Other Clutches

- Dog clutches: Described above. Positive engagement, non-slip. Partial engagement under any significant load is destructive.
- Cone clutches: Friction clutches; distinguished by conical friction surfaces. The cone's taper meant that a given amount of movement of the actuator made the surfaces approach (or recede) much more slowly than in a disc clutch. As well, a given amount of actuating force created more pressure on the mating surfaces.
- Torque limiter, slip clutch, or *Safety clutch:*: This device allows a rotating shaft to "slip" when higher than normal resistance is encountered on a machine. An example of a safety clutch is the one mounted on the driving shaft of a large grass mower. The clutch will "slip" or "give" if the blades hit a rock, stump, or other immobile object. Motor-driven mechanical calculators had these, between the drive motor and gear train, to limit damage when the mechanism jammed. (Motors had high stall torque.)

  Carefully-designed types disengage (but continue to transmit torque) in such tools as controlled-torque screwdrivers.

- Overrunning clutch or freewheel: If some external torque makes the driven member rotate faster than the driver, the clutch effectively disengages. Such a clutch was an essential part of the Borg-Warner Overdrive in cars. Typical bicycles have these, so that the rider can stop pedaling and coast. If one member oscillates, this type converts that motion into intermittent rotary motion. Some types are ratchets with the pawl mounted on a moving member; among others are (silent) wrap-spring types, such as the brake for a film camera's winding knob that keeps it from being turned backwards.
- Centrifugal clutch and semi-centrifugal clutch: When the driving shaft is running slowly, the clutch is disengaged; it engages when the driven member speeds up. One example is in engine-driven radio-controlled model cars.

- Hydraulic clutch: The driving and driven members are not in physical contact; coupling is hydrodynamic.
- Electromagnetic clutch: Typically, a clutch that is engaged by an electromagnet that is usually an integral part of the clutch assembly. However, magnetic particle clutches have a space between driving and driven members that also serve as pole pieces of an electromagnet. Applying DC causes the particles to clump together and adhere to the operating surfaces. Engagement and slippage are notably smooth.
- Double Dry Clutch

- Single-revolution clutch: When inactive, it is disengaged, and the driven member is stationary. When "tripped", it locks up solidly (typically in milliseconds or tens of ms) and rotates the driven member just one full turn. If the trip mechanism is operated when the clutch would otherwise disengage, the clutch remains engaged. Variants include half-revolution (and other fractional-revolution) types. These were an essential part of printing telegraphs, such as the Teletype page printers, as well as electric typewriters, notably the IBM Selectric. They were also found in motor-driven mechanical calculators; the Marchant had several of them. They are also used in farm machinery and industry. Typically, these were a variety of dog clutch.

- Wrap-spring clutches: These have a helical spring wound with square-cross-section wire. In simple form, the spring is fastened at one end to the driven member; its other end is unattached. The spring fits closely around a cylindrical driving member. If the driving member rotates in the direction that would unwind the spring, the spring expands minutely and slips, although with some drag. Rotating the driving member the other way makes the spring wrap itself tightly around the driving surface, and the clutch locks up.

  Single-revolution clutches in teleprinters were of this type. Basically, the spring was kept expanded (details below) and mostly out of contact with the driving sleeve, but nevertheless close to it. One end of the spring was attached to a sleeve surrounding the spring. The other end of the spring was attached to the driven member, inside which the drive shaft could rotate freely. The sleeve had a projecting tooth, like a ratchet tooth. A spring-loaded pawl pressed against the sleeve and kept it from rotating. The wrap spring's torque kept the sleeve's tooth pressing against the pawl.

To engage the clutch, an electromagnet attracted the pawl away from the sleeve. The wrap spring's torque rotated the sleeve, which permitted the spring to contract and wrap tightly around the driving sleeve. Load torque tightened the wrap, so it didn't slip once engaged. If the pawl were held away from the sleeve, the clutch would continue to drive the load without slipping.

When the clutch was to disengage, power was disconnected from the electromagnet, and the pawl moved close to the sleeve. When the sleeve's tooth contacted the pawl, the sleeve and the load's inertia unwrapped the spring to disengage the clutch.

Considering that the drive motors in some of these (such as teleprinters for news wire services) ran 24 hours a day for years, the spring could not be allowed to stay in close contact with the driving cylinder; wear would be excessive. The other end of the spring was fastened to a thick disc attached to the driven member. When the clutch locked up, the driven mechanism coasted, and its inertia rotated the disc until a tooth on it engaged a pawl that kept it from reversing. Together with the restraint at the other end of the spring, created by the trip pawl and sleeve tooth, this kept the spring expanded to minimize contact with the driving cylinder.

These clutches were lubricated with conventional oil, but the wrap was so effective that the lubricant did not defeat the grip.

These clutches had long operating lives, cycling for tens, maybe hundreds of millions of cycles without need of maintenance other than occasional lubrication with recommended oil.

- "Cascaded-Pawl" single-revolution clutches: These superseded wrap-spring single-revolution clutches in page printers (such as teleprinters), including the Model 28 Teletype (and its successors using the same design principles). As well, the IBM Selectric typewriter had several of them.

  These were typically disc-shaped assemblies mounted on the drive shaft. Inside the hollow disc-shaped housing were two or three freely-floating pawls arranged so that, when the clutch was tripped, the load torque on the first pawl to engage created force to keep the second pawl engaged, which in turn kept the third one engaged. The clutch did not slip, once locked up. This sequence happened quite fast, on the order of milliseconds.

The first pawl had a projection that engaged a trip lever. If the lever engaged the pawl, the clutch was disengaged. When the trip lever moved out of the way, the first pawl engaged, creating the cascaded lockup just described. As the clutch rotated, it would stay locked up if the trip lever were out of the way, but if it engaged, it would quickly unlock the clutch.

- "Kickback" clutch-brakes:

  These mechanisms were found in some types of synchronous-motor-driven electric clocks. Many different types of synchronous clock motors were used, including the pre-World War II Hammond manual-start clocks. Some types of self-starting synchronous motors always started when power was applied, but, in detail, their behavior was chaotic, and they were equally likely to start rotating in the wrong direction.

  Coupled to the rotor by one (or possibly two) stages of reduction gearing was a wrap-spring clutch-brake. The spring did not rotate. One end was fixed, the other free. It rode freely but closely on the rotating member, part of the clock's gear train. The clutch-brake locked up when rotated backwards, but also had some spring action. The inertia of the rotor going backwards engaged the clutch and "wound" the spring. As it "unwound", it re-started the motor in the correct direction. Some designs had no explicit spring as such; it was simply a compliant mechanism. The mechanism was lubricated; wear did not seem to be a problem.

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