

# STUDY OF TRANSMISSION SYSTEM

**AIM:** To study about transmission system

## **DESCRIPTION**

Transmission system is a system at which power delivered by the engine is transmitted to road wheels of the vehicle. The nature of the transmission is operated by the type and drive at the vehicle. According to the transmission system two wheel drive and four wheel drive systems are commonly used.

Parts of the transmission system are:

### 1) FRAME

It is the main structural components which support all the chassis system and the body. The frame is the instant part at any automobile chassis. It support power plant, transmission system, steering system, tyre and suspension system etc. The body is also fitted on it. The main function of the frame is:

- a) To support the power plant, body, transmission system and other miscellaneous unit.
- b) To maintain correct spacing and relating shape between other units.
- c) To understand dynamic and static load.
- d) To get normal function at the supported unit and freedom from stress, strain and wear caused by the operation in this aligned condition.

### 2) ENGINE

Engine is the heart of an automobile. Engine is the power plant of a vehicle which provides the motion power to all the units and the parts those needs power. All the major units at the vehicle function due to power of plant only.

### 3) LOAD SPRING or SHOCK ABSORBER

It is used in the suspension system, the automobile frame and body are mounted on the front and rear axle not directly but through from all spring and shock absorber. This absorbs the jerks and shocks induced in the road due to road spring and those provides comfort to the riders.

### 4) CLUTCH

It is used for transfer all the power from engine to the gear box whenever it is required. A vehicle requires maximum torque at its start. There after a gradual increase in speed is desired. Gear box provides different output torque to the road wheels.

### 5) PROPELLER SHAFT

Lab manual

The flow of power from gear box to differential assembly takes place through propeller shaft and universal joint.

6) DIFFERENTIAL

It has mainly three functions, these are transmit the power at an angle 90 degree to which reduce the speed and increase the torque and maintain as speed reduction in inner wheels to the outer wheels when the case of turning.

7) REAR AXLE

The rear axle transmits power from differential assembly to rear wheels. The rear axle are enclosed in casing.

8) WHEELS AND TYRES

The tyre mounted on the wheel impart rolling motion to the vehicle .They consist of the front wheel is mainly to steers the automobile. The rear wheels drive by rear shaft ran at the vehicle. The tyre employs a tube inside to turn the air .But there is also tubeless tyres.

9) FRONT AXLE

Front axle is a stationary beam at two front wheels are connected to it through stub axles and thus they able to turn during steering.

10) STEERING

Steering is a control system. The steering of a four wheels vehicle is as per as possible arranged so that the front wheels will raid truly without only central strip .These movement is provided by gearing and linkage between the steering wheel in front of the steering system is to convert the rotary movement of the steering wheel to angular turn of the front wheel.

11) SILENCER

It is the high pressure exhaust gas was allowed to enter atmosphere, directly from the exhaust manifold. It is desirable to reduce this noise as much as possible. A silencer is connected between the engine exhaust pipe and outlet pipe.

12) FUEL TANK

The purpose of the fuel tank is to store the fuel. The fuel tank is made as sheet metal. It is usually attached.

**Result:** studied about the transmission system.

## Cycle I

### STUDY OF SINGLE PLATE CLUTCH

**Ex no:1**

**Date:**

**AIM:** To study about single plate clutch.

**DESCRIPTION:**

It is the most common type clutch used in motor vehicle. Basically it consists of only one pressure plate and one friction plate mounted on the splines of clutch shaft. The fly wheel is mounted on the engine crank shaft. The clutch assembly is bolted to the fly wheel. Friction plate is held between the fly wheel and the pressure plate. There are springs arranged circumferentially which provide axial force to keep the clutch in engaged position. The frictional plate is mounted on a hub which is splined from inside and thus free to slide over the gear box shaft. Frictional facing is attached to the friction on both sides to provide two annular friction surfaces for the transmission of the power. A pedal is provided to pull the pressure plate against the spring force whenever it is required to be disengaged.

**RESULT:** Studied about the clutch and its function.

# **STUDY OF SLIDING MESH GEAR BOX**

**Ex no:2**

**Date:**

**AIM:** To study about the sliding mesh gear box and its functions.

**DESCRIPTION:**

It is the simplest type of gear box. The function of gear box to provide high torque at starting climbing, accelerating and carrying loads. The clutch gear is rigidly fixed on the clutch shaft. It remains allow connect to the drive gear of the counter shaft. They are second speed gear, first speed gear and reverse speed gear.

## 1) NEUTRAL POSITION

When the engine is running clutch is engaged the clutch shaft gear drives thus counter shaft gear. The counter shaft gear rotate opposite in direction of the clutch shaft. Note that in neutral position only the clutch shaft is free and hence the transmission main shaft is not running.

