TOYOTA
REPAIR MANUAL

MODEL FJ

CLUTCH

CLUTCH

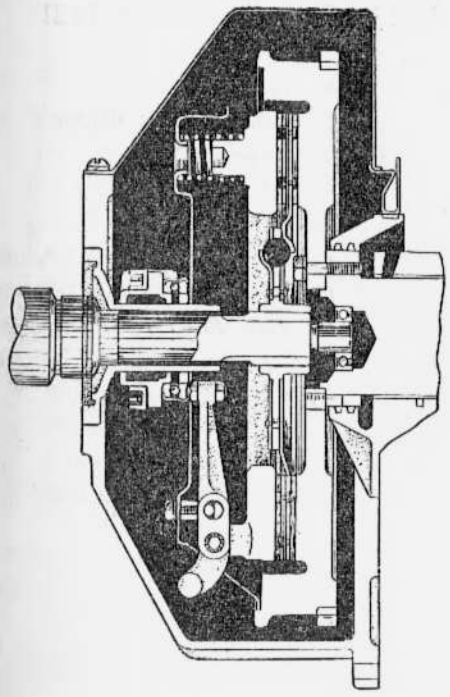
PURPOSE OF CLUTCH AND ITS REQUIREMENTS

When the gasoline engine is to be used as a power unit in an automotive vehicle, it is necessary that the starting be facilitated by freeing the engine from the drive system and starting the engine without load.

The gasoline engine differs from other power units such as the steam engine and electric motor so that it is unable to start by itself when under heavy load. Also the characteristic of an internal combustion engine is that unless it is revolving above a certain speed, it will not produce useful power.

When starting the vehicle, it is necessary that the high speed torque be gradually transmitted to the rear parts. Also when running, the transmission gears must be shifted and also at times, the engine must be freed from the rear parts. To take care of these requirements, the clutch is provided between the engine and the transmission.

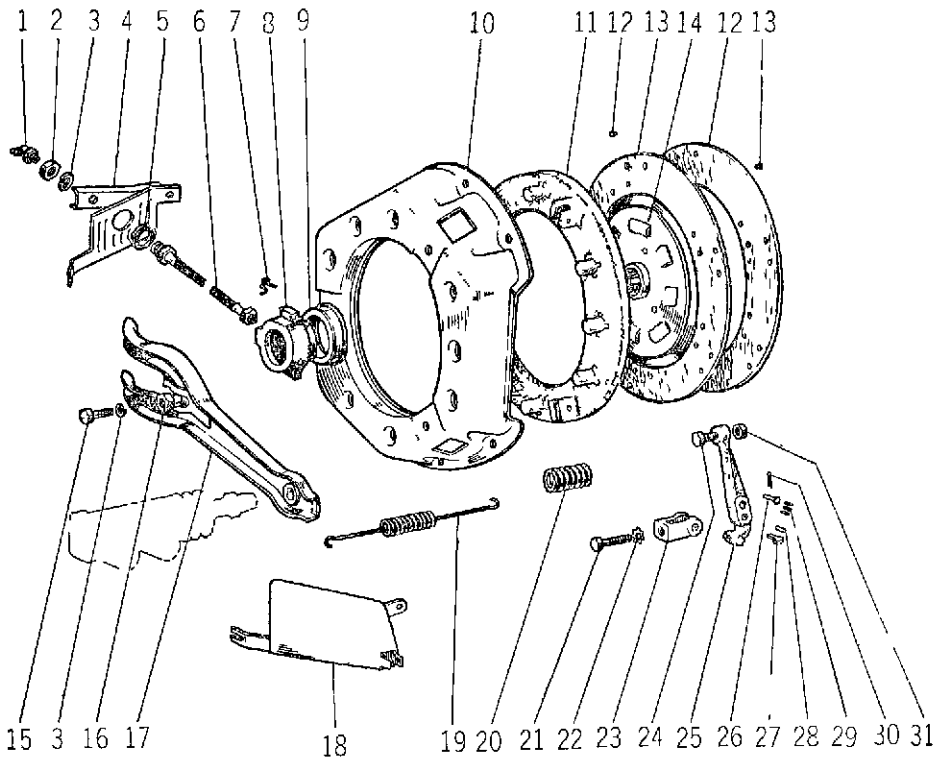
Thus, it can be seen that the clutch is an indispensable unit of any machine that utilizes the internal combustion engine. To serve this purpose, it is required that the clutch be constructed to fulfill the following conditions.



