Cold Weather Precautions

With the approach of cold weather, in regions where the temperature drops below the freezing point, 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 drain the system completely (see "Cooling System" Page 30) when putting up the vehicle in cold weather, unless it is kept 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 SOLUTION.

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

Common antifreeze solutions available are alcohol and ethylene glycol. The distillation or evaporating point of alcohol solution is approximately 170° F. (76.67° C.). The operating temperatures of the Jeep when used as a farm tractor and especially when 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. (10.4 lts.). The following table shows the correct quantity of both alcohol and ethylene glycol for protection at the various temperatures indicated:

		ALCOHOL			***ETHYLENE GLYCOL***		
Temp. Fahr.	***Temp. Cent.***	***U.S. Qts.***	***Imperial Qts.***	***Metric Liters***	***U.S. Qts.***	***Imperial Qts.***	***Metric Liters***
30°	-1.1°	1	4/5	0.946	1	4/5	0.946
20°	-6.7°	2-1/8	1-4/5	2.011	2	1-2/3	1.892
10°	-12.2°	3-1/4	2-4/5	3.075	3	2-1/2	2.839
0°	-17.8°	4-1/4	3-3/4	4.022	3-3/4	3-1/8	3.549
-10°	-23.3°	5	4-1/8	4.732	4-1/2	3-3/4	4.258
-20°	-28.8°	5-1/2	4-1/2	5.205	4-3/4	4	4.495
-30°	-34.4°	6-3/4	5-2/3	6.388	5-1/2	4-1/2	5.205
-40°	-40.0°	7-1/4	6	6.861	6	5	5.678

The engine should be operated to thoroughly mix the solution.

ENGINE OIL

In cold weather it is important that a lighter grade engine oil be used so that 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 congeal 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 too heavy grade or the

quality allows it to congeal at the prevailing temperature. This condition will also probably apply to the transfer case and the differentials. 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 without delay.

Emergency Chart

No adjustment should be made, or any parts tampered with, until the cause of the trouble is ascertained, Qtherwjse adjustments which are properly made may be destroyed. The trouble should be analyzed first.

STARTING MOTOR WILL NOT TURN ENGINE.

1. Battery weak.
2. Battery connections dirty or loose.
3. Battery or engine ground wire 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 22).
   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 inch (0.76 mm.).
4. Distributor points improperly set. Set to .020 inch (0.51 mm.).
5. Cylinders or manifold flooded with fuel.
   With ignition switch turned 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 wood 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 and clean. If porcelain insulator is cracked, install new plug.

3. Spark plug points improperly set.
   Points too close together or too far apart may cause missing.
   Spark plug points should be set .030 inch (0.76 mm.).
   Accumulation of carbon or oil on spark plug porcelain.
   Corrosion on end of spark plug cables at distributor cap connection.
4. Distributor faulty.
   Breaker arm sticking.
   Points improperly set or burned and pitted.
   The correct point opening is .020 inch (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 comrsression.
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 car under a heavy load.)

1. Ignition improperly timed.
2. Lack of fuel or 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 the carburetor. (Fuel pump strainer dirty, see Page 28.)
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 proper lubrication.
2. Stoppage of water circulation, faulty thermostat or lack of water.
3. Slipping fan belt.
4. Ignition timing improperly set.

Extra Equipment

Much of the utility of the Jeep is due to the extra equipment which has been designed to adapt it for farming and diversified occupations and industries. The maintenance and use of this equipment is outlined in the following paragraphs.

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 that the screw indicated in Fig. 35 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. 34. 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