## 2) FIRST GEAR POSITION

By operating the gear shift lever, the large gear on the main shaft is removed along the shaft to mesh with first gear of the first shaft. The main shaft turns in the same direction as the clutch shaft. Since the smaller counter shaft gear is engaged with the large main shaft gear. A gear relation of approximately 3:1 is obtained. ie, the clutch shaft turns 3 times for each revolution in the differential of the rear wheel provides a still higher gear ratio approximately 12:1 between the engine crank shaft and wheel.

## 3) SECOND GEAR POSITION

By operating the gear shift lever the large gear on the main shaft is demised from first gear of the counter shaft and then the smaller gear of the main shaft is meshed with second gear of the counter shaft. The main shaft turns in the same direction as the clutch shaft. A gear reduction of the differential gear ratio to approximately 3:1

## 4) THIRD /TOP/HIGHER SPEED GEAR POSITION

External teeth on the clutch shaft gear mesh with the internal clutch shaft and gear ratio 1:1 is obtained. The different gear reduction provides a gear ratio of about 4:1 between the engine crank shaft and the wheel.

5) REVERSE GEAR POSITION

By operating the gear shift lever, the bigger gears of the main shaft is meshed with the reverse /idle gears. The reverse idle gears always in mesh with counter shaft reverse gear into passing the idle gears between the counter shaft reverse gear and main shaft, bigger gears. The main shaft turns in the direction opposite to that of the clutch shaft.

**RESULT:** Study about sliding mesh gear box and its functions.

## **STUDY OF CONSTANT MESH GEAR BOX**

**Ex no:3**

**Date:**

**AIM:** To study about the constant mesh gear box and its functions.

**DESCRIPTION:**

In this type of gear box all the gears of the main shaft are in constant mesh with the corresponding gear of the main shaft. Three dog clutches are provided between second and first on reverse gear. The main shaft is splined and all the gears free on it. All gears on the counter shaft are rigidly fixed with the dog clutch can slide on the shaft and rotate with it.

When the left hand slide dog clutch is slide the left by means of the gear, box shift lever. It meshes with the clutch gear and the top gear is obtained. When the control dog clutch is slide to the left. The four gear is obtained when the right hand dog clutch is slide to the left, second gear is obtained. When it is slides to the right side, first gear is obtained.

**DOUBLE DE CLUTCHING:**

In the constant mesh gear box for the smooth engagement of the dog clutch. It is necessary that the speed of main shaft and the sliding dog must be equal. These to obtain lower gears, the speed of the clutch shaft, lay shaft and main shaft gear must be increased. This is done by double de clutching, is given below.

The clutch is engaged and the gear is brought to neutral then the clutch is engaged and accelerator pedal pressed to increase the speed of the main shaft gears. After this the clutch is again disengaged and the gear moved to the required lower gear and the clutch is again engaged as the clutch is disengaged twice in this process. It is called double de clutching. For changing to higher gear however reverse effect is desired, the drivers has to weight with the gear in neutral. Till the main shaft speed is decreased sufficiently for a smooth engagement of the gear.

**RESULT:** Study about constant mesh gear box and its function.

## **STUDY OF SYNCHRO MESH GEAR BOX**

**Ex no:4**

**Date:**

**AIM:** To study about the synchromesh gear box and its function.

### **DESCRIPTION**

The modern synchromesh helical and synchromesh device in the gear box that synchromesh rotation of the gears. That are about to be meshed this eliminates crashing of gears and made gear shifting easier. The synchromesh gear box is similar to the constant mesh gear box but the synchromesh gear box is produced with the synchromesh unit. It is provided in fixed into the constant with the speed after with they can engaged smoothly. In most of the synchromesh device are fitted on the output shaft. And some cases the first gear and reverse gear do not have synchromesh device they are depended to the vehicle.

Fig. shows the synchronizing unit of synchromesh gear box. When the gear lever is mounted at the synchromesh gears mesh with as are in the pinion is make to rotate at the same speed in the synchromesh unit to give a positive drive. Further movement of the gear lever enable the coupling to one into several spring load but and coupling increased with the one side of the pinion since both pinion and synchromesh unit are moving at the same speed. This arrangement is done without noise of damage to the dog clutch. A slight relay in meshing before the running dog teeth . So that the wise having a chance to bring the synchromesh any purpose to same speed.

**RESULT:** Studied about synchromesh gear box .

# **SINGLE PLATE CLUTCH**

**Ex no:1**

**Date:**

**AIM:** Dismantle and assemble the given friction type single plate clutch.

**TOOLS REQUIRED:** Spanners open end and ring , hydraulic press.

**MATERIALS REQUIRED:** Diesel, Cotton waste, Brush, Single plate clutch etc.

**PROCEDURE:**

a) **Dismantling**

- 1) First of all clutch is removed from the fly wheel.
- 2) Place the clutch assembly in a work bunch.
- 3) Compress the clutch cover to downward.
- 4) Loose the clutch cover by loosening the nut on it .
- 5) Dismantle the clutch cover.
- 6) Dismantle the clutch fork.
- 7) Remove the pressure plate and pressure spring etc.
- 8) Dismantle the clutch fingers and release bearing.