1. Be simple and easy to operate.
2. Power transmission and disengaging action must be quiet and positive.
3. Clutch spinning must be small but its transmitting torque must be large.

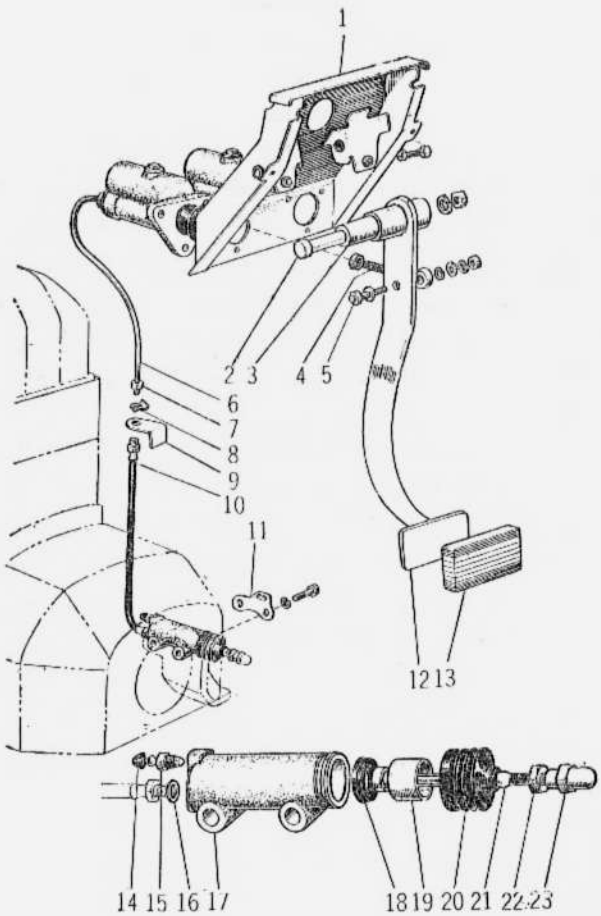
   By clutch spinning is meant the continued rotation of the clutch due to inertia action after being disengaged from the driving part. Large clutch spinning will make operation of transmission exceedingly difficult.
4. Material used for the clutch plate must be highly durable and should not overheat from repeated clutching action.
5. Must be simple in construction so that inspection, adjustment, and repairs can be made easily.

Clutch Parts



① *Grease Nipple*
② *Nut*
③ *Spring Washer*
④ *Cover Plate*
⑤ *Cover Plate Grommet*
⑥ *Grease Pipe*
⑦ *Bearing Hub Spring*
⑧ *Bearing Hub*
⑨ *Release Bearing*
⑩ *Clutch Cover*
⑪ *Pressure Plate*
⑭ *Clutch Facing*
⑬ *Rivet*
⑫ *Clutch Disc*
⑯ *Bolt*
⑱ *Clutch Fork Ball*
⑰ *Clutch Fork*
⑮ *Leather Cover*
⑲ *Back Spring*
⑳ *Clutch Spring*
㉑ *Bolt*
㉒ *External Tooth Washer*
㉓ *Lever Pin Yoke*
㉔ *Adjusting Bolt*
㉕ *Pressure Lever*
㉖ *Pressure Plate Pin*
㉗ *Lever Pin*
㉘ *Lever Roller*
㉙ *Pin Roller*
㉚ *Cotter Pin*
㉛ *Nut*

Clutch Pedal, Cylinder, and Release Parts



① *Pedal Bracket*
② *Pedal Shaft*
③ *Pedal Bushing*
④ *Push Rod*
⑤ *Push Rod Pin*
⑥ *Release Pipe*
⑦ *Union Nut*
⑧ *Hose Clip*
⑨ *Set Plate*
⑩ *Flexible Hose*
⑪ *Back Spring Hanger*
⑫ *Clutch Pedal*
⑬ *Pedal Seat*
⑭ *Rubber Cap*
⑮ *Bleeder Plug*
⑯ *Union Packing*
⑰ *Release Cylinder*
⑱ *Piston Cup*
⑲ *Piston*
⑳ *Boot*
㉑ *Piston Rod*
㉒ *Nut*
㉓ *Piston Rod Adjuster*

