

AUTOMOBILE LAB MANUAL

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EXPERIMENT NO - 1

AIM OF THE EXPERIMENT - Study of automobile chassis.

EQUIPMENT REQUIRED - Model of automobile chassis with electricity supply - 1 no.

THEORY

MACHINE - It is a device which gives output at it receives some input.

ENGINE - An engine is a machine used for converting any of various forms of energy into mechanical force and motion.

VEHICLE - A thing used for transporting passenger / goods, especially on the land / road is known as vehicle.

AUTOMOBILE - It is a self propelled vehicle, which is used to transport the goods and passenger upon the ground / road.

CHASSIS - It is the better framework of an automobile, which houses the running gears, engine, transmission drive shaft and differential.

BODY - ~~It~~ Without chassis, the other part of an automobile vehicle is known as body. It includes, doors, windows, seat, roof, structure etc.

DESCRIPTION

It is the foundation of an automobile & also ^{serves as} the bottom framework. It houses, the engine, clutch, transmission, drive shaft, propeller shaft, differential, brakes, front axle, rear axle, radiator, steering system, master cylinder.

front wheel, rear wheel and suspension system etc. It bears all the weight on the vehicle in both static & dynamic condition. (which is also called laden weight and unladen weight)

The components of chassis have perform the following function

ENGINE - An engine is designed to convert fuel to mechanical energy. It is basically an internal combustion engine has a chamber in which fuel added to it, which ignites and raise the temperature & volume of the gas.

CLUTCH - Its purpose is to enable the driver to disconnect the drive ~~from~~ shaft from the driven shaft instantaneously & to get different speed ratio by using gear shifting lever according to own convenient.

TRANSMISSION SYSTEM - It is otherwise called gearbox means a housing enclosed with the gear train.

Its function are as follows

(i) To disconnect the engine from the wheels when desired.

(ii) To increase the torque so it gives different speed

(iii) To provides automatic speed without manual operation.

(iv) To make a provision such that the driving wheels may rotate at different speeds while taking turns.

(v) To connect the engine to driving wheels without shock.

UNIVERSAL JOINT - It is a joint to connect the propeller shaft which is hollow tube in nature, to get the flexibility during power transmission, the arrangements are made.

PROPELLER SHAFT Its purpose is to deliver torque from gear box to the rear axle. With the help of the propeller shaft the vehicle moves forward/backward according to the use of gear shifting lever.

DIFFERENTIAL With the help of differential the power transmitted from gear box to the rear axle shafts and simultaneously to the rear wheel. While taking turns either towards right or towards left the rpm of inner wheels decreases & ~~out~~ the rpm of outer wheel increases, with this arrangement skidding to the vehicle is prevented.

BRAKES - It is a device used to stop/slow the vehicle when it needed.

Radiator - It is a part of a vehicle which is fitted at the front side of it. It is used to eliminate heat from the engine. When thermostat detects excess heat, the coolant and water get ~~are~~ released from the radiator and sent through the engine to absorb this heat.

MASTER CYLINDER It is a device which develops a pressure on brake fluid which helps to stop/slow the vehicle when it is activated by depressing the brake pedal.

WHEEL CYLINDER

It is a component of a hydraulic drum brake system. It is located in each wheel and is usually positioned at the top of the wheel above the shoes. Its function is to exert force onto the shoes, so as to bring them into contact with the drum, and stop / slow the vehicle.

FRONT AXLE - It is a single piece of I section or elliptical section ^{shaft} in nature fixed to the wheels with stub axle.

REAR AXLE - It is responsible for delivering power to the driving wheels. It is two halves which are connected with the differentials.

FRAME - It is the main supporting structure of a motor vehicle to which all other components are attached. These are three types

- (i) Conventional frame
- (ii) Semi Integral frame
- (iii) Unit frame

SUSPENSION SYSTEM - It is the system of springs, shock absorbers and links that connect a vehicle to its wheels, and allows to absorb shocks get comfort to the passengers / prevent brackage of the parts during the jerk.

