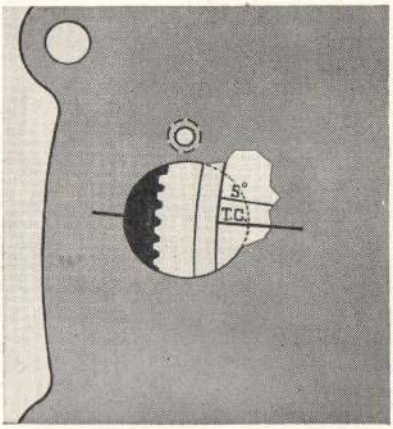


FIG. 7—FLYWHEEL TIMING MARKS

The distributor cap must be kept clean for efficient operation. It should be inspected at each engine tune-up 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 rotor for cracks or evidence 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 replacement should be made. 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 contact points, Fig. 8, No. 6, should be kept clean as dirty, burned or pitted points may cause missfiring. 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 the highest point of one of the cams. Adjust the points by loosening the lock nut and turning the threaded contact point. Recheck the gap and timing after tightening the lock nut.

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

SPARK PLUGS

Keep spark plug porcelains clean. Dirty, oil covered 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 at high speeds and when operating with wide open throttle, while a small gap causes poor idling. Uniform gap setting assures smooth engine operation.

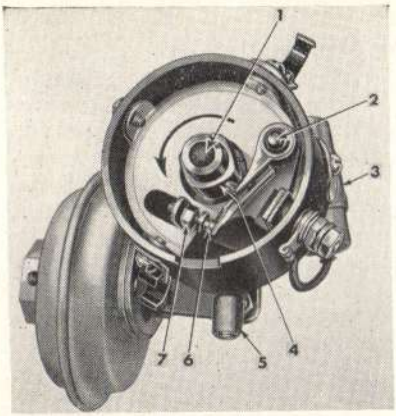


FIG. 8—DISTRIBUTOR

1—Lubrication Wick
2—Breaker Arm Pivot
3—Condenser
4—Breaker Cam
5—Oiler
6—Distributor Points
7—Adjusting Locknut

ENGINE FAILS TO START

Should the engine suddenly stop or fail to start, check the cause as follows: Also see the "Emergency Chart" Page 63.

1. Make sure there is gasoline getting to the carburetor. (NOTE: Should the trouble be traced to the gasoline supply see "Fuel System" Page 32.) Be sure the ignition is turned "ON."

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

3. Be sure the distributor breaker points are smooth, also clean and correctly spaced to the proper gap of .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 these conditions are found, replace the part.

5. See that ample current is reaching the distributor breaker points. To make this test, remove the cap and turn the engine until the breaker points are open. Turn the ignition switch "ON" and use a screwdriver to short across from the distributor body to the breaker arm. No flash indicates an open connection between the switch and the distributor points or an open circuit in the coil primary circuit. If the wire and connections leading to the coil are in good condition, an open primary in the coil is indicated and a new coil will be necessary.

6. To test the secondary coil circuit, remove the distributor cap and turn the engine until the breaker points are making contact. Remove the high tension wire (center wire) from the distributor cap and turn the ignition switch "ON." 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 a 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 this 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 wire connection to the distributor is not broken or 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 coil or condenser, it being necessary to replace them if inoperative.

OIL PUMP ASSEMBLY

The oil pump drive shaft drives both the pump and the distributor assembly; see Fig. 5, No. 20. Should it be necessary to remove the oil pump, first remove the distributor cap and carefully note the position of the rotor so that the pump may be reinstalled without disturbing the engine timing. To avoid disturbing the timing, the pump gear must be correctly meshed with the camshaft drive gear, to allow engagement of the distributor driving key with the oil pump shaft driving slot, without moving the distributor rotor. Assembly can be made in only one position as the slot and key are machined off center. When the pump is assembled to the block, use care that the driving key is correctly meshed in the slot to avoid damage to these parts. When the slot and key are correctly aligned the pump will slide freely into position against the engine crankcase.

The oil pump, Fig. 9 is provided with an adjustable oil relief valve which controls the maximum oil pressure. The pressure may be adjusted by installing or removing shims from between the relief valve plunger spring and the spring retainer No. 10. Add shims to increase the pressure or remove to decrease. Adding shims will not increase pressure at idling speeds but will increase maximum pressure at higher speeds only.

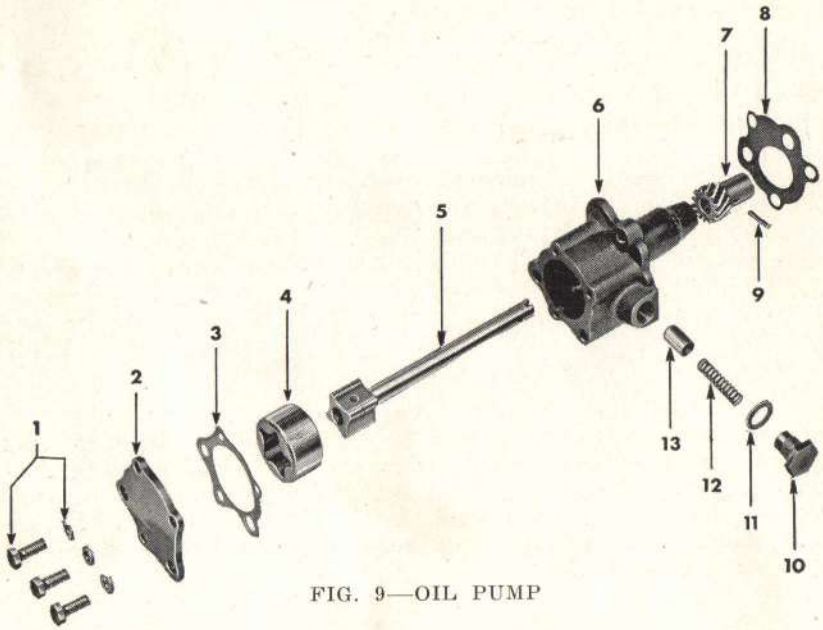


FIG. 9—OIL PUMP

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

The standard new engine pressure as registered by the dash gauge is approximately 35 lbs. (6.249 Kg/cm.) at 30 mph. (48 Km./h.), and approximately 5 lbs. to 10 lbs. (.872 to 1.785 kg./cm.) at the engine idling speed of 600 rpm. although these pressures will vary some with engine temperatures and grades of oil used.

OIL PRESSURE GAUGE

The oil pressure gauge is of the electric type. A "sender" is mounted on the left side of the crankcase at an opening into the main oil circulating line. A single wire connects the "sender" to the indicating unit mounted on the instrument panel.

Should the instrument panel unit fail to indicate pressure in the oil circulating system **STOP** the engine immediately. Failure to register may indicate no oil, a fault in the oil circulating system or in the gauge units or a loose or dirty electrical connection.

If tests show the circuit in good condition, disconnect the wire leading to the "sender" at the instrument panel unit and connect in its place one lead of a 6-volt, 1 candlepower test lamp. Touch the other test lamp lead to a clean, unpainted surface of the instrument panel to complete the circuit to "ground." Turn the ignition switch "ON" and if the unit is registering correctly, the indicating hand will register approximately three-quarters across the dial.

Should tests indicate that the "sender" is at fault, install a new unit as the assembly is sealed and cannot be repaired.

If investigation shows that there is a fault in the oil circulating system, consult your Willys-Overland Dealer. **DO NOT** operate the engine until the fault is corrected.

FLOATING OIL INTAKE

The floating oil intake, Fig. 5, No. 26 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 which may have accumulated at the bottom of the oil pan.

Once each year remove the oil pan, the float screen and tube and clean them thoroughly with a suitable cleaning fluid. When replacing the float support tube, install a new gasket where the tube flange bears against the engine crankcase. A leak at this point will allow air to enter the oil suction line, seriously affecting oil pressure.

MANIFOLD HEAT CONTROL

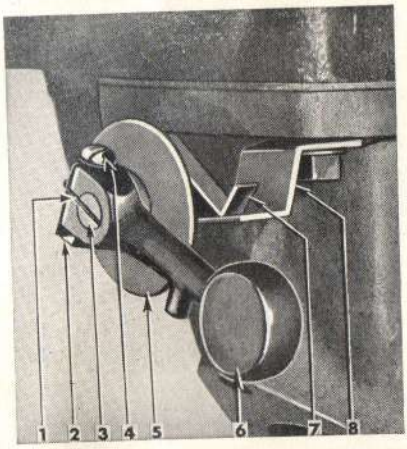
The manifolding is designed to utilize the hot exhaust gases of the engine to provide a quick means of heating the intake manifold, thereby reducing the length of time the choke must be used after starting a cold engine and making the engine more flexible during the warm-up period. The heat control valve, Fig. 10, controls the amount of exhaust gases by-passed around the intake manifold.

The valve is fully automatic as it is controlled by thermostatic spring No. 7.

The valve should turn freely in the manifold at all times. Be sure that the free end of the thermostatic spring No. 7 is placed above the stop No. 8.

CRANKCASE VENTILATOR

The crankcase ventilating system provides complete sealing of the crankcase to prevent entrance of dust and grit and also positive ventilation which reduces the formation of sludge to a minimum.



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 Bi-Metal Spring Washer
6—Heat Control Valve Counterweight Lever
7—Heat Control Valve Bi-Metal Spring
8—Heat Control Valve Bi-Metal Spring Stop

FIG. 10—HEAT CONTROL VALVE

In operation, Fig. 12, clean air flows from the air cleaner through the tube connecting the air cleaner and the oil filler tube and then through the crankcase and valve compartment to the intake manifold. Thus vapors in the crankcase are drawn into the manifold and burned. Positive air circulation reduces oil temperatures and the formation of moisture due to condensation. Air flow through the engine is controlled by an automatic valve mounted in the intake manifold.

Effective operation of the ventilating system is dependent upon the absence of air leakage between the air cleaner and the control valve. Be sure that the tube connecting the air cleaner and the oil filler tube is tight at all times. Also be sure the oil filler tube gasket forms a tight seal and that the cap is locked securely in place.

When tuning the engine or grinding valves remove the control valve and clean it thoroughly. Should the valve be blocked with carbon, the ventilating system will not operate. This may possibly result in abnormal crankcase pressure causing oil leakage. Should the valve fail to seat it will be impossible to make the engine operate satisfactorily at idle speeds.

ENGINE MOUNTINGS

The rubber engine mountings, which are attached to the frame side rail brackets and to the engine support plate, prevent for-and-aft motion of the engine, yet allow free sidewise and verticle movement 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.

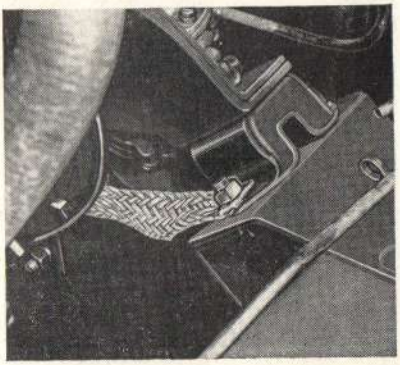


FIG. 11—ENGINE GROUND STRAP AND CONNECTIONS

The rubber mountings partially insulate the engine from the frame. To assure a positive electrical ground connection between the engine and frame a ground strap is provided at the right front engine support, Fig. 11. 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

GENERATOR

The generator is a 35-ampere, two-brush unit. The output is automatically controlled 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 proportionately higher as the battery requires charging.

As a general rule, it will not pay an owner, not having specialized test equipment, to undertake generator repairs. There are some adjustments which may be made however, and these are outlined below.

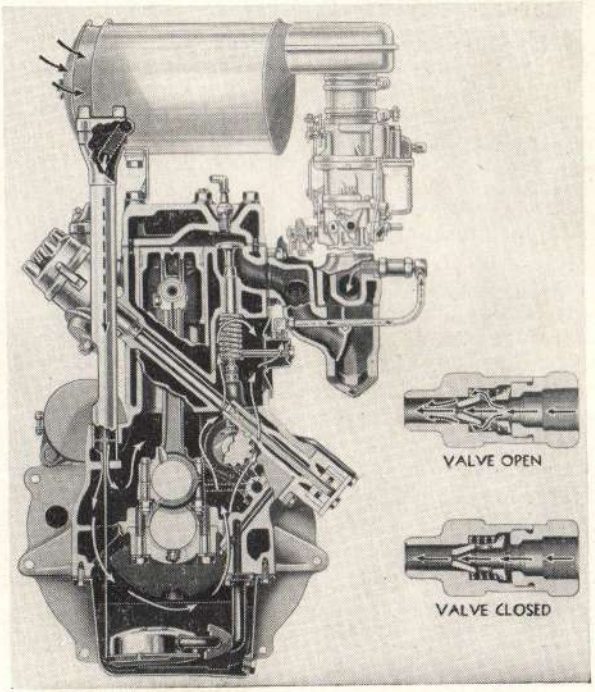


FIG. 12—CRANKCASE VENTILATING SYSTEM

Should the generator stop charging or fail to charge sufficiently, examine all external wiring connections to be sure they are clean and tight, also note the condition of the commutator and brushes. If the commutator is dirty, or discolored, clean it by holding a piece of No. 00 sandpaper against it with the engine running at idle speed. Do not use emery or carborundum cloth.

Check the brushes—they must slide freely in their holders and if they are badly worn or oil soaked, they must be replaced.

Excessive arcing between the commutator and brushes usually indicates incorrect seating of the brushes against the commutator or high mica in-

sulation between the commutator segments. Incorrect seating may be corrected by drawing of piece of No. 00 sandpaper around the commutator with the sanded side against the brushes. 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

Do not attempt to adjust the regulator, for without highly specialized test equipment, correction of faults cannot be accomplished. This unit must be adjusted with extreme accuracy; heat as well as voltage and amperage must be considered in making adjustments. Should trouble develop in this unit either install a new unit or consult your Willys-Overland Dealer.

STARTING MOTOR

The starting motor requires little attention except regular lubrication. It is a standard three-bushing type motor with manual drive pinion and flywheel engagement.

The starting motor pinion is manually engaged with the flywheel gear by the starting switch control linkage before electric contact is made to operate the starting motor. A clutch built in the pinion prevents damage to the starting motor drive when the engine starts. Release the starter button promptly when the engine starts.

FUEL SYSTEM

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 from water and make a periodic inspection for leaks.

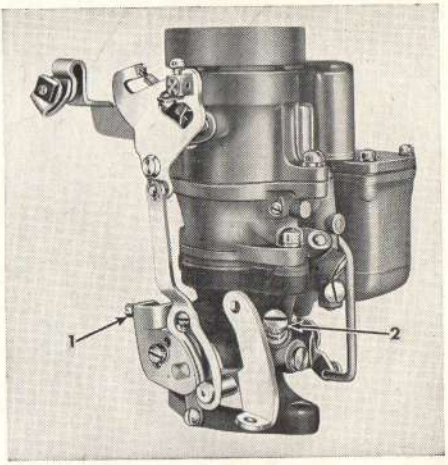


FIG. 13—CARBURETOR

Should the engine 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 empty. 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 can cause untold trouble. It may cause the fuel pump valves or the carburetor float valve to become stuck or possibly block the filter screen. 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 one gallon of gasoline will dissolve any deposits as it passes through the system with the fuel.

CARBURETOR

The Carter carburetor used is a precision instrument designed to deliver the proper fuel and air mixture under all engine operating conditions. Carburetor parts wear little; the chief cause of faulty operation

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 63. 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. No. 2, Fig. 13. To set this adjustment, proceed as follows:

Make sure that the choke is in the fully open position. Close the idle adjustment No. 2 by turning it to the right or in against the seat; then open it one and one-half turns. Start the engine and run it until operating temperature is obtained, then turn the adjustment in or out slightly until the engine fires evenly. Open the throttle for a few seconds to remove any surplus fuel which may have accumulated in the manifold and recheck the adjustment. Set the throttle stop screw No. 1 to secure an idle engine speed of 600 rpm., or approximately 8 mph. (12.4 Km.) vehicle speed in high gear.

AIR CLEANER—DRY TYPE

The filtering element should be washed and re-oiled at each vehicle lubrication or oftener if the vehicle is operated under extremely dusty conditions.

To clean the filtering element, remove the element from the assembly by loosening the wing nut holding it in place. Wash off the accumulated dirt by plunging the element up and down in a suitable solvent. Dry the element and re-oil by dipping it in engine oil, allowing excess oil to drain off before reassembling.

FUEL PUMP

The combination fuel and vacuum pump, Fig. 14 is of the diaphragm type. It is attached to the left side of the crankcase and operated by an eccentric on the camshaft.