CONSTRUCTION OF CLUTCH

The clutch equipped on the Toyota Land Cruiser is a hydraulically actuated single plate, dry disc type The disc plate on this clutch is connected to the main drive shaft of the transmission with splines and transmits power through the frictional force of this disc plate being held tightly against the flywheel by clutch springs acting on the clutch pressure plate

The clutch master cylinder is attached with 3 bolts to the pedal bracket on upper part of cowl. The clutch pedal is attached to the pedal bracket through the pedal shaft and is fixed with a nut The pedal bushing fits inside the pedal and the pedal turns between this bushing and the shaft To eliminate the necessity for frequent lubrication of this part, the pedal bushing is made of oilless metal The master cylinder push rod is attached to the pedal with the push rod pin and the other end of this push rod screws into the end of the master cylinder piston rod and is prevented from turning with a nut.

The clutch release cylinder is attached with 2 bolts to the outer side of the clutch housing The clutch master cylinder and clutch release cylinder are connected together with clutch release pipe and flexible hose. The end of the piston rod inside the clutch release cylinder is provided with piston rod adjuster and this adjuster fits into the clutch fork. The clutch fork is supported by the clutch fork ball attached inside the clutch housing, and the forked part of the clutch fork fits into the clutch release bearing hub. The clutch fork is provided with leather cover to prevent dirt and dust from entering clutch housing The clutch release bearing is force fitted into the release bearing hub and fits over the front bearing retainer on the transmission main drive gear, being free to slide on the retainer when actuated by the clutch fork. This bearing is held against the clutch fork side by the return spring in order that the bearing will always move together with the fork.

The clutch disc assembly consists of two clutch facings, driven plate, spline hub, and six friction springs. Each clutch facing is riveted on to the driven plate and disc tension springs with 16 brass rivets while the tension springs are riveted on to the driven plate with steel rivets. The spline hub fits into the splines cut on the main drive gear shaft of the transmission and is free to slide on the shaft although rotating together

The three pressure levers are linked to the pressure plate with pins and needle bearings and also to the yoke with pins and rollers. The yokes are attached to the clutch cover with bolts Adjusting screws are provided on the inner ends of each pressure lever. These screws are used for adjustment when the levers do not act uniformally or when clutch fails to disengage properly due to wear in pressure lever pins and needle bearings or plate pins and rollers. The outer ends of the levers are provided with centrifugal weights.

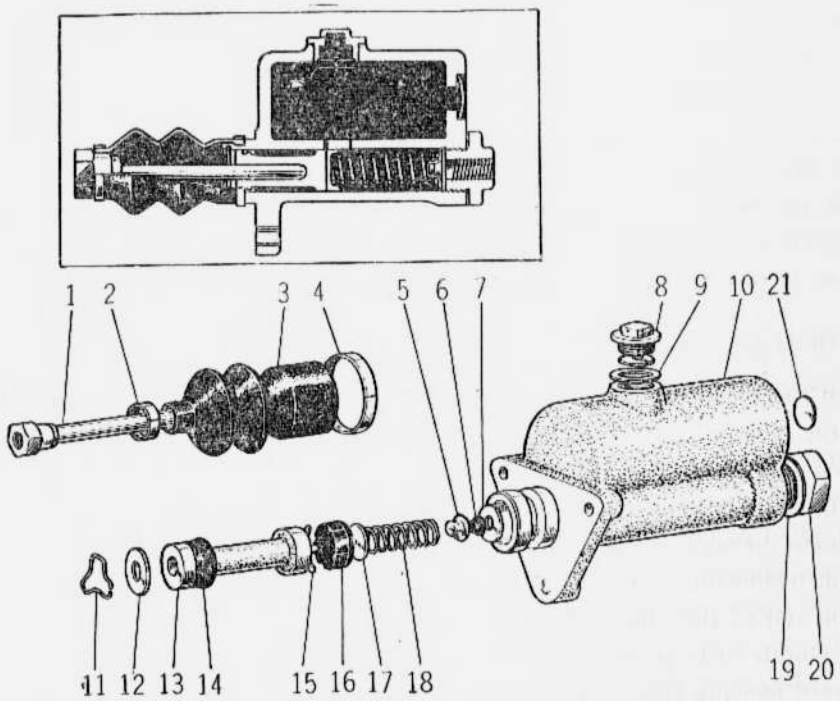
The clutch cover is attached to the rear face of the flywheel with 6 cap screws

and houses the clutch disc assembly, pressure plate, release lever, and clutch springs.

