



GOVERNMENT OF KERALA
DEPARTMENT OF TECHNICAL EDUCATION



AUTOMOTIVE LAB

DEPARTMENT OF MECHANICAL ENGINEERING

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INTRODUCTION

An automobile workshop is a place where repairs and servicing of automobiles and automobile systems are done.

Automobiles need maintenance from time to time. Like humans are required to maintain hygiene, similarly automobiles also need to be kept clean. Automobiles have to run on dirty roads and in a polluted environment. They run on uneven roads with potholes and other obstructions and are therefore subjected to loads which damage them. Therefore, there is a need for regular maintenance and servicing of automobiles for safe driving and durability of the vehicles, which is usually done in auto workshops or auto service stations.

AUTOMOTIVE MAINTENANCE SAFETY

Safety is the state of being “safe”, the condition of being protected against physical, social, spiritual, financial, or other types or consequences of failure, damage, error, accidents, harm or any other event which could be considered non-desirable.

This can take the form of being protected from the event or from exposure to something that cause health or economical losses.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal Protective Equipment, commonly known as PPE, plays a vital role in ensuring the safety of workers in automotive repair shops. The nature of work in these settings involves exposure to various potential hazards, including harmful chemicals, hot surfaces, sharp objects, flying debris, and more. PPE serves as the last line of defense, protecting workers from such risks when other control measures are insufficient.

Different tasks in an automotive repair shop require different types of PPE, each designed to safeguard a specific body part.

- **Gloves:** Protect hands from chemical exposure, cuts, and burns. They should be selected based on the type of work being performed. For instance, mechanics might use nitrile gloves when handling chemicals and cut-resistant gloves when working with sharp objects.
- **Safety goggles** and face shields protect the eyes and face from flying debris, sparks, and chemical splashes. Safety goggles are essential when grinding, cutting, or dealing with pressurized air or fluids. Face shields provide an additional layer of protection during activities with a higher risk of flying particles.
- **Respirators:** Protect the respiratory system from harmful dust, fumes, and vapors. They are crucial when painting, welding, or working with chemicals that emit harmful fumes.
- **Hearing protection:** Earplugs or earmuffs protect against noise-induced hearing damage, common in noisy work environments like automotive repair shops.
- **Safety footwear:** Safety shoes or boots with slip-resistant soles and steel toes protect feet from heavy falling objects, sharp objects, and spills.
- **Coveralls and aprons** protect the body against spills, splashes, and hot surfaces and keep the worker’s clothes clean.

VEHICLE SAFETY

Technicians need to ensure vehicles are stopped and the brakes are engaged before working on them. It’s also important to ensure that vehicles are supported properly before working beneath them

GENERAL SAFETY RULES

1. Do not block or obstruct stairwells, exits or accesses to safety and emergency equipment such as fire extinguishers or fire alarms.
2. Straighten or remove rugs and mats that do not lie flat on the floor.
3. Use a ladder or step stool to retrieve or store items that are located above your head.
4. Use the handle when closing doors, drawers and files.
5. Obey all posted safety and danger signs.
6. Use caution signs/cones to barricade slippery areas such as freshly mopped floors.
7. Do not run on stairs or take more than one step at a time.
8. Do not block your view by carrying large or bulky items; use a dolly or hand truck or get assistance from a fellow employee.
9. Do not tilt the chair you are sitting in on its back two legs.
10. Use handrails when ascending or descending stairs or ramps.
11. Do not stand in front of closed doors.
12. Walk around wet, icy, slick or oily areas if possible.
13. If required to cross a slippery surface, walk slow and flat-footed. Hold onto a handrail or solid object, if present, to maintain balance.
14. Use provided aisles, walkways or sidewalks. Do not take shortcuts.
15. Clean shoes of ice, water, mud, grease or other substances that could cause a slip or fall.
16. Pull merchandise carts through areas of restricted visibility.
17. Use a flashlight, turn on lights or take time for eyes to adjust when entering a dark room or dim surroundings.
18. Do not move faster than conditions allow on slippery surfaces or in congested areas.
19. Open one file cabinet drawer at a time.
20. Use a cord cover or tape the cord down when running electrical or other cords across aisles, between desks or across entrances/exits.

LIFTING PROCEDURES

1. Plan the move before lifting; remove obstructions from your chosen pathway.
2. Test the weight of the load before lifting by pushing the load along its resting surface.
3. If the load is too heavy or bulky, use lifting and carrying aids such as hand trucks, dollies, pallet jacks and carts or get assistance from a co-worker.
4. If assistance is required to perform a lift, coordinate and communicate your movements with those of your co-worker.
5. Position your feet 6 to 12 inches apart with one foot slightly in front of the other.
6. Face the load.
7. Bend at the knees, not at the back.
8. Keep your back straight.
9. Get a firm grip on the object with your hands and fingers. Use handles when present.
10. Never lift anything if your hands are greasy or wet.
11. Wear protective gloves when lifting objects with sharp corners or jagged edges.
12. Hold objects as close to your body as possible.
13. Perform lifting movements smoothly and gradually; do not jerk the load.
14. If you must change direction while lifting or carrying the load, pivot your feet and turn your entire body. Do not twist at the waist.
15. Set down objects in the same manner as you picked them up, except in reverse.

SAFETY PRECAUTIONS

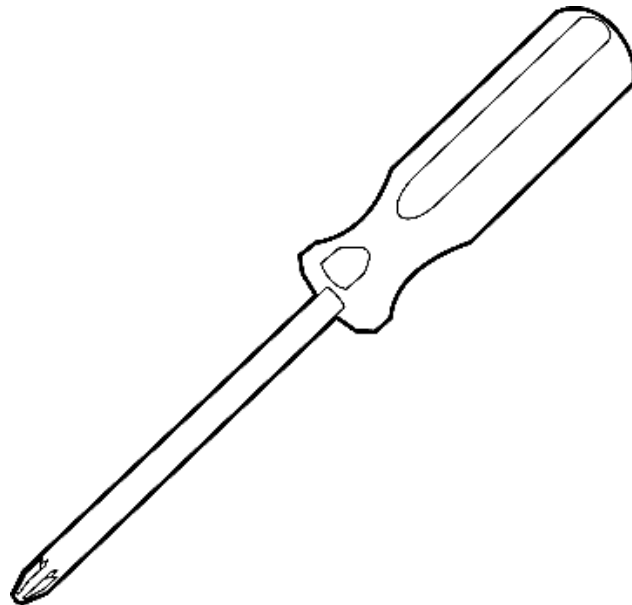
1. Work quietly and give your full attention for the job you are doing
2. Keep your tools and equipment under control
3. Keep jack handles out of the way when it is not in use
4. Don't put sharp objects, like screw driver in your pocket, You could cut yourself or you could damage upholstery in the car
5. Wipe excess oil and grease of your hands and tools so that you can get a good grip on tools and parts
6. Never use compressed air to blow dirt from your cloths. Never point a compressed air blow gun at another person
7. Always wear safety glasses or goggles or a face shield
8. Always use the right tool for the job. The wrong tool could damage the part being worked on and would get hurt.
9. Oiling or greasing may not be done while the machine is being operated
10. Never go under a vehicle that is elevated improperly (the jack to change the tire is NOT sufficient)
11. Know where the fire extinguisher is and have a planned exit route. The fire extinguisher should be kept in working order and in a place with easy access.
12. Keep an emergency response number handy and posted clearly where others can see it.
13. Before starting any work; full planning of the work may be sketched.

TOOLS AND EQUIPMENTS

A good automobile shop must have all the equipment that is needed before undertaking the responsibility of finding faults in all vehicle types and servicing jobs. The required list of tools and equipment are listed as follows:

SCREW DRIVERS

Screw drivers are important tools that are useful to remove/tighten different types of screws. The selection of screws depend upon material type, area to be joined, and tension requirement, etc. A wide variety of screws and drivers are available for your tasks. Screw drivers are basically classified as Straight head type, Phillips type, Offset type.



Phillips type screw driver

Phillips type screw drivers are widely used because they come with a better grip, this ensures that there are minimal chances of the driver slipping out from the screw slot. Offset screw drivers are useful for screws which are otherwise difficult to reach.

SPANNERS

Spanners are also called as wrenches. These are used for tightening bolts and nuts. Some of the common types are:

1. Open end spanners

These are the most commonly used spanners in garages. These spanners are not meant for complete tightening activity, they are good to be used in places that are difficult to be reached. Open end spanners are generally used post initial loosening of the bolt and nuts, they are later useful to tighten it up slightly. It is not recommended for loosening/tightening at high tensions. Any slippage would damage the sides of bolts and nuts, and could further complicate problems.

2. Ring Spanners

Ring spanners are also called as box spanners. The ends completely encircle bolt/nut head, thereby providing the best of grips to working on. The twelve-sided ring shape of this spanner provides a better grip at any position.

3. Combination Spanners

This type of spanner has a ring on one sided and the other side is left open. This helps in initial tightening using an open end spanner, and final tightening using a ring spanner.

4. Socket Spanner

This type of spanner is useful in restricted conditions where common type of spanners can not be used. The socket box consist of different sockets, socket extension rods, speed handle, etc and their sizes range from 10 to 32mm diameter. Ratchet is a special spanner with which a nut located in hard to reach places can be tightened easily. This spanner allows easy tightening and you can unbolt the nut when the handle is moved in a reverse direction.

5. Torque Wrenches

Most of the bolts and nuts in engine or specific part are needed to be tightened to exact specified torque setting. Else it could result in damage of vital parts or result in a dynamic imbalance. Torque wrenches are used to enable any average human to set-in same torque as specified for the bolt/nut. Here one can select the specified torque, and lock the key before tightening the nut. Once torque exceeds specified limit, it would brake the tightening effort indicated with a noise. This will assure the mechanic that the required tightening is done and he can move on to fix the next thing.

6. Adjustable Wrenches

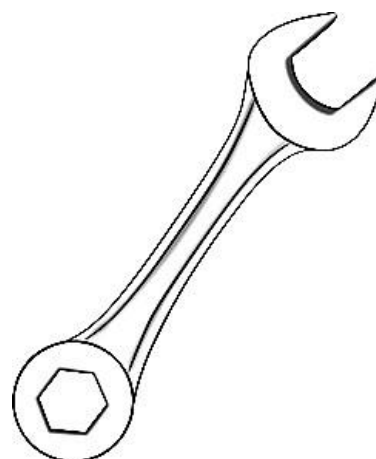
This type of wrenches have an advantage, they allow a single tool to be used for a number of bolt sizes. Tightening of the sliding lock enables to adjustments of required bolt sizes. However the limitation of this type is that it can not be used for high torque work, as chances of loosing grip due to slipping of lock is present.

7. Allen Wrenches (Allen Keys)

Allen keys are used on Allen Screws which have hexagonal shaped grooves on their heads.



Open end spanner



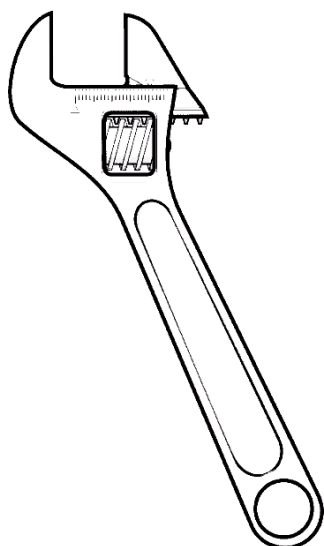
Combination spanner



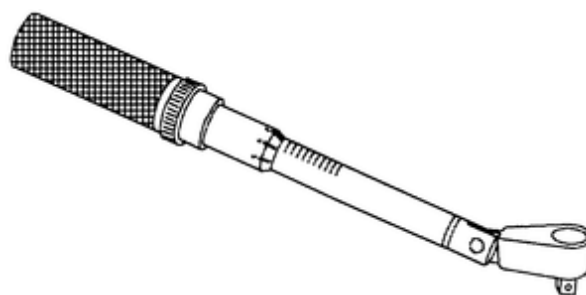
Ring spanner



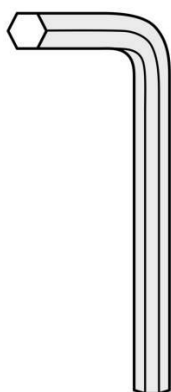
Socket spanner



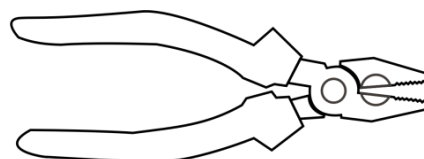
Adjustable wrench



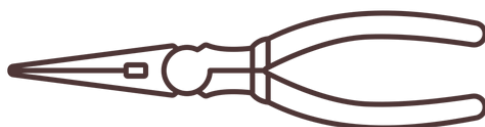
Torque wrench



Allen key



Combination Plier



Nose Plier

PLIERS

Plier is a tool for holding very small things, like that of a wire, a pin, twisting of a wire, etc. Wide types are available based on usage requirements. Some of examples are a Cutting plier, nose plier, and so on.

