

Lecture

Automobile engineering

• **.Positive Clutch (or) Dog and Spline Clutch**

- The positive clutch consists of two components, namely a driving member and a driven member.
- It is quite simple in construction and operation. It is generally used to lock two shafts together or for locking a gear to shaft. It consists of a sliding sleeve fitted with the driving member having two sets of internal splines.
- The smaller diameter splines are used to slide on a splined driving shaft whereas the bigger diameter splines match with the external dog clutch teeth on the driving shaft.
- Figure 3.11 shows this arrangement, when the sleeve is made to slide on the splined shaft, the larger internal splines match with the dog clutch teeth of the driven shaft. Thus, the sleeve turns the splined shaft with the driven shaft.
- It is called engaged position.
- These clutches are usually operated in conjunction with some type of synchronizing mechanism because they can only be operated when both sets of teeth match perfectly.
- To disengage the clutch, the sleeve is moved back on the splined shaft to have no contact with the driving shaft.

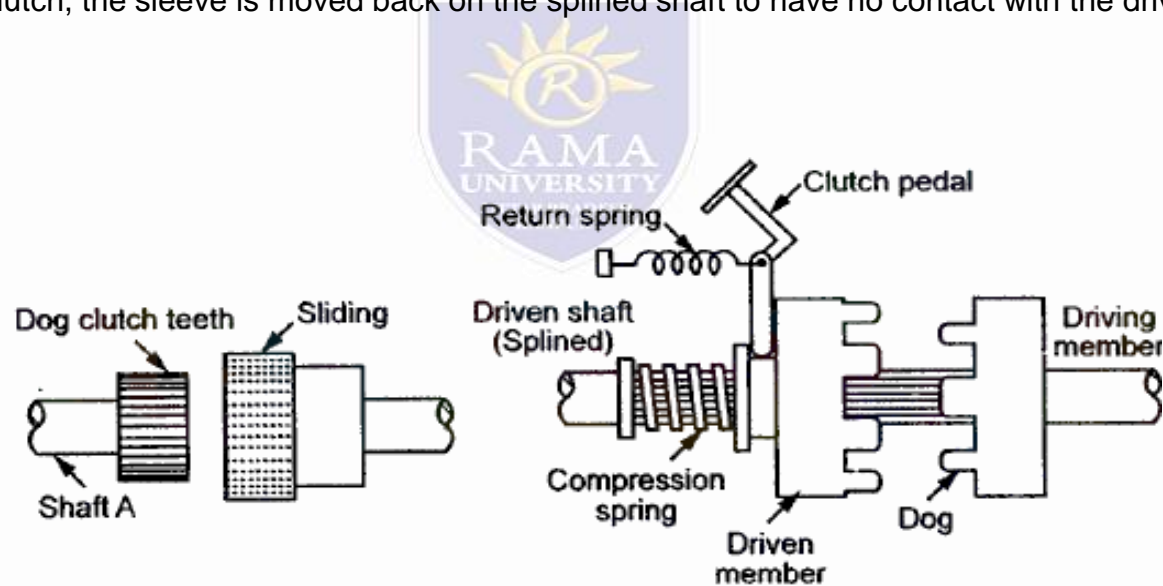


Figure 3.11 Dog and spline clutch

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- Hydraulic Clutch
- A hydraulically operated clutch is used under the following circumstances,
 - (i) When the clutch is located so that it would be difficult to run rods or cable from the foot pedal to the clutch.
 - (ii) In heavy-duty mechanically operated clutches with high clutch spring pressure, the force required by the driver to release the clutch becomes excessive.
- Figure 3.12 shows the line diagram of hydraulic clutch. It consists of a master cylinder and a slave cylinder and an oil reservoir. When the clutch pedal is pressed, the fluid under pressure from the master cylinder reaches the slave cylinder. The slave cylinder is mounted on the clutch itself. The fluid actuates the slave cylinder push rod which further operates the clutch release fork to disengage the clutch. The hydraulic system is designed to multiply the driver's efforts so that a light force applied to the foot pedal produces a much greater force on the clutch fork. A small piston in the master cylinder travels a relatively long distance with only a low input force. It moves the larger piston in the slave cylinder for short distance in transmitting a greater force. Another advantage is that no mechanical linkage is required. Only hydraulic lines are required. These lines can be performed to any angle by flexible turning. Since, it has no mechanical linkage