The front end of the clutch housing is installed on to the rear face of the cylinder block with 7 bolts and the rear face is attached to the transmission case with 2 stud bolts from the inner side of the housing. This part houses the release bearing and clutch fork. The clutch housing cover is attached to the bottom of the clutch housing with 4 cap screws and serves to prevent dust and dirt from entering into the clutch housing.

The clutch master cylinder is of special cast iron, the master cylinder body being made integral with the supply tank. The supply tank is always kept over 3/5

Master Cylinder



① *Piston Rod*
② *Boot Snap ring (Small)*
③ *Boot*
④ *Boot Snap ring (large)*
⑤ *Outlet valve Seat*
⑥ *Outlet valve*
⑦ *Valve seat packing*
⑧ *Cap*
⑨ *Cap Packing*
⑩ *Master Cylinder*
⑪ *Piston Snap Ring*
⑫ *Piston Stop*
⑬ *Piston*
⑭ *Piston Packing*
⑮ *Piston Cup Spacer*
⑯ *Piston Cup*
⑰ *Return Spring Seat*
⑱ *Return Spring*
⑲ *Plug Packing*
⑳ *Plug*
㉑ *Plate Plug*

full of brake fluid. The cylinder part and the supply tank part are connected together through the inlet port and the compensating port, these parts serving the following two functions. The first is to maintain a constant amount of brake fluid in the system regardless of any contraction or expansion due to temperature changes. The second is to perform as a pump during bleeding operations

In addition to the cylinder main body, the master cylinder consists of the valve assembly, return spring, piston cup, piston, push rod, and boot (rubber). The valve together with the piston cup, return spring, and piston are inside the cylinder and held in place with piston stop and lock wire The valve is pressed against the cylinder valve seat by the return spring The piston is of aluminum alloy and is provided with 6 small oil holes in the head and a rosette shaped piston cup spacer riveted on the center of the head, the rosette spring part being made to fit over the 6 oil holes.

One end of the piston rod fits into the piston and the other end links to the clutch pedal through the clutch push rod The piston rod is covered wiht a rubber boot to prevent dirt and dust from entering the master cylinder

The clutch release cylinder is of cast iron with aluminum alloy piston, piston cup, and piston rod arranged inside, with the rod part being covered with rubber boot to pevent dust and dirt from entering inside release cylinder The end of the piston rod is provided with adjuster and adjuster nut.

OPERATION OF CLUTCH

When the clutch pedal is depressed, this motion is transmitted through the push rod to the piston rod inside the master cylinder. The piston on the end of this piston rod is pushed forward and when it passes the return port, compresses the brake fluid inside the cylinder to push open the valve. The brake fluid under pressure passes through the pipe and hose to the clutch release cylinder to push out the piston inside this cylinder. This motion of the piston is transmitted through the piston rod to the clutch fork

The clutch fork pivoting on the clutch fork ball pushes the clutch release bearing forward causing the thrust surface of the bearing to push the heads of the three pressure levers. These levers, with the yoke pins and rollers acting as pivots, change positions so that the pressure plate linked to these pressure levers, pushes and depresses the clutch springs while being pulled toward the rear. This disconnects the clutch disc assembly from the pressure plate to cut off the power from the engine to the transmission main gear

When the clutch pedal is released, the pedal and the clutch fork return to their former positions being pulled back by the return springs. The hydraulic pressure inside the master cylinder and clutch release cylinder is also released and the fluid inside the clutch release cylinder flows back through the hose and pipe to the master cylinder Since there is a slight delay in the fluid returning back to the master

cylinder, a negative pressure is built up in the front side of the master cylinder piston preventing quick return of the piston to its former position. However, the fluid which entered into the back side of the piston through the inlet port now passes through the six small holes in the piston head and around the rim of the piston cup into the cylinder to eliminate this negative pressure and allow the piston to return quickly. After the piston passes beyond the compensating port, any surp lus fluid which enters the cylinder passes through this port into the supply tank.

In the above manner, a constant amount of fluid is always maintained in the system to assure positive operation and also can be made to serve as a pump when bleeding out the air from the system.