The pump draws gasoline from the fuel tank, through a filtering screen

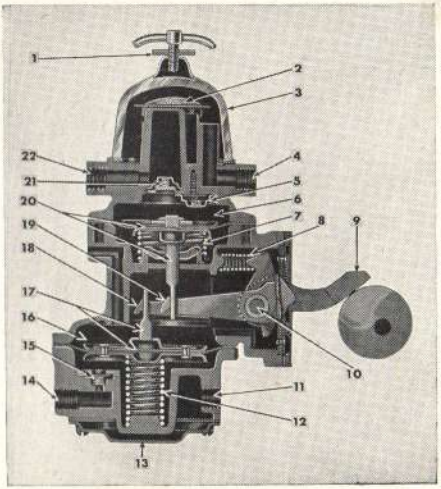


FIG. 14—FUEL AND VACUUM PUMP ASSEMBLY

1—Fuel Strainer Bail and Seat Assembly
2—Fuel Pump Filtering Screen Assembly
3—Fuel Pump Bowl
4—Fuel Inlet
5—Fuel Pump Inlet Valve Assembly
6—Fuel Pump Chamber
7—Fuel Pump Diaphragm Spring
8—Fuel Pump Rocker Arm Spring
9—Fuel Pump Rocker Arm Assembly
10—Fuel Pump Rocker Arm Pin
11—Vacuum Pump Inlet
12—Vacuum Pump Diaphragm Spring
13—Vacuum Pump Bottom Cover
14—Vacuum Pump Outlet
15—Vacuum Pump Valve Assembly
16—Vacuum Chamber
17—Vacuum Pump Diaphragm and Pull Rod Assembly
18—Vacuum Pump Rocker Arm Link
19—Fuel Pump Rocker Arm Link
20—Fuel Pump Diaphragm and Pull Rod Assembly
21—Fuel Pump Outlet Valve Assembly
22—Fuel Pump Outlet

in the pump sediment chamber and forces it to the carburetor. The pump pressure is 4½ lbs. (.8036 kg./cm.) measured at 16″ (40.64 cm.) above the outlet at 1,800 rpm. engine speed.

The most important service necessary with the fuel pump is the cleaning of dirt and water from the sediment chamber and filtering screen. Regular cleaning of the screen and sediment chamber twice yearly will prevent annoying delays due to a clogged screen or water freezing.

The sediment chamber bowl can be removed by backing off the thumb nut sufficiently to permit swinging the wire clamp to one side. The bowl and cover should be washed and wiped dry and the screen dried and then cleaned with a stiff brush. When reassembling the bowl, make certain that the cork gasket is not broken; reverse it and position it flat on the seat then install the bowl and tighten the thumb nut firmly. After cleaning, start the engine and carefully inspect the bowl 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 connection.
3. Bent or kinked tubing.
4. Clogged or frozen fuel line.
5. Sediment bowl loose on fuel pump.
6. Dirty screen.
7. Carburetor inlet valve stuck shut.

Caution: Do not attempt repairs which require disassembling of the fuel pump, other than cleaning, as special care is required. It is recommended that all fuel pump trouble be taken up with your Willys-Overland Dealer.

FUEL SUPPLY TANK

The capacity of the fuel tank is 15 gallons (56.77 liters).

When filling the tank, use care that no foreign matter or water enters. Once each season, at a time when the fuel supply is low in the tank, remove the drain plug in the bottom to drain sediment and water which may have accumulated.

COOLING SYSTEM

The practice of checking the condition of the cooling system of your truck while lubricating it will guard against unnecessary and possibly 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 an unexpected water leak or loose or broken 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 clear.

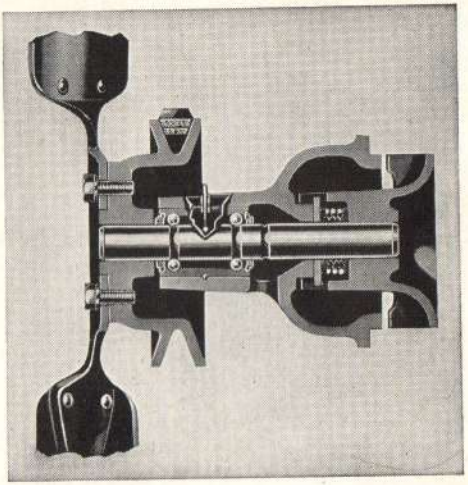


FIG. 15—WATER PUMP ASSEMBLY

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 in the cylinder block, back of the generator. Place a hose in the radiator filler

opening and adjust the water flow 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 will pay to place 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

The filler cap is of the pressure type which helps to prevent evaporation and loss from the cooling system. A pressure in the cooling system up to 4½ pounds (.8036 Kg./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 ½ to 1 pound (.0892 to .1785 Kg./cm.) vacuum.

DRAINING COOLING SYSTEM

Two drain cocks are provided to completely drain the cooling system. When draining the system, to guard against freezing damage, use care that **both** cocks are opened. One drain is in the bottom of the radiator and the other **in the cylinder block** directly behind the generator. Remove the radiator cap to break any vacuum which might prevent thorough draining.

THERMOSTAT

A thermostat, Fig. 4, No. 8 is used to provide quick warming and to prevent overcooling during normal vehicle operation. The temperature at which the unit operates is set by the manufacturer and cannot be altered. The valve starts to open at 148 degrees F. (64.38 cent.) to 155 degrees F. (68.33 cent.) and is fully open at 173 degrees F. (78.33 cent.). Should sudden overheating occur, check the thermostat first as failure of this unit to operate will nearly block the water circulation. As a test remove the thermostat and if overheating is eliminated, install a new one.

HEAT INDICATOR

The heat indicator is of the electric type. The "sending" unit is assembled in a metal case which is screwed into the water passage of the cylinder head. A single wire connects the sender with the indicating unit mounted on the instrument panel.

Should the unit fail in operation, first examine the wire and connections to guard against a broken wire or loose or corroded connection causing the trouble. Should these prove to be in order, disconnect the wire leading to the sender at the dash unit terminal and connect one lead of a 6-volt, 1-cp. test lamp to this terminal and with the ignition switch "ON" hold the other lead against a clean unpainted surface of the instrument panel. If the dash unit is operating correctly the indicating pointer will move approximately three-quarters across the calibrated dial.

Do not attempt to repair or adjust either unit as they are sealed and replacement is the only practical procedure.

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 prelubricated at the time of assembly with a special high melting point grease, so requires no lubrication for the life of the bearing.

The pump is designed to give maximum service without adjustments. Should trouble develop, consult your Willys-Overland Dealer.

FAN BELT

The fan and generator are driven by a "V" type belt. The drive is on the sides of the belt so it is not necessary to adjust it tight which might cause rapid wear of the water pump and generator bearings. Adjust the belt by swinging the generator away from the engine until the belt can be depressed 1″ (2.54 cm.) by thumb pressure midway between the pulleys.

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 failure in the electrical system.

BATTERY

The battery is of 6-volt, 15-plate, 100-ampere hour capacity. It is located under the hood on a bracket to the right hand side of the dash and is held firmly in the bracket 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 indicates that the battery is fully charged. Should the reading fall below 1.225 it will be necessary to recharge it or else use the lights and starting motor 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 probbly due to loose or corroded terminals or ground connection. The terminal connections should be removed and all corrosion cleaned from them as well as the posts, to insure proper contact. Clean and tighten the ground connections on the frame. A strong solution of baking soda and water will be found effective to neutralize and remove the corrosion.

Clean and tighten the engine ground cable located at the engine right front mounting support, Fig. 11.

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 there are no broken wires and that both units are well grounded. If no trouble is found in the wiring, 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 the 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.

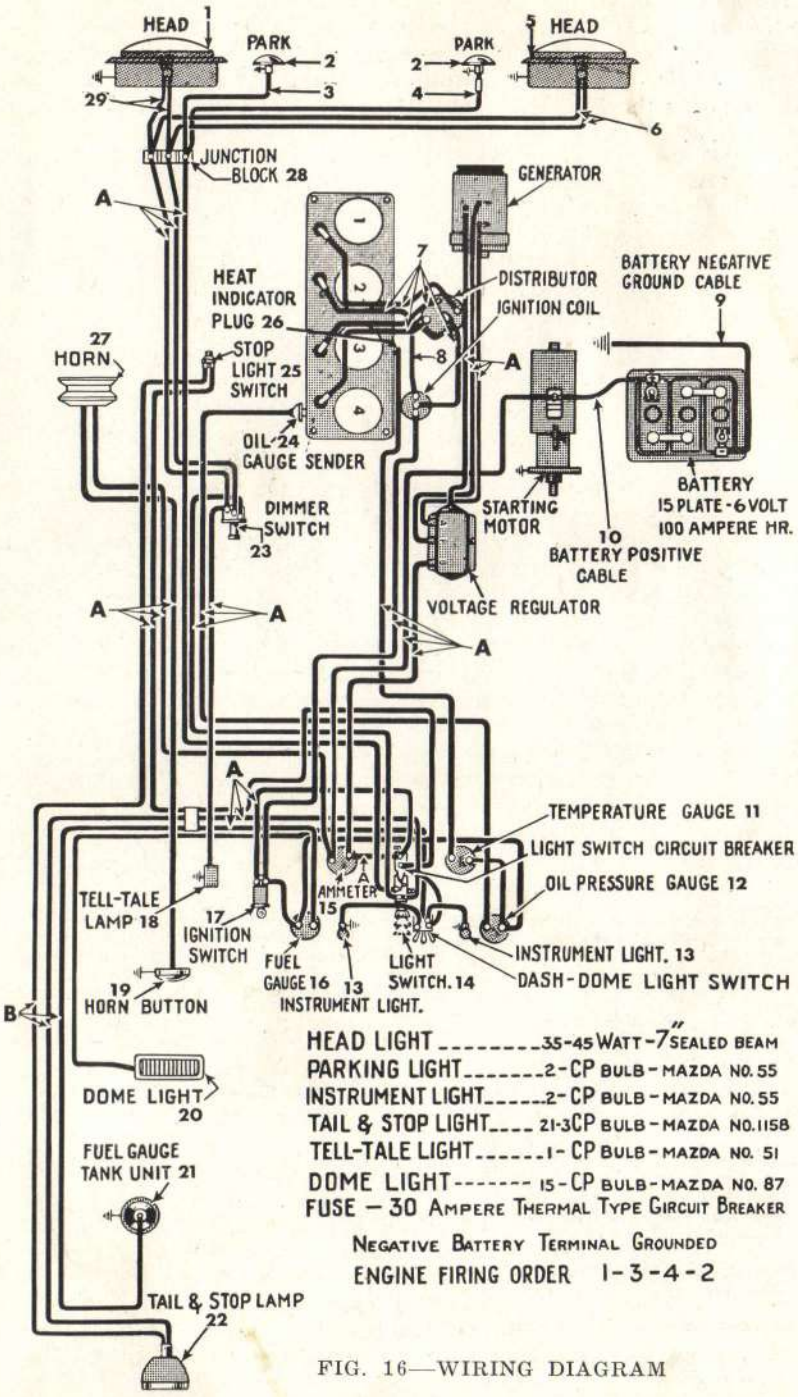


FIG. 16—WIRING DIAGRAM

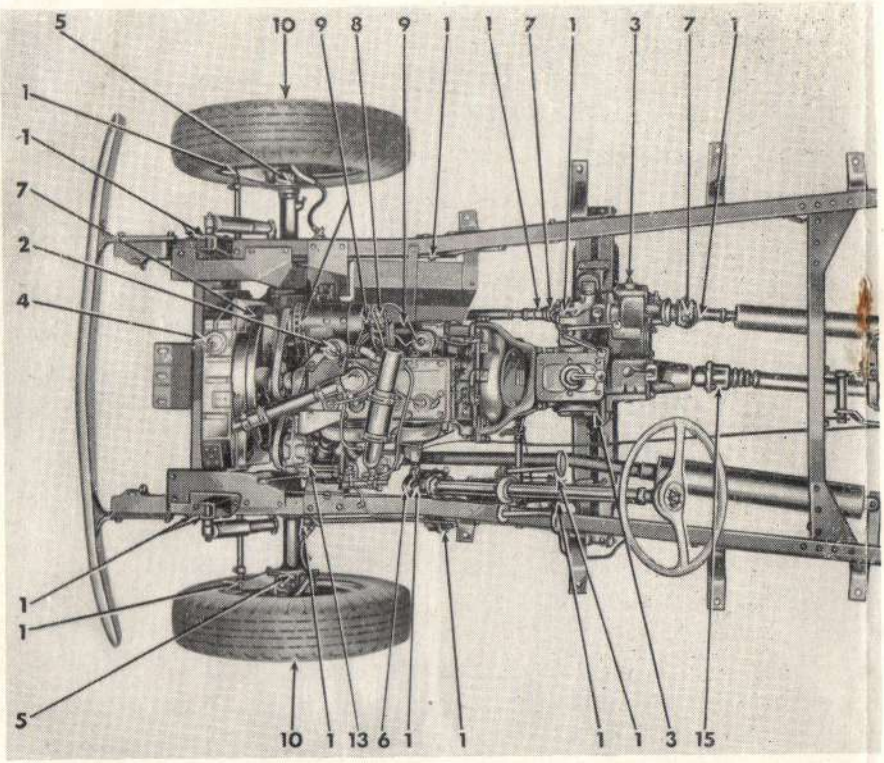


FIG. 17—MODEL 4WD CHASSIS

For Type and Quantity of

1. Chassis Bearings—Clean fittings and lubricate each 1000 miles (1600 Km.) of road service. Oil door hinges and locks, all clevis pins, hood lock and upper end of hand brake conduit. Lubricate these points daily when using the vehicle for field work as the new lubricant will force the old from the bearings with the dirt which may have accumulated.

2. Engine Crankcase—Drain engine oil when hot and refill with new oil each 2000 miles (3200 Km.) of road service. For power take-off and field work change 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.

3. Transmission and Transfer Case—Check oil level in the housings each 1000 miles (1600 Km.). Change the oil each 6000 miles (9600 Km.) of road service or 300 hours of field work. As the requirements of these housings are small for economy, it is important that the oil level be checked regularly and changed as specified.

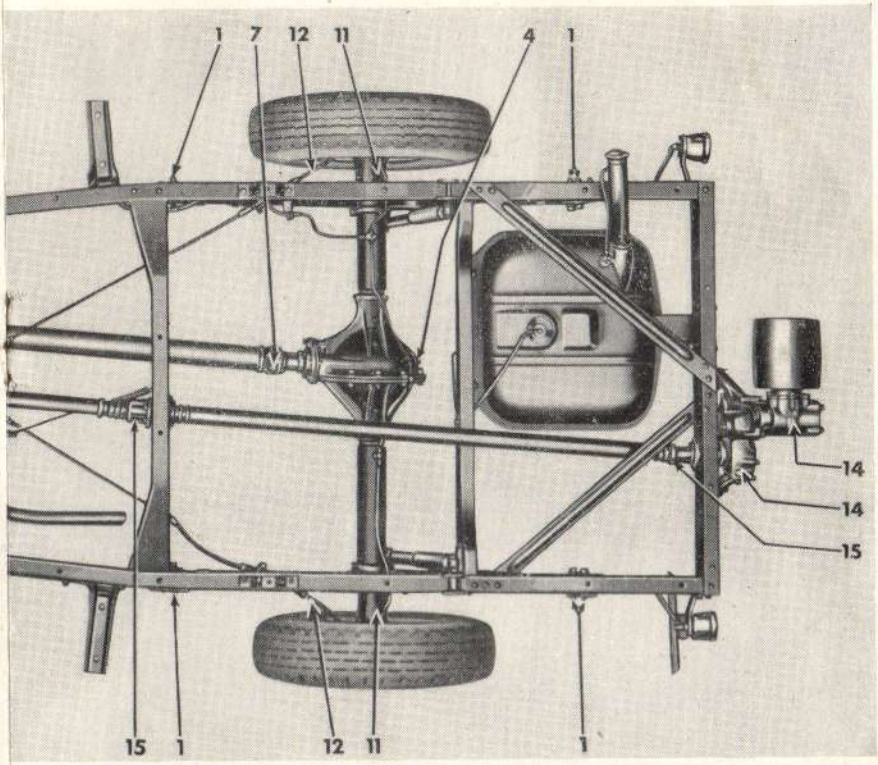
4. Differentials—Front and Rear—Check oil level each 1000 miles (1600 Km.) and change oil each 6000 miles (9600 Km.) of road service and 300 hours of field service.

5. Front Axle Pivot Pin Bearings and Universal Joints—Check the oil level each 1000 miles (1600 Km.). Change the lubricant at each 12000 miles (19200 Km.) or 300 hours of field service.

6. Steering Gear—Check oil level each 1000 miles (1600 Km.). When level is low, use a hand gun to fill the housing slowly.

7. Universal Joints—Lubricate each 1000 miles (1600 Km.).

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 the wick under the rotor and sparingly apply soft grease on the breaker arm cam and a drop of oil on the breaker arm pivot.



AND LUBRICATION CHART

Lubrication see Pages 15 and 16.

9. Generator and Starting Motor—Place three to five drops of oil in the oilers each 1000 miles (1600 Km.). DO NOT OVER-LUBRICATE.

10. Front Wheel Bearings—Remove the front wheel bearings to thoroughly clean and lubricate each 6000 miles (9600 Km.) or 300 hours of field work. See Page 20.

11. Rear Wheel Bearings—Lubricate the rear wheel bearings sparingly with a hand compressor. See Page 17.

12. Hand Brake Cables—Lubricate the hand brake cables, enclosed by conduits, each 12,000 miles (19200 Km.) or once each year. Use a good quality graphite grease.

13. Governor—At each 1,000 miles (1600 Km.) or equivalent check the oil level in the housing. Drain and refill each time engine oil is changed. Do not over-fill.