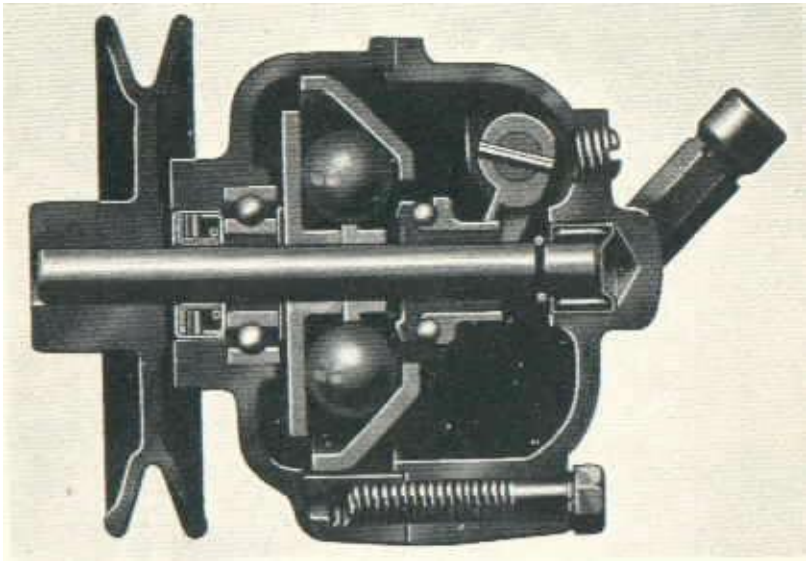

FIG. 33—GOVERNOR

to the last or ninth notch and the carburetor throttle is WIDE OPEN. The adjusted length will be approximately 6-3/4" (.17 m.) 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 long governor control arm which is correctly positioned with the adjustable clevis No. 3, Fig. 34.

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 13-1/2 to 15 miles per hour (22 to 24 Km./h.) 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.

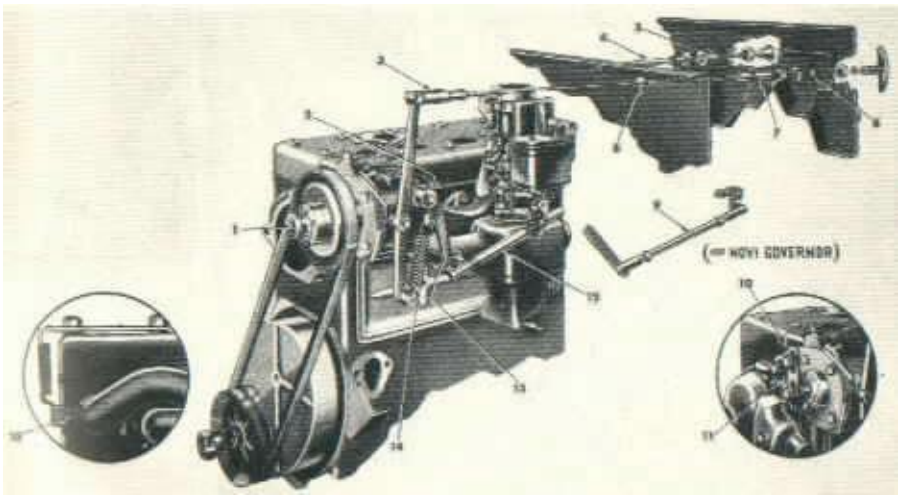

FIG. 34—GOVERNOR INSTALLATION AND ADJUSTMENT

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 200rpm 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.

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. 34.

First check the carburetor bell crank to be sure the screw as shown in Fig. 35 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” (.13 m.) 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. 34) 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 (24 Km./h.) 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 eliminate 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 1/4 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 1/4 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 l/16" (1.6 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 BELL CRANK.

The carburetor throttle bell crank at the end of the throttle shaft contains three holes as shown in Fig. 35. 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 King Seeley or Monarch governor is used, the screw is placed in the *top* hole and the inner end extends *above* the throttle lever.