HAMMERS

A hammer is a tool used for striking operations. The head and the handle form the two parts of hammers. Some of hammer types include Cross peen hammer, wooden hammer, ball peen hammer, etc. A medium weight ball peen hammer is most commonly used for automobile works. A forged steel hammer is used for hard surface work. Whereas, soft hammer is used for soft surfaces and denting work on sheet metal.

CHISELS

Chisels are meant for cutting metal with hammer. A common application is tearing open corroded nuts and bolts with a flat Chisel. The main parts of a chisels are the head, the body and the cutting edge or point. These are made of high carbon steel or chrome vanadium steel. Chisels should be kept sharp. These should be sharpened approximately 60 degree included angle. Safety glasses must be used when working with Chisels.

FILES

Files are tools that are used for smoothening the rough surfaces and removing small amount of metal. The layers of the files will cut the metal layers and hence smoothen the same. Different types of files are used depending upon work. Rough files are used for initial work, and smooth files are used for fine finishing.

HACKSAWS

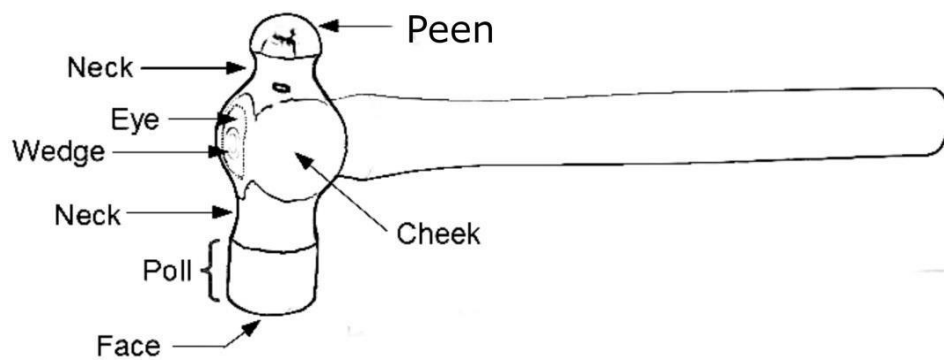
Hacksaws are meant for cutting metals by sawing. The blades are detachable and may have 14 to 32 teeth per 25mm of blade. The selection of size and strength of blades depends upon the thickness of metal and work.

PISTON RING COMPRESSOR

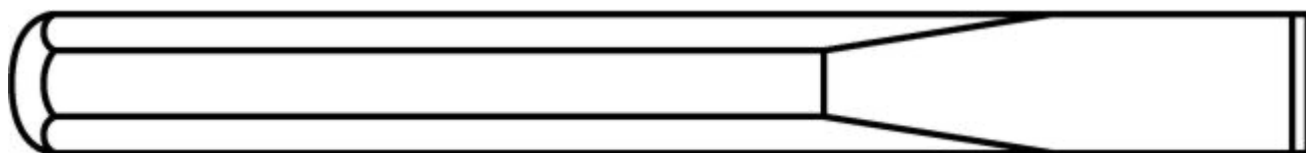
The piston ring compressor is a special tool that is specifically designed for compressing the piston rings when a piston is re installed

PISTON RING EXPANDER

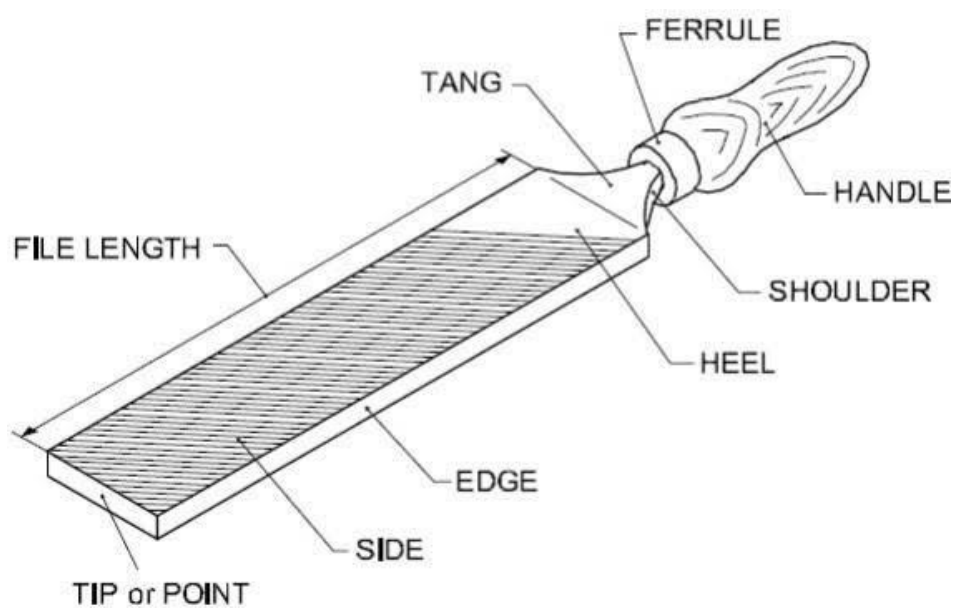
It is a unique that will speed the removal and installation of piston rings with minimum spring distortion



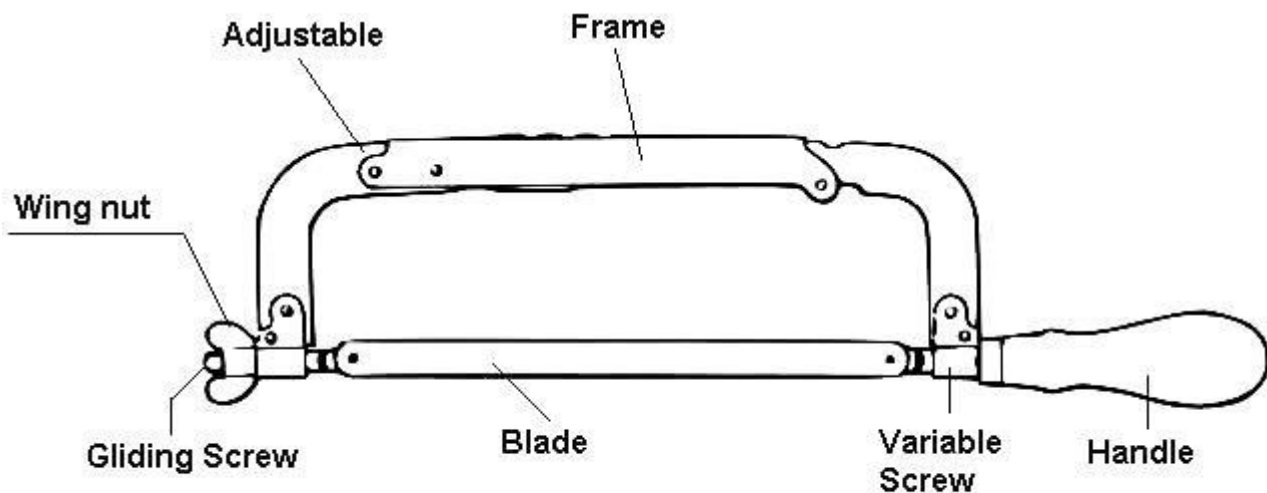
Ball peen Hammer



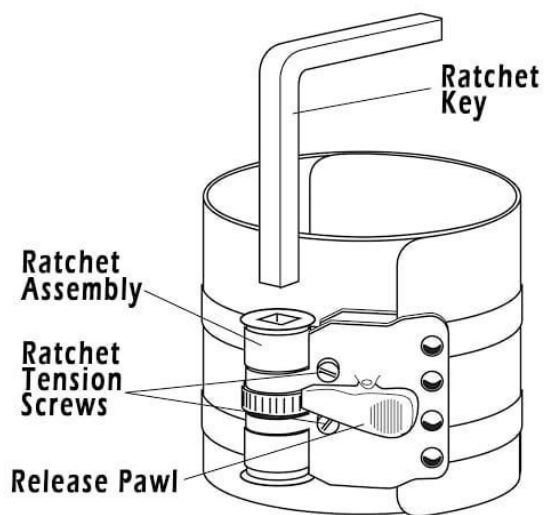
Chisel



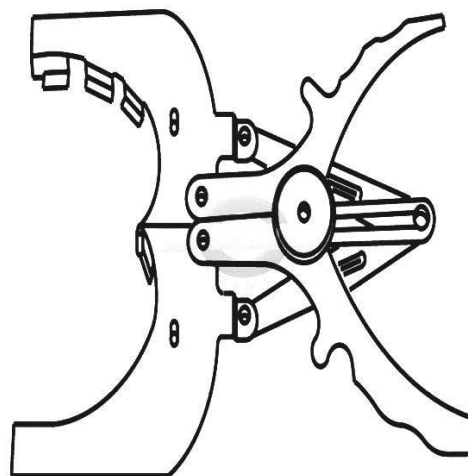
File



Straight Hacksaw Frame



Piston ring compressor



Piston ring expander

TROLLEY JACK

A trolley jack is a device designed to raise a part of a vehicle via its chassis. A trolley jack usually comes with: wheels for manoeuvring the trolley jack. a handle for positioning the trolley jack under the vehicle and for pumping the hydraulic cylinders. hydraulic cylinders for lifting the vehicle.

OIL FILTER WRENCH

A filter oil wrench is used to remove the oil filter from the engine. These wrenches are available in various designs and sizes, and some are adjustable to fit many filter sizes.

Chain-type oil-filter wrench: The chain is wrapped around a spin-on oil filter, and the hexagonal bar is turned anticlockwise to grip and unscrew the filter.

Strap-type oil-filter wrench: A ratchet is used to turn it

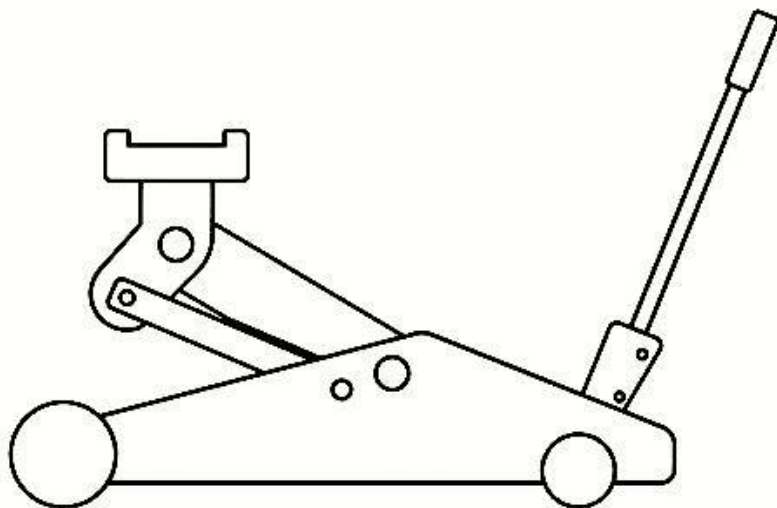
Strap-type oil-filter wrench: This one has a handle built in

Socket-type oil-filter wrench: It fits over the end of the filter and is turned with a ratchet. It is made of stamped steel.

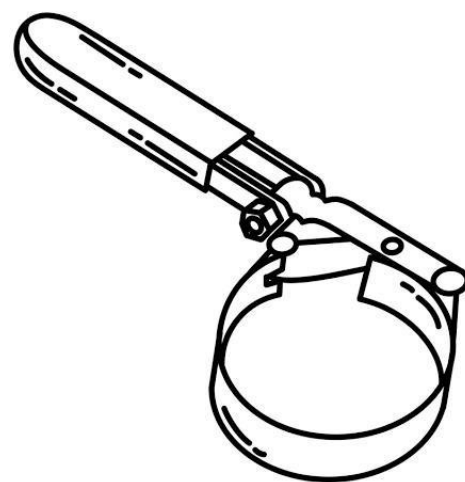
ENGINE HOIST

An engine crane (also referred as engine hoist) is a common repair tool used in vehicle repair shops to remove or install gasoline or diesel engines in small and crowded vehicle engine compartments.