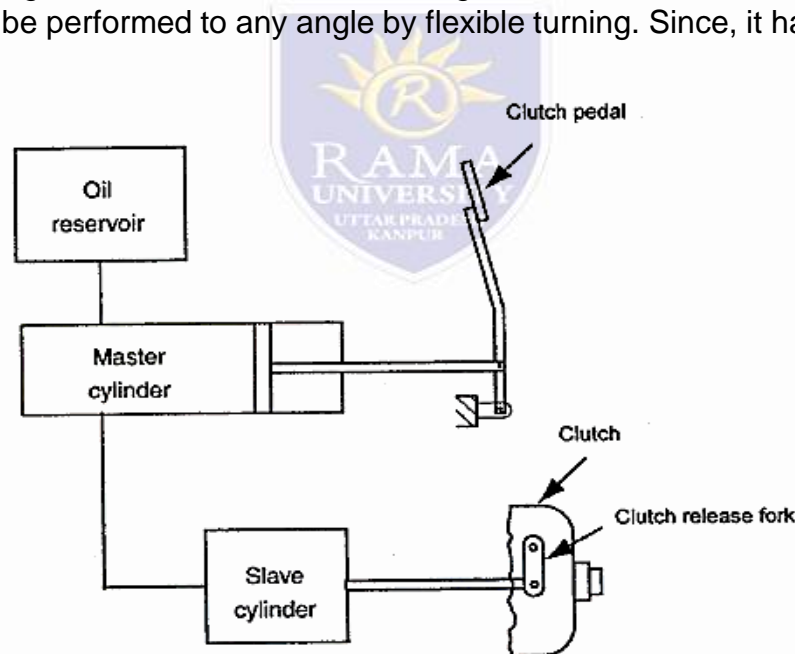


Figure 3.12 Hydraulic operated clutch
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- Electro-Magnetic Clutch
- An electro-magnetic clutch consists of an engine flywheel provided with electric winding.
- A driven plate lined with friction materials is provided.
- It is free to move on splines of the gearbox shaft. A pressure plate is applied for engaging or disengaging the clutch. Figure 3.13 shows the simplified diagram of this type of clutch.
- The operation of this clutch takes place when the electric current is passed through the electric winding placed on the flywheel. When the winding gets energized, the pressure plate moves towards the flywheel due to increase in armature attraction.
- It results the engagement of a clutch.
- The clutch is disengaged when the current supplied to the winding is cut off.
- There is no longer contact between pressure plate and intermediate plate.
- Since, the current from vehicles dynamo increases with increase in speed, the clutch engaging force will also increase with the engine speed to provide a progressive clutch engagement.