**b) CLEANING AND INSPECTION**

- 1) Clean all parts by using kerosene and cotton waste.
- 2) Check the friction plate for wearing and tear of shock of tension spring.
- 3) Check clutch releasing bearing fingers and recondition all parts.

**c) ASSEMBLING**

- 1) Assemble the pressure plate which clutch fingers and spring.
- 2) Insert the clutch shaft in the clutch cover.

- 3) Assemble clutch and releasing bearing.
- 4) Assemble pressure plate with cover.
- 5) Tighten the whole assembly.
- 6) Tighten the nuts and bolts on the clutch cover in correct order.
- 7) Check alignment after setting.
- 8) Refit the clutch assembly on the fly wheel of the vehicle.

**RESULT:** Dismantle and assemble of a single plate clutch assembly.

# **SLIDING MESH GEAR BOX**

**Ex no:2**

**Date:**

**AIM:** Dismantle, inspect and assemble the given sliding mesh gear box.

**TOOLS REQUIRED:** Open end spanners and ring spanners , screw driver, wooden hammer etc.

**MATERIALS REQUIRED:** Sliding mesh gear box, oil, gasket, cotton waste, etc.

**PROCEDURE:**

a) **DISMANTLING**

- 1) Park the vehicle in a level ground.
- 2) Lift the bonnet and remove the connection between gear box and the propeller shaft.
- 3) Remove the shaft housing and gasket from the top of gear box by loosening the bolts on the casing.
- 4) Dismantle the shaft housing by removing the shaft rail and fork [selector mechanism from the shaft housing]
- 5) Remove the side cover, clutch shaft and also remove the bearing.
- 6) Remove gears from the main shaft, then remove the shaft.
- 7) Remove the idle gear with idle shaft.
- 8) Remove the counter shaft with gear through washer, needle bearing, roller etc.
- 9) Then calculate the gear ratio.

**b) INSPECTION AND CLEANING**

- 1) Check any cracks, bend on main shaft, idle shaft and it recondition or replace.
- 2) Look out any teeth of gear worn out it is recondition or replaced.
- 3) Check the sleeves and replace and clean it.
- 4) Check the bearing and apply grease.

5) Also inspect splines ,gear lever, selector mechanism etc.

**c) ASSEMBLING**

- 1) Refit the counter shaft with fixed gear in gear box.
- 2) Refit the idle gear shaft with gears.
- 3) Refit the main shaft gears.
- 4) Refit the bearings.
- 5) Refit the clutch shaft and side cover.
- 6) Refit the top cover with selector mechanism.
- 7) Tighten the mounting bolts.
- 8) Connect the gear box in clutch and propeller shaft.

**RESULT:** Dismantle and assemble the sliding mesh gear box.

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$$\text{Gear ratio} = \frac{\text{product of no of driven gears}}{\text{Product of no of driving gear}}$$

Find :- 1,2,3 and reverse gear ratios (**find all type gear box**).

## **CONSTANT MESH GEAR BOX**

**Ex no:3**

**Date:**

**AIM:** Dismantling, inspecting and assembling the given 5 speed constant mesh gear box and find the gear ratio.

**Tools required:** screw driver, open end spanner, ring spanner, wooden hammer.

**Material required:** oil, constant mesh gear box, grease, cotton waste, kerosene.

**PROCEDURE:**

**a. Dismantling**

1. Park the vehicle on a level surface and prevent from rolling by using a wooden block.
2. Disconnect all external connections such as clutch pedal linkage, shift lever, speedometer cable, propeller shaft with universal joint.
3. Drain out the lubrication oil from the gear box by the removal of the drain plug and refit it.
4. Support the gear box by using jacks and loosen the bolts and bell housing bolts and remove the gear box from the engine.
5. Support the engine and insert another clutch shaft on to clutch assembly.
6. Take the gear box and placed in a work bench.
7. Loosening bell housing bolts and remove it.
8. Remove the shaft cover casing from the clutch shaft, main shaft and other fittings.
9. Remove the top cover by un screwing the mounding bolts.
10. Unscrewed the bolts and remove selector rod and selector fork.
11. Remove the clutch shaft bearings.
12. Remove the main shaft gears with dog clutch bearings and remove the main shaft from the gear box.
13. Remove the idle shaft and reverse gear.
14. Remove the counter shaft with gear and bearings.

15. Calculate the gear ratio.

**b) Inspection and cleaning**

1. Check the cracks and bending of all parts such as idle shaft, main shaft, counter shaft and clutch shaft.
2. Clean all parts, replace damaged parts.
3. Check the wearing of the gear teeth and hub.
4. Check the bearings.