14. Power Take-Off and Belt Pulley Housing—Check the oil level each 1,000 miles (1600 Km.) or equivalent. Should the units be used often, change the oil each 300 hours.

15. Power Take-Off Universal Joints—For average service the original lubrication will last for the life of the unit. If the power take-off is used often for continuous operation, disassemble and lubricate once each year.

Pintle Hook—Place a few drops of engine oil on the hook and hook-lock pivots each 1,000 miles (1600 Km.).

Air Cleaner—Oil Bath—Clean the air cleaner and replace the oil each 2000 miles (3200 Km.). Service this unit according to conditions of operation—twice daily when the vehicle is used in very dusty field service.

Note: The water pump, the clutch release and the power take-off propeller shaft intermediate bearings are lubricated at assembly, and the lubricant lasts for the life of the bearings.

Caution—Do not use lubricant of any kind on the shock absorber rubber mounting connections.

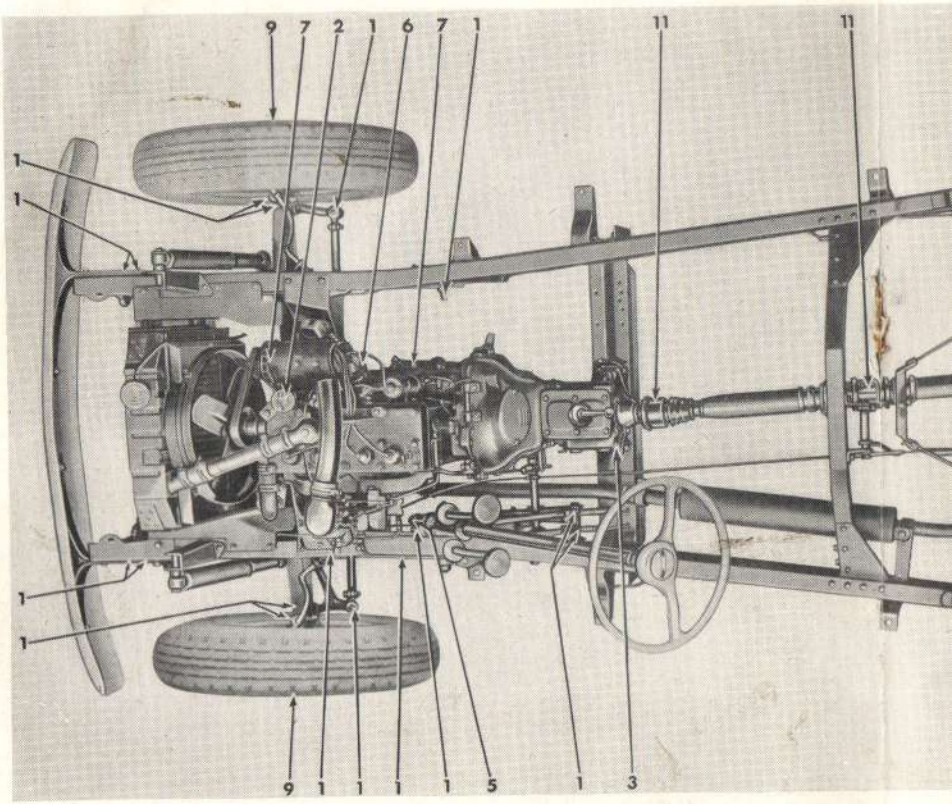


FIG. 18—MODEL 2WD CHASSIS AN
For Type and Quantity of Lubrican

1. Chassis Bearings—Lubricate each 1,000 miles (1600 Km.) with a compressor—prevents excessive wear, rattles and squeaks.

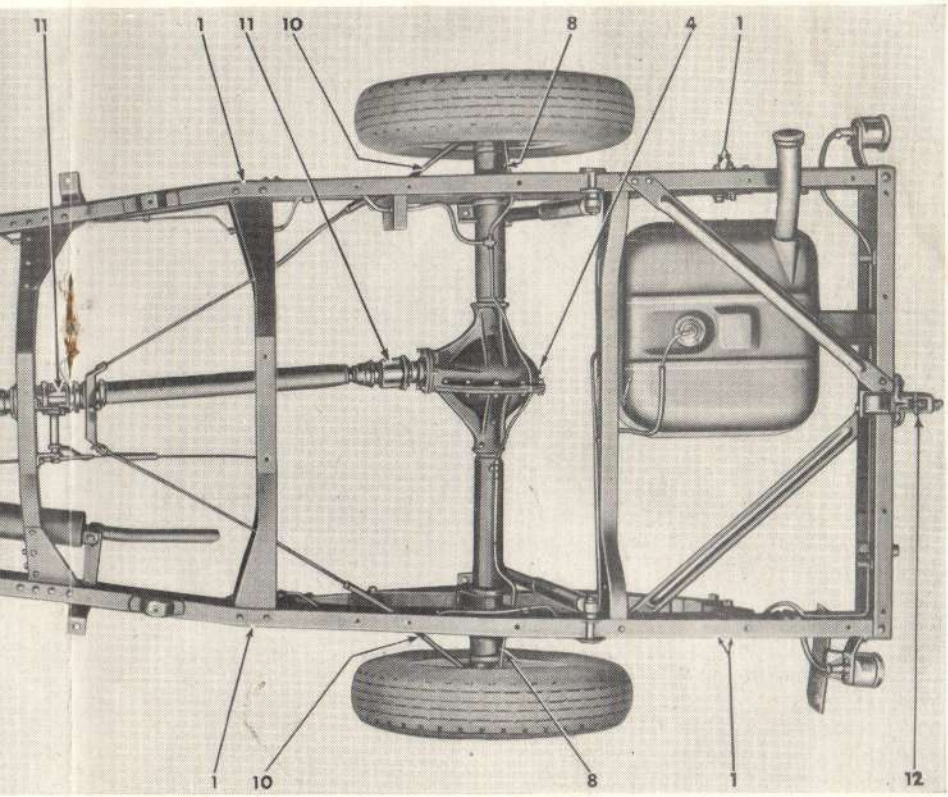
2. Engne Crankcase—Refill the engine with fresh oil every 2,000 miles (3200 Km.)—drain when hot. Watch the condition of the oil carefully and should it become contaminated due to conditions of operation change it immediately.

3. Transmission—Check the transmission lubrication level each 1,000 miles (1600 Km.). Change the oil each 6,000 miles (9600 Km.).

4. Differential—Check the differential lubricant level each 1,000 miles (1600 Km.). Change the oil each 6,000 miles (9600 Km.).

5. Steering Gear—Check the level of the lubricant in the steering gear housing each 1,000 miles (1600 Km.). When level is low fill the housing slowly with a hand gun. Avoid the use of cup grease, graphite or heavy solidified oil.

6. Distributor—Lubricate the distributor each 1,000 miles (1600 Km.). Place several drops of engine oil in oiler at side of housing; also place a drop of light oil on the wick in shaft end under the rotor and sparingly apply soft grease on the breaker arm cam and a drop of oil on the breaker arm pivot.



CHASSIS AND LUBRICATION CHART
y of Lubricant see Pages 15 and 16.

7. Generator and Starting Motor—Lubricate the starting motor and generaor with three to five drops of oil placed in the oilers each 1,000 miles (1600 Km.). Do not over-lubricate.

8. Rear Wheel Bearings—Lubricate the rear wheel bearings sparingly with a compressor.

9. Front Wheel Bearings—Remove the front wheel bearings to clean them thoroughly and relubricate them each 6,000 miles (9600 Km.).

10. Hand Brake Cables—Lubricate the hand brake cables, enclosed by conduits, each 12,000 miles (19200 Km.) or once each year. Use a good quality graphite grease.

11. Universal Joints—The universal joints were prelubricated at assembly. Disassemble and repack the joints each 20000 miles (32000 Km.). See Pages 18 and 48.

12. Pintle Hook—Oil the pintle hook joints each 1000 miles (1600 Km.) with engine oil.

Air Cleaner—Clean the air cleaner reservoir and refill to the level mark with oil of the same grade used in the engine at each engine oil change or more often when used under dusty conditions.

Note: The water pump and clutch release bearings are prelubricated at assembly and the lubricant will last for the life of the bearings.

Caution: Do not use any lubricant on the shock absorber rubber mounting connections.

Should a new tank unit be unavailable for this test, the instrument panel unit may be tested with a 6-volt, 1 cp. test light. Remove the wire (connecting the two units) from the instrument panel unit. Connect one lead of the 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 practical 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 used. The circuit breaker clicks on and off in the event of a short circuit in the wiring.

The upper and lower headlight beams are controlled by a foot switch located on the toe board at the left of the clutch pedal.

MAIN LIGHT SWITCH

The main light switch, Fig. 19 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, all 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.

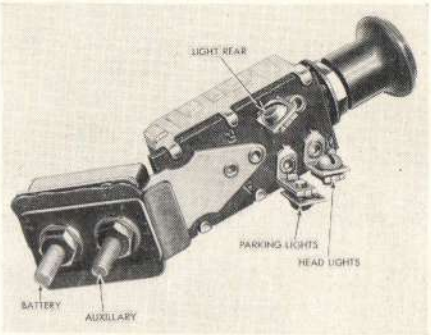


FIG. 19—MAIN LIGHT SWITCH

To remove the switch, loosen the set screw 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.

STOPLIGHT SWITCH

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

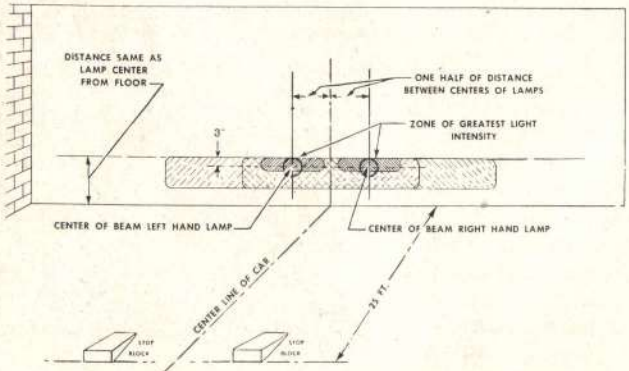


FIG. 20—HEADLIGHT AIMING CHART

HEADLIGHT AIMING

Head lamps may be aimed correctly by using an aiming screen or wall, Fig. 20, providing a clear, level space of 25 feet (7.6 m.) from the front of the headlights to the screen or wall is available.

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

Place the vehicle on the floor with tires inflated to the recommended pressure for highway use. Set the vehicle 25 feet (7.6 m.) 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 3 inches (76.2 mm.) *less*.

Turn on the 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 sealed beam unit until the beam is correctly aimed, then tighten.

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

CLUTCH

The clutch, Fig. 22 is of the single, dry plate type consisting of a pressure plate assembly and a faced driven plate. The pressure plate is equipped with three pressure springs to provide the driving pressure and three release levers for disengagement. The driven plate is spring cushioned to provide smooth engagement.

Clutch release is accomplished by moving the release bearing, Fig. 22, No. 7, toward the flywheel to compress the pressure springs through action of the three levers. 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, Fig. 22 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 down before the release bearing makes contact with the control lever. The correct free travel clearance is 1¼" (3.175 cm.). See Fig. 21. This adjustment is important for, without free travel in the pedal, the release bearing is operating at all times with resulting wear, also part of the driving spring pressure is dissipated at the release bearing which may result in clutch slippage.

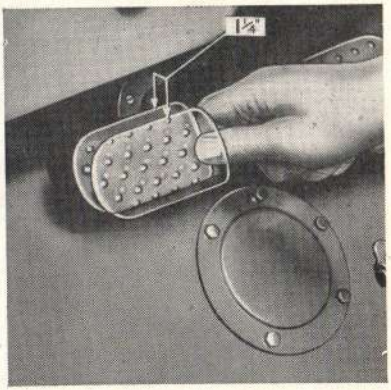


FIG. 21—CLUTCH PEDAL ADJUSTMENT

The free pedal travel is adjusted at the threaded connection between the clutch control lever and the clutch control tube lever, Fig. 23. To increase the free travel loosen the lock nut No. 12 and screw adjusting nut No. 11 forward. No adjustment of the clutch proper is required to compensate for wear on the facings.

CAUTION: Avoid the practice of resting the foot 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.

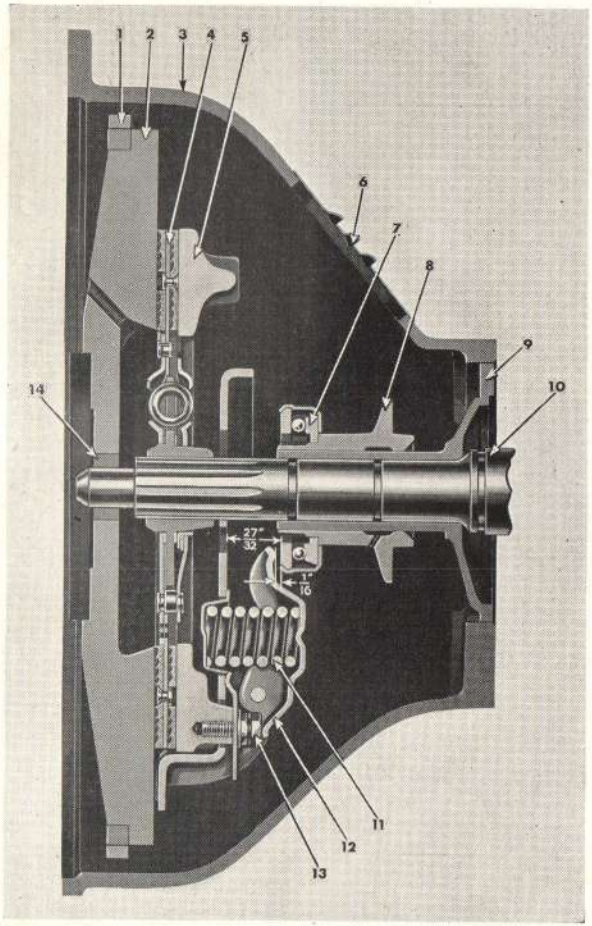


FIG. 22—CLUTCH ASSEMBLY

1—Flywheel Ring Gear
2—Flywheel
3—Flywheel Housing
4—Clutch Driven Plate and Hub
5—Clutch Pressure Plate
6—Inspection Opening Cover
7—Clutch Release Bearing
8—Clutch Release Bearing Carrier
9—Transmission Main Drive Gear Bearing Retainer
10—Transmission Main Drive Gear
11—Clutch Pressure Spring
12—Clutch Lever
13—Clutch Adjusting Screw

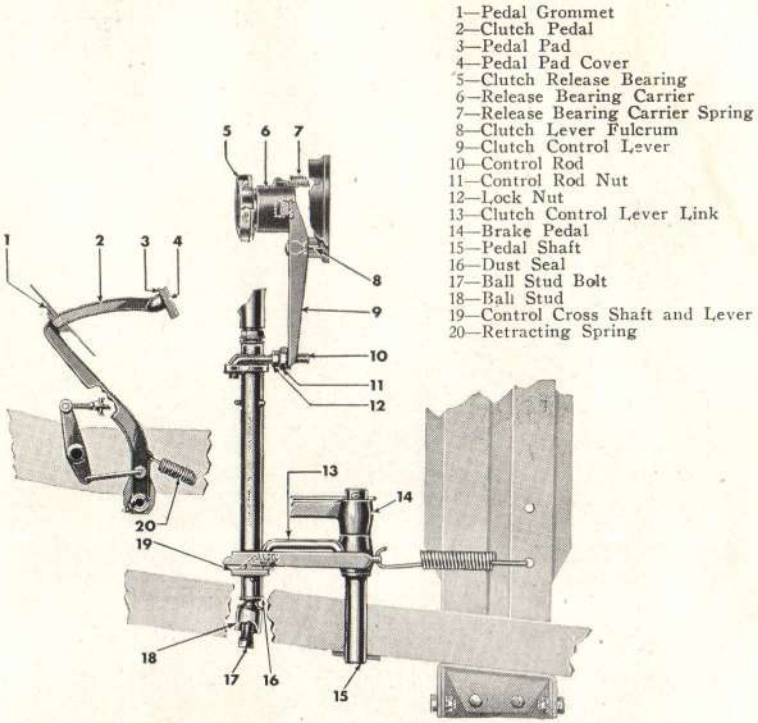


FIG. 23—CLUTCH CONTROL

TRANSMISSION

The transmission is a three-speed synchro-mesh type unit with cane type shift. It is bolted 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 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.

Basically both the 2WD and 4WD transmissions are the same. Most parts are interchangeable, however, necessary changes have been made at the rear end of the main shaft of the 4WD unit to allow installation of the transfer case required for four-wheel drive.

Should any trouble be experienced with the transmission assembly, consult your Willys-Overland Dealer.

TRANSFER CASE—MODEL 4-WD

The transfer case, Fig. 25, 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.