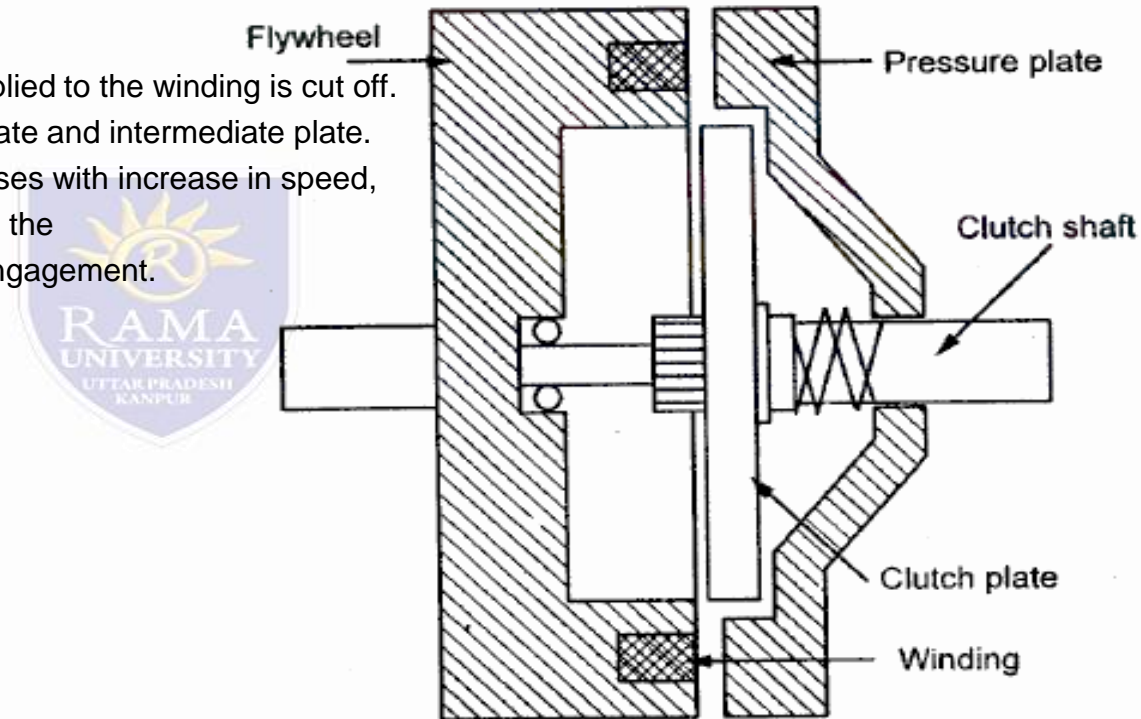


Figure 3.13 Electromagnetic clutch

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- Vacuum Clutch
- The vacuum clutch is operated in the same way as the hydraulic clutch.
- The only difference is that it is operated by vacuum pressure whereas the hydraulic clutch is operated by oil pressure.
- In vacuum clutches, the partial vacuum existing in the engine manifold is used for operating it. Figure 3.14 shows the line diagram of a vacuum clutch. It consists of a vacuum cylinder, solenoid valve, reservoir and non-return valve.
- One end of the reservoir is connected to the inlet manifold through a non-return valve whereas the other end is connected to the vacuum cylinder through a solenoid switch.
- The solenoid valve is operated by the battery and the circuit incorporates a switch which is placed in the gear lever.
- The switch is operated when the driver holds the lever to change gears
- A piston in the vacuum cylinder is connected to the clutch through linkages.
- When the throttle is opened in the engine inlet manifold, the pressure in the manifold increases due to which the non-return valve closes.
- It isolates the reservoir from the manifold. Thus, a vacuum exists in the reservoir all time