CONCLUSION - From the above study -

conclude that all the parts are assembled by using mounting & fastening elements & also vibration damping device used to assemble with the chassis / frame to get better performance and noise less journey of a vehicle.

EXPERIMENT D2

AIM OF THE EXPERIMENT - Study the differential mechanism of the tractor

EQUIPMENT REQUIRED - Working model of differential
- 1 no

THEORY - Generally the two rear wheel turn on the road exactly at the same speed when a vehicle travels in a straight line, there is no relative movement between the two rear wheels.

* The propeller shaft which is geared rigidly with the rear axle must rotate the rear axle wheel simultaneously.

* But when vehicle takes a turn, the outer wheels travels a longer radius than the inner wheel, the outer wheel turns faster than the inner wheel, so that there is a relative movement between the two rear wheels.

* If the two rear wheels were rigidly fixed to a rear axle then the inner wheel would have skidd which ~~will~~ will cause rapid ~~tyre~~ tyre wear, steering difficulties and poor road holding.

* The purpose of the differential is to the relative movement to the two rear wheels when the vehicle is taking a turn; the torque transmitted to each wheel is however always equal.

CONSTRUCTION

> A differential consist of two sun gears and two ~~differential~~ planet with are mounted on the inner end of each rear axle.

- A differential cage is assembled on the left axle. A ring gear, called crown gear is attached to the cage, so that the cage rotates with the crown gear.
- The crown gear is driven by the bevel pinion both the crown wheel and cage are free on the left rear axle.
- The cage supports two planet pinions on a shaft which mesh with the two sun gears.
- Thus, when the differential cage is rotate and both wheels turn which are attached do the outer end of the rear axle.

OPERATION:-

- when the differential cage is rotates, the planet gears will also rotate as they run around on the stationary axle sun gear.
- while rotating in this manner the planet pinions carry rotary motion to the other axle sun gear, and rotate.
- when the vehicle taking a turn, the planet gear spin on its shaft transmitting more rotary motion to one rear wheel than to other.
- Thus when the car is running a straight line, the crown wheel, differential cage, planet pinions and the sun gear are turns as a unit without any relative motion.
- But when the car takes a turn, the planet pinions rotate on their shaft to permit the outer rear wheel to turn more rapidly than the inner wheel.

CONCLUSION - From the above study conclude that the arrangement is made in differential of tractor, to achieve different speed at the turn.

Figure

The crown gear is driven by the wheel on both the crown wheel and cage. The cage is fixed to the axle. The planet is supported by two planet fingers on a shaft which with the two end gears.

When the differential cage is rotated and both wheels turn which are attached to the outer end of the rear axle.

OPERATION:

When the differential cage is rotated, the planet gears will also rotate as they are mounted on the stationary cage and gear.

While rotating in this manner the planet gears carry rotary motion to the other axle and gear, and rotate.

When the vehicle turns, the planet gears slip on its shaft transmitting more rotary motion to one gear wheel than to other.

Thus when the car is running a straight line, the crown wheel, differential cage, planet gears and the end gear are fixed as a unit without any relative motion.

But when the car takes a turn, the planet gears rotate on their shaft to permit the outer gear wheel to turn more rapidly than the inner wheel.

AIM OF THE EXPERIMENT - To study of the hydraulic brake system of an automobile

EQUIPMENT REQUIRED - Model of hydraulic brake system - 1 no

THEORY - Pascal's principle states that "The combined liquid transmits pressure without loss equally in all direction" The hydraulic brakes are applied by the liquid pressure, the pedal force is transmitted to the brake shoe by means of liquid through a system of force transmission which is applied the principle of pascal's principle.

DESCRIPTION

The two functions of brakes are

- (i) To stop and slow down the vehicle in the shortest possible distance in emergency
- (ii) To control the vehicle to be retained when descending a hill. Power brakes are classified to the nature of power employed hydraulic braking system one of them.

Hydraulic brake consist of the following parts

- 1) Master cylinder
- 2) Brake Pedal
- 3) Wheel cylinder

4/ suitable brake shoe.