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

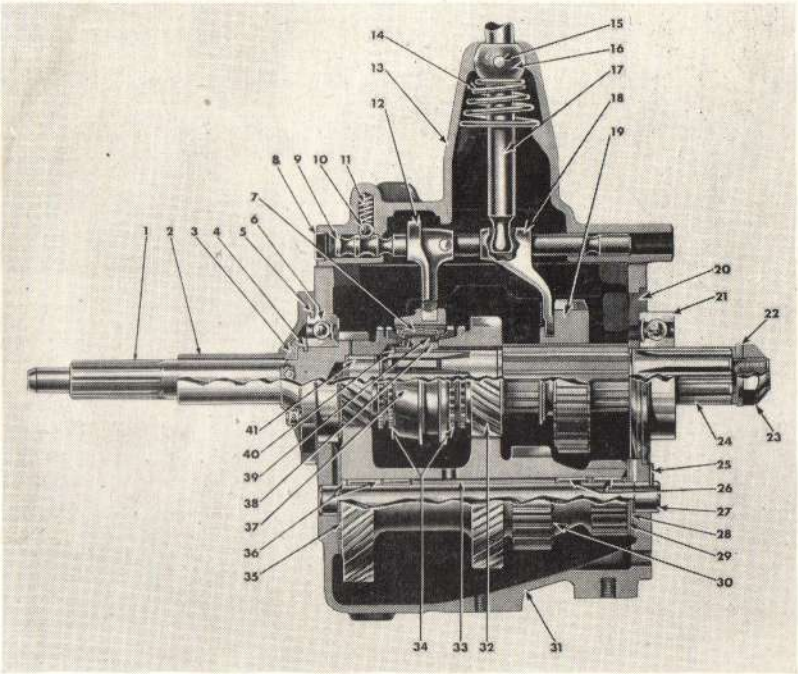


FIG. 24—TRANSMISSION

1—Main Drive Gear
2—Main Drive Gear Bearing Retainer
3—Main Drive Gear Bearing Reainer Oil Seal
4—Main Drive Gear Snap Ring
5—Main Drive Gear Bearing Snap Ring
6—Main Drive Gear Bearing
7—Synchronzer 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—Countershaft 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

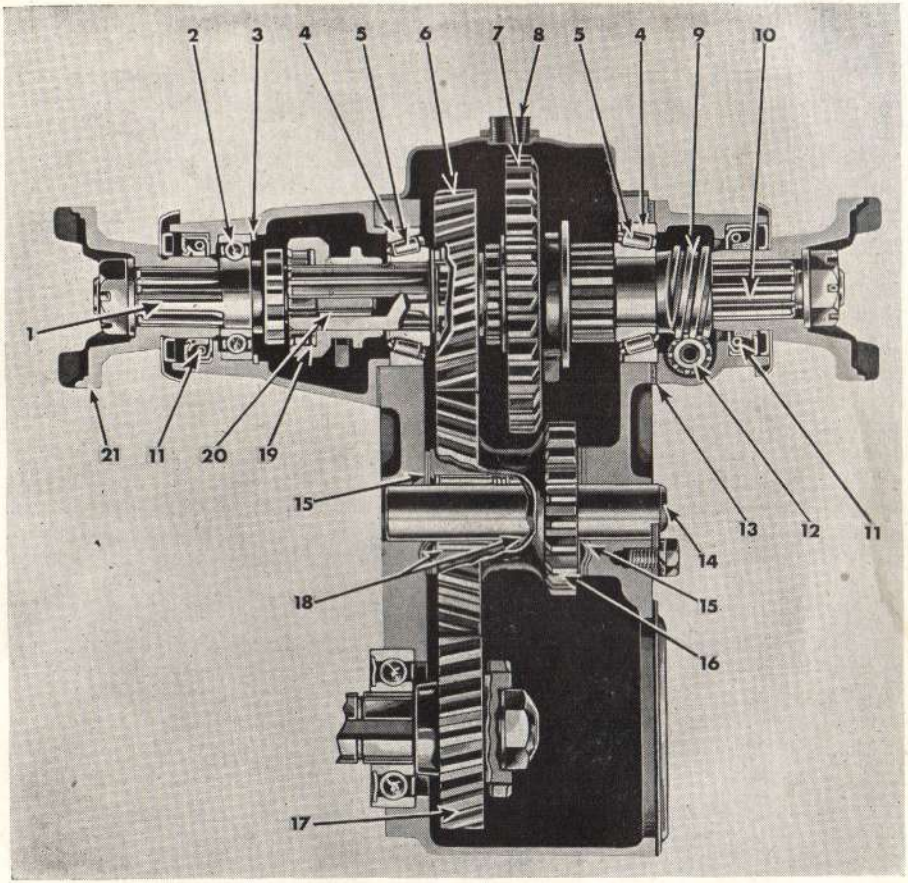


FIG. 25—TRANSFER CASE

Model 4WD

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

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. 2. 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.

The proper position for disengaging the axles to use the power take-off with the vehicle standing is shown as "N" in Fig. 2, 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 lubrication leakage. For economy the capacity is small—change the lubricant as instructed in the "Lubrication Section."

PROPELLER SHAFT—MODEL 2-WD

The drive from the transmission to the rear axle is through two tubular propeller shafts and three universal joints. The center universal joint is carried by a prelubricated and sealed ball bearing mounted in a rubber cushion, which is supported by a bracket attached to the frame cross-member.

The universal joints are enclosed by housings, which retain the lubricant and prevent the entrance of dust and dirt. The joints require little attention other than the usual inspection to guard against leakage of the lubricant and loose companion flange bolts. For information covering lubrication refer to Page 18.

PROPELLER SHAFTS—MODEL 4-WD

The drive from the transfer case to the front and rear axles is completed through two propeller shafts and four universal joints. Splined slip joints are provided at the transfer case ends to allow for variation in distance between the transfer case and the axles, due to spring action.

The journal trunnion and needle bearing assemblies are the only parts subject to wear, and should it be necessary to replace them, the propeller

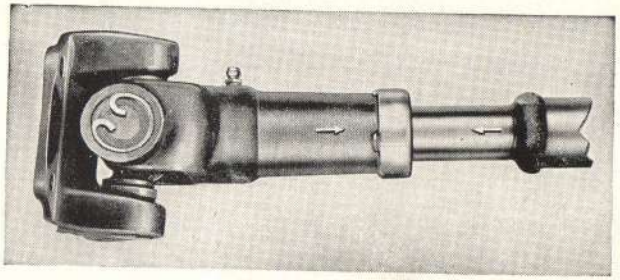


FIG. 26—ARROW MARKING—Model 4WD

shaft assembly must be removed. The needle type bearings are so designed that correct assembly is very simple. No hand fitting is required.

When reinstalling, note that the slip joint is marked with arrows, Fig. 26, at the spline and the sleeve yoke. Align these arrows so that the universal joint yokes at the front and rear of the shaft are in the same plane, which is necessary to avoid vibration.

Be sure the joint attaching bolts are tight at all times, however, guard against over-tightening the "U" type attaching bolts and be sure to draw them up evenly.

FRONT AXLE—MODEL 2-WD

The front axle is of the conventional "I" beam type with the front springs underslung. The load is carried on thrust type ball bearings at each spindle and on tapered roller bearings at the wheels. Wheel camber and caster are built into the axle and cannot be altered by adjustment.

FRONT AXLE—MODEL 4-WD

The front axle is a live driving unit with hypoid drive gears, Fig. 28 and spherical steering knuckles, Fig. 31, containing constant velocity type axle shaft universal joints.

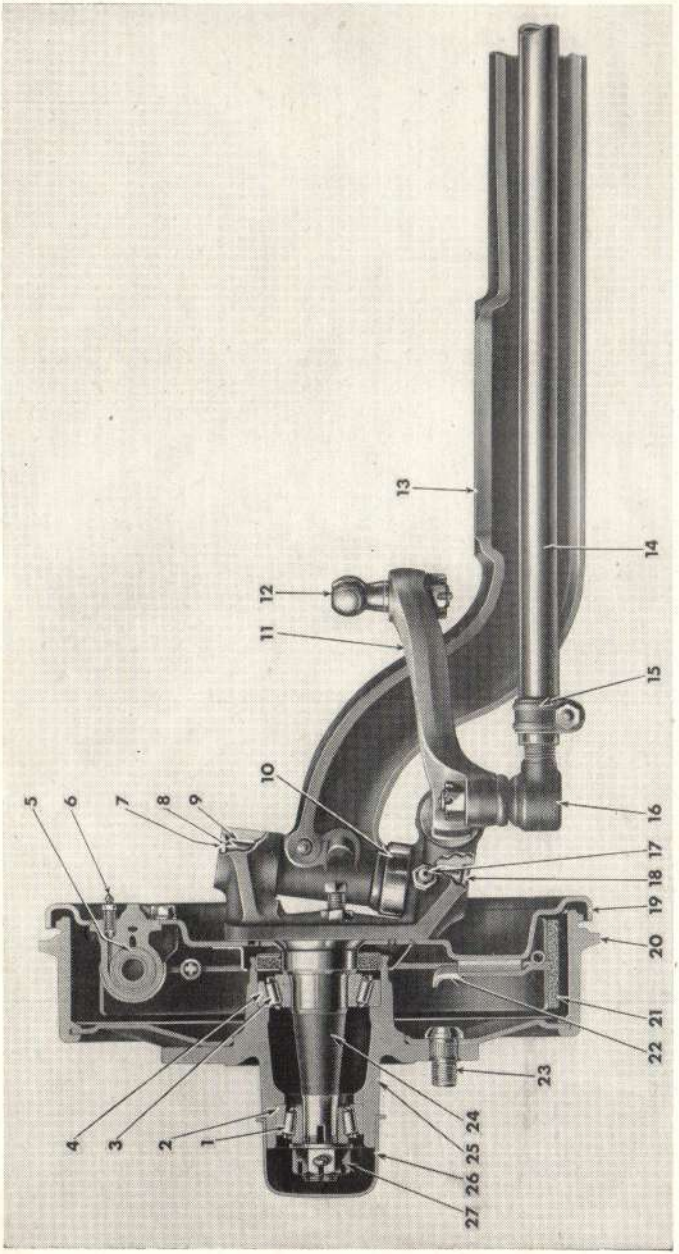


FIG. 27—FRONT AXLE ASSEMBLY—Model 2WD

1—Front Wheel Bearing Cone and Rollers—Outer
2—Front Wheel Bearing Race—Outer
3—Front Wheel Bearing Cone and Rollers—Inner
4—Front Wheel Bearing Race—Inner
5—Wheel Brake Cylinder
6—Wheel Brake Cylinder Bleeder Screw
7—Pivot Bolt Expansion Plug—Upper
8—Pivot Bolt
9—Steering Knuckle Bushing
10—Pivot Bolt Thrust Bearing
11—Steering Knuckle Arm
12—Steering Arm Ball
13—Front Axle "I" Beam
14—Steering Tie Rod
15—Steering Tie Rod Clamp
16—Steering Tie Rod Socket Assembly
17—Hydraulic Lubricator
18—Pivot Bolt Expansion Plug—Lower
19—Brake Backing Plate Assembly
20—Brake Drum
21—Brake Shoe Assembly
22—Brake Shoe Retainer Plate
23—Wheel Hub Bolt
24—Steering Knuckle Assembly
25—Front Wheel Hub
26—Hub Cap
27—Front Axle Spindle Nut

The differential drive gears are mounted in a housing similar to that used in the rear axle, except 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 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.

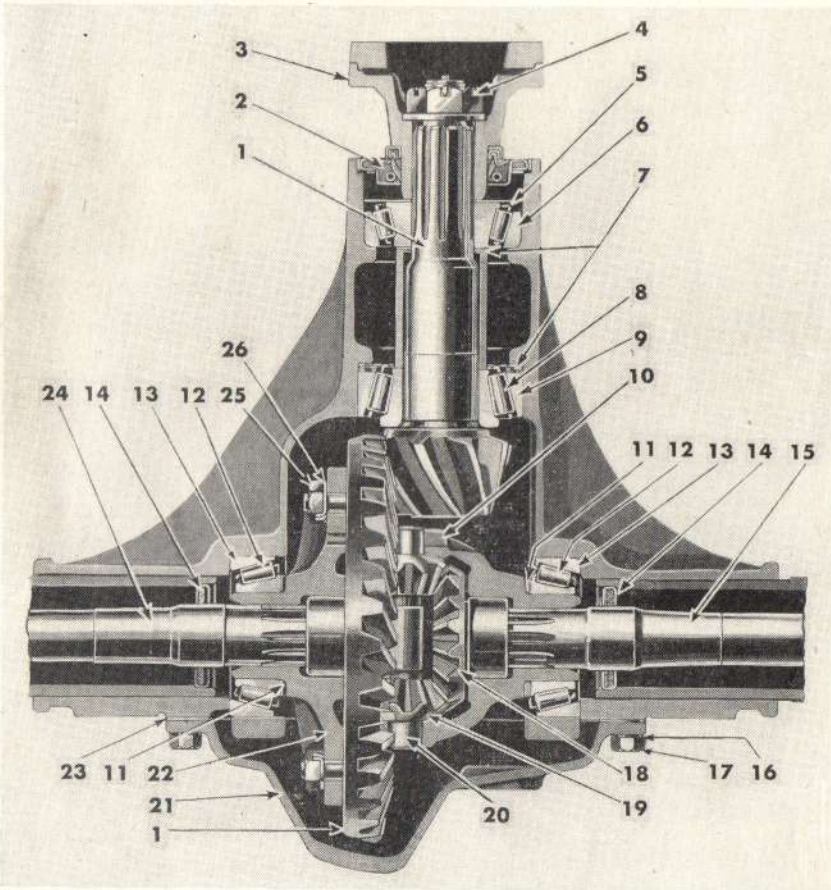


FIG. 28—FRONT AXLE DIFFERENTIAL—Model 4WD

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

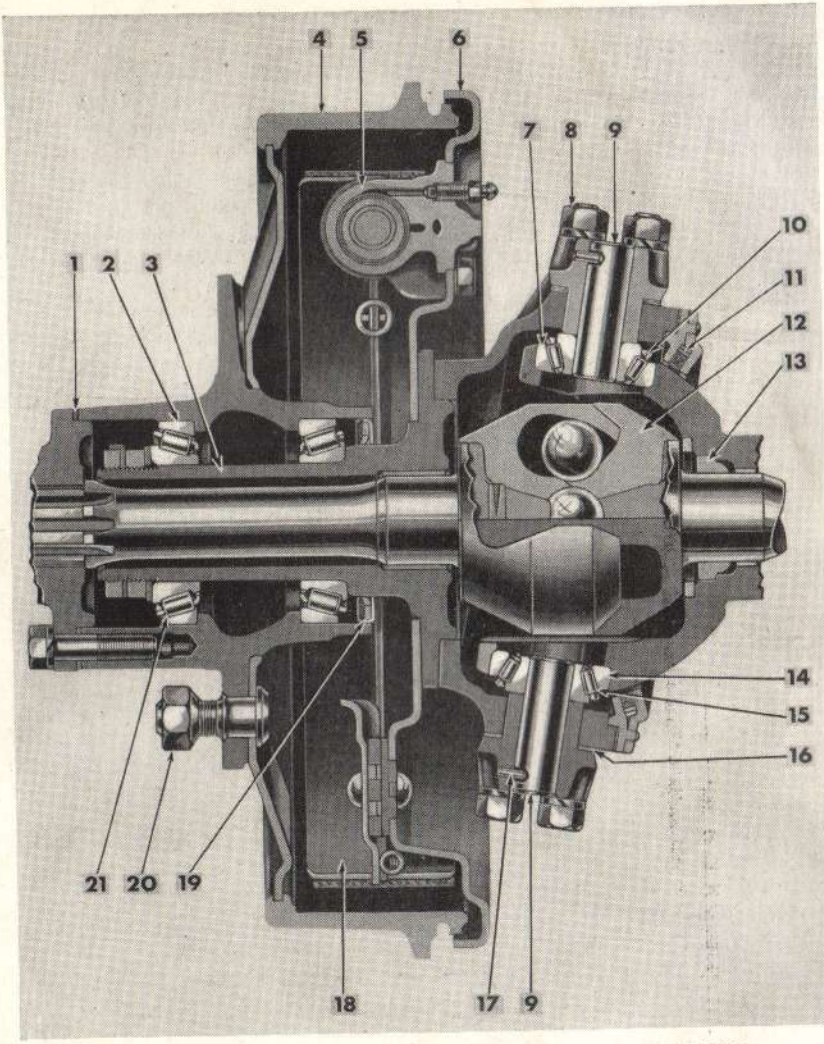


FIG. 29—FRONT STEERING KNUCKLE—Model 4WD

1—Shim Pack
2—Wheel Bearing Cup
3—Wheel Spindle
4—Brake Drum
5—Brake Cylinder Assembly
6—Backing Plate Assembly
7—King Pin Bearing Cup
8—Nut
9—King Pin
10—King Pin Cone and Roller Bearing
11—Oil Seal
12—Universal Joint Assembly
13—Axle Shaft Bushing
14—King Pin Bearing Cup
15—King Pin Bearing Cone and Rollers
16—Adjusting Shim Pack
17—Lock Pin
18—Brake Shoe and Lining Assembly
19—Hub Oil Seal Assembly
20—Wheel Hub Bolt
21—Wheel Bearing Cone and Rollers

A spring loaded air vent or breather is mounted on the differential housing cover. It is important that this vent be free of dirt at all times.