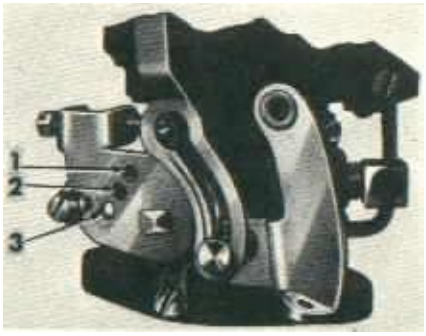

FIG. 35--~THROTTLE BELL CRANK

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

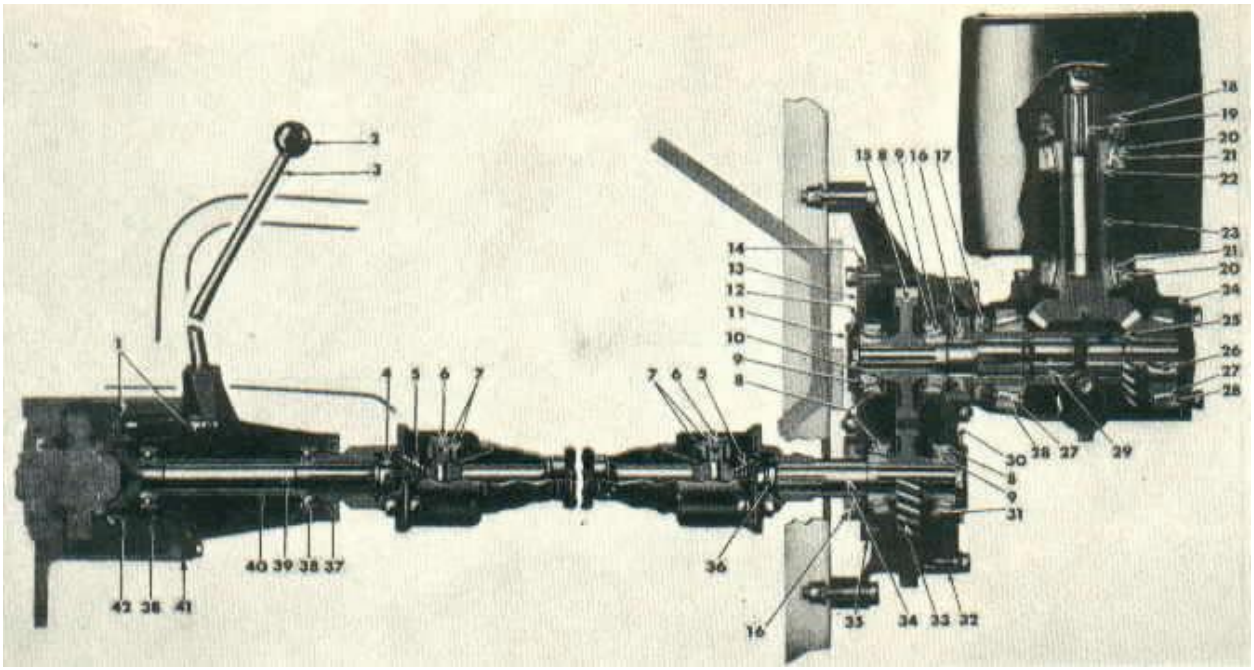

FIG. 36—POWER TAKE-OFF ASSEMBLY

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

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" (25 mm.) 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. Over-filling 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.

FRONT BUMPER WEIGHT.

The best performance of a four-wheel drive vehicle is achieved when the load is equally distributed for traction on the front and rear wheels. This equal distribution is disturbed when the vehicle is used for draw bar work because the load on the rear wheels is increased and that on the front wheels decreased. The addition of a 265-pound front bumper weight equalizes this load.

When the load is equalized the front and rear axles do approximately the same work which results in an equal and prolonged life of these parts and more satisfactory vehicle performance.

The bumper weight Fig. 37 is held in place by four bolts and is provided with hand holes for lifting. Do not add sand bags or other weights in the vehicle. When driving over rough terrain, with the bumper weight in place, the driver should exercise due care.

FIG. 37 —FRONT BUMPER WEIGHT

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.

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 67 or Page 68 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. 36.

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.

POWER TAKE-OFF SHAFT DRIVE.

The six-splined 1-3/8" (30.2 mm.) power take-off shaft, Fig. 38, 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 adopted 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 Page 67.

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 67 and 68 will give vehicle ground speed and shaft speed in these operating positions for power takeoff 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. 36. 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. 36,

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. 36. Bend back the lips of the nut locking 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.

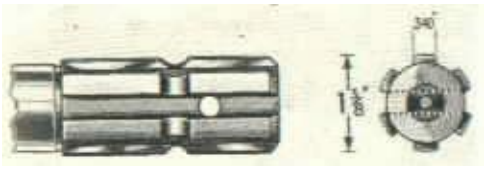

FIG. 38—POWER TAKE-OFF SHAFT

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 67 and 68 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 70.