Master cylinder :-

The master cylinder consist of fluid reservoir which contain the fluid to supply which piston, operates, the

Reservoir supply fluid for the brake system through two part, intake

part is connected to the hollow piston

other piston between the primary and secondary act which connected

with the reservoir directly with the cylinder and lines when the piston is in the reciprocating position

Wheel cylinder :-

It consist of the two pistons which can move in opposite direction by the fluid pressure. It is rigidly mounted on the brake shield piston

and show the mechanism against leakage of the brake fluid. A spring serve to hold the cups against the position where the pressure is decrease.

Brake Pedal †

The brake pedal is connected to the master cylinder piston by means of a piston rod when it is applied the fluid increasing its pressure and rushes into entire hydraulic cylinder piston network thus piston is turn force the brake shoes at against the brake drum for which brakes are applied. When operator release the brake pedal, the master cylinder returns to its original position due to return spring pressure and then the fluid pressure in the entire system drops to its original low value which allows retracting shoes out of contact with brake drum into their original position as per which brakes.

CONCLUSION †

From the above study I concluded that due to fluid pressure equal braking effort is done to all the wheels.

AIM OF THE EXPERIMENT

Study of the Solex Carburettor

EQUIPMENT REQUIRED:-

Cut Section model of SOLEX Carburettor - 1 no

THEORY:-

Carburettor is a mixing device which supply air fuel mixture to the engine. It atomizes & vapourise the fuel and mixture it with air in a varying proportion, to meet the changing operation condition.

There are so many carburettor used in automobile industry.

SOLEX Carburettor one of them.

DESCRIPTION:-

The SOLEX Carburettor is one, of the used known carburettor for easy starting good performance and its reliability. It is used for various Indian cars & jeeps it consists for various fuel and air circuits these are

- 1) Normal running
- 2) Cold starting & warming
- 3) Idling & slow speed operation
- 4) Acceleration.

(1) Normal running:-

In normal running circuit, the fuel is provided by the main jet and the air by

the choke tube or venturi. The fuel from the main jet enters into the air bleed emulsion tube. The correct balance of air & fuel is automatically ensured by air entering through air correction jet the metered emulsion of fuel and air is discharged through the orifice drilled horizontally in the vertical pipe in the middle of venturi tube.

(2) Cold Starting & Warming

In this carburettor it has also provision for progressive starter. The starter valve is in the form of a flat disc with different sizes of holes.

Contⁿ to cold starting & warming

It helps to reduce the amount of fuel supply the partly opened throttle valve at that state enables the main jet also to deliver fuel for starting richer mixture is required. So in the start position bigger holes are the connecting holes when the throttle valve is in closed position, the engine suction is applied to starting passage. The air enters from the starting air jet and fuel from starter jet. This mixture is sufficiently rich to start the engine. After the engine has started

the starter lever is brought to the intermediate position thus reducing the amount of petrol, till it reaches the normal running temperature. After this the starter lever is brought to the off position.

Idling & Slow Speed running

In this circuit the pilot jet is taken from the main jet. At the idling, the throttle is almost closed and hence engine suction is applied at the pilot jet. Fuel is drawn there from and mixed with a small amount of air from pilot air feed orifice. This mixture is conveyed down the vertical passage and discharged into the throttle body through the idling screw. The idling screw permits variation of the slow running jet is delivery of petrol and allows the richness of the mixture.

Acceleration

When extra quantity of fuel is needed during acceleration, the carburetor is provided with a diaphragm pump system. When accelerator pedal is pressed for

acceleration, the pump lever is connected to it is also pressed. Due to this movement the fuel is compressed and it flows through pump jet and accelerate pump injector to mixing chamber. When the force on lever is removed, the diaphragm retains its original position due to spring. Due to this movement of diaphragm a suction is created, thus opening the pump valve and admitting the fresh fuel into the pump.

CONCLUSION

From the above experiment I have thoroughly study the circuit of Solex carburetor.

Acceleration

When engine operates at high speed during acceleration, the carburetor is provided with a diaphragm pump system when accelerator pedal is pressed for

AIM OF THE EXPERIMENT - study of the actual cut section of gear box.