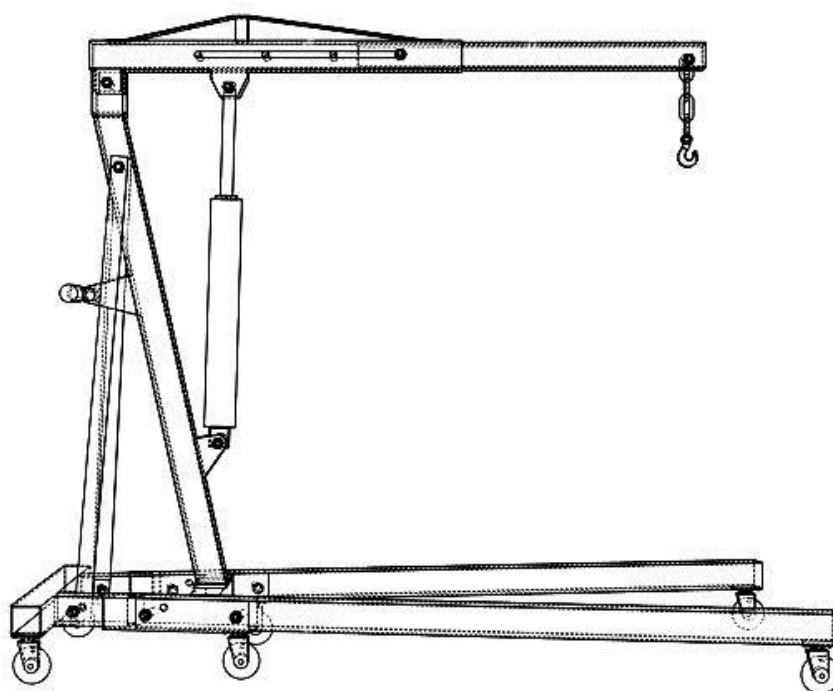
Engine cranes/hoists have three commonly used types: hydraulic hoists, chain hoists and electric chain hoists. The type of engine crane is chosen based on the amount of weight the user is lifting, cost, and convenience.



Trolley Jack



Oil filter wrench



Engine Hoist

MEASURING TOOLS

Most familiar and frequently used tool is an ordinary steel ruler of 300MM long. However, for special purpose such checking spark plug gap, diameter of a screw and nut, a special measuring tool such as feeler gauge, vernier caliper, micrometer, etc may be used.

STEEL RULE

It consists of a hardened steel strip having graduations etched in it. They are usually 150mm or 300mm long and is used to take linear measurements to an accuracy of 0.5mm.

MEASURING TAPE

A measuring tape is a flexible tool used for measuring length. It is made up of materials like fiberglass, cloth, plastic, metal ribbon or strip. So, it is a kind of flexible ruler also known as a tape measure. It is marked in centimeters and inches.

CALIPERS

A caliper is used to transfer and compare a dimension from one object to another or from a part to scale or micrometer where the measurement cannot be made directly. The commonly used calipers are shown in the figure.

Outside caliper

An outside caliper is a two legged steel instrument with its legs bent inwards as shown in figure. It is used for measuring or comparing thickness, diameters, and other outside dimensions. A steel rule must be used in conjunction with them if a direct reading is desired.

Inside caliper

An inside caliper is exactly similar to an outside caliper in appearance with its leg bent outward as shown in figure. This is used for comparing or measuring hole diameters, distances between shoulders, or other parallel surfaces of any inside dimensions. To obtain a specific reading steel scale must be used, as with the outside calipers.

Vernier caliper

Vernier caliper is a precision measuring instrument which is used for outside, inside and depth measurements. Its accuracy is 0.02mm. The vernier scale for 0.02mm least count has the scale length of 49mm and it is divided to 50 equal divisions. Hence one division of Vernier scale is 1/50mm less than 1mm. This gives a least count of 0.02mm.

Outside micrometer

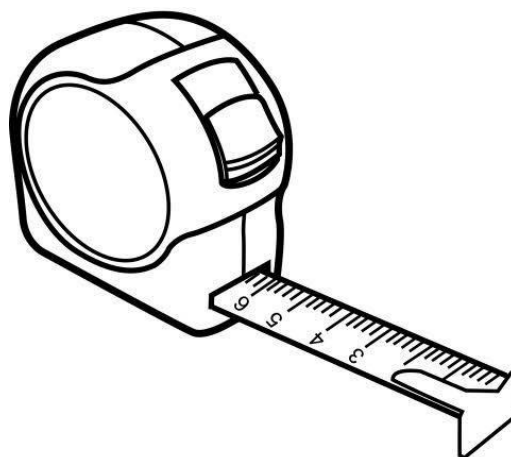
In case of measurements where still greater accuracy is required in that place micrometer is used. External dimensions of parts such as thickness, diameter are measured with the help of outside micrometer, whereas internal dimensions are measured with inside micrometer

FEELER GAUGE

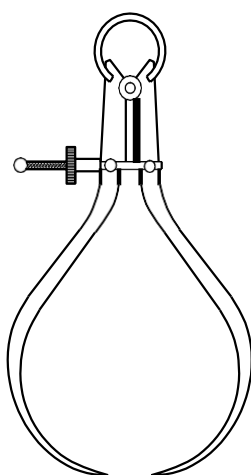
A feeler gauge is a tool used to measure gap widths. They are mostly used in engineering to measure the clearance between two parts. They consist of a number of small lengths of steel of different thickness with measurements marked on each piece.



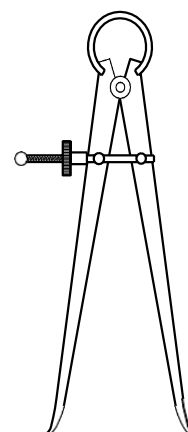
Steel Rule



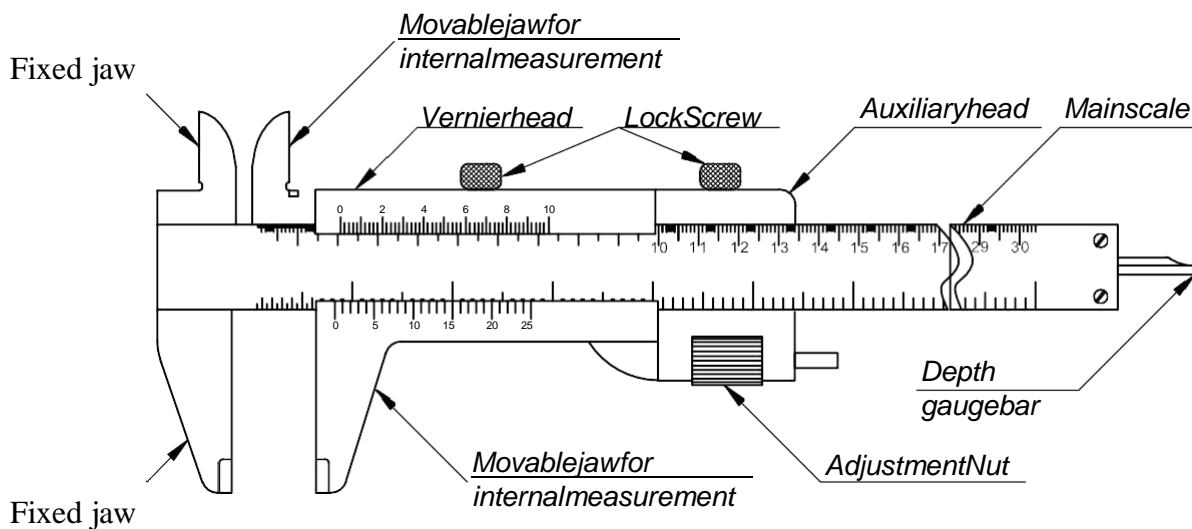
Measuring Tap



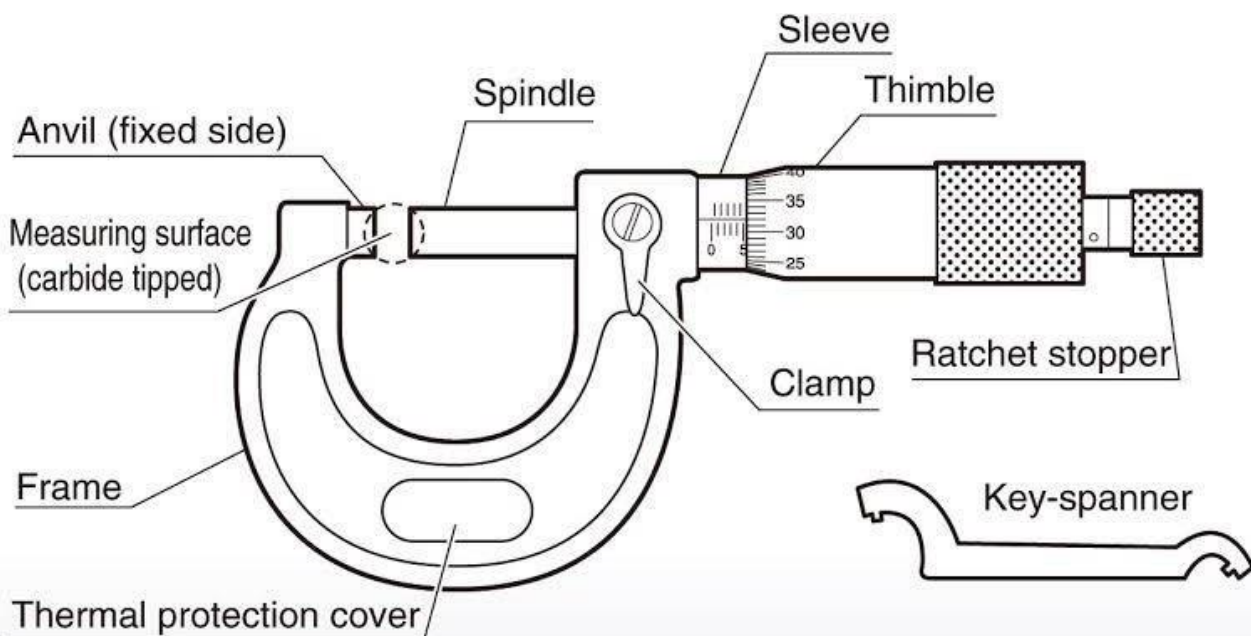
Outside calliper



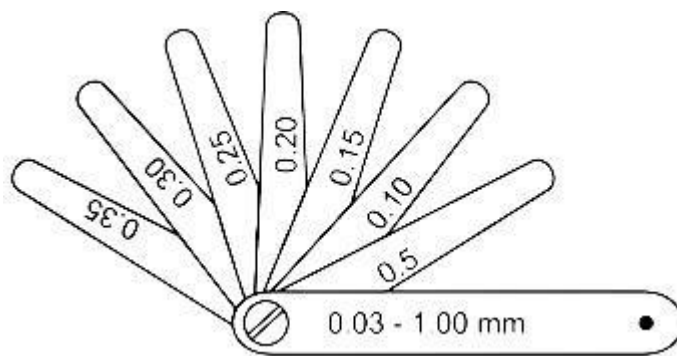
Inside caliper



Vernier caliper



Micrometer



Feeler Gauge

Experiment No:1

Date : / /.....

DISMANTLING AND ASSEMBLING OF PETROL ENGINE**AIM**

Dismantle, study and assemble the given four stroke four cylinder petrol engine

EQUIPMENTS, TOOLS AND MATERIALS REQUIRED

- Four stroke multi cylinder petrol engine
- Spanner set, socket set, screw driver, pliers(combination,nose,circlip)
- Feeler gauge, dial gauge, torque wrench
- Lifting hook chain
- Valve spring compressor, piston ring compressor, piston ring expander
- Lap stick, wire brush, tray, oil,grease,petrol,gasket,cotton waste, and some new parts

FUNCTIONAL DESCRIPTION

In a motor vehicle the engine develops power to propel the vehicle .it converts the heat energy of the fuel in to mechanical energy. The reciprocating motion of connecting rod and piston converted in to rotary motion of crank shaft which is required to drive the vehicle.