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. 3.

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 70 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”.)

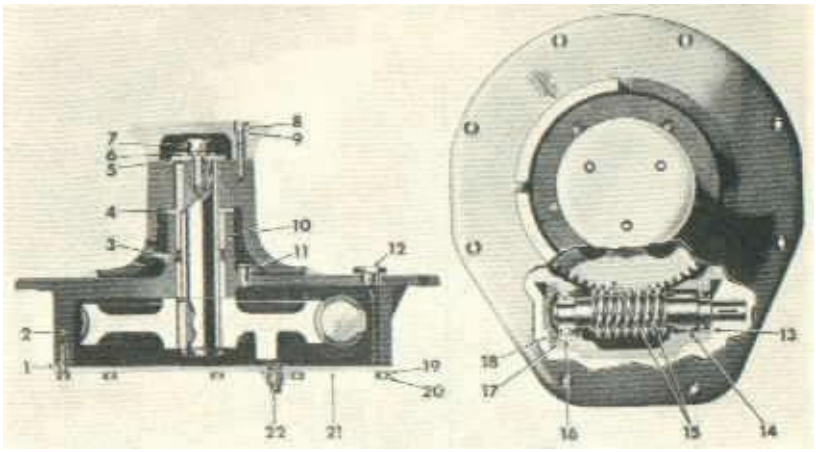

FIG. 39 CAPSTAN WINCH

1—Cover Plate Gasket
2—Gear Box
3—Capstan Shaft Grease Fitting
4 —Capstan Shaft Thrust Washer
5—Capstan Shaft Retaining Washer
6—Capstan Shaft Screw Lockwasher
7—-Capstan Shaft Screw
8—Cover Screw
9 —Cover Screw Lockwasher
10 —Capstan Shaft Bushing (Upper)
11—Capstan Shaft Bushing (Lower)
12—Filler Plug
13— Worm Shaft Oil Seal
14—Worm Shaft Needle Bearing
15—Worm and Gear Set
1 6—Worm Shaft Ball Bearing
17— Bearing Retainer Cap Gasket
18 —Bearing Retainer Cap
19—Gear Box Cover Plate Screw Lockwasher
20— Gear Box Cover Plate Screw
21—Cover Plate
22 —Drain Plug

CAPSTAN WINCH.

The capstan winch is designed for 5000 lb. (2268 Kg.) pull, using either 3/4" (19 mm.) or 1” (25 mm.) manila rope. The worm gears have a ratio of 75 to 1 which provides a rope speed of 19 feet per minute (5.8 m./min.) with an engine speed of 1200 rpm. A shift lever is mounted on the assembly for engagement control. Engage the drive with the engine idling only and without load; limit the engine speed to 1200 rpm.

Lubrication is important because the parts must withstand high pressures when operating at maximum pull. Filler and drain plugs are provided in the gear housing with an oil level stick on the filler plug. The oil capacity is one quart of SAE 90 gear oil in Summer and SAE 80 in Winter. Change the oil twice each year—in Fall and Spring.

Hydraulic fitting No. 3, Fig. 39, indicated by the arrow cast on the gear box, is provided to lubricate the capstan spindle. To lubricate, align the opening in the capstan with arrow. Use chassis lubricant to lubricate the spindle, also lubricate the rope roller at each end and the shift rail and the drive shaft bushing in the winch drive support bracket mounted on the front of the engine. Use an oil can to lubricate the winch drive universal joints.

A cotter pin is used to pin the winch drive shaft to the universal joint at the engine end and acts as a shear pin to prevent overloading. Should this pin shear off, be sure to replace it with a cotter pin of the same size. Do not replace it with a solid pin or drill the hole oversize for a larger pin.

Draw Bar Pull

The power plant of the Universal Jeep is particularly well adapted to the great variety of applications of the Jeep. For higher speed highway use, and draw bar pull requirements for towing loads, the full engine power is available; for power take-off shaft and pulley drive, the full engine torque (turning effort) is available.