EQUIPMENT REQUIRED - Actual cut section of gear box.

THEORY -

The mechanism that transmits the power developed by the engine to the driving wheel is called the transmission system. The most common transmission system that have been used for the automobile, industry are manual transmission, automatic transmission (trans axle) semi-automatic transmission and continuous variable transmission (CVT).

Description:-

There are four types of gear boxes are used in automobile such as:-

- i) sliding mesh gear box
- ii) constant mesh gear box
- iii) synchro mesh gear box
- iv) Epicycle Gear box

Sliding Mesh Gear Box:-

It is a power transmission system in which any given pair of gears is engaged by sliding one axially into mesh with the other. Sliding mesh gear box consist of 3-shafts these are.

- i) main shaft
- ii) Clutch shaft
- iii) Lay shaft

It also consist of gears with gear leaves.

Main shaft:-

It is the shaft used as an output shaft in sliding mesh over which the sets of gears with internally splined grooves are arranged in an organized fashion. The outer surface of this shaft is made splined so that the gears can easily slide over this shaft in order to mesh with the appropriate gear.

Clutch shaft:-

It is the shaft is used to carry engine output to the transmission box with the help of engaging and disengaging clutch which is mounting at the engine end, gear or a pair of gear is mounted over this shaft which is used to transmit rotational motion to the lay shaft.

Lay shaft:-

It is the shaft having gears mounted over its outer surface and is in continuous rotation with the clutch shaft as one gear of its shaft is always in contact with a gear on the clutch shaft. It is used as an intermediate shaft (between main shaft and clutch shaft) that provide the meshing of the gear of the main shaft in order to transmit appropriate output to the final drive.

Gears:-

Two types of gears were usually used in sliding mesh gear box

i) spur gear

ii) Helical gear

spur gear:-

This is the type of gears having straight cut teeth over its surface, straight teeth providing maximum meshing gear.

Helical Gear:-

This is the type of gear in which the teeth are cut in angular with smooth and less noise.

Gear lever:-

It is the selecting mechanism operated by the driver in order to select the appropriate gear ratio. This lever is connected to the main shaft along with the selector forks.

working of sliding mesh gear box:-

The shifting of gears is obtained by the ~~meshing of the gears on the main shaft with the gears~~ gears on the main shaft with the gears on the lay shaft by right or left sliding of gears on the main shaft in order to obtain appropriate gears.

First Gear:-

First Gear provides maximum torque at low speed which is obtained when the smallest gear on the lay shaft meshes with the biggest gear on the main shaft in order to provide high torque.

second Gear:-

It provides less torque and higher speed than first gear and is obtained when the middle size gear of the main shaft meshes with the second

Smallest gear on the lay shaft and high speed and second high torque is transmitted to the final drive.

Third Gear:-

It provides maximum speed and minimum torque to the final drive and is also known as high speed gear or top gear in sliding mesh gearbox. This gear is obtained when the smallest gear of main shaft meshes with the biggest gear of the lay shaft of the drive is obtained a maximum speed of the clutch shaft.

Reverse Gear:-

When the reverse gear is selected, the rotation of the output shaft reversed which is made possible by using an idler gear between the main shaft and lay shaft that changes the rotation of the output shaft and the vehicle starts moving in the reverse direction.

CONCLUSION:-

From the above experiment we studied about the actual cut section of gear box model.

AIM OF THE EXPERIMENT - Study the fuel pump cut section Model.

EQUIPMENT REQUIRED :- Cut section of a fuel pump - 1 no

THEORY :- It is a mechanical device, which is used to supply the fuel from fuel tank through a coarse filter.

Then after, a metered amount of fuel is pumped by the high pressure pump to a ~~the~~ distributor block. The distributor functions to distribute the fuel uniformly to each cylinder as the cams come into contact with the distributor at an appropriate time, and correct firing order is maintained.

DESCRIPTION :

The pump has a cylindrical plunger which operates inside a closely fitting barrel. The barrel is closed at the top by a spring loaded valve from where a pipe leads the fuel to the engine cylinder via injector.

