Clutches and Brakes

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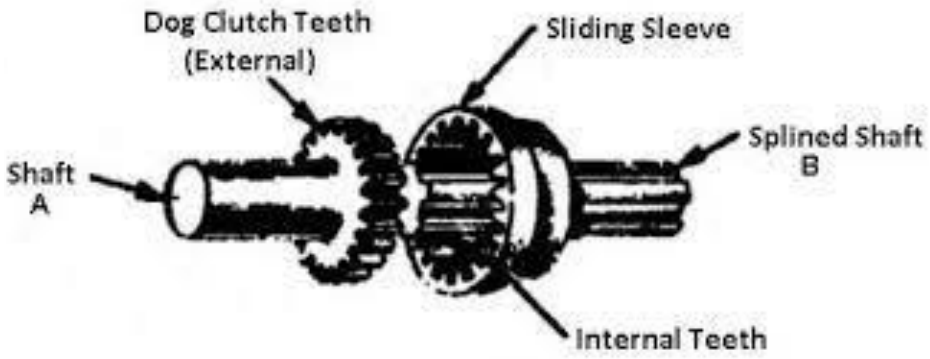
Introduction: clutches

- What are clutches?
  - A mechanical device which permits the connection and disconnection of shafts
- Types: Positive contact, Friction, Magnetic, Fluid coupling, Over-running
- Why are clutches and brakes discussed together?

Dog Clutch



Classification of '**friction**' clutches

- Based on configuration
- Types
  - Disk or axial
  - Cone
  - Rim type with external contracting shoes
  - Rim type with internal expanding shoes
  - Band type

Design goals

- Friction torque to be transmitted
- Amount of actuating force required to transmit this torque
- Geometrical constraints
- Thermal considerations
- Life of product

Materials

- High and reproducible coefft of friction
- Resistance to wear
- Impervious to environmental conditions such as moisture
- Should withstand high temperatures
- High thermal conductivity and diffusivity, and specific heat capacity