**c) Assembling**

1. Refit counter shaft with gear and bearing.
2. Refit the reverse gear and idle shaft.
3. Refit the main shaft and gears with dog clutch and bearing.
4. Refit the clutch shaft.
5. Tighten the bolt and refit the selector rod and selector fork.
6. Refit the top cover by tighten the mounding bolts.
7. Refit the shaft cover using from clutch shaft, main shaft and other fittings.
8. Refit the ball housing and tighten the ball housing bolts.
9. Refit the gear box into engine and tighten the mounding bolts and ball housing bolts.
10. Refill new lubricating oil(S.A.E 90)
11. Connect all external connections such as clutch pedal linkage, speedometer cable, gear box cable and propeller shaft.
12. Start the vehicle and check the performance of the gear box.

**Result:** Dismantle & assemble the given constant mesh gear box & inspect the parts.

## **SYNCHROMESH GEAR BOX**

**Ex no:**4

**Date:**

**AIM:** To dismantle, inspect and assemble the given synchromesh gear box.

**Tools required:** Screw driver, open end spanner, ring spanner, plastic hammer, adjustable spanner etc.

**Materials required:** synchromesh gear box, gasket, oil, cotton waste etc.

### **PROCEDURE:**

#### **a) Dismantling**

1. Park the vehicle on a level ground.
2. Disconnect the electrical connections.
3. Disconnect all other external connections such as clutch pedal linkage, shift lever, speedometer cable etc.
4. Drain the lubricating oil from the gear box by removing the oil drain plug and relief it.
5. Then remove the axle nuts and then pull out the half drive axle.
6. Then loosen the foundation nuts and bolts.
7. Loosen the ball housing bolts of the gear box.
8. Then the transmission assembly is taken out which include gear box differential.
9. Place the gear box on the work bench.
10. Then remove the top cover 5<sup>th</sup> speed gear and the selection mechanism.
11. By loosening the bolts, remove the main cover of the gear box.
12. Remove the selector mechanism.
13. Remove idle shaft with reverse gear.
14. Remove lay shaft with main shaft.
15. Remove synchronizing unit. it has a selector sleeve, hub, male cone, female cone(synchronizing ring).

16. Remove differential unit from which output is taken. The drive for speedometer is given from this unit.
17. Then calculate the gear ratio.

**b) Inspection and cleaning**

1. Check any crack, bend on which shaft, idle shaft is necessary recondition or replace the parts.
2. Check the gears for crack, wear etc. and worn out the damaged parts.
3. Check the synchronizing unit, selector sleeve, hub, male cone and female cone.
4. Check bearings and apply oil.
5. Also inspect splines , gear lever, selector mechanism, gasket etc.

**c) Assembling**

1. Refit the differential unit to the gear box.
2. Refit the main shaft with clutch shaft.
3. Refit the idle shaft with reverse gear.
4. Refit the selector fork on each sleeve and there by the selector mechanism.
5. The main cover is placed on the base and tightens the nuts and bolts.
6. Refit the 5<sup>th</sup> gear with selector mechanism and refit top cover on the top gear and then tighten the bolts by spanner.
7. Then the transmission assembly refits into the vehicle.
8. Tighten the bell housing bolts using suitable spanners.
9. Tighten the foundation nuts and bolts of the gear box.
10. Refit half drive axle and tighten the axle nut.
11. Refill new lubricating oil(SAE.90.120)
12. Connect all external connections such as clutch pedal linkage, shift lever, speedometer cable.
13. Connect all external connections.
14. Then start the vehicle and check the performance of the gear box.

**Result:** Dismantled, inspected and assembled the given synchromesh gear box.

## Cycle 2

# PROPELLER SHAFT WITH UNIVERSAL JOINT

**Ex no:1**

**Date:**

**AIM:** To study about propeller shaft with universal joint and their working function.

**Tools required:** Open end spanner, Ring spanner etc.

**Materials required:** propeller shaft with universal joint, cotton waste, grease etc.

**Description:**

The function of propeller shaft is power transmitted from gear box to differential at correct length and varied angles. In vehicle having long wheel base two drive shaft is in two place and is supported at the centre shaft to sequence and increase length. The splined end of the shaft slides inside the other end to increase or decrease in length. The propeller shaft is connected with transmission and driving axle by means of universal joints.

Universal joint is the joint which enables the drive shaft to transmission power at a varied angle. The transmission which is connected with the driving angle by means of drive axle is at high level is subjected to transmit power at an angle. It varies when the road wheels moves up and down in relation to wheel depending upon the amount of weight in the vehicle body.

**Procedure:**

a) **Dismantling**

1. Park the vehicle on the level ground.
2. Remove the connection between gear box and universal joint also removes the connection between housing and universal joint.
3. Remove the propeller shaft and universal joint and place it on a work bench.

4. Remove the slip joint and propeller shaft.
5. Yokes are removed from universal joint by removing needle bearing from yoke.

**b) Inspection**

1. Check all parts and check the slip joint splines.
2. Check all parts and clean all parts.
3. Lubricate the joints.

**c) Assembling**

1. Refit the needle bearing in yoke.
2. Yoke are refitted on universal joint.
3. Refit the slip joint on propeller shaft.
4. Refit the propeller shaft within between differential housing and gear box through flange on their shaft.
5. Tight the bolts on the flange.