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 lubricant as specified in the "Lubrication Section."

The lubricant is retained in the steering knuckle housings by oil seals mounted in twin retainers attached to the inner face of the housings as shown as No. 13, Fig. 29. These seals also prevent dirt and grit entering the housings.

Replacement of the oil seal halves can be easily made by removing the eight screws which hold them in place. Before reinstalling the seals, examine the spherical surface of the housings for scores or scratches which might wear the seals. Roughness of any kind should be smoothed down with emery cloth.

After driving in wet, freezing weather, swing the front wheels from right to left to wipe off moisture adhering to the seals and the spherical surfaces of the housings. This will prevent freezing with resulting damage to the seals. Should the vehicle be stored for any length of time, coat these surfaces with light grease to prevent rusting.

REAR AXLE

The rear axle is the semi-floating type with spiral bevel drive gears, Fig. 30.

End float of the axle shafts and adjustment of the tapered type roller wheel bearings is accomplished by shims placed between the brake backing plate and the axle flange. Sufficient shims are placed at one axle flange **only** to provide .003″ to .007″ (.0762 to .1778 mm.) end float of the rear axle shafts and bearings. The axle shafts butt at the center of the differential and the end float is divided between the two shafts.

To remove a shaft for replacement or re-shimming, first remove the hub cap, the axle shaft cotter pin and the 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. With these parts removed, shims may be added or removed to secure correct shaft and bearing end float or the shaft may be replaced. While in production shims are placed at one axle flange only; they may also be installed at the other flange, if it is found necessary, to obtain the correct end float of a new shaft.

Periodically clean the vent located on top of the axle tube next to the differential housing to guard against its becoming clogged. A clogged vent may allow pressure build-up in the housing causing leakage of the lubricant.

BRAKES

The foot brakes are hydraulically actuated in all four wheels. They are of the floating shoe, self-centralizing type and have chrome-nickel alloy drums.

The hand brake is mechanically controlled, through cables, which operates the rear brakes.

The foot brake system is shown in Fig. 32. 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 pistons outward in the wheel cylinders, 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 pressure against the drum.

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.

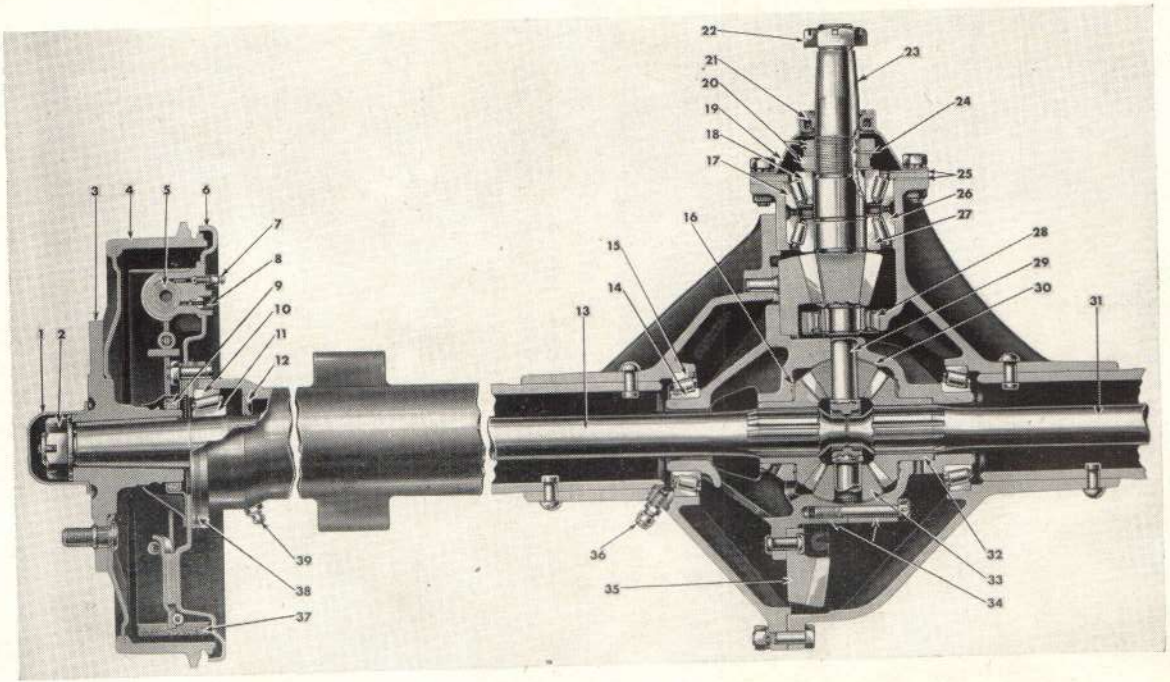


FIG. 30—REAR AXLE ASSEMBLY

1—Wheel Hub Cap—Left or Right
2—Axle Shaft Nut
3—Wheel Hub
4—Brake Drum
5—Brake Cylinder Assembly—Rear
6—Brake Backing Plate
7—Brake Cylinder Bleeding Screw
8—Brake Hose Connection
9—Axle Shaft Grease Retainer—Outer
10—Axle Shaft Bearing Race
11—Axle Shaft Bearing Cone and Rollers
12—Axle Shaft Grease Retainer—Inner
13—Axle Shaft—Left
14—Differential Bearing Cone and Rollers
15—Differential Bearing Race
16—Differential Side Gear Thrust Washer
17—Pinion Shaft Bearing Race
18—Pinion Shaft Bearing Cone and Rollers
19—Pinion Front Bearing Cover
20—Pinion Front Bearing Adjusting and Lock Nut
21—Pinion Cover Oil Seal
22—Pinion Nut
23—Pinion
24—Pinion Adjusting Nut Lock
25—Pinion Cover Gaskets
26—Pinion Bearing Race
27—Pinion Bearing Cone and Rollers
28—Pinion Rear Bearing
29—Differential Spider
30—Differential Pinion Thrust Washer
31—Axle Shaft Right
32—Differential Side Gear
33—Differential Pinion
34—Differential Case
35—Spiral Bevel Drive Gear
36—Axle Breather (Shown 90° out of position)
37—Brake Shoe Assembly
38—Axle Shaft Bearing Shim
39—Lubricator

The master cylinder is directly in front of the foot brake pedal and may be reached by raising the hood. Keep the cylinder reservoir full at all times. Use only genuine hydraulic brake fluid. Check the level each 1,000 miles (1600 Km.) and use care, when removing the filler plug, that no dirt enters the reservoir. The fluid capacity is approximately ¾ pint (0.36 liters).

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. Air 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

When the brake linings become worn, the effective brake pedal travel is reduced. The effective travel may be restored by adjusting the brake shoes.

Before adjusting the brakes, check the spring clip nuts, brake dust shield to axle flange bolts, and wheel bearing adjustments because any looseness in these parts will cause grabby or erratic brake action.

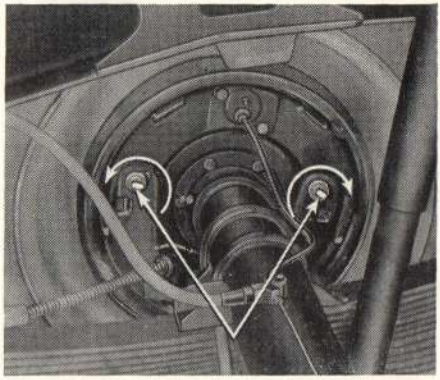


FIG. 31—BRAKE ADJUSTMENTS

Move the hand brake lever to the released position or as far forward as possible. Be sure the brake pedal retracting spring returns the brake pedal freely to the released position against the toe board. Also make sure that the pedal has approximately ½" (1.27 cm.) free travel without moving the master cylinder piston, which is necessary to prevent the brakes from dragging due to expansion of the hydraulic fluid.

Brake adjustment is accomplished as follows:

1. Jack up all four wheels in a safe manner.
2. Centralize the brake shoes in the drums by making a hard brake application and releasing the pedal.
3. At each *left front* and *left rear* wheel turn the *forward* shoe adjusting cam *clockwise* until the shoe is tight against the drum. Turn the cam in the opposite direction until the wheel rotates freely without brake drag. Turn the *rear* shoe adjusting cam *counter-clockwise* until the shoe is tight against the drum, then turn the cam in the opposite direction until the wheel rotates freely without drag. See Fig. 31.
4. At each *right front* and *right rear* wheel turn the *forward* shoe adjusting cam *counter-clockwise* until the shoe is tight against the drum, then turn the cam in the opposite direction until the wheel rotates freely without drag. Turn the rear shoe adjusting cam *clockwise* until the shoe is tight against the drum, then turn the cam in the opposite direction until the wheel rotates freely without drag.
5. Remove the jacks.

The brake shoes are self-centralizing so no anchor adjustments are required, also, as the fluid pressure is equal in all parts of the system the brakes are self-equalizing.

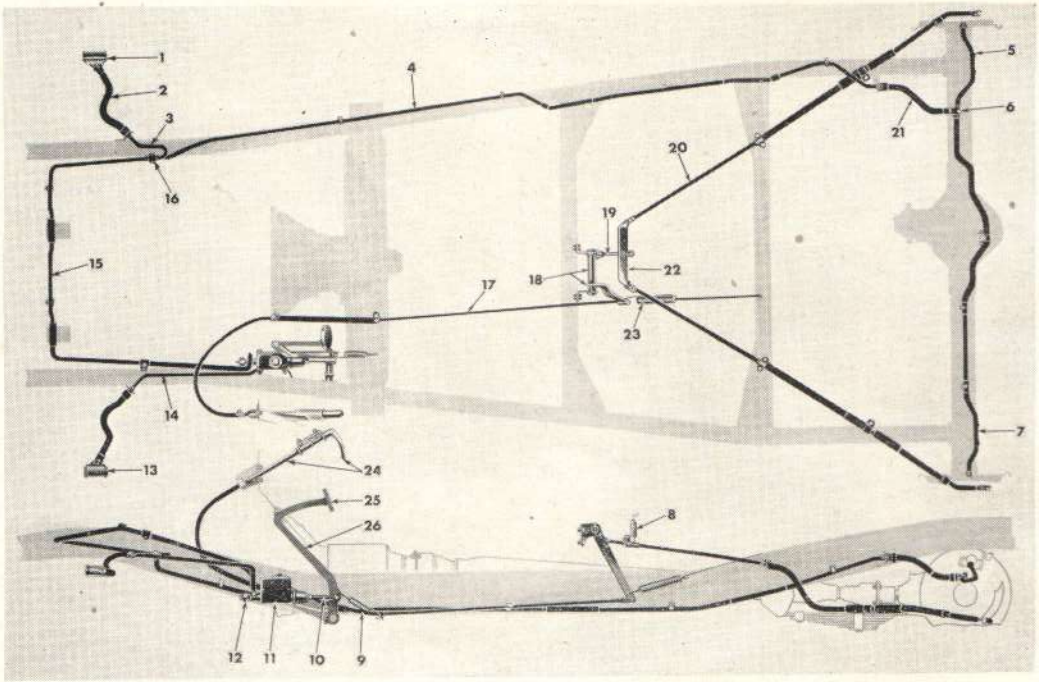


FIG. 32—HYDRAULIC BRAKE SYSTEM

1—Right Front Brake Cylinder
2—Front Brake Hose
3—Right Front Brake Tube
4—Right Brake Tube
5—Right Rear Brake Tube
6—Rear Axle Tube Tee
7—Left Rear Brake Tube
8—Retracting Spring
9—Pedal Retracting Spring
10—Eye Bolt
11—Master Cylinder
12—Stop Light Switch
13—Left Front Brake Cylinder
14—Left Front Brake Tube
15—Front Brake Tube
16—Front Brake Tube Tee
17—Hand Brake Front Cable
18—Hand Brake Lever
19—Adjusting Rod
20—Hand Brake Rear Cable
21—Rear Brake Hose
22—Equalizer Bar
23—Retracting Spring
24—Hand Brake Handle
25—Brake Pedal Pad
26—Brake Pedal

HAND BRAKE ADJUSTMENT

The hand brake system should be adjusted only after the foot brakes have been adjusted. Pull up the hand brake control handle two notches before adjusting the brake cable adjusting rod, No. 19, Fig. 32. Loosen the locknut and tighten the adjustment until a slight drag is felt at the rear wheels, then relock the adjusting nut. Release the hand brake control handle and check the rear wheels to be sure that the brakes do not drag.

BRAKE MAINTENANCE

Keep brakes free of grease and oil as they cannot be expected to work well when little braking friction can be obtained between the linings and drums.

The wheel bearings should be lubricated only with wheel bearing grease, also use care that excessive lubricant is not put into the wheel bearings or the differential.

When wheels are removed, wash out the drums with solvent to remove all grease and dirt. Should there be any grease on the brakes, wash them thoroughly. It will be necessary to replace the brake lining should it become thoroughly saturated with lubricant.

When the rear wheels are removed the hand brake control cables should be lubricated. To lubricate the cables, clean the exposed surfaces, then disconnect the conduits from the brake backing plates by removing the retaining clips. Remove the clamps at the front end of the conduits and slide the conduits forward until the parts of the cables ordinarily covered are exposed. Apply graphite grease liberally to the cables after which reasemble conduits in their original positions.

STEERING SYSTEM

The steering system requires little attention other than proper lubrication and the maintenance of correct wheel alignment.

Alignment may be thrown out by striking curbs or other obstructions. Looseness through the steering system will make it impossible to properly align the front wheels without first adjusting the various connections, including front wheel bearings.

The correct toe-in of both the Model 2-WD and the Model 4-WD is from $\frac{3}{32}$" to $\frac{3}{64}$" (2.379 to 1.188 mm.) which must be accurately measured for satisfactory front tire wear and steering. The best method of checking wheel alignment is by use of a wheel alignment device, which is available in most every well equipped shop. It is impossible to use a straight edge or line to accurately set the toe-in as the tread is less in front than in the rear.

Periodic inspection and adjustment of the steering parts will aid greatly in maintaining alignment. Keep the steering connecting rod and tie rod ball joints snug; they must operate freely without lost motion. Keep the steering gear arm tight on the lever shaft and the steering housing bracket tight on the frame. For information covering adjustment of the front wheel bearings refer to the following paragraphs.

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.

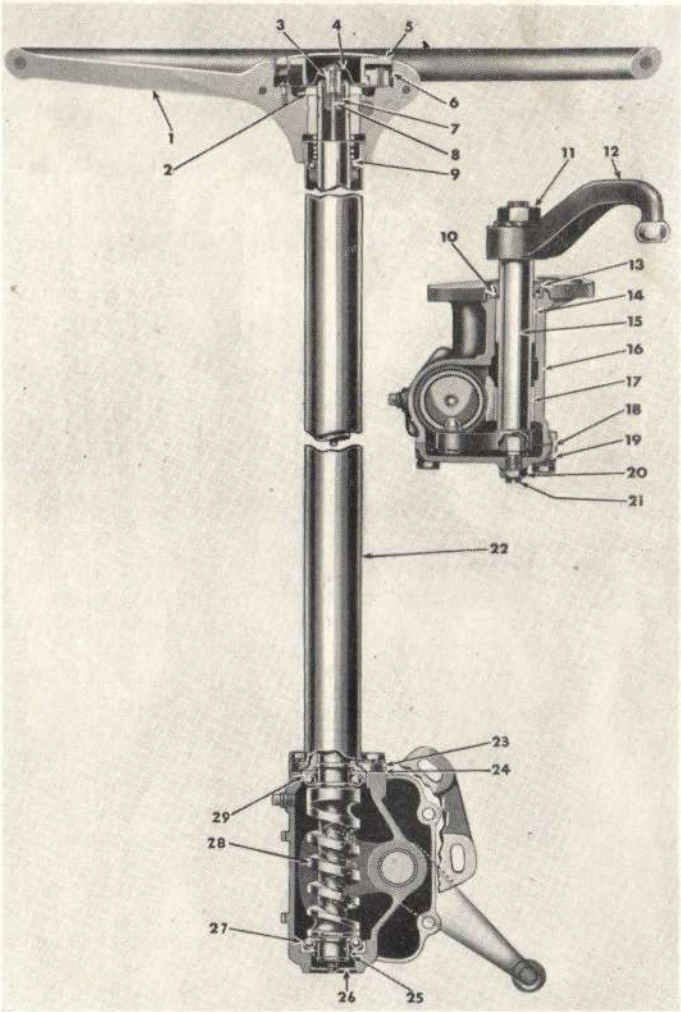


FIG. 33—STEERING GEAR

1—Steering Wheel
2—Steering Wheel Nut
3—Horn Button Ferrule
4—Contact Button Cup
5—Horn Button
6—Trim Ring
7—Horn Button Spring
8—Horn Button Spring Cup
9—Steering Column Bearing
10—Lever Shaft Oil Seal
11—Lever Shaft Nut
12—Steering Gear Arm
13—Lever Shaft Oil Seal Gasket
14—Outer Housing Bushing
15—Shaft and Lever
16—Steering Gear Housing
17—Inner Housing Bushing
18—Side Cover Gasket
19—Housing Side Cover
20—Adjusting Screw Lock Nut
21—Adjusting Screw
22—Steering Gear Column
23—Housing Upper Cover
24—Upper Cover Shim
25—Bearing Snap Ring
26—End Cover
27—Cam Bearing Balls
28—Steering Gear Tube with Cam
29—Cam Bearing Cup

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 regular periodic attention and correct lubrication.