Materials

Table 16–5

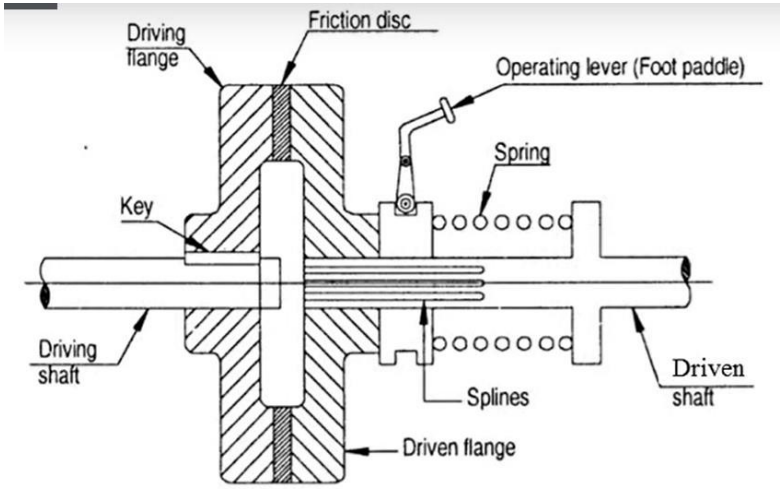
Friction Materials for Clutches

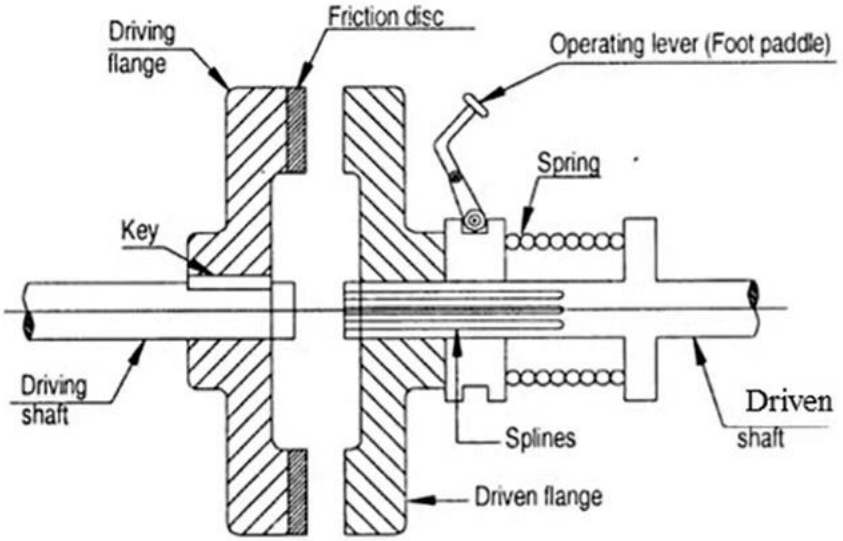
Material	Friction Coefficient		Max. Temperature		Max. Pressure	
	Wet	Dry	°F	°C	psi	kPa
Cast iron on cast iron	0.05	0.15–0.20	600	320	150–250	1000–1750
Powdered metal* on cast iron	0.05–0.1	0.1–0.4	1000	540	150	1000
Powdered metal* on hard steel	0.05–0.1	0.1–0.3	1000	540	300	2100
Wood on steel or cast iron	0.16	0.2–0.35	300	150	60–90	400–620
Leather on steel or cast iron	0.12	0.3–0.5	200	100	10–40	70–280
Cork on steel or cast iron	0.15–0.25	0.3–0.5	200	100	8–14	50–100
Felt on steel or cast iron	0.18	0.22	280	140	5–10	35–70
Woven asbestos* on steel or cast iron	0.1–0.2	0.3–0.6	350–500	175–260	50–100	350–700
Molded asbestos* on steel or cast iron	0.08–0.12	0.2–0.5	500	260	50–150	350–1000
Impregnated asbestos* on steel or cast iron	0.12	0.32	500–750	260–400	150	1000
Carbon graphite on steel	0.05–0.1	0.25	700–1000	370–540	300	2100

*The friction coefficient can be maintained with ±5 percent for specific materials in this group.