Draw bar pull is the force exerted by a vehicle to tow a trailed load and is expressed in pounds.

For continuous agricultural work, the maximum draw bar pull should be limited to 1200 pounds (544 Kg.). The Universal Jeep is capable of much higher draw bar pulls than the 1200 pounds (544 Kg.) approved for continuous service, which may be used for starting loads or towing loads for short periods on good ground in which case a draw bar pull as high as 1800 pounds (817 Kg.) may be safely used.

Maximum continuous draw bar pulls are most often encountered in plowing, disking and harrowing and it is in these applications that the owner should guard against continuously exceeding the recommended limit.

The approved limit of 1200 pounds (544 Kg.) may be judged by the following operations which nearly approach this limit:

Operating two 12 inch (30.5 cm.) plows at a depth of 6’2 inches (16.5 cm.) in dry clay loam.

Operating a 7 foot (2.13 meter) tandem disk at a depth of 412 inches (11.4 cm.) in hard winter packed soil.

Operating a 3-section spring tooth harrow at a depth of 5 inches (12.7 cm.) in soil which has been previously disked.

It is expected that, either on account of soil conditions or implement adjustments, these draw bar pulls will be exceeded. In these instances, tire slippage provides an inherent safeguard against overloading. Do not add weight, other than the standard bumper weight, Page 61, to equalize traction on all four wheels to increase draw bar pull.

Full information is given in the charts on Page 70 of horsepower at the drawbar and also, at the power take-off splined shaft under various operating conditions.

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

POWER TAKE-OFF 5 TO 6 GEAR RATIO

	Transmission Gear In						Engine
	Low		Intermediate		High		Speed
	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.	
	298	2.22	537	4.01	833	6.22	
1	298	5.40	637	9.75	833	15.13	1000
	357	2.67	644	4.81	1000	7.47	
2	357	6.48	644	11.71	1000	18.15	1200
	417	3.11	752	5.62	1166	8.72	
3	417	7.56	752	13.66	1166	21.17	1400
	476	3.56	859	6.42	1333	9.96	
4	476	8.65	859	15.61	1333	24.20	1600
	536	4.00	967	7.22	1500	12.08	
5	536	9.73	967	17.56	1500	27.22	1800
	595	4.44	1074	8.02	1666	12.45	
6	595	10.81	1074	19.51	1666	30.28	2000
	655	4.89	1182	8.83	1833	13.70	
7	655	11.89	1182	21.46	1833	33.27	2200
	714	5.34	1289	9.63	2000	14.94	
8	714	12.97	1289	23.41	2000	36.31	2400
	774	5.78	1396	10.43	2166	16.19	
9	774	14.05	1396	25.36	2166	39.33	2600

POWER TAKE-OFF 6 TO 5 GEAR RATIO

Governor Control Position	Transfer In	Transmission Gear In						Engine
		Low		Intermediate		High		Speed
		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.	
	Low	428	2.22	773	4.01	1200	6.22	
1	High	428	5.40	773	9.75	1200	15.13	1000
	Low	614	2.67	928	4.81	1440	7.47	
2	High	514	6.48	928	11.71	1440	18.15	1200
	Low	600	3.11	1083	5.62	1680	8.72	
3	HIgh	600	7.58	1083	13.66	1680	21.17	1400
	Low	685	3.56	1237	8.42	1920	9.96	
4	High	685	8.65	1237	16.61	1920	24.20	1600
	Low	771	4.00	1392	7.22	2180	12.08	
5	High	771	9.73	1392	17.56	2160	27.22	1800
	Law	857	4.44	1547	8.02	2400	12.45	
6	High	857	10.81	1647	19.51	2400	30.25	2000
	Low	942	4.89	1702	8.83	2640	13.70	
7	High	942	11.89	1702	21.46	2640	33.27	2200
	Low	1028	5.34	1856	9.63	2880	14.94	
8	High	1028	12.97	1856	23.41	2880	36.31	2400
	Low	1114	5.78	2011	10.43	3120	16.19	
9	High	1114	14.05	2011	25.36	3120	39.33	2600