**Result:** Studied about the propeller shaft with universal joint and its working.

## **DIFFERENTIAL UNIT**

**Ex no:2**

**Date:**

**Aim:** To study, dismantle and assemble the differential unit.

**Tools required:** Ring spanner, open end spanner, screw driver, hammer etc .

**Materials required:** Differential unit, cotton waste, grease etc.

**Description:**

**Final drive:** up to the drive axle , the power flows through one straight line at the drive line , it is divided at right angle to flows towards the wheels. The change in direction of power flow is obtained by means of final drive. The final drive also provides a fixed speed reduction between the drive shaft and the driving axles. Final drive is following two main classes, 1) chain type, 2) Gear type.

**Differential:** it is the mechanism by means of which outer wheel runs faster than the inner wheel while taking a turn. It is 3 type conventional, power lock and double reduction type.

The conventional consist of a cage which contains differential gears. The differential gears consist of two sun gears and two or four star pinions, all of bevel gear type. The star pinion fitted on a pin. The pinion is free to move around their axes. The pin is held in between the two parts of the cage which encloses the differential gears. The sun gears and star pinions are always in mesh with each other. The sun gears are free to move inside the cage .the differential assembly is supported on taper roller bearings provided on both sides of the cage. When installed in the drive axle, the whole assembly moves around the bearings.

**Procedure:**

a) **Dismantling**

1. Park the vehicle on a level ground.
2. Drain out the oil from differential casing.
3. Remove the universal joint and flange connection of rear end of propeller shaft from final drive pinion.
4. Remove the differential unit by loosening the nuts and bolts.
5. Loosening the hubs of both wheels and push out the half axle from the both ends so that the connection to the sun gear is removed.
6. Remove bearing cup by loosening the bolts.
7. Take the crown wheel with the cage assembly.
8. Remove the pinion gear.
9. Remove the cage from the crown wheel by loosening bolts current to the crown gear.
10. Remove sun gear from unit.
11. Remove the planetary gear with spider , cross then separate the planetary gear and spider.
12. Remove the planetary gear from the shaft.

**b) Inspection and cleaning**

1. Check any problem with casing, sun gear, planetary gear etc is necessary recondition or replaced.
2. Check pinion gear and bearings of differential unit.
3. Clean all parts of differential unit by using kerosene or diesel.

**c) Reassembling**

1. Refit gears and spider and calculate final drive reduction ratio.
2. Refit the planner gears on the spider and placing over the sun gear.
3. Refit second sun gear over the planetary gear assembly.
4. Refit the cage on the crown wheel by tightening the bolts.
5. Take the crown case assembly in to differential casing in the rear axle beam place the crown wheel correctly mesh with pinion gears and adjust the back lash.
6. Push the half axle in to the axle tube on both ends. So external splines on the half shaft are connected to the internal splines of sun gear.
7. Refit the universal joint and propeller shaft to the differential.
8. Refit the new differential oil in the unit.

**Result:** Dismantled and assembled the differential unit.

## **REAR AXLE**

**Ex no:3**

**Date:**

**Aim:** To study about semi- floating type rear axle and then dismantle and assemble the semi-floating type rear axle.

**Tools required:** Open end spanner, ring spanner, screw driver, ratchet handle, torque wrench, hydraulic jack etc.

**Materials required:** Semi-floating type rear axle, kerosene, cotton waste, oil etc.

**Description:**

Rear axle is placed in between differential and driving wheel, the rear axle is situated to transmit power from differential to driving wheel. The rear axle is not single piece. But it has two half connected by differential each part is known as half shaft. A housing completely encloses and protecting from water. The drive from propeller shaft comes to the pinion shaft, which is supported in bearing in the axle casing. The crown wheel is mesh with the pinion and is mounted on shaft on the ends of which are fixed the caps which serves to restrict the wheel in axial direction. The wheels are mounted on bearings on the end of the axle shaft.

**Type of rear axle:**

1. Semi-floating type
2. Full- floating type
3. Three-quarter type

**Semi –floating type**

Studied about the rear axle, wheel hub is actually connected to the axle shaft is examine the same unit end of axle shaft is splined and supported by single bearing lag inside axle casing. This all are taken by axle shaft through the casing and the bearing. These are the bending load and tendency to hub at pull.

#### Full -floating type

This type is much shortened is used for heavy vehicle. The axle shaft has flanged to sleeve by means of balls bearing. These are two type of roller bearing supported the axle casing in hub which taken upon side load. The axle cans only the torque and other load supported by wheel and axle casing.

#### Three -quarter floating type

In this type the load of rear position of vehicle controlled by partially the axle tube and axle itself. In this type the bearing located between brake drum and axle casing.