PROCEDURAL TASKS**DISMANTLING**

- Park the vehicle on a level surface
- Choke all the four wheels with wooden blocks.
- Unscrew the bonnet mountings and remove the bonnet, along with the grill.
- Disconnect the battery's positive and earth connections and take out the battery.
- Drain the radiator.
- Drain the engine oil
- Remove the air cleaner.
- Disconnect the throttle and choke connections of the carburetor linkages.
- Disconnect the fuel lines from the fuel tank to the fuel pump and plug the fuel line to prevent fuel leakage.
- Remove the fuel line from the fuel pump to the carburetor.
- Remove the lower and upper hoses of the radiator.
- Remove the radiator.

- Remove the wire connections of the starter motor, dynamo/alternator, distributor, ignition coil, spark plug and oil pressure unit, temperature sensor and other electrical connections to the dashboard to prevent foreign material getting into it.
- Disconnect accelerator pedal connections.
- Disconnect the clutch and gear linkages.
- Disconnect the propeller shaft at the gear box end and support it at a convenient point on the chassis.
- Disconnect the gearbox mounting bolts and remove the gearbox with the flywheel housing.
- Fit a suitable engine lifting bracket.
- Support the engine at the front end with wooden blocks.
- Remove the nuts holding the engine's mounting bracket to the cross member.
- Attach the engine lifting bracket to the engine hoist.
- Lift the engine slowly. Pull the engine forward until it comes out from the gearbox side.
- Avoid oscillations and jerks. Ensure that the engine hoist does not Shift from its place while lifting the engine.
- Take out the engine from the vehicle. Ensure that the engine does not oscillate while removing it from the vehicle and does not hit the body of the vehicle or any accessories.
- Place it on a suitable workbench. if placed on the floor, sufficient support below the front and rear brackets so that the engine does not rest on the oil sump.
- Remove the tappet cover with its gasket.
- Remove the rocker shaft assembly and then push rod.
- Remove the nuts of inlet and exhaust manifold and remove them.
- Remove the cylinder head nuts and remove cylinder head with its gaskets.
- Tilt the engine to one side, remove the oil sump with its gaskets.
- Remove timing cover and chain.
- Remove oil pump with strainer after removing pump foundation bolts.
- Flywheel is then removed.
- Remove connecting rod big end bolts, remove the cap, push the connecting rod so that piston comes out from the other side.
- After the pistons are removed the crank shaft is taken out from the cylinder block.
- Remove the water pump.
- Remove timing gear from the cam shaft.
- Remove the cam shaft.

CLEANING AND INSPECTION

- Clean all the parts with kerosene oil
- Inspect all parts, find missing and defective parts

ASSEMBLING

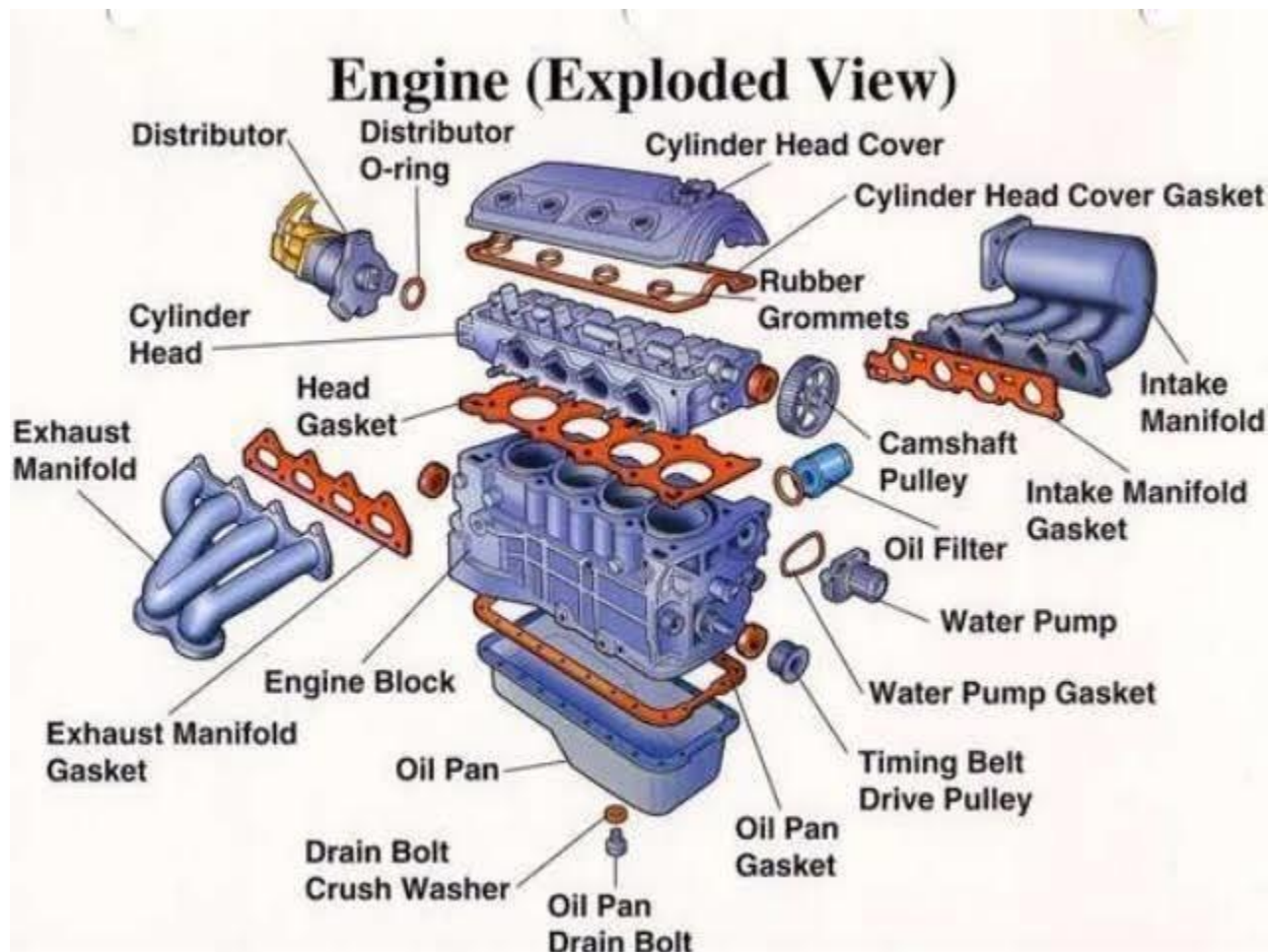
- The procedure for dismantling operation is adopted in the reverse to assemble operation.

CONCLUSION

- List out the defects noticed.
- Give reason for fitting new parts.
- Enumerate the faults that have been eliminated by fitting new parts.
- Precaution to be adopted which cleaning and inspection.

RESULT

Dismantled, studied and assembled the given four stroke four cylinder petrol engine



Experiment No: 2

Date : / /

OVERHAULING OF AC MECHANICAL FUEL PUMP**AIM**

To dismantling and assembling of ac mechanical fuel pump

EQUIPMENTS, TOOLS AND MATERIALS REQUIRED

- Petrol engine mechanical fuel pump assembly
- Screw driver
- Ring spanner
- Double end spanner
- Cotton waste
- Kerosene (as required).

FUNCTIONAL DESCRIPTION

The fuel pump is mounted on the side of cylinder blocks, it consist of a diaphragm springs, pushrod, rocker arm, inlet and outlet valves and upper and lower bodies. The eccentric in the cam shaft pushes the rocker arm and diaphragm is moves down which cause suction in the main chamber. During this time inlet valve due to suction effects and fuel comes into inner chamber from the inlet chamber when the eccentric pressure in rocker arm is released the diaphragm moves upward due to the tension in the spring placed below it. This time the outlet valves opens and the fuel flow through the outlet valve. When the needle valve in the float chamber of carburetor is closed and normal fuel could not flow into the carburetor. The fuel pressure of the chamber of fuel pumps increases and hold the diaphragm at it down position. The action in the rocker arm moves along the eccentric in freely it is called dead action of the fuel pump

PROCEDURAL TASKS**DISMANTLING**

- Disconnect the inlet fuel line from the fuel tank to the fuel pump.
- Tie the fuel line (from the tank) slightly above the tank level, to avoid spillage of fuel.
- Remove the outlet pipe connection which connects the fuel pump and the carburetor float chamber elbow.
- Secure the outlet pipe line.
- Remove the fuel pump mounting bolts.
- Remove the fuel pump with the gasket.

- Make an inline mark on the valve housing cover, pump chamber and bottom cover to ensure the same position of the above parts when assembling back.
- Remove the screws and washers of the pump body.
- Separate the pump chamber and bottom cover.
- Remove the housing cover screw then remove the housing cover.
- Remove the valve housing gasket.
- Remove the strainer.
- Remove the inlet valve set.
- Remove the outlet valve set.
- Remove the lever pin plug.
- Remove the lever pin lock.
- Remove the cam lever return spring.
- Remove the cam lever pin.
- Remove the cam lever.
- Remove the diaphragm assembly.
- Remove the diaphragm return spring lock.
- Remove the diaphragm return spring.

CLEANING AND INSPECTION

- Clean all the metal parts by kerosene oil
- Clean the diaphragm, valve housing, gasket and the valves by petrol
- Dry the metal parts with high compressed air
- Dry the diaphragm ,gasket, valves by low compressed air
- Check visually all the parts for crack or damage
- Check the valves for its one-way function
- Check the pump chamber seating surface and the bottom cover seating surface for its smoothness. If pitting is found, clean the surface with the help of zero grade water emery paper to avoid leakage.

ASSEMBLING

The procedure for dismantling operation is adopted in the reverse to assemble operation.

- Fix the diaphragm return spring on the diaphragm and lock the spring with the diaphragm lock.
- Align the fuel pump lever center hole and bottom chamber cam lever pin boss.
- Insert the cam lever pin.
- Lock the cam lever pin by retainer pin lock.

- Fix the lever pin plug.
- Fix the fuel pump lever with the diaphragm spindle.
- Install the outlet valve set.
- Place the strainer.
- Place the valve housing gasket.
- Fix the housing cover.
- Align the mark lines of the valve housing cover pump chamber and bottom cover to position these parts.
- Fix the pump body screws. While fixing them first tighten up two threads by hand.
- Then tighten the screws alternatively with a spanner.
- Test pump for suction and delivery.
- Clean the pump flange surface.
- Clean the seating area of the pump on the engine block.
- Apply shellac on the mounting flange surface. Fix the new gasket on the mounting flange.
- Position the fuel pump on the cylinder block.
- Ensure the cam lever of the fuel pump sits on the eccentric cam lobe side.
- Align the mounting bolt screw holes of the cylinder block and fuel pump flange hole.
- Fix the fuel pump mounting bolts. While fixing the fuel pump mounting bolts, tighten two threads by hand to avoid wrong thread formation.
- Tighten the bolts alternatively with a spanner.
- Connect the outlet pipe connection (which connects the fuel pump and carburetor float chamber).
- Connect the inlet pipe connection which connects the fuel pump and the fuel tank. While connecting pipe lines tighten two threads by hand to avoid wrong thread formation.
- Start the engine and check for fuel leakage.
- The work is completed.