The plunger has a constant stroke and reciprocating motion to it is given by a cam on a cam shaft. The plunger can also be rotated by a rack and

Pinion arrangement.

The plunger has a vertical slot & a helical groove which supplies varying quantity of fuel as per requirement. In the upper portion of the pump or the pump cylinder there are two ports. One port connected with the fuel tank by an intake pipe through the filter & the other is connected to spill port which spills to the fuel tank.

WORKING: -

During the starting position the plunger is at the bottom of its stroke and the two ports (inlet port and spill port) leading to the suction space are open and cylinder is filled with fuel oil.

When delivery stroke started, the plunger moves up, and displaces some fuel back from the ports in the barrel. This operation continues until the top edge of plunger covers the ports and the remainder of the fuel oil is forced out through the delivery pipe to the engine cylinder.

The supply of fuel to the injectors continues until the helical edge covers the ports and releases fuel back to suction line. At this position of the plunger, the pump space connected with the spill port through the vertical

groove & thus connected to the atmosphere that releases the pressure on the spring, the delivery valve falls back on its seat and the supply of fuel to the injector is stopped. At the same time the fuel in the barrel escapes through the by pass i.e. spill port during downstroke of the plunger, suction is created and fuel is drawn into the barrel through the supply port.

The quantity of fuel being supplied to the injector depends upon the position of the helical groove. When the plunger is turned to the right by means of tooth rack, the effective pump stroke is increased. It means at which space linked with the spill port can be delayed and so more fuel can be supplied to the engine at higher loads. The rack is operated by a governor or by accelerator pedal.

CONCLUSION:-

I study very thoroughly how fuel is supplied from fuel tank to the engine through fuel pump.

AIM OF THE EXPERIMENT - Study of car engine

APPARATUS REQUIRED - Working model of 4-cylinder car engine - 1 no

THEORY - In a car engine, the energy developed by the combustion of fuel in such a way that for petrol engine, air fuel mixture burns with proper ratio & in case of diesel engine, fuel injection pump is used to develop that energy.

That energy transmitted to the rear axle with the help of gear box & propeller shaft.

DESCRIPTION - In an engine the parts are assembled together to get best performance. These are as follows

- | | |
|--|----------------------|
| (i) Engine Head | (xii) Piston |
| (ii) Engine block | (xiii) Crankshaft |
| (iii) Alternator | (xiv) Connecting rod |
| (iv) Water pump | (xv) Crank case |
| (v) Exhaust manifold | (xvi) Oil pump |
| (vi) Inlet manifold | (xvii) Ignition coil |
| (vii) Valves
(a) Inlet valve
(b) Exhaust valve | (xviii) Spark plug |
| (viii) Carburettor | (xix) Fly wheel |
| (ix) Distributor | |
| (x) AC pump | |
| (xi) Oil filter | |

Engine Head - The top of cylinder is closed by a component is known as engine head / cylinder head which is usually casted

as one piece and then bolted to the cylinder top. It contains the valve seat and ports, support the valves & valve actuated mechanism and is fitted with a spark plug in case of petrol engine.

Cylinder Block

The cylinder block is the backbone of the engine in which all the mechanisms and components are secured.

These components are

(i) cylinders which are large holes machined in the cylinder block for the pistons to have reciprocating motion.

(ii) Passages for the circulation of cooling water

(iii) oil galleries that are drilled passages meant for carrying lubricating oil to various components.

Alternator

An alternator is a type of electric generator used in modern automobiles to charge the battery and to power the electrical system when the engine is running. Generally DC dynamo generators with commutators are used.

Water pump

It is a belt driven pump that drives its power from the engine crankshaft. The water pump draws the cooled fluid through the pump's centre inlet from the radiator. It then circulates the fluid outward into the engine and back into the car's cooling system.

Exhaust manifold

The exhaust manifold collects the exhaust gases from multi cylinders into one pipe which is bolted to the engine block.

bp. Inlet manifold - The function of the inlet manifold is to evenly distribute the combustion mixture to reach intake port in the cylinder head. Even distribution is important to optimize the efficiency and performance of the engine.

