TYPES OF CLUTCH

Multiple plate clutch

This type of clutch has several driving members interleaved with several driven members. It is used in race cars including F1, Indy car, World rally and even most club racing, motorcycles, automatic transmissions and in some diesel locomotives with mechanical transmissions. It is also used in some electronically controlled all-wheel drive systems.

Vehicular

There are different designs of vehicle clutch, but most are based on one or more friction discs, pressed tightly together or against a flywheel using springs. The friction material varies in composition depending on whether the clutch is dry or wet, and on other considerations. Friction discs once contained asbestos, but this has been largely eliminated. Clutches found in heavy duty applications such as trucks and competition cars use ceramic clutches that have a greatly increased friction coefficient. However, these have a "grabby" action and are unsuitable for road cars. The spring pressure is released when the clutch pedal is depressed thus either pushing or pulling the diaphragm of the pressure plate, depending on type. However, raising the engine speed too high while engaging the clutch will cause excessive clutch plate wear. Engaging the clutch abruptly when the engine is turning at high speed causes a harsh, jerky start. This kind of start is necessary and desirable in drag racing and other competitions, where speed is more important than comfort.

Wet vs. dry

A "wet clutch" is immersed in a cooling lubricating fluid, which also keeps the surfaces clean and gives smoother performance and longer life. Wet clutches, however, tend to lose some energy to the liquid. A "dry clutch", as the name implies, is not bathed in fluid. Since the surfaces of a wet clutch can be slippery (as with a

motorcycle clutch bathed in engine oil), stacking multiple clutch disks can compensate for the lower coefficient of friction and so eliminate slippage under power when fully engaged.

The Hele-Shaw clutch was a wet clutch that relied entirely on viscous effects, rather than on friction.

Automobiles

This plastic pilot shaft guide tool is used to align the clutch disk as the spring-loaded pressure plate is installed. The transmission's drive splines and pilot shaft have an identical shape. A number of such devices fit various makes and models of drivetrains

In a car the clutch is operated by the left-most pedal using a hydraulic or cable connection from the pedal to the clutch mechanism. On older cars the clutch would be operated by a mechanical linkage. Even though the clutch may physically be located very close to the pedal, such remote means of actuation are necessary to eliminate the effect of vibrations and slight engine movement, engine mountings being flexible by design. With a rigid mechanical linkage, smooth engagement would be near-impossible, because engine movement inevitably occurs as the drive is "taken up." No pressure on the pedal means that the clutch plates are engaged (driving), while pressing the pedal disengages the clutch plates, allowing the driver to shift gears or coast.

A manual transmission contains cogs for selecting gears. These cogs have matching teeth, called dog teeth, which means that the rotation speeds of the two parts have a synchronizer, a device that uses frictional contact to bring the two parts to the same speed, and a locking mechanism called a blocker ring to prevent engagement of the teeth (full movement of the shift lever into gear) until the speeds are synchronized.

Push/Pull

Clutches can be classified as Push Type Or Pull Type depending on the location of the pressure plate fulcrum points. In a pull type clutch, the action of pressing the pedal pulls the release bearing, pulling on the diaphragm spring and disengaging the vehicle drive. The opposite is true with a push type, the release bearing is pushed into the clutch disengaging the vehicle drive. In this instance, the release bearing can be known as a thrust bearing (as per the image above).

FACTS

Various materials have been used for the disc friction facings, including asbestos in the past. Nowadays, however, an organic resin and copper wire facing or a Ceramic material. A typical coefficient of friction used on a disc friction surface is 0.35ų for an organic and 0.25 for ceramic. Ceramic materials can be used in heavy applications such as trucks carrying large loads or racing however, since the material is harder than the organic material it increases flywheel and pressure plate wear.

As well as the dampened disc centres, which reduce driveline vibration, pre-dampeners are used to reduce gear rattle at idle due to changing the natural frequency of the disc. These are weaker springs which will be compressed solely by the radial vibrations from an idling engine. They are fully compressed and no longer in use once drive is taken up by the main dampener springs.

A clamp load of 33Kn is normal for a single plate 430 whereas a 400 Twin for the Mercedes application offers a clamp load of a mere 23,000N.

Bursts speeds are typically around 5,000rpm with the weakest point being the facing rivet. For trucks.
With regards to the manufacture of diaphragm springs, heat treatment is crucial. Laser welding is becoming more common as a method of attaching the drive plate to the disc ring with the laser typically being between 2-3KW and a feed rate 1m/minute. Modern clutch development focuses its attention on the simplification of the overall assembly and/or manufacturing methods for example drive straps are now commonly employed to transfer torque as well as lift the pressure plate upon disengagement of vehicle drive. Drive straps are the smaller

Non-powertrain in automobiles

There are other clutches found in a car. For example, a belt-driven engine cooling fan may have a clutch that is heat-activated. The driving and driven elements are separated by a silicone-based fluid and a valve controlled by a bimetallic spring. When the temperature is low, the spring winds and closes the valve, which allows the fan to spin at about 20% to 30% of the shaft speed. As the temperature of the spring rises, it unwinds and opens the valve, allowing fluid past the valve which allows the fan to spin at about 60% to 90% of shaft speed depending on whether it's a regular or heavy-duty clutch. There are also electronically engaged clutches (such as for an air conditioning compressor) that use magnetic force to lock the driving and driven shafts together.

Motorcycles

On most motorcycles, the clutch is operated by the clutch lever, located on the left handlebar. No pressure on the lever means that the clutch plates are engaged (driving), while pulling the lever back towards the rider will disengage the clutch plates through cable or hydraulic actuation, allowing the rider to shift gears. Motorcycle clutches are usually made up of a stack of alternating plain steel and friction plates. One type of plate has lugs on its inner diameter that key it to the engine crankshaft, while the other type of plate has lugs on its outer diameter that key it to a basket that turns the transmission input shaft. The plates are forced together by a set of coil springs or a diaphragm spring plate when the clutch is engaged. Racing motorcycles often use slipper clutches to eliminate the effects of engine braking, which, being applied only to the rear wheel, can lead to instability.

Centrifugal

Some cars and mopeds have a centrifugal clutch, using centrifugal effects to automatically engage the clutch, when the engine is accelerated above certain rpm, see Saxomat and Variomatic.

Mopeds also use centrifugal clutches. On the flat they may be pedalled manually, on approaching a hill the engine speed is increased, engaging the clutch to assist with the climb.

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