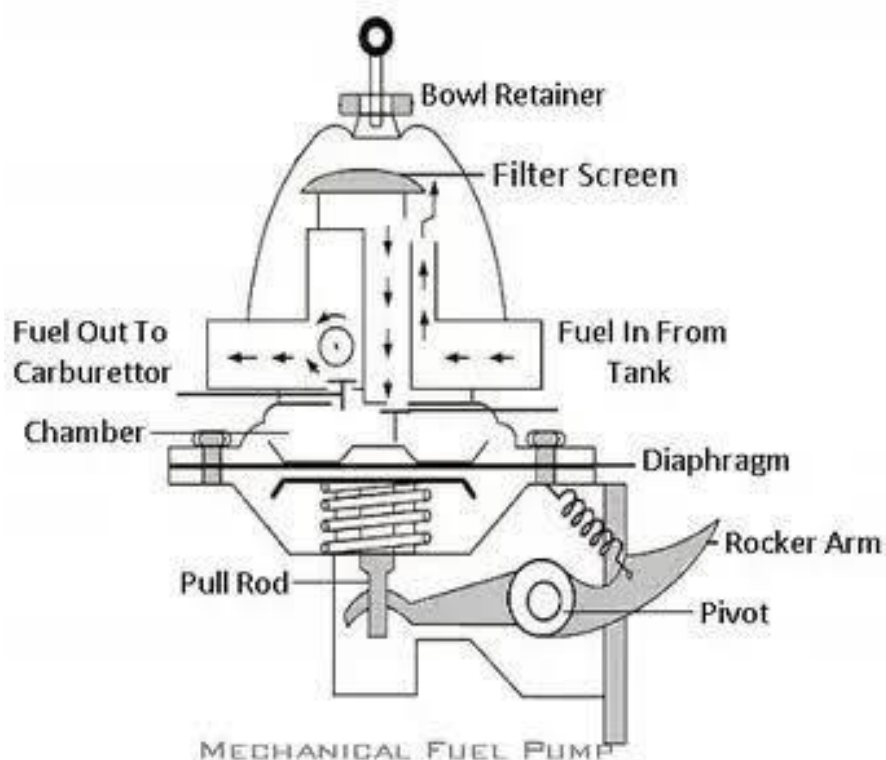
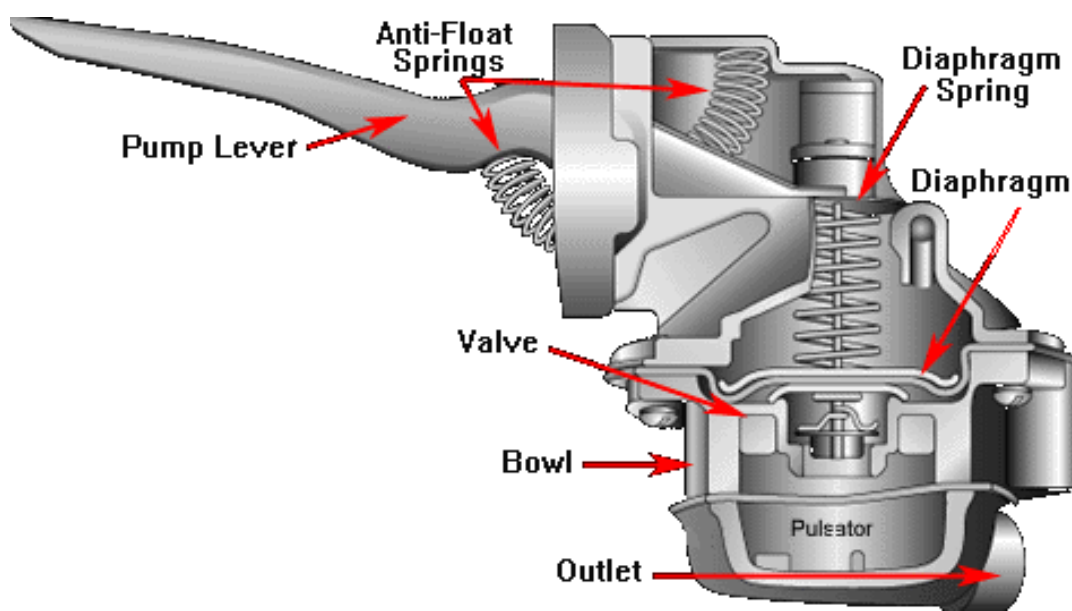
CONCLUSION

- List out the defects noticed.
- Give reason for fitting new parts.
- Enumerate the faults that have been eliminated by fitting new parts.
- Precaution to be adopted which cleaning and inspection.

RESULT

Studied, Dismantled and assembled the given Ac Mechanical Pump

AC MECHANICAL FUEL PUMP



Experiment No:3

Date : / /.....

SERVICING & MAINTENANCE OF SOLEX CARBURETOR**AIM**

To Dismantling and assembling of solex carburetor.

EQUIPMENTS, TOOLS AND MATERIALS REQUIRED

- Key
- Vice
- Cloth
- Screw driver
- Double and spanner set
- Kerosene
- Packing kit
- Required super parts
- Grease

FUNCTIONAL DESCRIPTION

The function of a carburetor is to supply a combustible mixture of a fuel and air in correct proportion.

PROCEDURAL TASKS**DISMANTLING**

- Dismantle the carburetor
- Disconnect able connection
- Remove air cleaner
- Remove carburetor from the engine inlet main fold
- Unscrew there studs on the float clam per cover
- Remove float cover assembly
- Remove float with toggle
- Remove pump injector, assembly with gas kit
- Pedal accelerator pump connection links
- Give punch mark of the accelerator pump assembly cover proper injection
- Unscrew accelerator pump assembly
- Remove accelerator pump assembly
- Unscrew the main jet holder

- Unscrew the starter lever screws
- Remove main jet from the holder
- Unscrew the pump jet holder and remove pump jet

CLEANING AND INSPECTION

- Clean all the parts with kerosene oil
- Inspect all parts, find missing and defective parts

REASSEMBLING

- Tighten the pump jet holder and get in proper place.
- Fit main jet and it's holder.
- Install the starter cover and tighten the screw.
- Install the accelerator connection to throttle and pump.
- Install the injector assembly with new gasket.
- Plane the float and toggle in the float chamber.
- Lighten float chamber cover assembly with new gasket.
- Tighten the carburetor on the inlet main fold with new gasket.
- Give connections to accelerator links with vacuum advance unit.
- Installed the carburetor
- Tune the carburetor.

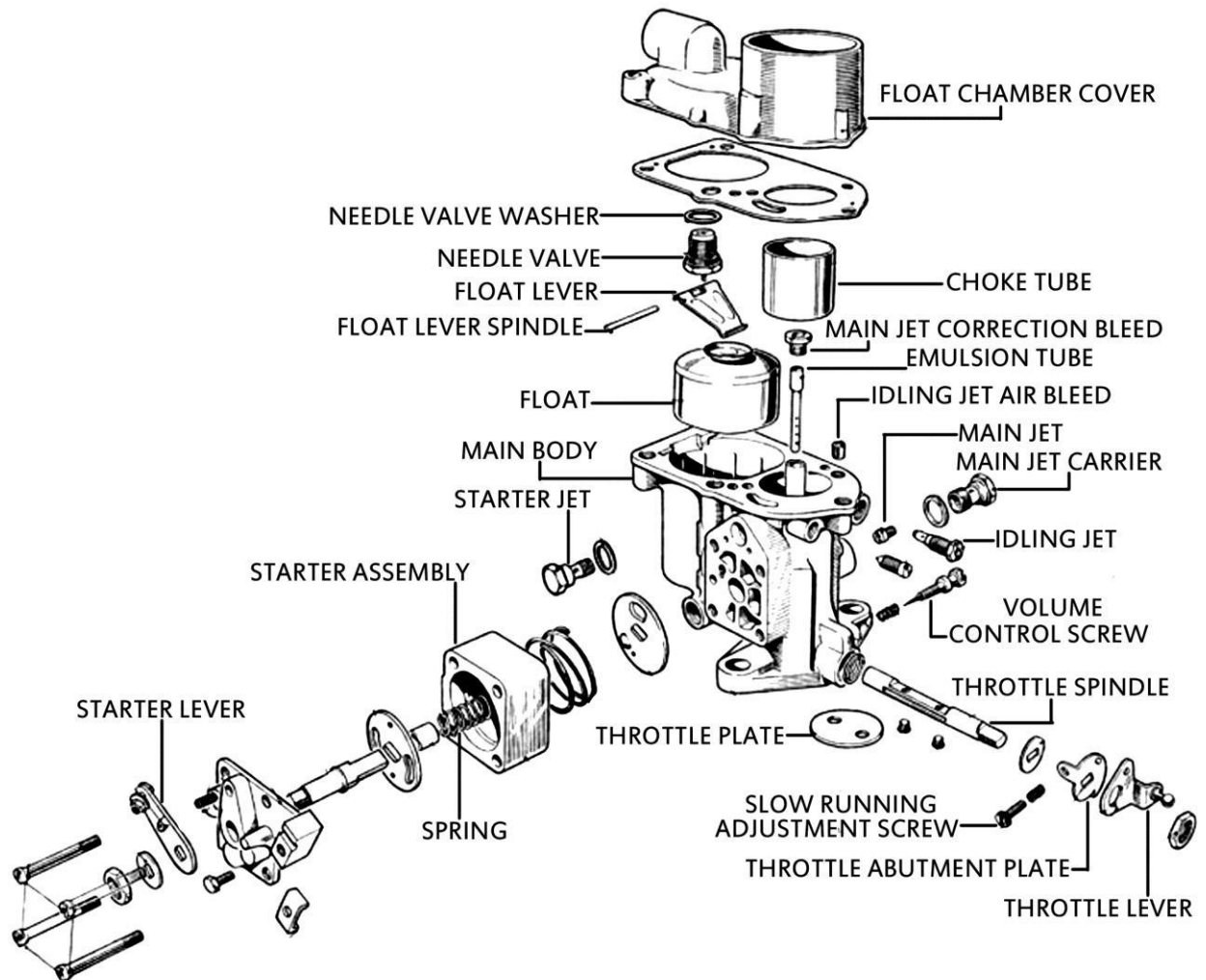
CONCLUSION

- List out the defects noticed.
- Give reason for fitting new parts.
- Enumerate the faults that have been eliminated by fitting new parts.
- Precaution to be adopted which cleaning and inspection.

RESULT

Studied, Dismantled and assembled the given Carburetor

SOLEX CARBURETOR



Experiment No:4

Date : / /.....

DISMANTLING AND ASSEMBLING OF DIESEL ENGINE**AIM**

Dismantle, study and assemble the given four stroke four cylinder diesel engine

EQUIPMENTS, TOOLS AND MATERIALS REQUIRED

- Four stroke multi cylinder diesel engine
- Spanner set, socket set, screw driver, pliers(combination,nose,circlip)
- Feeler gauge, dial gauge, torque wrench, oil wrench
- Lifting hook chain
- Valve spring compressor, piston ring compressor, piston ring expander
- Lap stick, wire brush, tray, oil,grease,gasket,cotton waste, and some new parts

FUNCTIONAL DESCRIPTION

In a motor vehicle the engine develops power to propel the vehicle .it converts the heat energy of the fuel in to mechanical energy. The reciprocating motion of connecting rod and piston converted in to rotary motion of crank shaft which is required to drive the vehicle.

PROCEDURAL TASKS**DISMANTLING**

- Drain off all the oil from the engine
- Remove the tappet cover with its gasket.
- Remove the rocker shaft assembly and then push rod.
- Remove the nuts of inlet and exhaust manifold and remove them.
- Remove the cylinder head nuts and remove cylinder head with its gaskets.
- Tilt the engine to one side, remove the oil sump with its gaskets.
- Remove timing cover and chain.
- Remove oil pump with strainer after removing pump foundation bolts.
- Flywheel is then removed.
- Remove connecting rod big end bolts, remove the cap, push the connecting rod so that piston comes out from the other side.
- After the pistons are removed the crank shaft is taken out from the cylinder block.
- Remove the water pump.
- Remove timing gear from the cam shaft and Remove the cam shaft.

CLEANING AND INSPECTION

- Clean all the parts with kerosene oil
- Inspect all parts, find missing and defective parts

ASSEMBLING

The procedure for dismantling operation is adopted in the reverse to assemble operation.