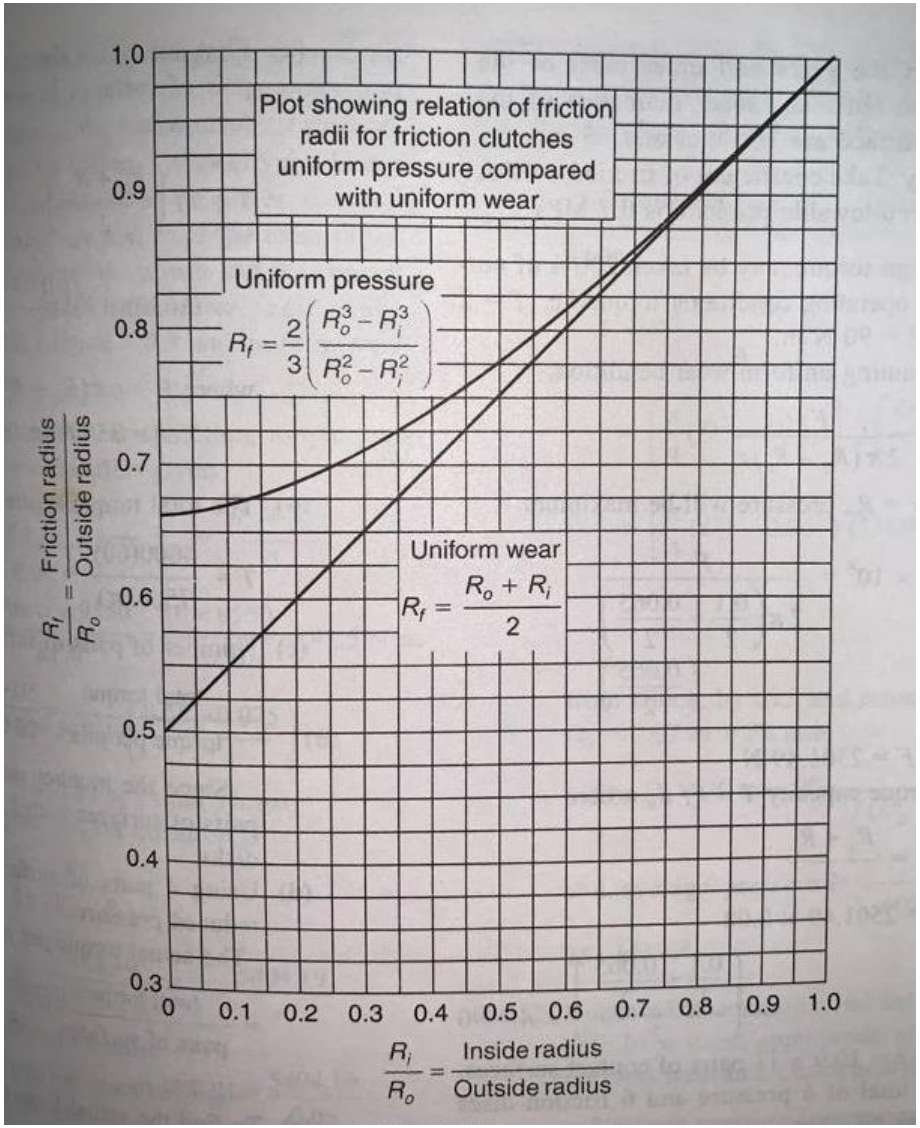
Disk or axial type (friction) clutch

- Springs



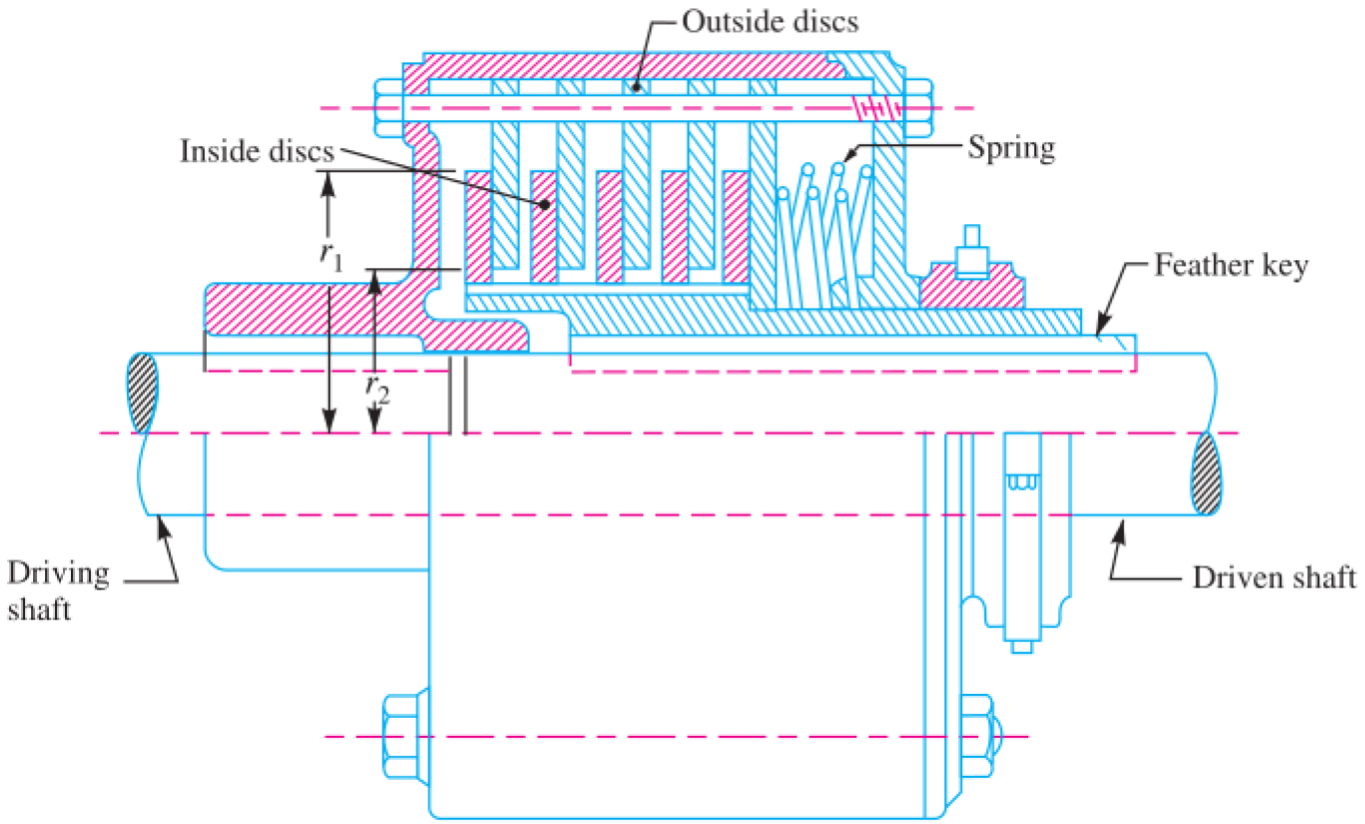


Uniform pressure and uniform wear

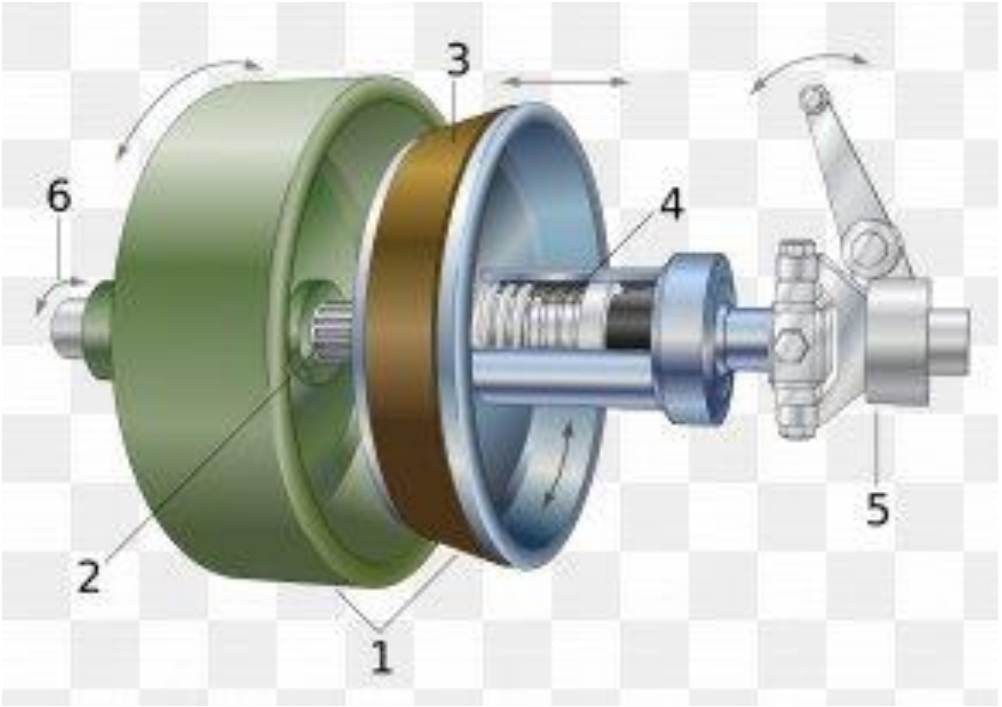


Multi-plate clutch

- video



Cone clutch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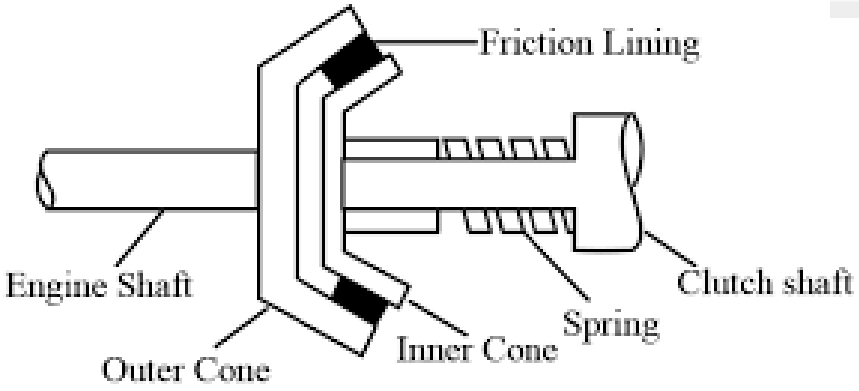
4
5
2
1


Friction Lining
Engine Shaft
Clutch shaft
Spring
Inner Cone
Outer Cone

References

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