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

POWER TAKE—OFF 1 TO 1GEAR RATIO

Governor Control Position	Transfer In	Transmission Gear In: Low Take-Off Shaft R.P.M.	Low Vehicle Speed M.P.H.	Intermediate Take-Off Shaft R.P.M.	Intermediate Vehicle Speed M.P.H.	High Take-Off Shaft R.P.M.	High Vehicle Speed M.P.H.	Engine Speed
	Low	358	2.22	644	4.01	1000	6.22	
	High	358	6.40	644	9.76	1000	15.13	1000
	Low	428	2.67	773	4.81	1200	7.47	
2	High	428	6.48	773	11.71	1200	18.15	1200
	Low	500	3.11	902	5.62	1400	8.72	
3	High	500	7.56	902	13.66	1400	21.17	1400
	Low	671	3.66	1031	6.42	1600	9.96	
4	High	671	8.65	1031	15.61	1600	24.20	1600
	Low	643	4.00	1160	7.22	1800	12.08	
5	High	643	9.73	1160	17.56	1800	27.22	1800
	Low	714	4.44	1289	8.02	2000	12.46	
6	.High	714	10.81	1289	19.51	2000	30.25	2000
	Low	786	4.89	1418	8.83	2200	13.70	
7	High	786	11.89	1418	21.46	2200	33.27	2200
	Low	857	5.34	1647	9.63	2400	14.94	
8	High	857	12.97	1547	23.41	2400	36.31	2400
	Low	929	5.78	1675	10.43	2600	16.19	
9	High	929	14.05	1675	25.36	2600	39.33	2600

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

POWER TAKE-OFF 5 TO 6 GEAR RATIO

Governor Control Position	Transfer In	Transmission Gear In: Low Take-Off Shaft R.P.M.	Low Vehicle Speed K.P.M.	Intermediate Take-Off Shaft R.P.M.	Intermediate Vehicle Speed K.P.M.	High Take-Off Shaft R.P.M.	High Vehicle Speed K.P.M.	Engine Speed
	Low	298	3.57	537	6.45	833	10.00	
1	High	298	8.68	537	15.68	833	24.35	1000
	Low	357	4.29	644	7.73	1000	12.02	
2	High	357	10.43	644	18.84	1000	29.20	1200
	Low	417	5.00	762	9.04	1166	14.02	
3	High	417	12.16	752	21.98	1186	34.05	1400
	Low	476	5.72	859	10.33	1333	18.03	
4	High	476	13.91	859	25.12	1333	38.93	1600
	Low	536	6.44	967	11.61	1500	19.43	
5	High	536	15.65	967	28.25	1500	43.80	1800
	Low	595	7.15	1074	12.90	1666	20.00	
6	High	595	17.39	1074	31.40	1666	48.65	2000
	Low	655	7.86	1182	14.20	1833	22.02	
7	High	655	19.11	1182	34.53	1833	53.53	2200
	Low	714	8.59	1289	15.48	2000	24.03	
8	High	714	20.87	1289	37.66	2000	58.40	2400
	Low	774	9.30	1396	16.78	2166	26.04	
9	High	774	22.60	1396	40.80	2166	63.28	2600

POWER TAKE-OFF 6 TO 5 GEAR RATIO

Governor Control Position	Transfer In	Transmission Gear In I Low Take-Off Shaft R.P.M.	Low Vehicle Speed K.P.M.	Intermediate Take-Off Shaft R.P.M.	Intermediate Vehicle Speed K.P.M.	High Take-Off Shaft R.P.M.	High Vehicle Speed K.P.M.	Engine Speed
	Low	428	3.57	773	645	1200 I	10.00	
							2435	lOGO
					9.04			
					10.33	1920	16.03	
4	Higl	685	13.91	1237	25.12	1920	38.93	1600
	Low	771	6.44	1392	11.61	2160	19.43	
5	HI~I	771	15.65	1392	28.25	2160	43.80	1800
	Low	857	7.15	1547	12.90	2400	20.00	
6	HigI	857	17.39	1547	31.40	2400	48.65	2000
		942	7.86	1702	14.20	2640	2202	
7	igl	942	19.11	1702	34.53	2640	53.53	2200
		1028	8.59	1856	15.48	2880	24.03	
8		1028	20.87	1856	37.66	2880	50.40	2400
		1114	9.30	2011	16.78	3120	26.04	
9		1114	22.60	2011	40.80	3120	63.28	2600