Valves

The valves are usually mushroom shaped with conical seating surface. The face of the valve and its seat on the cylinder are very accurately ground at an angle of 30° or 45° . It is generally made from steel with a small percentage of nickel & chromium.

Valves are two types

- (1) Inlet valve
- (2) Exhaust valve.

Inlet valve - It is device to allow the air fuel mixture into the engine cylinder.

Exhaust valve - It is device which is responsible for discharge the combustion products after expansion to the atmosphere.

Carburettor - It is device which supplies the metered spray of petrol fuel mixture with correct proportion suitable to all condition of engine.

Distributor - A distributor is an enclosed rotating shaft used in spark ignition internal combustion engine that have mechanically timed ignition. Its main function is to route secondary voltage, current from the ignition coil to the spark plugs in the correct firing order and for the correct amount in the time.

AC Pump. Air compressor pump is a device which pumps refrigerant through AC system to provide the vehicle with cool & comfortable air. It is located at the front of the engine with the rest of the belt driven accessories. A rotary compressor is used for said purpose. The compressor rotates at a fixed speed. A compressor is compressing refrigerant vapour, which increases its pressure and turns it into a hot gas.

OIL FILTER

It is a device which is used to filter out contaminants within the oil. Its work is to cycle the clean oil back through the engine parts to keep the components running as smoothly as possible.

Piston

Piston is a cylindrical plug which has reciprocating movement in the engine cylinder.

It has following functions.

- * To transmit the force of explosion to the crankshaft via connecting rod and its bearing.

- * To form a seal so that high pressure gases in the combustion chamber does not escape to the crankcase.

- * To serve as a carrier for the piston rings.

- * To act as a bearing and guide the small end of the connecting rod.

It is made cast or forged cast iron or semi steel.

or aluminium alloy.

CRANKSHAFT

It is a device which is placed inside the engine with engine housing.

There are two types of journals one is connecting journal & other one is main journal.

connecting journal is connected with ~~the~~ big end of the connecting rod & other end of connecting rod is attached with piston by a ~~gudgeon~~ ~~pin~~ gudgeon pin. Both the journals are assembled with thrust bearing, crankshaft is having

oil hole through which engine oil sucked through the oil pump with a strainer used for filtering the oil & transfer it to the oil

ring of the piston. With this arrangement inside of the engine being lubricated. A fly

wheel is mounted at the rear end. It is made of heat treated alloy steel which is

forged ~~and~~ / cast as single piece.

Connecting Rod

Connecting rod transmits the reciprocating motion of the piston into

rotary motion of the crankshaft. The connecting rod connects the piston at one end and the crank at the other end. Connecting

rods are manufactured by casting or drop forging process, and are generally made of alloy steel or aluminium alloy.

Crank Case

The crankcase is situated at the base (lower part) of the engine &

Its functions

- ① support

the engine block and various

AC Pump - mounting/ accessories such as carburettor, fuel pump, air cleaner, oil filter, water pump, starting motor & fan etc.
* Serves as an oil sump for the storage of lubricating oil.
* Protect the engine parts against dust, water & splashing mud.

Oil Pump - Oil pump is fitted inside the engine chamber rotated with the help of crankshaft. When oil pump rotate, the engine oil sucked through it & supplied to oil ring of the piston & lubricated inside the engine properly.

Ignition (oil) transformer that serves to convert the relatively low voltage of 12 volt supplied by the battery into high voltage between 10000 and 15000 volts. The high voltage is needed to create an adequate spark across the gap of spark plugs.

Spark plug - spark plug is a device which ~~receives~~ received high voltage ignition current from secondary coil of the ignition system & supplies spark which jumps across the electrodes. The spark gap is generally kept between 0.6 mm to

1 mm. Too large or too small gap has an adverse effect on the efficiency of ignition system.

FLYWHEEL - It is a heavy wheel which is attached to a the rotating shaft so as to smooth out delivery of power from an engine. The inertia of the flywheel opposes & moderates fluctuations in the speed of the engine & stores excess energy for intermittent use.

CONCLUSION

I have thoroughly study all parts & functions of the car engine