DISASSEMBLING CLUTCH

The procedure outlined below should be followed to remove and disassemble the clutch without removing the engine from the frame

1. Remove transmission and transfer case as described in Chapter on Transmission.
2. Unloosen bolt holding clutch fork hole leather cover and pull out cotter pin to remove leather cover.
3. The clutch fork is attached to fork bell with flat spring so that the fork can be removed by pulling out toward the fork hole
4. Romove clutch release bearing together with hub.
5. Remove 6 bolts holding clutch cover This will enable taking clutch pressure plate assembly off from the flywheel so that it can be removed together with clutch disc.
6. To remove pressure plate from clutch cover, it is only required to remove 3 bolts on pressure plate However, the cover must be held in a press as the pressure of the clutch springs inside the assembly will tend to make the cover fly off, making this an extremely dangerous operation. To remove cover, place a flat steel plate on upper surface of clutch cover and hold down lightly in a press Using a socket wrench, take the 3 pressure lever screws out completely. The press is then loosened gradually and the clutch cover removed

NOTE.

In disassembling the clutch cover from the pressure plate, it is important that the clutch assembly does not become unbalanced To prevent this, the clutch cover and the pressure plate should be punched mating marks so that they can be placed in their original positions when reassembling

This completes the disassembly of the clutch. All parts should now be carefully inspected and all necessary adjustments and repairs made.

CHECKING CLUTCH FOR REPAIRS

Before starting repair operations on clutch, make the following check-up

1. Check to see if the engine is loose or if the frame rubber has become deteriorated.

2. Check for play in clutch pedal.

There should be a play of about 40 mm in the clutch pedal from the place where it just begins to disengage to its original position.

3. Check to see if the clutch pedal wobbles or shakes when clutch is just beginning to disengage.

4. Check to see if clutch pedal bushing is worn, the shaft rusted on tight, or the pedal hitting the toeboard.

5. Check to see if the clutch release bearing is properly lubricated

6. Check to see if any uncomfortable vibration is felt when the clutch is being engaged during starting. This is usually caused by the clutch slipping due to the surface of the clutch facings becoming glazed or oil soaked, or the clutch tension springs becoming weakened.

INSPECTING CLUTCH PARTS

After disassembling the clutch, all parts are carefully checked for wear and defects. The following are the items which should be specially checked

1. If the clutch plate hub splines and main drive gear splines are found to be worn such that they are loose, they should be replaced with new parts.

2 Check for loose rivets in clutch facings

3. Check for weakened clutch disc tension springs

4. Check for presence of oil on clutch facings.

If clutch facings are found worn so that the heads of brass rivets are rubbing or if the facings are badly glazed or cracked, the disc plate should be relined. Also, if the brass rivet holes in the facings are found to be enlargened, relining is necessary.

If oil is found on clutch facings, it is being caused by troubles such as worn or damaged release bearing so that its source should be traced. When there is oil on the facings, wash with gasoline and blow dry with compressed air. Also, wipe the contact surfaces of the flywheel and pressure plate clean with gasoline.

If facings are found hardened, wash with gasoline and dry, then with a stiff wire brush, rub the surfaces of the facings until they can be reused.

5. Check for runout on clutch disc.

If the clutch disc is warped, the clutch will disengage poorly so that the disc is checked for warping with a clutch disc runout tester. The runout is measured on the circumference 100 mm from the center of the shaft. If the runout on one revolution, that is, the difference of the maximum and minimum readings, is less than 0.020 inch (0 5 mm), the clutch disc is satisfactory.

6 Check clutch pilot bearing.

If the bearing is found defective, it should be replaced with new part.

7 Check for play between pressure lever pin and needle bearing, and between pressure plate pin and roller, caused by wear.

The wear on pressure lever pins can be determined by holding pressure plate with the left hand and holding inner end of pressure lever with right hand and noting the amount of play by shaking the lever up and down. The wear on the pressure plate pins can be determined by holding the inner end of lever with left hand and noting the amount of play by shaking each pressure lever up and down with the right hand

The play in these parts can be taken up to a certain degree by turning the adjusting screw on the inner end of pressure lever so that it will not be necessary to disassemble the levers from the pressure plate if the amount of wear is small. In this case, after adjustment, just wash with kerosene and blow dry with compressed air, after which apply a small amount of good grade lubricating oil to pressure lever pins and pressure plate pins. However, if the amount of play is found to be too great after adjusting with pressure lever adjusting screw causing noises and poor disengaging of the clutch, the levers or yokes should be removed and replaced with new parts.

8. The pressure levers can be disassembled from the pressure plate by pulling out their cotter pins from the pressure lever pins and taking out the lever pins. When doing this, be careful not to lose the 15 pressure lever needle bearings contained in each lever assembly.