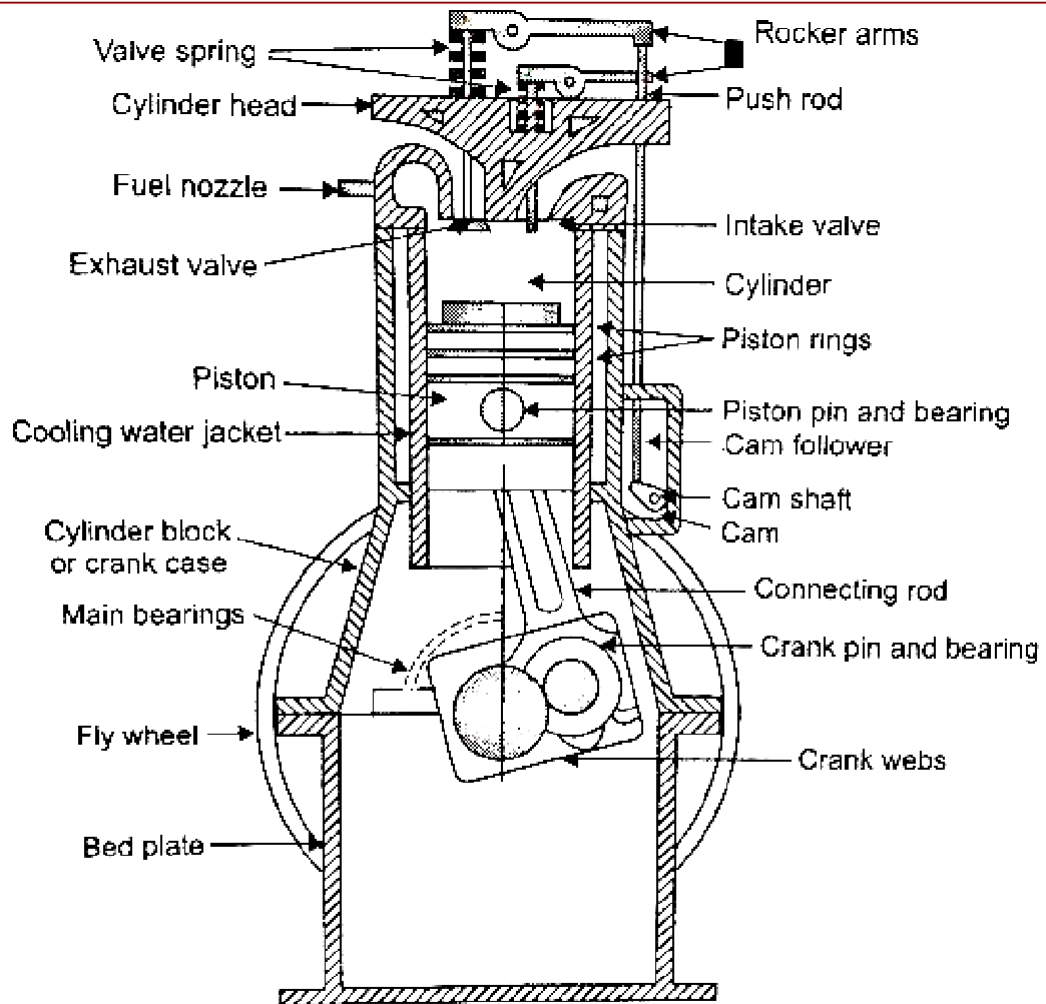
- At first cam shaft is placed properly.
- Timing gear is attached to the camshaft correctly.
- Water pump is then attached.
- Crank shaft is kept inside the cylinder block.
- Pistons connecting rod assembly is then inserted into the cylinder bore properly and then attached to the crank shaft.
- Flywheel is then attached to the crank shaft.
- Oil pump with strainer is then placed, followed by timing cover and chain. ❖ Oil sump with its gaskets is then attached.
- Cylinder head with its gaskets is then attached to the cylinder block.
- Place the inlet and exhaust manifold.
- Place the push rod and rocker shaft assembly in the engine head.
- Finally tappet covers with its gaskets are attached.

CONCLUSION

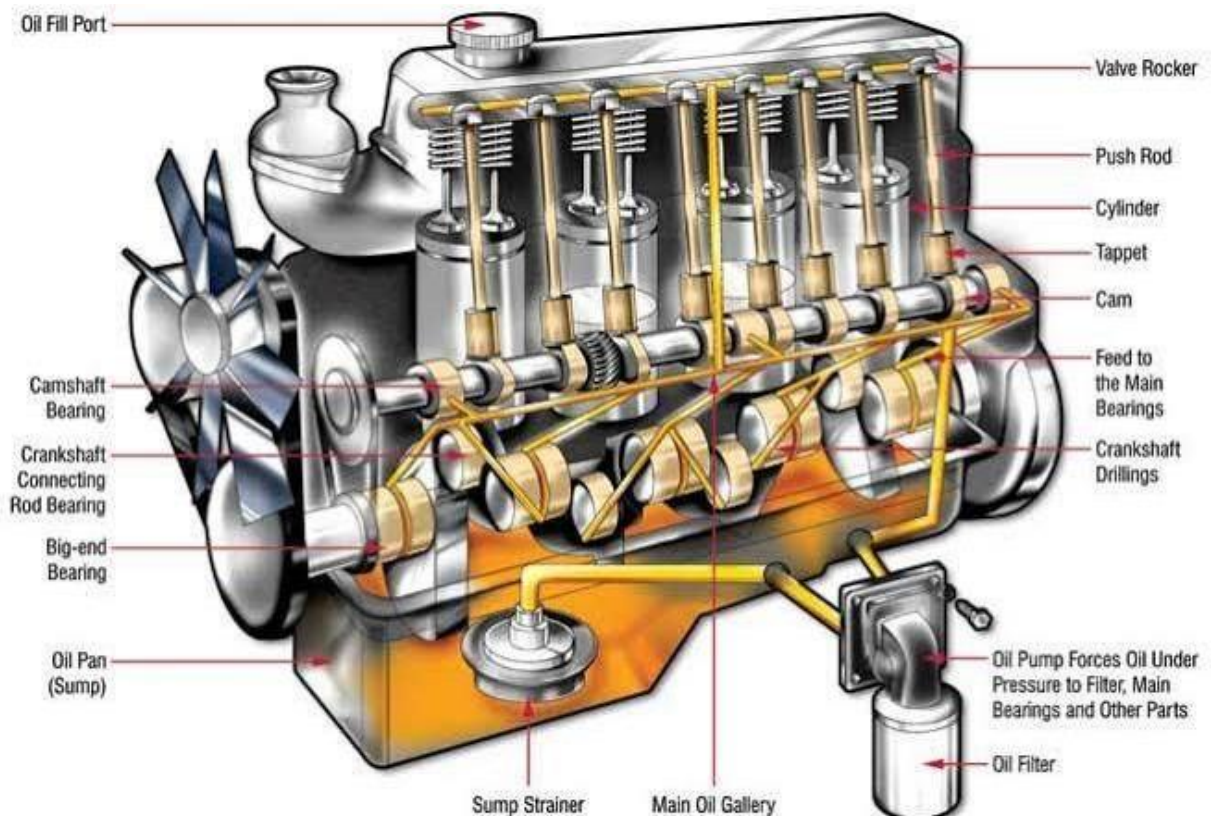
- List out the defects noticed.
- Give reason for fitting new parts.
- Enumerate the faults that have been eliminated by fitting new parts.
- Precaution to be adopted which cleaning and inspection.

RESULT

Dismantled, studied and assembled the given four stroke four cylinder diesel engine



Major Components of Diesel Engine



Experiment No:5

Date : / /.....

OVERHAULING OF CLUTCH ASSEMBLY**AIM**

To Dismantling and assembling of single plate clutch.

EQUIPMENTS, TOOLS AND MATERIALS REQUIRED

- Clutch assembly
- Fixtures
- Head press
- Feeler gauges
- Spanners
- Necessary spare parts
- Kerosene/diesel
- Brush
- Cotton waste.

FUNCTIONAL DESCRIPTION

The clutch in an automobile provides a means of connecting and disconnecting the engine from the transmission. When the clutch is in coupling position, power flows through it from the engine to the transmission. If the transmission is in gear power flows on through it to the real wheels. The clutch has the job of permitting the driver to uncouple the engine, temporarily so that the gear can be shifted.

PROCEDURAL TASKS**DISMANTLING**

- Make a mark on clutch cover with flywheel to locate the correct position while assembling
- Press the whole unit with the help of the suitable press
- Loss the clutch finger adjusting nut equally and evenly
- Remove the clutch assembly from the press
- Dismantle the cover by unscrewing the nut keeping the pressure plate
- Take out the parts in the following sequence (a) clutch fork (b)clutch release bearing (c)pressure plate assembly(d)friction plate
- Dismantle the pressure spring and clutch fingers from the pressure plate

CLEANING AND INSPECTION

- Clean all parts by using kerosene/diesel except the friction plate..
- Check the friction plate for wearing and tear of shock of tension spring.
- Check clutch releasing bearing fingers and recondition all parts.

ASSEMBLING

The procedure for dismantling operation is adopted in the reverse to assemble operation.

- Assemble the pressure plate with clutch fingers and spring.
- Insert the clutch shaft in the clutch cover.
- Assemble clutch and releasing hearing.
- Assemble pressure plate with cover.
- Tighten the whole assembly.
- Tighten the nuts and bolts on the clutch cover in correct order.
- Check alignment after setting.
- Refit the clutch assembly on the fly wheel of the vehicle.

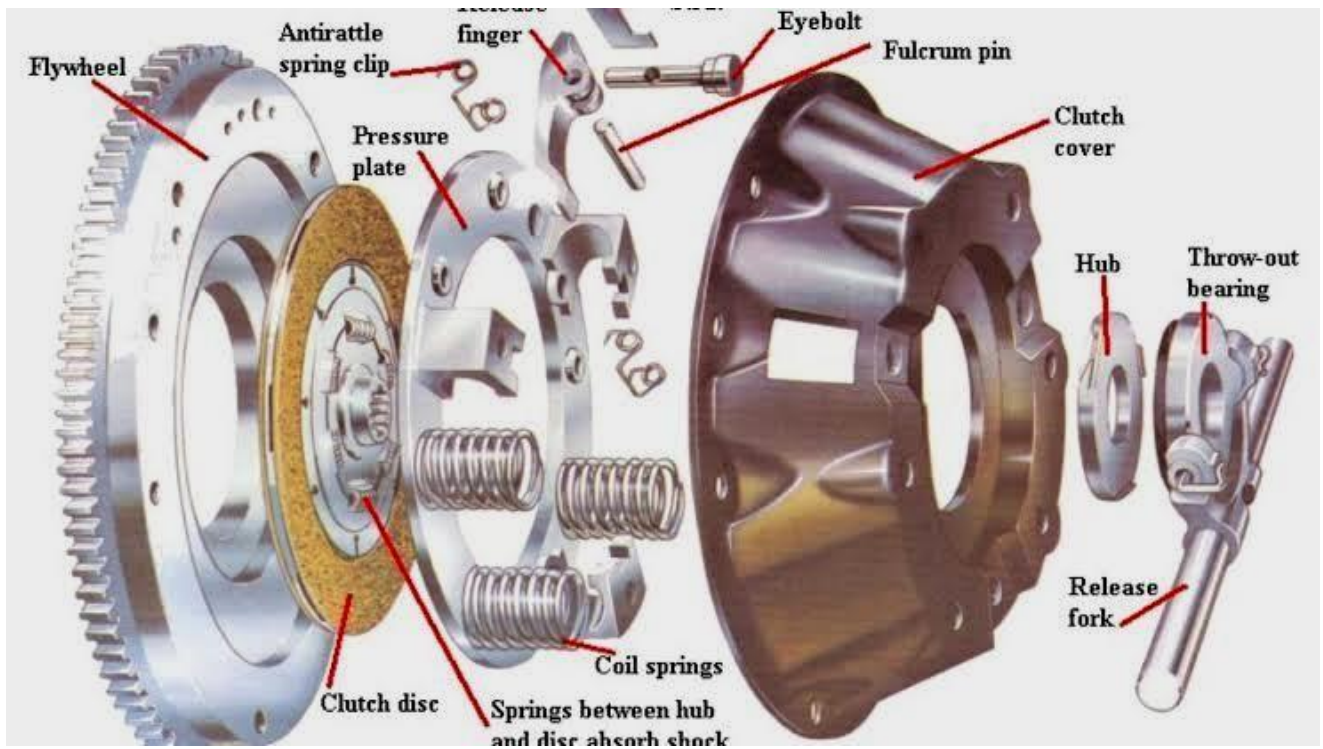
CONCLUSION

- List out the defects noticed.
- Give reason for fitting new parts.
- Enumerate the faults that have been eliminated by fitting new parts.
- Precaution to be adopted which cleaning and inspection.

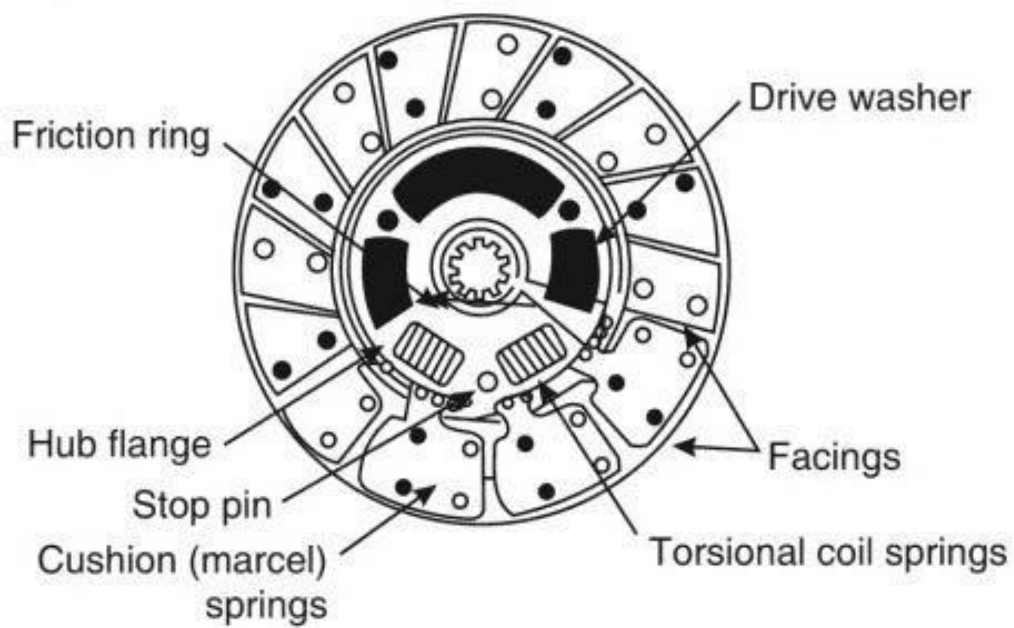
RESULT

Studied, Dismantled and assembled the given Clutch assembly

SINGLE PLATE CLUTCH ASSEMBLY



CLUTCH DISC



Experiment No:6

Date : / /.....