#### **Procedure:**

##### **a) Dismantling**

1. Park the vehicle on level ground and prevent from rolling.
2. Loosen the wheel nut by wheel spanner and jack up the vehicle.
3. Remove the brake fluid connection and hand brake cable connection from both back plate.
4. Remove the wheels by loosening nut from the both sides.
5. Loosen the axle nut and remove it.
6. Remove the brake drum assembly by loosening the bolts.
7. Remove the brake plate from shaft with brake shoes.
8. Remove the half shafts of rear axle by hammer it and hand pulling.
9. Remove the other half shaft by the same procedure and remove the oil seal from rear axle by shaft.

##### **b) Cleaning and inspection**

1. Clean all parts by using kerosene and cotton waste.
2. Identify the worn out parts and repair or replace it.

##### **c) Assembling**

1. Refit the oil seal on both sides.
2. Insert the axle shaft into sun gear of differential assembly through the axle casing.
3. Reassemble the brake plate assembly to the axle shaft casing.
4. Refit the brake drum to the brake.
5. Tighten the axle nut.
6. Reconnect the hand brake connection and brake fluid connection.
7. Refit the wheel to the brake drum assembly.

8. The above procedures repeated into other of rear axle for consequence second half and wheel assembly on other side.
9. Run the vehicle and checked the performance of rear axle.

**Result:** Studied, dismantled, and assembled the semi-floating type rear axle.

## STEERING GEAR BOX

**Ex no:**4

**Date:**

**Aim:** To study dismantle and assembling the steering gear box.

**Tools required:** Spanner, screw driver, hammer, ratchet handle etc.

**Materials required:** Steering gear box, grease, oil, cotton waste etc

**Description:**

Steering system composed of following elements.

1. Steering.
2. Steering linkage.
3. Steering knuckle.

**STEERING:**

It is the mechanism which changes the direction of steering shaft linkage or mechanical advantage between steering and steering linkage. Steering composed of following components.

Steering wheel.

It is a circular wheel mounted of the steering rod by a nut on control for steering the wheel for the vehicle.

Steering column.

It is a circular wheel mounted at gear is employ the steering gears,

1. Worm and wheel
2. Worm and sector
3. Worm and roller
4. Screw and nut
5. Cam and lever
6. Rack and pinion
7. Recirculating ball type ,worm and nut

### **Procedure**

#### **a) Dismantling**

1. Park the vehicle on a level ground and block the wheel.
2. Separate the steering column, drop arm and universal joint connection from steering gear box.
3. Loosen the foundation bolts of steering gear box and take it on the work bench.
4. Remove the side cover by loosening the bolts.
5. Remove the worm shaft with nut assembly.
6. Remove the cross shaft.
7. Remove the worm nut assembly and separate recirculating balls.
8. Disconnect universal joint from steering shaft, then disconnect clamp from frame or shell and also disconnect tie rod end from steering knuckle on both side.
9. Remove the rack and pinion steering assembly from the vehicle and placed on the work bench.
10. Remove the test boot from tie rod.
11. Remove the tie rod by disconnecting ball joint from the rack.
12. Separate the rack and pinion.

#### **b) Inspection and cleaning**

1. Check the parts from wear and tear.
2. Check the worm nut and rack and pinion etc.
3. Clean all parts.

#### **C) Assembling**

1. Refit worm shaft with nut assembly.
2. Refit gear sector with cross shaft also the side cover.
3. Place gear box on frame then connect drop arm on cross shaft and also connect steering rod worm shaft through universal joint.
4. Refit rack and pinion.
5. Connect tie rod in to rack by using ball joint and also connect dust boot.
6. Connect rack and pinion assembly into steering knuckle through tie rod end by using ball joints.
7. Connect steering case to the frame by using clamp and connect steering rod to the pinion through one or more universal joint.

**Result:** Studied, dismantled and assembled the steering gear box.

## CYCLE III

**EX NO:**

**DATE:**

### **STUB AXLE**

**AIM :** To Study, dismantle and assemble the stub axle of a vehicle.

**Tools required:** Wheel spanner, hammer, tire lever, screw driver, spanners, combination pliers, screw jack, ratchet handle etc.

**Materials required:** stub axles

#### **Description:**

Stub axle is an integral part of the steering knuckle. The wheel hub rotates on ball bearing on stub axle. Tapered roller bearings are also used some time. The stub axle is which reverse Elliot type. The thrust bearing is placed between lower ends of beam axle. The king pin is locked with beam axle by a cotter pin and steering knuckle can turn. The brass bushes are provided in the part of the knuckle. A castle retaining nut is provided at the treaded end of the stub axle. This can be locked by means of cotter pin. The stub axle is mainly five types.

1. **Eliot type:** The construction of this axle steering knuckle is provided in between the forked end of beam by means of king pin is fixed in the stub axle by means of cotter pin.
2. **Reversed Eliot type:** This type arrangement is most commonly used on automobile vehicles. Hence axle beam is placed between the forked ends of steering knuckle. These are pivoted by means of king pin. The bearing surfaces may be replaced or repaired easily without damaging the axle beam.
3. **Lamoine type:** The construction of this axle with stub axle is connected to the beam axle from below (that is "L" shaped spindle and steering knuckle). It is generally used on front axle of tractor.