9. Checking and repairing pressure plate.

The surface of the pressure plate which contacts the clutch facing must be a flat plane. If there are scoring or other defects, or wear on one side, this must be corrected by sanding down the surface with a very fine sandpaper or by machining the surface on a lathe.

ASSEMBLING CLUTCH

After the clutch parts have been inspected, the clutch is reassembled in accordance with the procedure described below.

1. Assembling pressure plate to clutch cover.
   a. Insert 15 clutch pressure plate pin rollers into pressure lever and install on clutch pressure plate. Fit in clutch pressure plate pin and insert cotter pin.
   b. Place clutch pressure lever roller into clutch pressure lever yoke attaching hole and fix on yoke Place in clutch pressure lever pin and insert cotter pin.
   c Place pressure plate on a press and arrange the 6 clutch springs in their proper places. Place the clutch cover on pressure plate such that the mating marks made during disassembly coincide. Place a flat steel plate on top of cover and press down slowly with the press.

With the clutch cover compressed, bolt down the cover to clutch pressure lever pin yoke.

2 Assembling clutch assembly to flywheel.

In this case, the clutch disc must be accurately centered or considerable difficulty will be encountered in fitting the main drive shaft when installing the transmission For centering, use clutch disc centering tool or a spare main drive shaft and accurately locate the clutch disc in relation to the pilot bearing at center of flywheel At this position, install clutch assembly to flywheel. The 6 mounting bolts should be tightened uniformally and after the assembly is completed, the centering tool or the spare shaft used is pulled out.

MEASURING HEIGHT OF PRESSURE LEVER

After the clutch parts have been inspected and corrections made, and the clutch assembled, the pressure levers are adjusted. This adjustment is made through the adjusting screws provided on the ends of the pressure levers.

To adjust, first set the finger on one of the pressure levers so that its height from the clutch disc surface near the rivets to where it contacts the bearing plate measures to the specified 56 to 57 mm Then using the finger height gauge, adjust the other two levers to correspond to this height The difference between the maximum and minimum heights should be less than 0.2 mm (0.008 inch). This adjustment must be made when the disc and pressure plate are firmly contacting the flywheel.

By making the above repairs and adjustments, the clutch will now be able to display its fullest efficiency and hold down the amount of repair to a minimum

ADJUSTING CLUTCH PEDAL PLAY

The clutch pedal play is the sum of the combined plays in master cylinder and release cylinder, and the clearance between the release bearing and pressure lever The clearance between the release bearing and pressure lever should be about 3 mm and the combined plays in master cylinder and release cylinder should be about 14 mm when measured at end of clutch pedal.

If the pedal play should become more than 40 mm, the heights of pressure levers and the cylinders should be checked.

CLUTCH MAINTENANCE AND ADJUSTMENT

The clutch is an indispensible unit in the operation of the motor vehicle and is subjected to repeated usage during running. Its construction is such that with usage, the facings will gradually wear out. Consequently, this will increase the play in the clutch pedal causing the clutch to disengage poorly and make adjustments necessary

The release bearing is of the non lubricating type being sealed with grease

Thus while lubrication of this part is not required, it should never be washed with kerosene or other mineral spirits when disassembled

The clutch pedal bushing is of the oiless type and also does not require lubrication However, when disassembled, this bushing should be placed in oil to allow the oil to soak into the bushing

TROUBLES FREQUENTLY ARISING IN CLUTCH

A. Slipping Clutch

When the clutch fails to transmit proper amount of power, the clutch is said to be slipping. When the clutch begins to slip, the amount of slip is so small at first that it usually passes unnoticed but the harm already done begins to appear by the following signs

1. Vehicle begins to lose speed
2. Fuel consumption begins to increase.
3 Engine overheats
4. When the accelerator pedal is depressed suddenly while running, the engine responds but the vehicle does not pick-up in proportion
5. No power when climbing hills

When conditions (4) and (5) are reached, it is quite evident that the clutch is slipping but the beginning conditions (1), (2), and (3) are usually believed to be due to engine troubles so that care should be taken to also check the clutch when these symptoms appear.

If operation is continued with the clutch slipping, the clutch facings will wear excessively or else burn out and eventually make the clutch inoperative.

When the clutch seems to be slipping, check-up by making the following test:

Pull the hand brake lever back fully and make sure that the propeller shaft is properly braked. Disengage clutch and shift transmissin into low gear. Then while turning the engine over at fairly high speed, slowly engage the clutch. If the clutch is working properly, the engine should stop but if the engine fails to stop and the vehicle does not move forward, it is a proof that the clutch is slipping.