Loose front wheel bearings may cause excessive wear and will effect 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.

FRONT WHEEL BEARING ADJUSTMENT—MODEL 2-WD

Should the test indicate that adjustment is necessary, remove the hub cap, grease cap, and the cotter pin from the adjusting nut. Spin the wheel and while it is turning very slowly, tighten the adjusting nut until a slight braking effect on the turning wheel is noticed; then back off the adjusting nut to the nearest cotter pin hole and install a cotter pin. Be sure the wheel turns freely without bind or without side shake.

FRONT WHEEL BEARING ADJUSTMENT—MODEL 4-WD

Should the check indicate that adjustment is necessary, remove the hub cap, the axle shaft nut and washer, and the axle shaft driving flange with the adjusting shims. See Fig. 29. Bend the lip of the wheel bearing nut locking washer so that the adjusting nut can be loosened. Rotate the wheel slowly 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. Tighten the locking nut, bending over the locking washer lip. Check the adjustment and replace the shims and driving flange, the axle shaft nut and washer and the hub cap. Guard against losing any of the shims as they are necessary for the correct adjustment of the axle shaft universal joint end float.

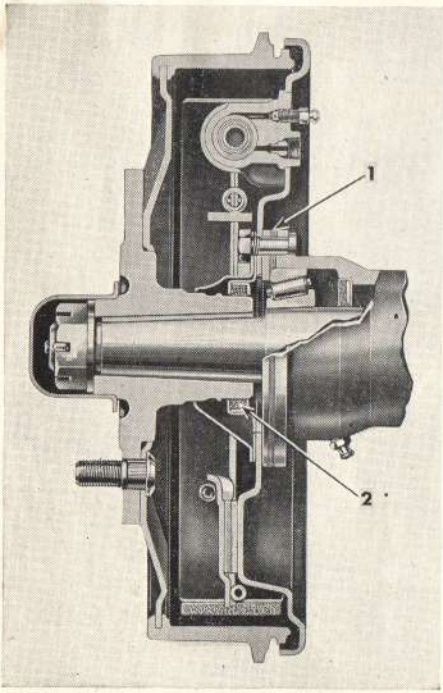


FIG. 34—REAR WHEEL HUB

REAR WHEEL BEARINGS

Each rear wheel is carried on a single tapered roller bearing which is adjusted by shims which in original assembly are placed **only** between one brake backing plate and the axle flange. Fig. 34, No. 1.

Check the 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 to adjust the bearing to provide .003" to .007" (.0762 to .1778 mm.) end-float of the axle shafts.

In production, shims for the adjustment of both bearings are installed at only one axle flange. It is in order to add shims at the opposite flange should they be required to correctly adjust a new bearing or axle shaft.

Examine the grease retainer to be sure it is serviceable; install a new one if in doubt, and reassemble.

MAINTENANCE OF FRONT WHEEL BEARINGS

To insure long service, lubricate and adjust the front wheel bearings once each year.

The bearings should be given more than a 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 with the recommended lubricant (See Lubrication Section) and reassemble in the reverse order of dismantling. Adjust them as directed above.

MAINTENANCE OF REAR WHEEL BEARINGS

The rear wheel bearings are equipped with hydraulic lubricators. Lubricate them sparingly to guard against surplus oil saturating the brake linings.

Should it be necessary to adjust the bearings, clean them thoroughly and repack them with the recommended lubricant. Should the bearings be removed for any reason it is advisable to install new oil seals to guard against leakage of lubricant.

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 the "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 pressure for both the 6.50 x 16 and 7.00 x 16 tire is 30 lbs. (5.357 Kg./cm.) for the front and 45 lbs. (8.036 Kg./cm.) for the rear.

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

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 left front wheel moved straight back to the rear position. Place the spare on the right rear and use the right front as a spare.

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 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 rim, using care not to damage the inner tube.

When mounting the wheel, alternately tighten opposite stud nuts to prevent wheel wobble. After nuts have been tightened, with the wheel jacked up, lower the 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 ends of the front springs and the rear ends of the rear springs are shackled. The rear ends of the front springs and the front ends of the rear springs are bronze bushed and pivoted on bolts in brackets mounted on the frame.

"U" type shackles with threaded bushings are used at the front end of the front springs. The threaded bushings use right and left hand threads depending upon where they are used. One left hand threaded and three right hand threaded bushings are used; the left hand bushing is used in the left spring eye.

For identification the right hand threaded bushings have plain hexagon heads—the left has a groove cut around the head. The left hand threaded "U" shackle is identified by a small forged boss on the lower shank of the shackle.

When making installation use care that the left hand threaded shackle is placed at the front end of the left front spring with the left hand threaded end down.

The bushings are anchored solidly in the frame brackets and in the spring eyes and the oscillation is taken between the threads of the "U" shackles 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 seals and retainers over the threaded ends 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" (.793 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.

Conventional type shackles are used at the rear end of the rear springs. Should the bronze bushings become worn, new bushings may be readily pressed into position and reamed to size. Guard against fitting the bushings too tightly as spring breakage may result.

SHOCK ABSORBERS

The shock absorbers are of the direct action type giving two-way control. They hydraulically dampen spring action, as the vehicle passes over irregularities in the road.

When installing the rear shock absorber, face the stone shield toward the front of the vehicle.

The shock absorbers are mounted on rubber bushings at both the top and bottom. Should squeaks occur in the bushing, 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.

Cold Weather Precautions

With the approach of cold weather, in regions where the temperature drops below freezing, precautions must be taken to prevent freezing of the water in the cooling system. When water freezes it expands and may burst the radiator and cylinder block.

Be careful to completely drain the cooling system (see "Cooling System") when putting up the vehicle in cold weather, unless it is stored in a heated garage or an anti-freeze solution has been added to the water to sufficiently lower the freezing point of the cooling mixture.

ANTI-FREEZE SOLUTIONS

It is important that the cooling system be made leak-proof before installing any anti-freeze solution. Should there be doubt regarding the condition of either radiator or heater hoses, replace them.

Common anti-freeze solutions available are alcohol and ethylene glycol.

The distillation or evaporating point of alcohol is approximately 170 degrees F. (77 cent.). The operating temperature of the engine, when used in heavy duty service and especially when the Model 4-WD is used for belt work through the power take-off, is somewhat higher. As a result, alcohol will not be satisfactory to use as an anti-freeze due to evaporation. Should it be necessary to use it, the solution must be CHECKED OFTEN with a hydrometer to guard against damage due to freezing. Alcohol is satisfactory for highway use, however, it must be checked frequently to make certain that freezing will not occur at anticipated temperatures.

Ethylene glycol has a much higher evaporating point than alcohol, so may be used at higher operating temperatures without loss of the solution. In a tight cooling system, water only is required to replace evaporation losses, however, any solution lost mechanically through leakage or foaming must be replaced with additional solution.

The capacity of the cooling system is 11 qts (10.409 liters). The following table shows the correct quantity of both alcohol and ethylene glycol for protection at the varioua temperatures.

	Alcohol			Ethylene Glycol		
Temp. Fahr.	U. S. Qts.	Imperial Qts.	Metric Liters	U. S. Qts.	Imperial Qts.	Metric Liters
30 Degrees	1	4½	0.946	1	4½	0.946
20 Degrees	2⅛	1⅘	2.011	2	1⅔	1.892
10 Degrees	3¼	2⅘	3.075	3	3½	2.839
0 Degrees	4¼	3¾	4.022	3¾	3⅛	3.549
−10 Degrees	5	4⅛	4.732	4½	3¾	4.258
−20 Degrees	5½	4½	5.205	4¾	4	4.495
−30 Degrees	6¾	5⅘	6.388	5½	4½	5.205
−40 Degrees	7¼	6	6.861	6	5	5.678

After installing anti-freeze mixture or adding to a mixture run the engine a few minutes to thoroughly mix the solution.

ENGINE OIL

In cold weather it is important that a lighter grade engine oil be used so the engine may be started easily and to assure an adequate flow of oil to every part of the engine. Use oil having a low cold test which will not con-

geal at the temperature to which it will be subjected.

GEAR LUBRICATION

Hard shifting of the transmission gears in cold weather is a positive indication that the transmission lubricant is either a too heavy grade or the quality allows it to congeal at the prevailing temperature. This condition will also probably apply to the other units. If the oil is too heavy to allow ease in shifting, it is too heavy to properly lubricate the close fitting parts. Change the lubricant to a lighter grade.

Emergency Chart

No adjustment should be made, or any parts tampered with, until the cause of the trouble is determined, otherwise adjustments which are properly made may be destroyed. Analyze the trouble first.

STARTING MOTOR WILL NOT TURN ENGINE

1. Battery weak.
2. Battery connections dirty or loose.
3. Battery or engine ground cable connections loose.
4. Battery to starting motor wire connections loose at starting motor end.
5. Starter switch contacts dirty.

ENGINE FAILS TO START

1. No fuel.
2. No ignition current—see Page 27. May be due to failure to turn on the switch or to a broken or disconnected wire.
3. Spark plug points improperly set. Set to .030" (0.76 mm.)
4. Distributor points improperly set. Set to .020" (0.51 mm.)
5. Cylinders or manifold flooded with fuel. With ignition switch on, choke open (control pushed all the way in), hold accelerator all the way down and rotate engine which will reduce the fuel supply in the cylinders.
6. Moisture on high tension terminals of the spark plugs or distributor cap. Wipe terminals dry with a rag.
7. Gas mixture too lean. Choking is necessary to start cold engine.

ENGINE STOPS

1. Lack of fuel.
2. Disconnected wire.
3. Lack of oil.
4. Carburetor flooding.
5. Engine overheated.
6. Distributor breaker points dirty or pitted.

ENGINE MISSES AT ALL SPEEDS

1 Faulty wiring.

2. Fouled spark plugs. The spark plugs should be short circuited one after another by touching a hammer or insulated handle screw driver from the cylinder to the terminal of each spark plug. When one is reached which makes no difference in the running of the engine it is an indication that the plug is at fault. Remove, clean and adjust. If the porcelain insulator is cracked, install a new plug.

3. Spark plug points improperly set. Points too close together or too far apart may cause missing. Set the points .030" (.076 mm.) Accumulation of carbon or oil on spark plug porcelains. Corrosion on end of spark plug cables at the distributor cap connections.
4. Distributor faulty. Breaker arm sticking. Points improperly set or burned and pitted. The correct point setting is .020" (0.51 mm.)
5. Faulty condenser or coil.
6. Water in fuel.
7. Engine overheated.

ENGINE MISSES AT LOW SPEED ONLY

1. Intermittent flow of fuel.
2. Poor ignition or compression.
3. Distributor points improperly adjusted or making poor contact.
4. Incorrect timing.
5. Faulty condenser.
6. Spark plug points too far apart (on pull) or too close together (on idle).
7. Air leak at intake manifold connections.

LOSS OF POWER

(The engine will run but will not pull the truck under a heavy load.)

1. Ignition improperly timed.
2. Lack of fuel or the carburetor flooding.
3. Dragging brakes.
4. Engine overheated because of lack of oil or water.
5. Poor compression.
6. Improper valve timing.
7. Clutch slipping.
8. Exhaust pipe or muffler obstructed.

LACK OF COMPRESSION

1. Faulty cylinder head gasket.
2. Insufficient tappet clearance.
3. One or more improperly fitted pistons or piston rings.
4. Valves not seating properly.

POPPING BACK THROUGH CARBURETOR

(This usually indicates too lean a mixture.)

1. Dirt in carburetor or fuel pump strainer dirty, see "Fuel System", Page 32.
2. Water in fuel.
3. Air leak at intake manifold connections.
4. Incorrect ignition timing.
5. Incorrect valve timing.
6. Inlet valves holding open.
7. Spark plug wires connected to incorrect plugs. Firing order 1-3-4-2.

ENGINE OVERHEATING

1. Lack of lubrication.
2. Stoppage of water circulation, faulty thermostat or lack of water.
3. Slipping fan belt.
4. Ignition timing improperly set.

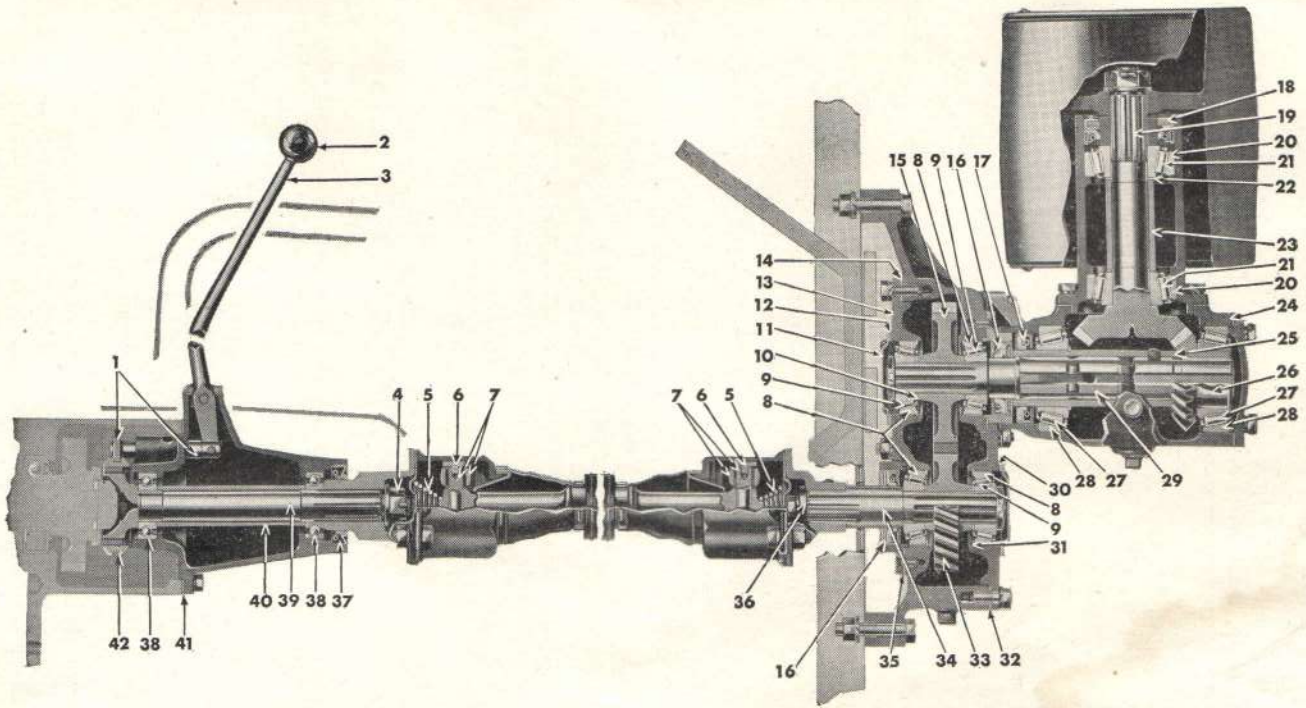


FIG. 35—POWER TAKE-OFF ASSEMBLY—Model 4WD

1—Fork and Rod
2—Ball
3—Lever
4—Nut
5—Spring
6—Button and Spring
7—Trunnion and Ball
8—Cup
9—Bearing
10—Snap Ring
11—Plate
12—Gasket
13—Retainer
14—Gasket
15—Gear
16—Oil Seal
17—Oil Seal
18—Oil Seal
19—Gear and Shaft
20—Cup
21—Cone and Roller
22—Shims
23—Spacer
24—Shims
25—Shims
26—Pinion
27—Cone and Roller
28—Cup
29—Shaft
30—Gasket
31—Shims
32—Gasket
33—Gear
34—Shaft
35—Gasket
36—Washer
37—Oil Seal
38—Ball Bearing
39—Gear and Shaft
40—Spacer
41—Gasket
42—Sleeve

Extra Equipment

The utility of the four-wheel drive Model 4-WD is greatly increased by use of the extra equipment which is available. The rear power take-off and the belt pulley drive provide power outlets to operate equipment which is trailed or driven by a belt. A governor is available to control engine speed when this equipment is used.

The maintenance and adjustment of this equipment is outlined below.

GOVERNOR

Three different governors are used as standard in production; the King Seeley, the Novi and the Monarch. These governors are similar in design, being of the centrifugal type which gives precision control of engine speeds. Adjustment, operations and maintenance of each is outlined below.

NOVI GOVERNOR ADJUSTMENT

First tune the engine to obtain smooth operation.

Check the carburetor bell crank to be sure the screw indicated in Fig. 37 is correctly installed. Also check the carburetor throttle to make certain that it opens and closes fully. Disconnect the carburetor spring to eliminate any bind or stiffness in the carburetor control linkage. Free operation of the throttle control linkage is essential to avoid surging of the governor in operation. After checking, reconnect the accelerator spring.

The carburetor throttle is connected to the governor operating arm with an adjustable link, No. 9, Fig. 38. The link used on the Novi governor is not spring loaded and is slightly longer than that used on the other type governors. Adjust the length of the connecting link to accurately assemble over the two ball studs when the hand governor control is **pulled out** to the last or ninth notch and the carburetor throttle is **wide open**. The adjusted length will be approximately 6¾" (17.145 cm.) between the ball stud centers.