4. Reversed Lamoine type: The construction is same as that Lamoine type. The difference only in this that the down side of the stub axle has been used at upside. The wheel axle is above the axle beam is steered below.
5. Ball joint connection type: The stub axle is more recent and finds the follower of modern cars in such types the stub axle is connected to suspension member of vehicle by means of ball joints that the head of king pin eliminated.

**Procedure:**

**a) Dismantling:**

1. Park the vehicle on the level ground.
2. Loosen the wheel nut and jack up the vehicle and remove the wheel assembly and brake drum.
3. Remove the brake fluid cable, hand brake cable connections from stub axle assembly.
4. Remove the axle nut from stub axle. Then remove wheel hub assembly from stub axle.
5. Remove brake plate and brake shoe assembly from the stub axle.
6. Disconnect the steering knuckle arm connection from the stub axle.
7. Pull out the cotter pin from the slot of main axle beam.
8. Remove the king pin by hammering it downward.
9. Remove the stub axle from front axle.

**b) Assembling:**

1. Refit the stub axle to the front axle beam y placing the king pin and cotter pin.
2. Reconnect the steering knuckle arm connection.
3. Refit the carrier plate assembly.
4. Refit the wheel nut to the stub axle.
5. Tighten the axle nut to the stub axle.
6. Reconnect the brake drum over the wheel hub.
7. Reconnect the brake fluid cable connection in carrier plate.
8. Refit the tire and wheel over the drum by tight the wheel nut of the wheel hub.
9. Make sure that the work is very correct and all the nuts and bolts are tight.

**Result:** Studied, dismantled and assembled the given reverse Eliot type stub axle.

## **STRUT ASSEMBLY**

**Ex no: 2**

**Date:**

**Aim:** To study, dismantle and assemble Macpherson strut type independent suspension.

**Tools required:** Bench vice, open end spanner, coil spring compressor, ratchet handle, box spanner Etc.

**Materials required:** strut, coil spring, shock absorber, mounting bush, kerosene, petrol, cotton waste.

**Description:**

When a vehicle with rigid axle suspension encounters road irregularities. The axle tilts and the wheel on longer remains vertical. This causes the whole the vehicle to tilt on one side. Such stage of causing rough ride, wheel wobbles. The road friction is also decreased. To avoid this wheels are connected by sprung that is independent type Macpherson suspension.

The type only lower wishbones are used, the strut containing shock absorber and the coil spring carries also the stub axle on which the wheel is mounted on the lower wish bone position. The wheels as well as resist accelerating, braking, and side forces. The system is simpler than double wishbone type and is also lighter, keeping the unsprung weight lower, further the camber also doesn't change when the wheels move up and down. This is claimed to provide more ride safely, improve side comfort and self stability steering, which means that car contains along its chosen line to travel when the brakes are applied even though the road surface may vary. Nowadays Maruthi, Fiat, Uno, Lancer are used this type.

**Procedure:**

a) **Dismantling:**

1. Park the vehicle on a level ground and jack up the vehicle.

2. Remove the brake line connection and steering knuckle connection.
3. Remove strut assembly by disconnecting from apron.
4. Fix the strut assembly on the bench vice.
5. Using coil spring compressor, compress the coil spring.
6. Loosen the lock nut and dismantle stopper, bearing seal, coil spring, upper seal, stopper etc from plunger.
7. Remove the coil spring with coil spring compressor.

**b) Inspection and cleaning:**

1. Check and identify the problems of strut, coil spring, stopper, bearing seal, mounting bush etc.
2. Clean all parts by using kerosene or petrol and cotton waste.
3. Remove the worn out parts and inspect all parts.

**c) Assembling:**

1. Inspect the coil spring in the strut.
2. Refit all parts like dust boot, coil spring, bearing seal, support, stopper and mounting bush.
3. Tighten the nut and remove the strut from the bench vice.
4. Refit the strut assembly in the vehicle by fitting the support on apron and connect brake lines and steering knuckle connection.
5. Check the performance.

**Result:** Dismantled, assembled and studied the strut assembly and identified the parts.

## **BRAKE SYSTEM**

**Ex no:3**

**Date:**

**Aim:** to dismantle and assemble the given master cylinder and wheel cylinder. Identify the parts, and replace the damaged parts.

**Tools required:** screw driver, circlip plier, spanner set etc.

**Materials required:** master cylinder, wheel cylinder, kerosene, cotton waste, petrol etc.

**Description :**

**Master cylinder:**

It is the heart of hydraulic brake system. There are two main chambers viz, the fluid reservoir and compression chamber in which the piston operates.

The pedal rod is operated with a foot brake pedal, as the pedal is pressed, piston rod moves to left against the force of the spring till it covers the by-pass port. Further movement of the pedal rod causes building up of pressure has built up, the inner cup of the fluid check valve is deflected, forcing the fluid under pressure on the lines. The fluid enters the wheel cylinder and moves the piston here by applying the brakes.

