



Figure 1.5: Amontons' sketch of his apparatus for friction experiments. The spring D measures the friction force during the sliding process between materials A and B. Spring C adjusts the normal force. (From<sup>1</sup>)

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#### 1.4 Guillaume Amontons (1663-1705)

Two centuries after Leonardo's discoveries, the French physicist Guillaume Amontons considered the problem of friction again. In his experiments he used springs to measure lateral forces (see Fig. 1.5) and therefore he must have been able to measure both static and kinetic friction. However, we must conclude, that also Amontons wasn't aware of the difference of the two friction phenomena. Amontons postulated the following friction laws:

1. The resistance caused by rubbing only increases or diminishes in proportion to greater or lesser pressure (load) and not according to the greater or lesser extent of the surfaces.
2. The resistance caused by rubbing is more or less the same for iron, lead, copper and wood in any combination if the surfaces are coated with pork fat.
3. The resistance is more or less equal to one-third of the pressure (load).

Amontons found a material-independent friction coefficient of 0.33 and therefore also he believed in the existence of an universal friction coefficient.