OVERHAULING OF SYNCHROMESH GEAR BOX**AIM**

To Dismantling and assembling of synchromesh gear box.

EQUIPMENTS, TOOLS AND MATERIALS REQUIRED

- Constant mesh gear box
- Tool kit
- Tray
- Packing paper
- Oil scales
- Bearing puller
- Diesel or kerosene
- Grease
- Oil
- Cotton waste

FUNCTIONAL DESCRIPTION

Gear box transmit power from engine to propeller shaft. It provides varying speed ratio between the engine and rear wheels. In addition to this the vehicle can be reversed by using reverse gear.

PROCEDURAL TASKS**DISMANTLING**

- Remove the top cover along with the gear shifting lever using suitable spanners by unscrewing the bolts
- Open the plate lock and unscrew the bolts of the selector rods
- Remove the clamps on both ends
- Remove the selector rod in the following order a) Reverse gear b) First gear c) Second and third gear d) Forth gear and top gear
- Remove the front cover by unscrewing the belts
- Remove the spacer ring
- Turn the driving shaft to bring the slot on the lock ring at the top
- Pull out the driving shaft with the cage roller bearing
- Remove the back cover by unscrewing the bolts
- Press the lock pin at the front end of the main shaft and turn the butt ring for releasing the lock
- Pull out the main shaft through the back end
- Remove all the gears one by one from the gear box

- Remove the front cover of the counter shaft
- Remove the outer race of the taper roller bearing and pull out the counter shaft after releasing its meshing with the ideal reverse gear
- Remove the shaft of the ideal reverse gear
- Dismantle the gear shifting lever from the top cover

CLEANING AND INSPECTION

- Thoroughly clean all the parts with diesel or kerosene
- Wipe out the oil from the parts
- Layout on a clean card board
- Check all the gear for wear and tear and breakage
- Check the shaft for damage splines.
- Check the shifting fork for wear and tear
- Check the bearing spring washer etc.
- Check the fitness of new or re conditioned part with the mating parts

ASSEMBLING

The procedure for dismantling operation is adopted in the reverse to assemble operation.

- Insert the ideal reverse gear with the shaft
- Refit the counter shaft with bearing
- Fix the front cover of the countershaft
- Fix the back cover with suitable shim so that the countershaft should rotate freely without any play
- Remove the back cover again
- Insert the main shaft with bearing
- Arrange the gears on the shaft in the following sequence a) Reverse gear wheel b) Shift sleeve c) First gear with sleeve and roller cage d) Spacer ring e) Second gear wheel with sleeve and roller cage f) Shift sleeve g) Fixed dog h) Third gear wheel with sleeve & roller cage i) Forth gear j) Fixed dog having the extended sleeve
- Lock the gear on the shaft with the but ring with spring and lock pin
- Insert the cage roller and assemble the driving shaft
- Fix the covers on both ends
- Check the rotation of the gear
- Place the selector rod with shifting forks
- Arrange the slot in the neutral position
- Fix the upper cover with the shifting unit

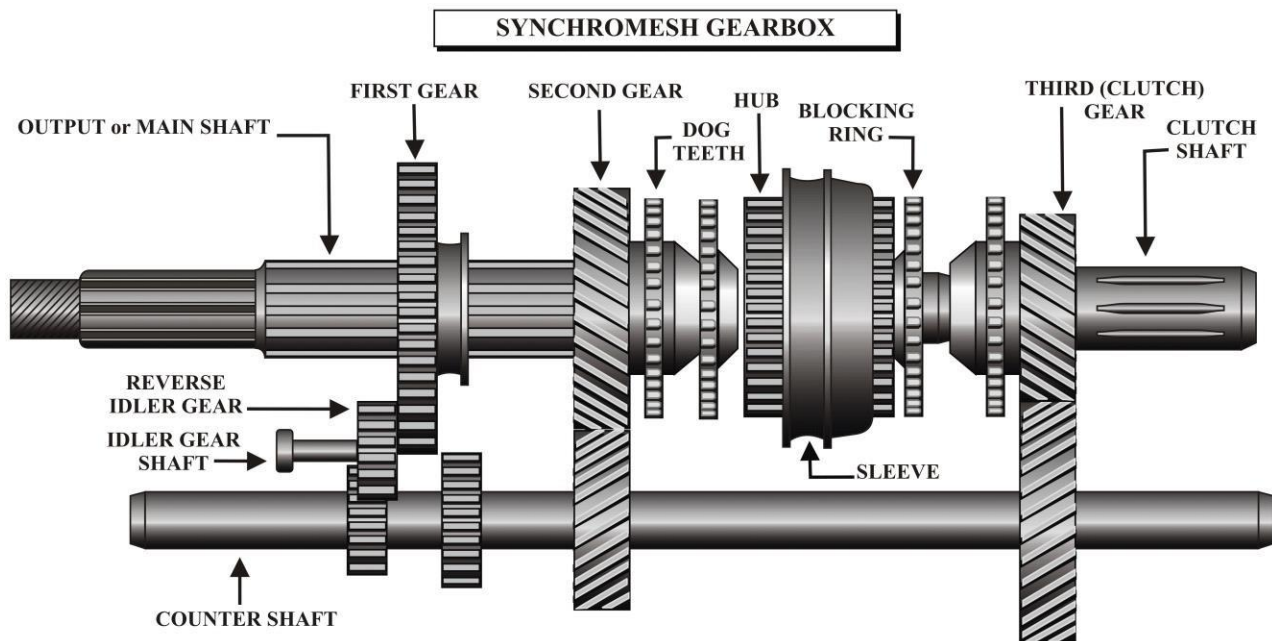
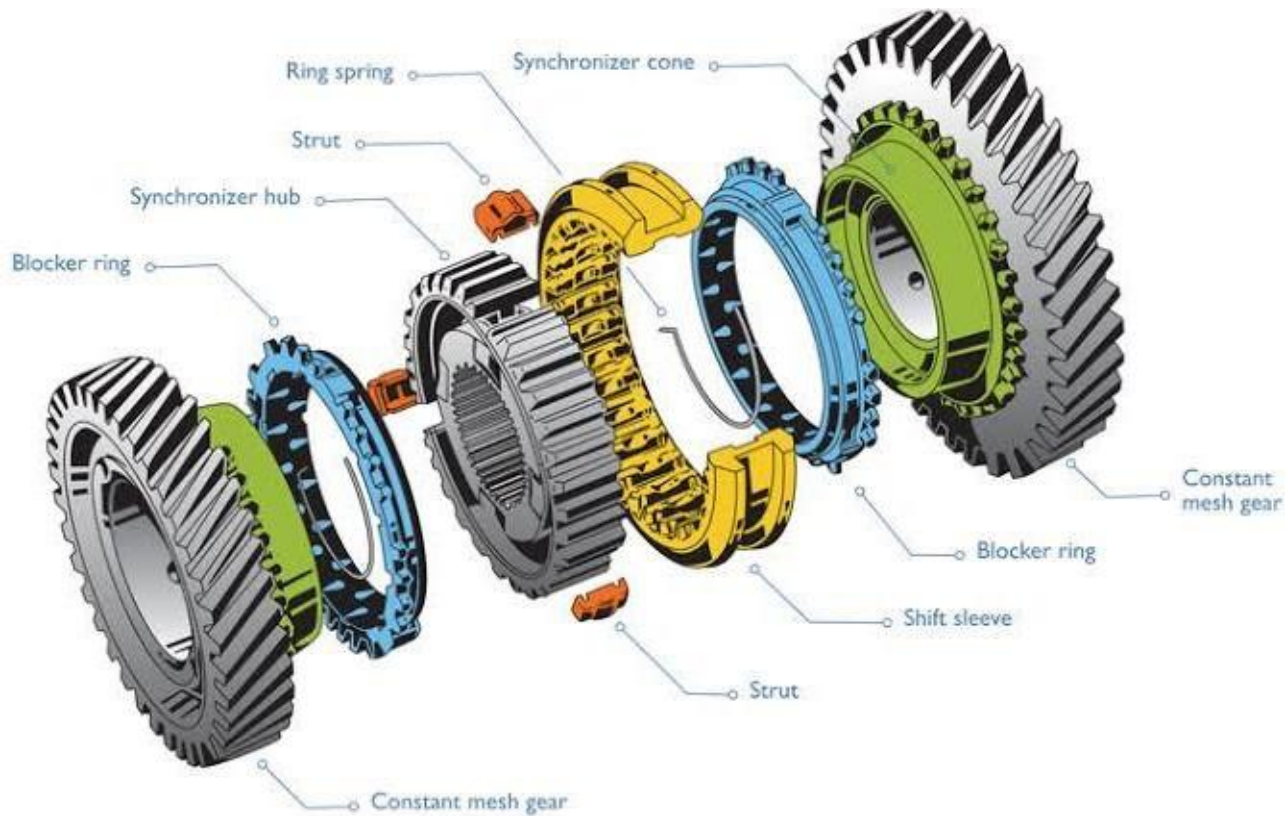
- Check the performance in each gear position

CONCLUSION

- List out the defects noticed.
- Give reason for fitting new parts.
- Enumerate the faults that have been eliminated by fitting new parts.
- Precaution to be adopted which cleaning and inspection.

RESULT

Studied, Dismantled and assembled the given Gear box



Experiment No:7

Date : / /.....

OVERHAULING OF DIFFERENTIAL ASSEMBLY**AIM**

To Dismantling and assembling of Differential assembly.

EQUIPMENTS, TOOLS AND MATERIALS REQUIRED

- Differential unit with rear axle assembly
- Hand tool
- Necessary spare parts
- Spanners
- Tool kit
- Tray
- Diesel or kerosene
- Grease
- Oil
- Cotton waste

FUNCTIONAL DESCRIPTION

It is a mechanism which helps in rotating outer wheel at a higher speed than the inner one while taking a turn. When the vehicle is running on a straight level road there is no movements among the planetary pinion and sun gears and move as a whole unit along with the crown wheel. at the time taking a turn the inner wheel is held just to stationary due to which the sun gear of that side is jammed. During this movement planetary pinion move upon the teeth of the held up sun gear, doubling up the speed of the other side, since the rolling planetary gear over the held up sun gear impart the whole of the driver to the other side sun gear.

PROCEDURAL TASKS**DISMANTLING**

- Removal of differential unit from rear axle assembly
- Unscrew the axle nut at both ends
- Remove both the axles
- Remove the rear differential cover and drain n the oil from the housing
- Unscrew the lock nut and locking device of back lash adjustment
- Cup nut on both sides are removed
- Take out the bearing from both side of the differential assembly

- Take out the differential assembly from the housing
- Remove the pinion assembly from the housing
- Remove the lock wire of the crown wheel set screw
- Unscrew the crown wheel set Screw
- Remove the crown wheel
- Unscrew the main big nut by opening the lock
- Remove the pair ball bearing
- Remove the distance plate
- Remove the lock wire of the cage bolts
- Unscrew the cage bolts
- Remove the differential cage
- Remove the sun gear with thrust washer
- Take out the planetary gear with spider
- Remove the other sun gear with thrust washer

CLEANING AND INSPECTION

- Thoroughly clean all the parts with diesel or kerosene

ASSEMBLING

The procedure for dismantling operation is adopted in the reverse to assemble operation.