When the brake pedal is released, the spring pressure in the master cylinder moves the piston to the right extreme position. The same force of the spring keep the fluid check valve pressed on its seat for some time and there by delays the return of fluid from the lines in to the compression chamber again. Some delay is also caused by the inertia of the fluid in the lines. This produce a vaccum in the compression chamber and unless this is destroyed immediately, there are all chance for air leaking into the system even a very small amount of air will enter the brakes unless, the air being compressed. The problem is solved by having in take port as shown. As soon as some vaccum formed, the atmospheric pressure in the fluid reservoir forces the fluid through in take port and holes in the piston wheel deflects the rubber cup and enters the compression chamber to destroying the vaccum.

But by the time this vacuum is destroyed, the fluid from the lines come back into reservoir by lifting the fluid check valve off its seat. The extra fluid now has to accommodate some have, because the compression chamber is already full. If this is not done the pressure in the line will not be relieved fully and there are all chances of brake shoes rubbing with the drum. This avoided by means of by-passport. The extra fluid coming from the line passes to the fluid reservoir where pressure is maintained atmosphere by providing an air-vent.

#### Tandem master cylinder:

In tandem master cylinder, separate lines go to rear and front brakes and it is so arranged that if the front brake lines are damaged, the rear brakes will be still effective. Similarly if rear brake line defective, at left front brake will be applied.

#### Wheel cylinder:

It consist of two position. It is fixed in the back plate, the brake fluid under pressure forces the piston apart there by applying the brakes.

#### **Procedure:**

##### **a) Master cylinder (dismantling and assembling)**

1. Park the vehicle on a level ground.
2. Drain out the brake fluid from the reservoir.
3. Remove the dust boot.
4. Remove the circlip on piston assembly.
5. Remove the piston.
6. Remove the piston primary cup and piston return spring with residual check valve.
7. Remove residual check valve rubber seat.
8. Remove brake light switch assembly.
9. Inspect the parts for wear and tear.
10. Replace the primary and secondary rubber cup.
11. Recondition the cylinder assembly.
12. Clean the vent cup and ensure the vent cup hole must be open.
13. Dip all parts in brake fluid and lubricating inside the cylinder.
14. Reassemble all parts.
15. Install circlip and dust cover and brake light pressure switch.

##### **b) Wheel cylinder(dismantling and assembling):**

1. Remove the dust boot.
2. Remove the circlip of the piston assembly then remove the piston on both sides.
3. Remove the piston return spring, primary cup, bleed screw cover and the bleeder screw.

4. Clean all parts such as two piston, return spring, rubber boot, bleeder screw etc.
5. Inspect all parts for tear and wear and replace rubber cup.
6. Re-condition the cylinder assembly.
7. Dip all parts in brake fluid and lubricate inside the cylinder with brake fluid.
8. Re-assemble all parts.
9. Install circlip and dust cover.

**Result:** Dismantled and assembled the given master cylinder, wheel cylinder and identify the parts.

## **LEAF SPRING**

**Ex no:4**

**Date:**

**Aim:**To study about leaf spring suspension system.

**Tools required:** Spanners, hammer, plier.

**Materials required:** Leaf spring, steel rule, grease, cotton waste.

**Description:**

This is the most widely used suspension system. In which the semi elliptical type is the important. This spring consist of number of springs called blades. The large blade is called master blade. The master blade has eye on its ends is fixed and bolted rigidly on frame and other end fixed by means of a shackle. This helps to adjust the length of the spring while vehicle is running on irregular road. Elliptical spring, quarter elliptical spring and transverse elliptical spring are the other type of leaf spring used in a vehicle in case of heavy vehicle helper spring also used to carry the load.

**Procedure:**

a) **Dismantling::**

1. Park the vehicle on a level ground and jack up the vehicle on front axle on both ends.
2. Lift the chassis frame at position one just behind shackle and one end joint.
3. Loosen the U-bolt attached to the axle and remove the connection from the shackle spring by removing the pin and take out the leaf and clean well.

4. Loosening the lock nut of the centre bolt and loosen the clamp bolt by strip bolt take the master leaf from the assembly of the leafs.

**b) Inspection and cleaning::**

1. Check the leaf spring, it is done by checking center to end distance and height at either side by means of steel rule.
2. Check and remove brake spring and lubricate the spring by grease.
3. Check for worn bearing, loosen eye cranks, lever broken shackles.

**c) Re assembling::**

1. Assemble the leaf that has been dismantled.
2. Tight the lock nut on centre of master leaf and tight the gland nut.
3. Take the spring assembly to the vehicle.
4. Place the leaf spring on spring seat of rear axle and tighten the U-bolt assembly.
5. Reconnect the leaf assembly and provide the pinion leaf.
6. Remove the stand from chassis and remove the screw jack.

**Result:** Studied about the leaf spring.