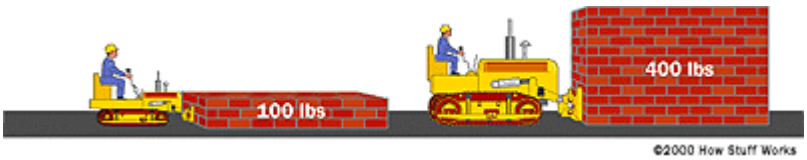
Friction and Clutch

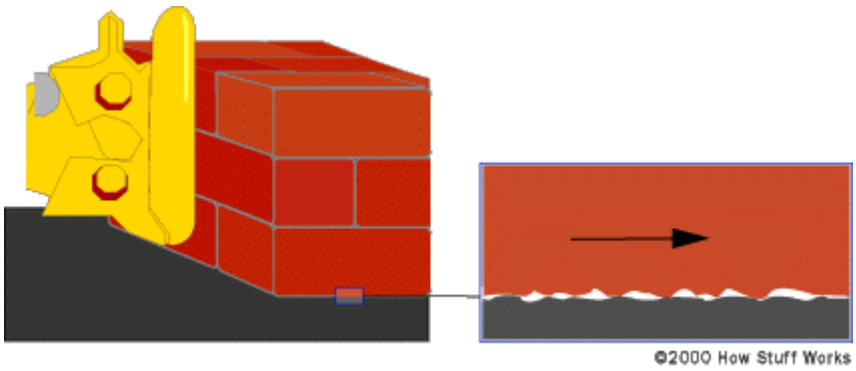
Friction

Friction is a measure of how hard it is to slide one object over another. Take a look at the figure below. Both of the blocks are made from the same material, but one is heavier. I think we all know which one will be harder for the bulldozer to push.



Friction force versus weight

To understand why this is, let's take a close look at one of the blocks and the table:



Because friction exists at the microscopic level, the amount of force it takes to move a given block is proportional to that block's weight.

Even though the blocks look smooth to the naked eye, they are actually quite rough at the microscopic level. When you set the block down on the table, the little peaks and valleys get squished together, and some of them may actually weld together. The

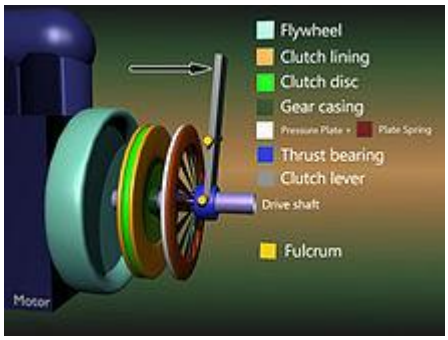
weight of the heavier block causes it to squish together more, so it is even harder to slide.

Different materials have different microscopic structures; for instance, it is harder to slide rubber against rubber than it is to slide steel against steel. The type of material determines the **coefficient of friction**, the ratio of the force required to slide the block to the block's weight. If the coefficient were 1.0 in our example, then it would take 100 pounds of force to slide the 100-pound (45 kg) block, or 400 pounds (180 kg) of force to slide the 400-pound block. If the coefficient were 0.1, then it would take 10 pounds of force to slide to the 100-pound block or 40 pounds of force to slide the 400-pound block.

So the amount of force it takes to move a given block is proportional to that block's weight. The more weight, the more force required. This concept applies for devices like brakes and clutches, where a pad is pressed against a spinning disc. The more force that presses on the pad, the greater the stopping force.

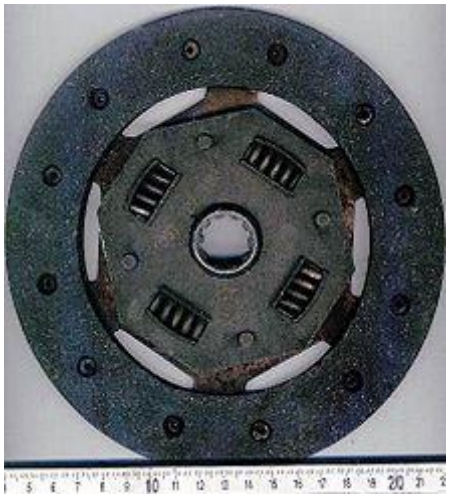
Clutch

For other uses, see Clutch (disambiguation).



Clutch for a drive shaft: The clutch **disc** (center) spins with the flywheel (left). To disengage, the lever is pulled (black arrow), causing a white pressure plate (right) to disengage the green clutch disc from turning the drive shaft, which turns within the thrust-bearing ring of the lever. Never will all 3 rings connect, with no gaps.

Rear side of a Ford V6 engine, looking at the clutch housing on the flywheel



Single, dry, clutch friction disc. The splined hub is attached to the disc with springs to damp chatter.

A **clutch** is a mechanical device, by convention understood to be rotating, which provides driving force to another mechanism when required, typically by connecting the driven mechanism to the driving mechanism. Clutches and brakes are similar; if the driven member of a clutch is fixed to the mechanism frame, it serves as a brake.

Clutches are useful in devices that have two rotating shafts. In these devices, one shaft is typically attached to a motor or other power unit (the driving member), and the other shaft (the driven member) provides output power for work to be done. In a drill,

for instance, one shaft is driven by a motor, and the other drives a drill chuck. The clutch connects the two shafts so that they can either be locked together and spin at the same speed (engaged), or be decoupled and spin at different speeds (disengaged).

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.