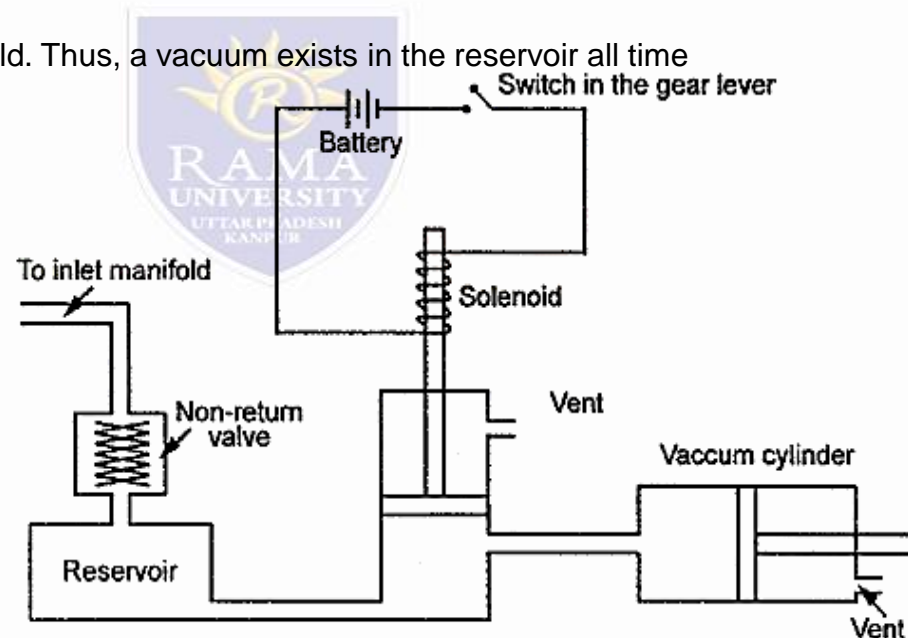


Figure 3.14 Vacuum operated clutch

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- During normal running conditions, the switch in the gear lever remains open and the solenoid valve remains in its bottom.
- The atmospheric pressure acts on both sides of the piston of vacuum cylinders.
- Since, the vacuum cylinder is opened to the atmosphere through vent.
- When the driven member holds the lever to change the gear, the switch is closed.
- It causes the solenoid to pull the valve up.
- Now, one side of the vacuum cylinder is connected to the reservoir.
- Due to the vacuum pressure, the piston moves in the left hand side to actuate the

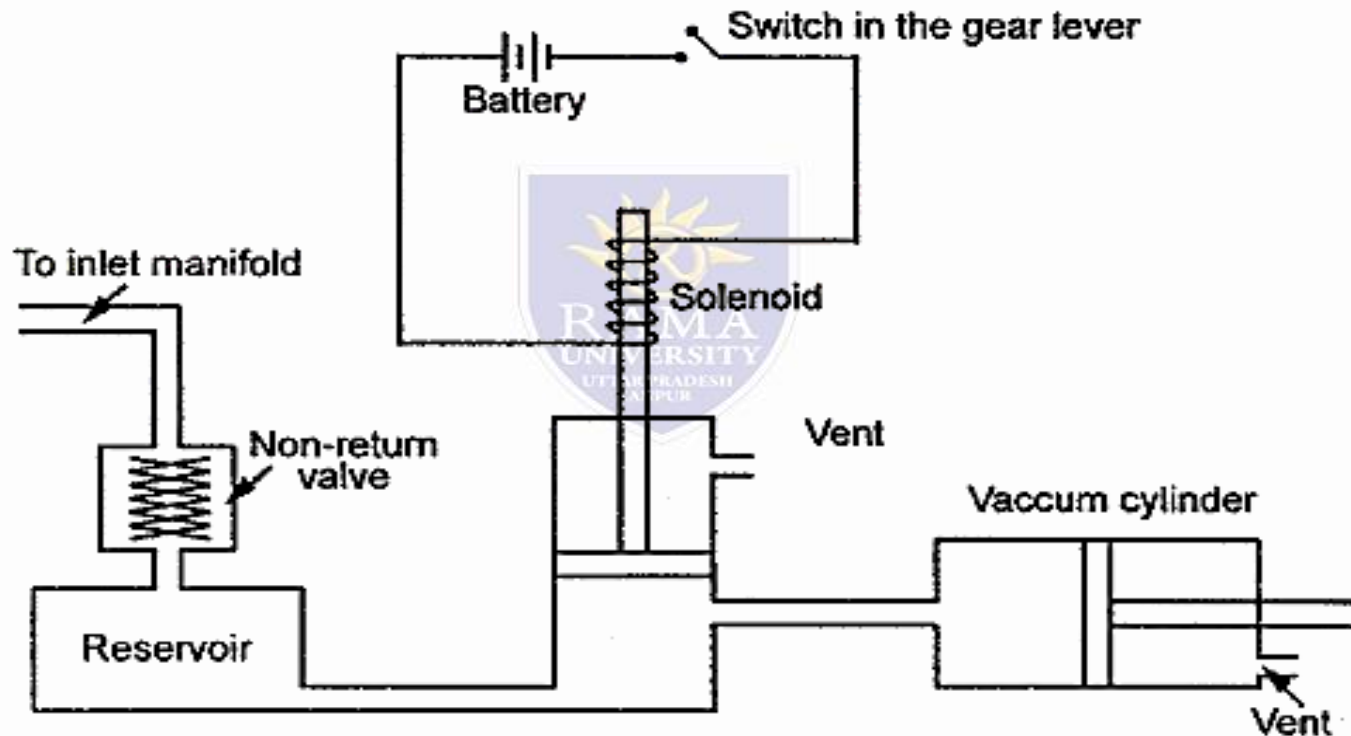


Figure 3.14 Vacuum operated clutch