The following are the causes for slipping clutch

1. No play in clutch pedal.

In this case, set the play to about 40 mm by the methods outlined in adjusting clutch pedal play

2. Oil on clutch facing.

In this case, it is necessary that the clutch be disassembled and the clutch facings washed with gasoline and then thoroughly dried, or else replaced with new parts. At the same time, repairs or adjustments should be made to prevent entrance of oil before the clutch is reassembled.

—NOTE—

Oil entering into clutch is usually caused by over-lubrication of clutch throw-out bearing, transmission oil leaking out through the front bearing and travelling along the main drive shaft into the clutch facing, or lareg quantities of engine oil leaking into the flywheel side through the crankshaft rear bearing

3. Clutch facings worn

In this case, the clutch is disassembled and the facings relined.

4. Clutch disc springs weakened or damaged.

In this case, disassemble the clutch and replace defective springs with new parts.

B. Clutch Disengages Improperly

The symptom for this trouble is that a disagreeable grating sound is produced when shifting transmission gears with difficulty in shifting This trouble is most pronounced when shifting from neutral to low gear, although there will be some differences depending on the skill of the operator The disengaging action of the clutch is checked by making the following test.

First disengage the clutch and shift into gear. Then shift back into neutral and while depressing the clutch pedal, accelerate the engine and again shift back into gear. (During this operation, the clutch pedal is continuously depressed). If the noise is still produced, the clutch is not disengaging properly.

The following are the causes for improper disengagement of clutch

1. Clutch pedal play is too large.

In this case, the pedal play is adjusted by the methods outlined before.

2. Clutch parts are badly worn.

When operating parts except the clutch facings become worn, the pedal play will be taken up by the amount of wear in these parts to make the disengaging action of the clutch poor so that the clutch should be disassembled and all badly worn parts replaced with new parts.

3. Clutch pilot bearing is worn or damaged.

Defective pilot bearing will cause looseness in clutch shaft so that the clutch disc will not uniformally disengage from the surface of the flywheel and prevent proper cutting-off of power. In this case, the clutch should be disassembled and the bearing replaced

4. Clutch facings are too thick

When clutch disengages poorly due to the above cause, the trouble usually appears after the facings have been relined with the other parts of the clutch being in worn condition. The trouble may also be due to improper relining job in which the linings are uneven.

In relining, check to make sure that the disc has the proper thickness and also do not fail to check the clutch parts for wear.

C. Vibration Created When Starting

When a disagreeable vibration is always created when the vehicle is just beginning to move, that is, when the clutch pedal being released slowly is at half clutch position, the trouble is usually due to the clutch facings becoming glazed, oil on the facings, or the heights of clutch pressure levers not being uniform. In this case, the clutch should be disengaged, the parts inspected, and all necessary repairs, adjustments, and replacements made to eliminate the trouble.

OPERATING INSTRUCTIONS

The clutch is an indispensible unit in the transmission of engine power to the driving parts. Thus, the following precautionary instructions on its maintenance and operation should be strictly observed.

1. Do not rest foot on clutch pedal while driving.

Resting foot on clutch pedal while driving will tend to make the clutch slip and will eventually result in early wear or burning out of the clutch facings. It should be made a practice to always keep the foot off the clutch pedal except when actually operating the clutch.

2. Always start out the vehicle from low gear.

Always start out the vehicle from low gear and release the clutch pedal slowly. But when shifting into higher gears, this releasing action should be made correspondingly faster.

Unless the above operations are strictly carried out, not only will the clutch facings wear out rapidly but the life of the other parts of the vehicle will be shortened because of the strain imposed.

3. Do not half clutch.

Use of half clutch will cause excessive wear in the clutch facings and pressure plate, and will lead to making the clutch slip.

4. Do not allow oil or grease to enter clutch.

If oil enters into clutch functional parts, its operations will be greatly impaired and its life shortened.

5. Note condition of clutch adjustment.

Constant attention should be paid on the condition of clutch action and care should be taken not to neglect its periodical checking and adjusting.

6. The clutch pedal shaft and clutch throw-out bearing should be lubricated every 1,000 kms with gear oil or grease.

7. If the action of the clutch seems to be faulty, inspection and repairs should be made as soon as possible. Never continue to use clutch in faulty condition.

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