POWER TAKE-OFF GEAR RATIO

POWER TAKE-OFF TO1 GEAR RATIO

Governor Control Position	Transfer In	Transmission Gear In Low Take-Off Shaft R.P.M.	Low Vehicle Speed K.P.M.	Intermediate Take-Off Shaft R.P.M.	Intermediate Vehicle Speed K.P.M.	High Take-Off Shaft R.P.M.	High Vehicle Speed K.P.M.	Engine Speed
	Low	358	3.57	644	6.45	1000	10.00	
1	High	358	8.88	844	15.68	1000	24.35	1000
	Low	428	4.29	773	*7.73*	1200	12.02	
2	High	428	10.43	773	18.84	1200	29.20	1200
	Low	500	5.00	902	9.04	1400	14.02	
3	High	500	12.16	902	21.98	1400	34.05	1400
	Low	571	5.72	1031	10.33	1600	16.03	
4	High	571	13.91	1031	25.12	1600	38.93	1600
	Low	643	L44	1160	11.61	1800	19.43	
5	High	843	15.85	1160	28.25	1800	43.80	1800
	Low	714	7.15	1289	12.90	2000	20.00	
6	High	714	17.39	1289	31.40	2000	48.65	2000
	Low	786	7.86	1418	14.20	2200	22.02	
7	High	786	19.11	1418	34.53	2200	53.53	2200
	Low	857	8.59	1547	15.48	2400	24.03	
8	High	857	20.87	1647	37.68	2400	58.40	2400
	Low	929	9.30	1675	16.78	2800	26.04	
P	High	929	22.60	1875	40.80	2600	63.28	2600

Pulley Speeds (R.P.M.) - 8" (20. 3CM.) Pulley
Power Take-Off Gear Ratios

Governor Control Positions	6-6 RATIO TRANSMISSION			6-5 RATIO TRANSMISSION			1-1 RATIO TRANSMISSION			Engine Sp~eds
	Low	Inter.	Hh '6 —	Low ~.	Inter	High	Low	Inter.	High	
1 255 460 I			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	~ -	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	j612	1105	1714	2000
7	561	1031	1571	807	1458	2262	673	1237	1885	2200
8	612	1105	1114	881	1591	2468	734	1326	2057	2400
9	663	1197	1851	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 3500 Lb. Vehicle Moving with Vehicle Stationary 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	18.3	16.2	14.0	12.0	9.8	7.8
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	25.6	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	33.11	33.0	29.7	25.5	21.1	16.9
2600	5.8	18.68	33.0	33.0	31.4	26.7 I		22.1 17.5

*Vehicle speed in low transmission and transfer case ratios.
**Based on maximum recommended draw bar pull for cantinuouu servnce-—1200 Lbs.

METRIC

Governed Engine	Vehicle Speed	Draw Bar H.P.~'	Metric H.P. at P.T.O. Spline Shaft 1590 Kg. Vehicle Moving with Vehicle Stationary DrawLr Pull	135 Kg. Draw Bar Pull	270 Kg. Draw Bar Pull	405 Kg. Draw Bar Pull	540 Kg. Draw Bar Pall
R.P.M.	K.P.H.~	(Metric)					
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	33.6	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
2800	9.3	18.94	33.5	33.6	31.8	27.1	22.4	17.7

~Vehicle speed in low transmission and transfer case ratios.
[1]'Based on maximum recommended draw bar mull for continuous service 640 Kg.

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 located on the right side of the dash under the hood.

Engine number will be found stamped on top 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 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 when received.

Write, stating what you are sending and the purpose for which it is sent regardless of any previous correspondence. All parts are held until advice is received.

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

NOTE: Parts replaced under the terms of the Warranty (Page 4) 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 satisfaction of the Dealer.

In this connection, a forwarding address should be given by the owner in order to insure the receipt of proper credit.

ACCEPT ONLY GENUINE FACTORY PARTS

Alphabetical Index

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