- Place the differential cage over a suitable fixture such that the trunion bores face upward
- Place the sun gear with thrust washer
- Assemble the planetary gears with thrust washer on the trunion after smearing some oil to ensure free rotation
- Place the assembled planetary unit in the cage such that the trunion arm are located in its grooves
- Place the sun gear with thrust washer over the planetary gears
- Fit the cage over the sun gear and trunion arms
- Fit the cage bolt and lock them with wire
- Place the distance piece and the pair ball bearing
- Tight the main big nut and lock it
- Fit the crown wheel over it
- Screw the bolt and lock it with wire
- Check the rotation of the wheels
- Insert the differential unit in the housing
- Place the bearing on both side of the unit

- Fix the cap nuts on both sides
- Tight the lock nut and locking device of backlash, adjustment
- Check the backlash, provided shims if necessary
- Fix the rear cover
- Fix both the axles and tight the axle nuts
- Fix the pinion assembly to the housing
- Check the overall performance of rear axle assembly

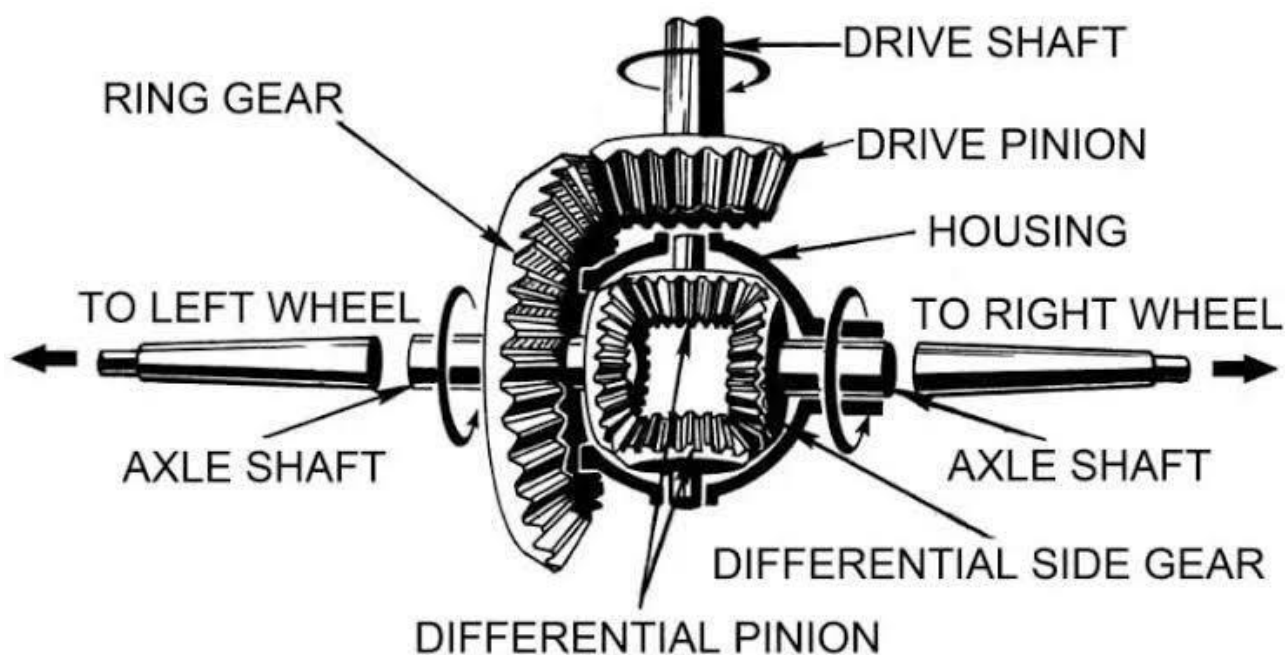
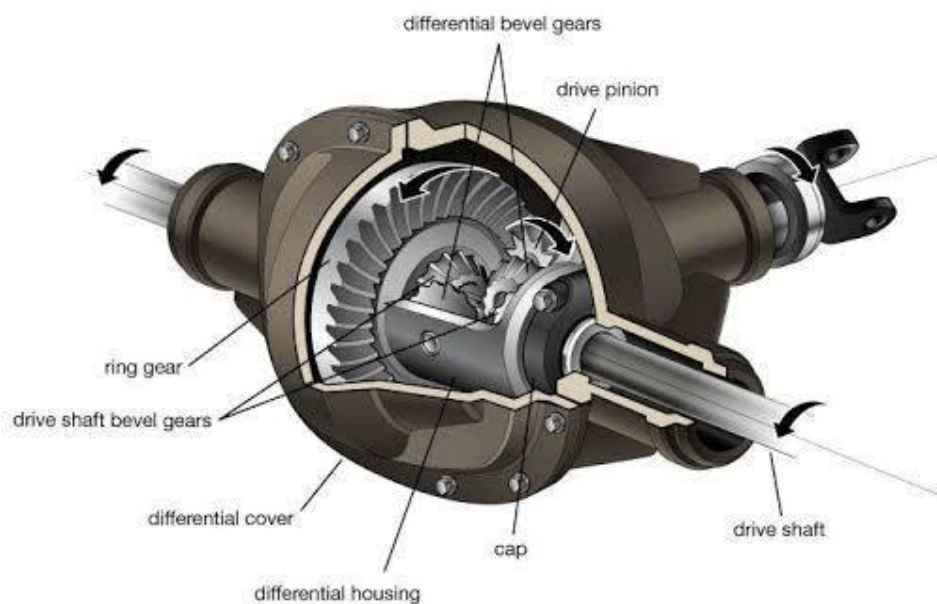
CONCLUSION

- List out the defects noticed.
- Give reason for fitting new parts.
- Enumerate the faults that have been eliminated by fitting new parts.
- Precaution to be adopted which cleaning and inspection.

RESULT

Studied, Dismantled and assembled the given Differential unit

DIFFERENTIAL UNIT



Experiment No:8

Date : / /.....

OVERHAULING OF BRAKE & WHEEL CYLINDERS**AIM**

To dismantle clean, inspect, study and reassemble the wheel assembly

EQUIPMENTS, TOOLS AND MATERIALS REQUIRED

- Wheel assembly
- Spanners
- Nose plier
- Jack
- Jack stand
- Screw driver
- Ratchet handle
- Hammer,
- Speed handle
- Torque wrench.
- Necessary spare parts
- Cotton waste

FUNCTIONAL DESCRIPTION

Hydraulic brake system work under principle of Pascal's law. The foot pedal actuate the piston of master cylinder and force out fluid along piping system to wheel cylinder, which is located at wheel brackets .the piston of wheel cylinder pushes the brake shoe against the wheel drum since all the operating cylinders are connected by a pipe line to the master cylinder. The pressure in all cylinders is the same hence braking of wheel automatically obtain.

PROCEDURAL TASKS**DISMANTLING**

- Lift the vehicle using a jack, so as to get enough ground clearance for free rotation of wheels.
- Remove hub cap and loose the nut
- Remove the nut and remove the tyre.
- Spray the hub at the wheel penetrating oil such as PB blaster.
- Grab the edges of brake drum and pull it off.
- Spray the whole brake mechanism with brake cleaner.
- Dismantle the brake, remove the shoes return springs.
- Holds the shoe retaining pins from the back and remove retainer spring

- Spread the shoes apart from the top and disengage the shoes from the wheel cylinder pins.
- Remove whole shoes and self-adjuster as one unit.
- Remove self-adjuster.

CLEANING AND INSPECTION

- Clean the brake shoes with suitable solvent.
- Look for excessive wear and tear on brake shoe liner.
- Look for broken rivets.
- Replace the liner if wear and tear is excessive.

ASSEMBLING

The procedure for dismantling operation is adopted in the reverse to assemble operation.

- Put shoes back in place and slip the retaining pins through the right holes.
- Install shoe retainer springs.
- Attach the shoes to the wheel cylinder pins.
- Install the return spring.
- Install the drum.
- Install the tyre and hub cap and tight it up to the required torque level.

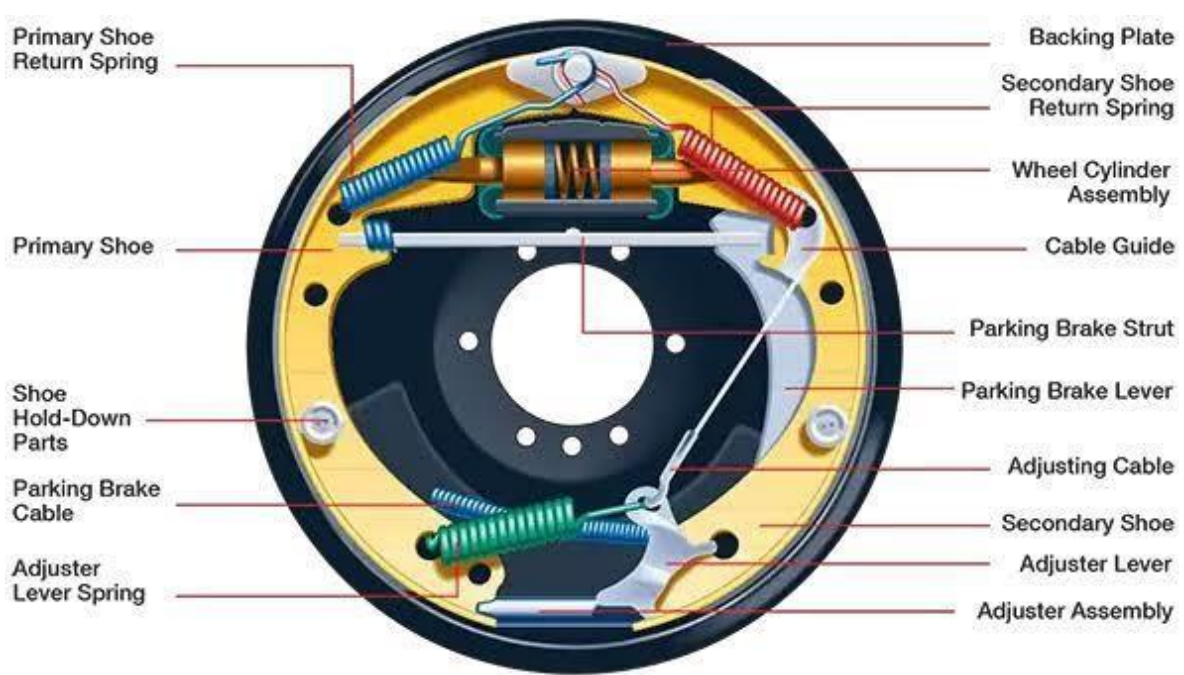
CONCLUSION

- List out the defects noticed.
- Give reason for fitting new parts.
- Enumerate the faults that have been eliminated by fitting new parts.
- Precaution to be adopted which cleaning and inspection.

RESULT

Studied, Dismantled and assembled the given wheel assembly

BRAKE&WHEEL CYLINDER ASSEMBLY



Experiment No:9

Date : / /.....

OVERHAULING OF MASTER CYLINDER**AIM**

To dismantle and assemble the given master cylinder. Identify the parts and replace the damaged parts.

EQUIPMENTS, TOOLS AND MATERIALS REQUIRED

- Master cylinder
- Spanner set
- Screw driver
- Circlip plier
- Nose plier
- Necessary spare parts
- Kerosene/Petrol
- Cotton waste

FUNCTIONAL DESCRIPTION

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 vacuum 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 vacuum formed, the atmospheric pressure in the fluid reservoir forces the fluid through in take port and a hole in the piston wheel deflect the rubber cup and enters the compression chamber to destroying the vacuum.

But by the time this vacuum is destroyed, the fluid from the lines comes 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.

PROCEDURAL TASKS**DISMANTLING**

- Park the vehicle on a level ground
- Drain out the brake fluid from the reservoir
- Remove the dust boot
- Remove the circlip on piston assembly
- Remove the piston
- Remove the piston primary cup and piston return spring with residual check valve
- Remove residual check valve rubber seat
- Remove brake light switch assembly

CLEANING AND INSPECTION

- Inspect the parts for wear and tear
- Replace the primary and secondary rubber cup
- Recondition the cylinder assembly
- Clean the vent cup and ensure the vent cup hole must be open
- Dip all parts in brake fluid and lubricating inside the cylinder.

ASSEMBLING

The procedure for dismantling operation is adopted in the reverse to assemble operation.

- Reassemble all parts
- Install circlip and dust cover and brake light pressure switch

CONCLUSION

- List out the defects noticed.
- Give reason for fitting new parts.
- Enumerate the faults that have been eliminated by fitting new parts.
- Precaution to be adopted which cleaning and inspection.

RESULT

Studied, Dismantled and assembled the given master cylinder

MASTER CYLINDER