Start the engine and allow it to run until operating temperature is reached. Set the throttle idle adjusting screw to provide an idle speed of 600 to 650 rpm.

The governed engine speed is controlled by the position of the upper or lcng governor control arm which is correctly positioned with the adjustable clevis No. 3, Fig. 38.

Pull the governor hand control out to the **first** notch and position the upper arm with the clevis No. 3 to give an engine speed of from 900 to 1000 rpm.

After making this adjustment push the governor hand control all the way in and check the engine idle speed which should be from 600 to 650 rpm. as originally set. If the engine runs faster than this speed, loosen the lock nut which locks the governor hand control handle on the dash to the rod and back off the handle until the carburetor idle speed adjusting screw bears on the stop boss. Tighten the lock nut.

In the absence of electrical tachometer equipment, engine speed may be determined by the speedometer. Safely jack up the rear wheels and be sure the front wheel drive is not engaged. When driving the rear wheels in high or direct transmission gear, the speedometer will read from 13½ to 15 miles (21.60 to 24 Km.) per hour at an engine speed of from 900 to 1000 rpm.

NOVI GOVERNOR OPERATION

The Novi governor is directly belted to the engine—no clutch is provided to disconnect the drive.

To operate the vehicle **without** governor control, push the governor hand control all the way **"in"** against the instrument panel.

To operate the vehicle **"with"** governor control pull the governor hand control out. The hand control has nine notched positions. Pulling the control out to the first notch sets the controlled engine speed at approximately 1000 rpm. and each successive notch increases the speed 200 rpm. until 2600 rpm. is set in the ninth notch. The hand control may be released by turning the handle one-quarter turn in either direction.

When the engine is being operated under governor control (hand control out) the controlled engine speed may be exceeded at any time by depressing the foot accelerator in the conventional manner to secure a greater carburetor throttle opening than that determined by the governor hand control setting.

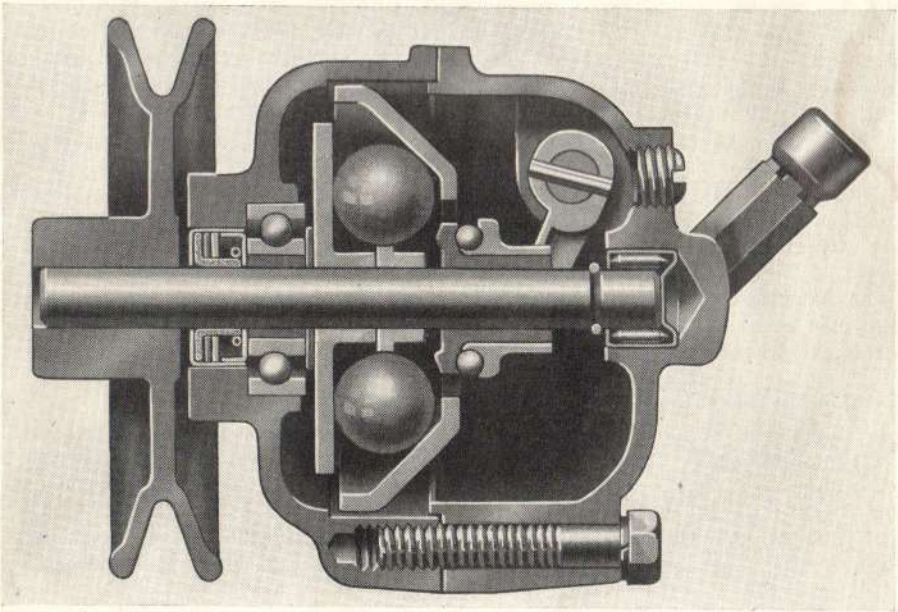


FIG. 36—NOVI GOVERNOR

KING SEELEY GOVERNOR ADJUSTMENT

First tune the engine to obtain smooth operation.

Mechanical adjustment of speed control is obtained by adjusting the length of the hand control cable with clevis No. 3, Fig. 38.

First check the carburetor bell crank to be sure the screw as shown in Fig. 37 is correctly located. Check the carburetor throttle rod to make certain the throttle opens and closes fully. Disconnect the accelerator spring and eliminate any bind or stiffness in the throttle connections and carburetor linkage. Free operation of the throttle is necessary to avoid surging of the governor when the engine is placed under load. After checking, reconnect the accelerator spring.

Set the dash hand throttle in the fully open position and leave it there. All the adjustments are made with the throttle in this position.

Adjust the length of the spring loaded governor-to-throttle link No. 12 to allow exact assembly between the short or lower governor lever and the carburetor throttle lever without moving either lever and with the throttle fully open. The length of this link after adjustment should be approximately 6″ (15.24 cm.) between centers of the ball sockets. Tighten the adjustment lock nut and install the link.

Engage the governor clutch by turning the control on the pulley hub until the driving pins engage the deeper recesses. Place the governor hand control in the closed or **"in"** position and check to be sure the hand throttle on the dash is fully out. Start the engine and allow it to run until operating temperature is reached.

The governed engine speed is controlled by the position of the upper or long governor lever. Adjust the yoke No. 3 (Fig. 38) on the hand control cable and attach it to the governor arm when the arm is positioned to give an engine speed of 1000 rpm. In the absence of electrical tachometer equipment, the engine speed may be determined by the speedometer. Safely jack up the rear wheels and be sure the front wheel drive is not engaged. When driving the rear wheels in high or direct transmission gear, the speedometer will read 15 mph. at an engine speed of 1000 rpm.

In some cases it may be necessary to adjust the surge screw at the rear of the governor to elimintae surge. Should this be necessary, loosen the lock nut and turn the slotted screw in until the engine stops surging when the governor hand control is suddenly operated from low to high speeds, then tighten the lock nut. Use care in making this adjustment not to turn the screw in too far or governor speed control will be lost.

KING-SEELEY GOVERNOR OPERATION

When speed control is not desired the governor may be disengaged with the twin-pin type clutch mounted on the driven pulley hub. Never attempt to engage this clutch with the engine running. To operate it pull the cap out toward the radiator and rotate it ¼ turn in either direction until you feel the two driving lugs drop into the recesses provided. The governor is engaged when the lugs are in the deeper recesses and locked in the disengaged position when in the shallow recesses.

The controlled engine speed may be varied with the governor hand control. With this control in against the dash, the controlled engine speed is 1000 rpm. The speed is increased 200 rpm per notch, as the hand control is pulled out. The top speed is 2600 rpm in the ninth notch. The hand control is released by turning the handle ¼ turn in either direction.

When the governor is to be used, stop the engine, engage the governor clutch and pull the hand throttle control fully out to allow the governor to take over engine speed control. When the governor clutch is disengaged, release the hand throttle by turning the handle one-quarter turn in either direction.

MONARCH GOVERNOR ADJUSTMENT

The adjustment of the Monarch governor is the same as that listed above for the King-Seeley with the exception of the adjustment of the spring loaded governor-to-throttle link No. 12. Adjust this link to have approximately 1/16" (1.587 mm.) slack or lost motion. No surge adjustment is provided and this lost motion is allowed to cushion any slight irregularities in governor control.

CARBURETOR THROTTLE CRANK

The carburetor throttle bell crank at the end of the throttle shaft contains three holes as shown in Fig. 37. When no governor is installed on the vehicle the screw is placed in the **center** hole and through the throttle lever locking the two parts as a unit. When the Novi governor is used, the screw is placed in the **lower** hole and the inner end extends **below** the throttle control lever. When either the King-Seeley or Monarch governor is used, the screw is placed in the **top** hole and the inner end extends **above** the throttle lever.

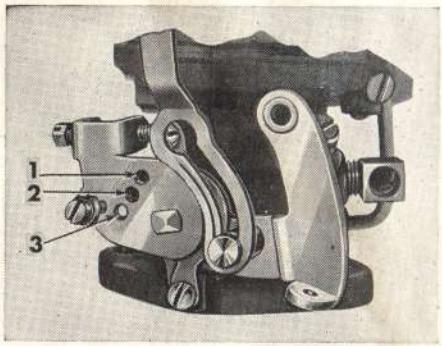


FIG. 37—THROTTLE BELL CRANK

IMPORTANT—The bell crank and the throttle lever are positively locked together only when no governor is used.

MONARCH GOVERNOR OPERATION

The operation of the Monarch governor is the same as that of the King-Seeley excepting the clutch control. Clutch control is through a spring loaded lever mounted on the top of the unit. To engage the drive unlatch the lever and allow the spring to carry the engaging assembly forward. Do not engage this clutch with the engine running.

GOVERNOR MAINTENANCE (All Types)

The belt tension may be adjusted by raising or lowering the governor in the slotted holes in the mounting bracket. Keep the pulleys and belt free of dirt and oil. Belt slippage will affect governor operation and a tight belt may cause rapid wear of the governor shaft and bearings. Adjust it to allow 1" (2.54 cm.) depression midway between the pulleys with thumb pressure.

There is little wear of the internal parts as they operate in oil. The governor housings are equipped with both fill and drain plugs and also (with the exception of some Novi type governors) with level indicating plugs. Check the oil level at each vehicle lubrication and change the oil each time the engine oil is changed using the same grade oil used in the engine. **Important**—Do not fill the governor housing above the level plug. Overfilling will prevent governor control and possibly cause damage to governor internal parts.

Guard against overfilling the Novi units, which are not equipped with level indicating plugs. The capacity of these governors is two fluid ounces. The Novi filler plug is also a vent which should be cleaned thoroughly at each oil change to be sure that the vent operates.

POWER TAKE-OFF WITH SHAFT AND BELT PULLEY

The complete power take-off consists of three assemblies; the shift unit (mounted on the transfer case), the shaft drive assembly and the pulley drive assembly (mounted at the rear of the vehicle). The rear units are driven through the shift assembly by a propeller shaft and two universal joints.

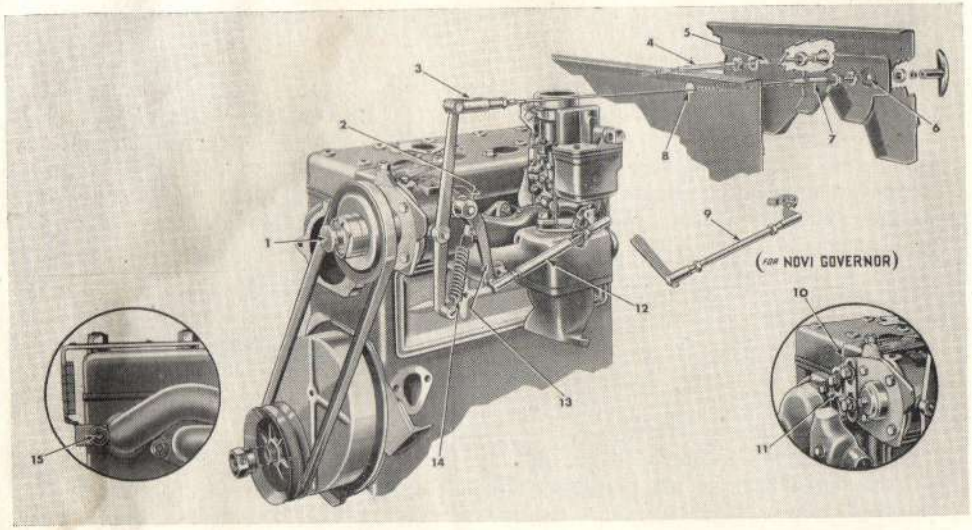


FIG. 38—GOVERNOR INSTALLATION AND ADJUSTMENT

The assembly, mounted at the rear of the vehicle, is designed to drive trailed equipment or operate belt driven machines. The shaft and pulley speeds conform to SAE standards and are obtained at the maximum torque speed of the engine.

For information covering the power take-off shaft and pulley speeds, reference is made to Page 73 or Page 75 for metric conversion.

FRONT UNIT OR SHIFT ASSEMBLY

This assembly, attached to the rear of the transfer case and operated from the transmission main shaft, provides a gear shift for control of the power take-off. See. Fig. 35.

The shift assembly is lubricated from the transfer case and no attention is required other than the regular lubrication of the transfer case.

Keep the attaching screws tight at all times. Always disengage the clutch when shifting the gear. When using the belt drive, do not attempt the shift until the machine being driven has "coasted" to a stop.

PROPELLER SHAFT AND UNIVERSAL JOINTS

The power take-off propeller shaft is tubular and has two universal joints. The joints are enclosed by housings and boots, which contain the lubricant. The torque capacity of the propeller shaft is far greater than that developed by the engine and as there is very little flexing of the joints, this unit will

require no attention for the life of the vehicle under normal use other than an inspection at each regular vehicle inspection, to guard against loose companion flange attaching screws or leakage of lubricant at the boots. Should the power take-off be used often for continuous operation, disassemble the joints and repack them with lubricant once each year. See "Lubrication" Section.

POWER TAKE-OFF SHAFT DRIVE

The six-splined 1⅜" (30.2 mm.) power take-off shaft, Fig. 39, provides a power output to operate trailed equipment. This shaft turns clockwise, when viewed from the rear, at a speed of approximately 536 rpm., which is the standard speed adapted by most farm tractor manufacturers. For information of the horsepower available, both drawbar and splined shaft at the engine speed provided by each of the nine governor control positions, see the charts on Pages 73 and 74.

Always use four-wheel drive when towing power driven equipment. Selection of the most satisfactory governed engine speed, as well as transmission and transfer case gear shift positions will depend upon soil conditions and the power required to pull the trailed equipment; also, when operating agricultural machines upon ground and machine speed requirements and crop conditions.

Some power take-off assemblies are supplied with a 1 to 1 gear ratio to provide one standard output shaft speed and are so identified. Other assemblies are equipped with a gear ratio of 5 to 6 (20 teeth to 24 teeth), the gears of which may be interchanged to vary the output shaft speed in relation to vehicle ground speed.

When towing power-driven farm machines under average conditions, best operation will be secured by using either No. 5 or 6 governor control position with both the transmission and transfer case gears in the low range position. Reference to the tables on Pages 73 and 74 will give vehicle ground speed and shaft speed in these operating positions for power take-off assemblies equipped with each of the shaft gear ratios.

The shaft speed of the power take-off assemblies equipped with the 1 to 1 ratio cannot be changed. The shaft speed, in relation to vehicle ground speed, can be changed in assemblies equipped with the 5 to 6 ratio, however, by interchanging the gears.

Under heavy crop conditions, it may be found that the machine being operated cannot handle the volume of crop which is cut at the vehicle ground speed necessary to maintain power take-off shaft speed. To handle the crop, it is necessary to reduce vehicle ground speed without changing the power take-off shaft speed. This is accomplished by interchanging gears No. 33 and No. 15, as shown in Fig. 35. The original factory installation is made to provide a ratio of 5 to 6—the 20 tooth gear being assembled on the input shaft and the 24 tooth gear on the output shaft, as shown in Fig. 35.

To interchange the gears, first remove the power take-off assembly from the vehicle and drain the lubricant from the housing. Remove the bearing retaining plate No. 11, Fig. 35. Bend back the lips of the nut locking

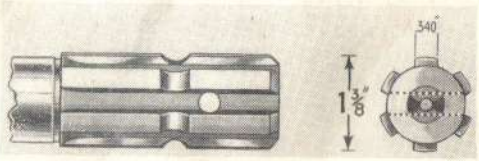


FIG. 39—POWER TAKE-OFF SHAFT

washer and remove the bearing retaining nut. The cover may then be removed with the bearing assembly. Use care not to lose the shims which are placed between the gear hub and the bearing cone. The gear may be slipped from the shaft through the cover opening.

The other gear may be removed in the same manner after removing cover plate. Interchange the gears and reassemble in the reverse order with the long side of the gear hub toward the cover opening. Use care that the shims are replaced in the same position relative to the bearings from which they were removed. Do not overlook refilling the housing with lubricant.

The speed of the output shaft in relation to vehicle ground speed is important. To aid in the selection of engine speeds and gear ratio positions, refer to the charts on Pages 73 and 74 which show both the shaft and vehicle speeds, with power take-off assemblies having each ratio, through the range of governor controlled engine speeds and in all transmission and transfer case gear positions.

CAUTION: When the vehicle is reversed, the power take-off shaft drive will turn in the reverse direction. Some farm machines will be damaged if reverse driven. When operating trailed equipment, *be sure to disengage* the power take-off with the shift lever before reversing the vehicle. Being able to reverse some power driven machines is an advantage to aid in freeing the machine should it become clogged in operation.

Inspect the power take-off unit periodically and add sufficient lubricant to keep it at filler plug level. Keep the attaching screws tight at all times and the breather or vent free of dirt.

When using the shaft drive, always install the shield which is provided for the safety of the operator.

PULLEY DRIVE ASSEMBLY

The pulley drive assembly, with 8" (203 mm.) pulley, is driven through the power take-off shaft. It is held in position with four cap screws and can be quickly removed or installed. Always remove this assembly when it is not in use to avoid damage through accident. For pulley speed data see Page 76.

