Friction of Sliding Electrical Contacts. Friction is the resistance to motion produced when one object moves, or attempts to move, tangentially with respect to another object which it touches.

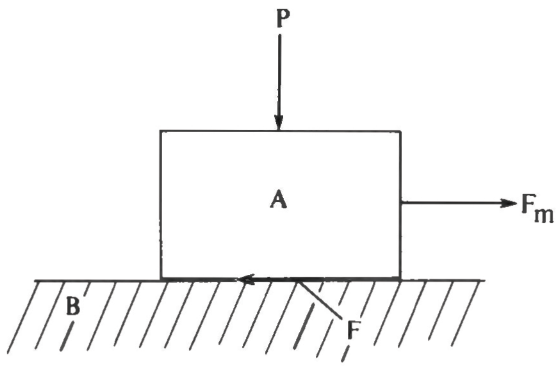

Fig. 1-16. Sliding bodies.

Figure 1-16 shows two bodies **A** and **B** which are touching with a normal force **P** applied. If a tangential force $\mathbf{F}_m$ is applied, it would cause motion, provided the frictional force **F** is less than $\mathbf{F}_m$. The ratio of the frictional force F to the normal load P is the coefficient of friction, μ

$$\mu = \frac{F}{P} \qquad \text{Eq. 1.12}$$

Static coefficient of friction is the value of μ at which a body first begins motion. It could be measured by applying a gradually increasing F_m and noting its value when motion first starts for a given normal load. Static friction is important since it determines the force that must be available to start motion in a sliding system. The *kinetic coefficient of friction* is the value that μ assumes when motion is continuous and it has a slightly lower value than the static coefficient. This tells us simply that it take more force to start a body in motion than to keep it in motion that has already begun.

From earlier sections of this text we recall that real contact, either metallic or quasi-metallic, occurs only at a few asperities and that the tiny metallic areas are welded together microscopically. Most of the frictional force stems from the shearing of those micro-welds. Some of the frictional energy can also be from mechanical interlocking of surface irregularities and from the *ploughing* effect when a hard substance deforms a softer or more pliable member.

Frictional energy is dissipated in the form of heat which is conducted into the sliding bodies and eventually to the ambient atmosphere. With the contact forces and surface speeds encountered. in instrument contacts, the temperature developed in the asperities from frictional effects plays an insignificant role. The surface speeds considered are up to 200 inches/second (~500 cm/sec) above which frictional heat could have some influence. With these speeds as a maximum, the kinetic coefficient of friction is not changed in value as a result of the self-generated heat.

Friction is very sensitive to conditions at the interface of two members. The extremes are (1) well lubricated surfaces and (2) materials that are perfectly clean, sliding in a vacuum. Whereas the lubricated pair would have a kinetic coefficient of friction of 0.05 or less, values above 5.0 are common in a vacuum environment. Between these two extremes we find a region of values in which practical contact systems perform as intended. Values of from 0.1 to 0.5 will be found for all but very special purpose systems. For Ney alloys, we usually suggest that a value of 0.5 be used for static coefficient of friction in normal (unclean) air.