When operating the pulley drive assembly use care that the vehicle is correctly aligned so the belt runs at the center of the pulley. Do not tighten the belt excessively: when too tight, rapid wear of the drive parts of both the machine being driven and pulley drive assembly may occur. If correctly adjusted the hand brake will hold the vehicle when ample drive tension is placed on the belt.

The belt pulley drive is operated from the transmission main shaft, giving the same power and speed ratios that are provided by the transmission for the vehicle on the highway. To operate the pulley, with the vehicle standing, place the auxiliary (right hand) transfer case shift lever in the neutral position, designated as "N" in Fig. 2.

The nine governor controlled engine speeds in conjunction with the transmission gear shift positions provide a large selection of pulley speeds. Select the governor and transmission gear shift positions that will provide the *recommended speed* of the machine being driven. Machines driven below this speed will seldom do a satisfactory job while speeds above normal will cause rapid wear and are, in some cases, dangerous.

The table on Page 76 is provided as a guide in selecting the correct control position to secure the recommended speed.

CAUTION: When the belt drive is used, ground the vehicle with a bar or piece of chain so static electricity is dissipated or sparks might cause a fire in dusty or inflammable surroundings.

Keep the housing filled with lubricant to the level of the filler plug. (See "Lubrication Chart".)

Power Take-Off and Vehicle Speeds

To satisfactorily operate most power-driven equipment, the operator should know the speed of the power take-off shaft or the belt pulley as well as the vehicle ground speed. A great variety of speeds are made available by the governor control, the gear ratios in the transmission and transfer case and by interchanging the gears in the power take-off housing.

The table below indicates the speed for each of the nine positions of the manual governor control. Note that the shaft speeds are all computed with the vehicle in four-wheel drive and that of the belt pulley in the transmission drive only. Reference to this table will be of material assistance especially in the operation of the farm combine or grain separator.

POWER TAKE-OFF SHAFT AND VEHICLE GROUND SPEEDS
ALL GEAR SHIFT POSITIONS
MILES PER HOUR

Governor Control Position	Transfer In	POWER TAKE-OFF 5 TO 6 GEAR RATIO						Engine Speed
		Transmission Gear In						
		Low		Intermediate		High		
		Take-Off Shaft R.P.M.	Vehicle Speed M.P.H.	Take-Off Shaft R.P.M.	Vehicle Speed M.P.H.	Take-Off Shaft R.P.M.	Vehicle Speed M.P.H.	
1	Low	298	2.22	537	4.01	833	6.22	1000
	High	298	5.40	537	9.75	833	15.13	
2	Low	357	2.67	644	4.81	1000	7.47	1200
	High	357	6.48	644	11.71	1000	18.15	
3	Low	417	3.11	752	5.62	1166	8.72	1400
	High	417	7.56	752	13.66	1166	21.17	
4	Low	476	3.56	859	6.42	1333	9.96	1600
	High	476	8.65	869	15.61	1333	24.20	
5	Low	536	4.00	967	7.22	1500	12.08	1800
	High	536	9.73	967	17.56	1500	27.22	
6	Low	595	4.44	1074	8.02	1666	12.45	2000
	High	595	10.81	1074	19.51	1666	30.25	
7	Low	655	4.89	1182	8.83	1833	13.70	2200
	High	655	11.89	1182	21.46	1833	33.27	
8	Low	714	5.34	1289	9.63	2000	14.94	2400
	High	714	12.97	1289	23.41	2000	36.31	
9	Low	774	5.78	1396	10.43	2166	16.19	2600
	High	774	14.05	1396	25.36	2166	39.33	

Governor Control Position	Transfer In	POWER TAKE-OFF 6 TO 5 GEAR RATIO						Engine Speed
		Transmission Gear In						
		Low		Intermediate		High		
		Take-Off Shaft R.P.M.	Vehicle Speed M.P.H.	Take-Off Shaft R.P.M.	Vehicle Speed M.P.H.	Take-Off Shaft R.P.M.	Vehicle Speed M.P.H.	
1	Low	428	2.22	773	4.01	1200	6.22	1000
	High	428	5.40	773	9.75	1200	15.13	
2	Low	514	2.67	928	4.81	1440	7.47	1200
	High	514	6.48	928	11.71	1440	18.15	
3	Low	600	3.11	1083	5.62	1680	8.72	1400
	High	600	7.56	1083	13.66	1680	21.17	
4	Low	685	3.56	1237	6.42	1920	9.96	1600
	High	685	8.65	1237	15.61	1920	24.20	
5	Low	771	4.00	1392	7.22	2160	12.08	1800
	High	771	9.73	1392	17.56	2160	27.22	
6	Low	857	4.44	1547	8.02	2400	12.45	2000
	High	857	10.81	1547	19.51	2400	30.25	
7	Low	942	4.89	1702	8.83	2640	13.70	2200
	High	942	11.89	1702	21.46	2640	33.27	
8	Low	1028	5.34	1856	9.63	2880	14.94	2400
	High	1028	12.97	1858	23.41	2880	36.31	
9	Low	1114	5.78	2011	10.43	3120	16.19	2600
	High	1114	14.05	2011	25.36	3120	39.33	

Governor Control Position	Transfer In	POWER TAKE-OFF 1 TO 1 GEAR RATIO						Engine Speed
		Transmission Gear In						
		Low		Intermediate		High		
		Take-Off Shaft R.P.M.	Vehicle Speed M.P.H.	Take-Off Shaft R.P.M.	Vehicle Speed M.P.H.	Take-Off Shaft R.P.M.	Vehicle Speed M.P.H.	
1	Low	358	2.22	644	4.01	1000	6.22	1000
	High	358	5.40	644	9.75	1000	15.13	
2	Low	428	2.67	773	4.81	1200	7.47	1200
	High	428	6.48	773	11.71	1200	18.15	
3	Low	500	3.11	902	5.62	1400	8.72	1400
	High	500	7.56	902	13.66	1400	21.17	
4	Low	571	3.56	1031	6.42	1600	9.96	1600
	High	571	8.65	1031	15.61	1600	24.20	
5	Low	643	4.00	1160	7.22	1800	12.08	1800
	High	643	9.73	1160	17.56	1800	27.22	
6	Low	714	4.44	1289	8.02	2000	12.45	2000
	High	714	10.81	1289	19.51	2000	30.25	
7	Low	786	4.89	1418	8.83	2200	13.70	2200
	High	786	11.89	1418	21.46	2200	33.27	
8	Low	857	5.34	1547	9.63	2400	14.94	2400
	High	857	12.97	1547	23.41	2400	36.31	
9	Low	929	5.78	1675	10.43	2600	16.19	2600
	High	929	14.05	1675	25.36	2600	39.33	

POWER TAKE-OFF AND VEHICLE GROUND SPEEDS
ALL GEAR SHIFT POSITIONS
KILOMETERS PER HOUR

Governor Control Position	Transfer In	POWER TAKE-OFF 5 TO 6 GEAR RATIO						Engine Speed
		Transmission Gear In						
		Low		Intermediate		High		
		Take-Off Shaft R.P.M.	Vehicle Speed K.P.M.	Take-Off Shaft R.P.M.	Vehicle Speed K.P.M.	Take-Off Shaft R.P.M.	Vehicle Speed K.P.M.	
1	Low	298	3.57	537	6.45	833	10.00	
	High	298	8.68	537	15.68	833	24.35	1000
2	Low	357	4.29	644	7.73	1000	12.02	
	High	357	10.43	644	18.84	1000	29.20	1200
3	Low	417	5.00	752	9.04	1166	14.02	
	High	417	12.16	752	21.98	1166	34.05	1400
4	Low	476	5.72	859	10.33	1333	16.03	
	High	476	13.91	859	25.12	1333	38.93	1600
5	Low	536	6.44	967	11.61	1500	19.43	
	High	536	15.65	967	28.25	1500	43.80	1800
6	Low	595	7.15	1074	12.90	1666	20.00	
	High	595	17.39	1074	31.40	1666	48.65	2000
7	Low	655	7.86	1182	14.20	1833	22.02	
	High	655	19.11	1182	34.53	1833	53.53	2200
8	Low	714	8.59	1289	15.48	2000	24.03	
	High	714	20.87	1289	37.66	2000	58.40	2400
9	Low	774	9.30	1396	16.78	2166	26.04	
	High	774	22.60	1396	40.80	2166	63.28	2600

Governor Control Position	Transfer In	POWER TAKE-OFF 6 TO 5 GEAR RATIO						Engine Speed
		Transmission Gear In						
		Low		Intermediate		High		
		Take-Off Shaft R.P.M.	Vehicle Speed K.P.M.	Take-Off Shaft R.P.M.	Vehicle Speed K.P.M.	Take-Off Shaft R.P.M.	Vehicle Speed K.P.M.	
1	Low	428	3.57	773	6.45	1200	10.00	
	High	428	8.68	773	15.68	1200	24.35	1000
2	Low	514	4.29	928	7.73	1440	12.02	
	High	514	10.43	928	18.84	1440	29.20	1200
3	Low	600	5.00	1083	9.04	1680	14.02	
	High	600	12.16	1083	21.98	1680	34.05	1400
4	Low	685	5.72	1237	10.33	1920	16.03	
	High	685	13.91	1237	25.12	1920	38.93	1600
5	Low	771	6.44	1392	11.61	2160	19.43	
	High	771	15.65	1392	28.25	2160	43.80	1800
6	Low	857	7.15	1547	12.90	2400	20.00	
	High	857	17.39	1547	31.40	2400	48.65	2000
7	Low	942	7.86	1702	14.20	2640	22.02	
	High	942	19.11	1702	34.53	2640	53.53	2200
8	Low	1028	8.59	1856	15.48	2880	24.03	
	High	1028	20.87	1856	37.66	2880	58.40	2400
9	Low	1114	9.30	2011	16.78	3120	26.04	
	High	1114	22.60	2011	40.80	3120	63.28	2600

Governor Control Position	Transfer In	POWER TAKE-OFF 1 TO 1 GEAR RATIO						Engine Speed
		Transmission Gear In						
		Low		Intermediate		High		
		Take-Off Shaft R.P.M.	Vehicle Speed K.P.M.	Take-Off Shaft R.P.M.	Vehicle Speed K.P.M.	Take-Off Shaft R.P.M.	Vehicle Speed K.P.M.	
1	Low	358	3.57	644	6.45	1000	10.00	1000
	High	358	8.68	644	15.68	1000	24.35	
2	Low	428	4.29	773	7.73	1200	12.02	1200
	High	428	10.43	773	18.84	1200	29.20	
3	Low	500	5.00	902	9.04	1400	14.02	1400
	High	500	12.16	902	21.98	1400	34.05	
4	Low	571	5.72	1031	10.33	1600	16.03	1600
	High	571	13.91	1031	25.12	1600	38.93	
5	Low	643	6.44	1160	11.61	1800	19.43	1800
	High	643	15.65	1160	28.25	1800	43.80	
6	Low	714	7.15	1289	12.90	2000	20.00	2000
	High	714	17.39	1289	31.40	2000	48.65	
7	Low	786	7.86	1418	14.20	2200	22.02	2200
	High	786	19.11	1418	34.53	2200	53.53	
8	Low	857	8.59	1547	15.48	2400	24.03	2400
	High	857	20.87	1547	37.66	2400	58.40	
9	Low	929	9.30	1675	16.78	2600	26.04	2600
	High	929	22.60	1675	40.80	2600	63.28	

PULLEY DRIVE SPEEDS

The following chart provides a guide for selection of the correct governor control position to obtain the desired pulley speed. This chart shows the pulley speed in each governor control position, in each transmission ratio and in each power take-off shaft ratio. Use care that approximately the correct pulley speed is selected for power driven equipment operated below rated speed seldom performs satisfactorily and often higher speeds are dangerous.

Pulley Speeds (R.P.M.) - 8" (20.3CM.) Pulley
Power Take-Off Gear Ratios

Governor Control Positions	5-6 RATIO TRANSMISSION			6-5 RATIO TRANSMISSION			1-1 RATIO TRANSMISSION			Engine Speeds
	Low	Inter.	High	Low	Inter.	High	Low	Inter.	High	
1	255	460	714	367	663	1028	306	552	857	1000
2	306	552	857	440	795	1234	367	662	1028	1200
3	357	645	1000	514	928	1440	428	774	1200	1400
4	408	737	1143	587	1061	1645	490	884	1372	1600
5	459	829	1285	660	1193	1851	551	995	1542	1800
6	510	921	1428	734	1326	2057	612	1105	1714	2000
7	561	1031	1571	807	1458	2262	673	1237	1885	2200
8	612	1105	1714	881	1591	2468	734	1326	2057	2400
9	663	1197	1857	954	1723	2674	796	1436	2228	2600

SPLINE SHAFT HORSEPOWER

The chart below shows the draw bar horsepower at the governor controlled engine speeds and the horsepower at the spline shaft with the vehicle stationary. Also is shown the horsepower available at the spline shaft with the vehicle at the maximum approved weight (3500 lbs.) (1590 Kg.) moving at the speed shown and exerting a draw bar pull of zero pounds through 1200 pounds (544 Kg.) (maximum recommended) in steps of 300 pounds (136 Kg.).

Governed Engine R.P.M.	Vehicle Speed M.P.H.*	Draw Bar H.P.**	H.P. at P.T.O. Spline Shaft					
			Vehicle Stationary	3500 Lb. Vehicle Moving with				
				No Lbs. Draw Bar Pull	300 Lbs. Draw Bar Pull	600 Lbs. Draw Bar Pull	700 Lbs. Draw Bar Pull	1200 Lbs. Draw Bar Pull
1000	2.2	7.18	15.4	12.8	11.0	9.3	7.5	5.7
1200	2.7	8.62	19.3	16.2	14.0	12.0	9.8	7.6
1400	3.1	10.06	23.3	19.6	17.1	14.7	12.1	9.6
1600	3.6	11.49	27.1	22.9	20.1	17.4	14.4	11.5
1800	4.0	12.93	30.9	26.3	23.0	19.9	16.7	13.5
2000	4.5	14.38	33.0	29.1	25.5	21.9	18.4	14.8
2200	4.9	15.80	33.0	31.7	27.8	23.8	20.0	16.0
2400	5.4	17.24	33.0	33.0	29.7	25.5	21.1	19.9
2600	5.8	18.68	33.0	33.0	31.4	26.7	22.1	17.5

*Vehicle speed in low transmission and transfer case ratios.

**Based on maximum recommended draw bar pull of 1200 Lbs. for continuous service.

METRIC

Governed Engine R.P.M.	Vehicle Speed K.P.H.*	Draw Bar H.P.** (Metric)	Metric H.P. at P.T.O. Spline Shaft					
			Vehicle Stationary	1590 Kg. Vehicle Moving with				
				No Kg. Draw Bar Pull	135 Kg. Draw Bar Pull	270 Kg. Draw Bar Pull	405 Kg. Draw Bar Pull	540 Kg. Draw Bar Pull
1000	3.5	7.28	15.6	13.0	11.2	9.4	7.6	5.8
1200	4.4	8.74	19.6	16.4	14.2	12.2	9.9	7.7
1400	5.0	10.20	23.6	19.9	17.3	14.9	12.3	9.7
1600	5.8	11.65	27.5	23.2	20.4	17.6	14.6	11.7
1800	6.4	13.11	31.3	26.7	23.3	20.2	16.9	13.7
2000	7.2	14.58	33.5	29.5	25.9	22.2	18.7	15.0
2200	7.9	16.02	33.5	32.1	28.2	24.1	20.3	16.2
2400	8.7	17.48	33.5	33.5	30.1	25.9	21.4	17.1
2600	9.3	18.94	33.5	33.5	31.8	27.1	22.4	17.7

*Vehicle speed in low transmission and transfer case ratios.

**Based on maximum recommended draw bar pull of 540 Kg. for continuous service.

Directions for Ordering Parts

When new parts are necessary, it is recommended that these be ordered from the nearest Willys-Overland Dealer.

Do not order parts in a letter in which some other subject is treated.

When ordering parts for a particular vehicle, give the model, engine and serial number of the vehicle.

The serial number will be found stamped on a plate attached to the outside of the left frame side rail at the front end and at the left of the drivers' seat on the floor riser.

The engine number will be found stamped on top of the water pump boss at the front end of the cylinder block.

Never order in sets, but give the exact quantity of the parts desired.

Specify both the part number and the name of the part in full, and if similar parts are used on both the right and left hand sides, specify for which side you want the new part or parts, because many parts made for right and left sides are not interchangeable.

If in doubt as to the parts needed, take the broken parts to your dealer. Write your name and address plainly on the package, so that it can be identified.

Give definite shipping instructions—whether the new parts are to be sent by express, freight or parcel post.

In ordering parts by telegram, be sure to send the message prepaid and confirm it by written order, bearing notation, "Confirmation of Wire Order."

NOTE: Parts replaced under the terms of the Warranty (Page 6) must be left with the Willys-Overland Dealer who makes the replacement, if full credit is expected.

This is important for owners to know when traveling outside the territory in which their vehicle was originally purchased, particularly when credit for old parts cannot be established to the satisfaction of the Dealer.

In this connection, a forwarding address should be given by the owner in order that the proper credit may be forwarded to him.

ACCEPT ONLY GENUINE FACTORY PARTS

Alphabetical Index

Alphabetical Index—Continued