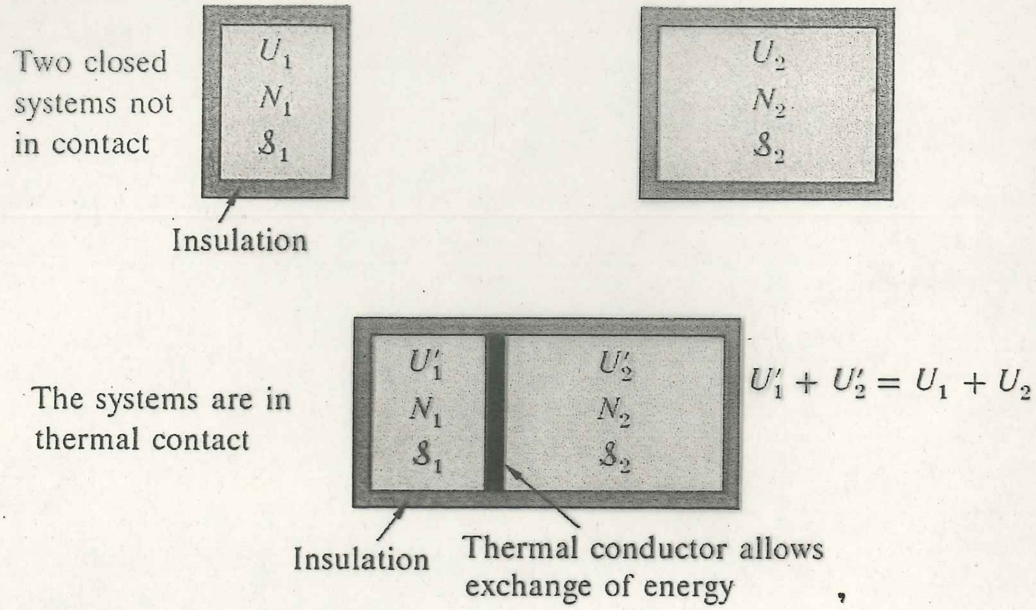

Figure 2.5 Establishment of thermal contact between two systems $\mathcal{S}_1$ and $\mathcal{S}_2$.

systems can be different in size and constitution. A constant total energy can be shared in many ways between two systems.

* The most probable division of the total energy is that for which the combined system has the maximum number of accessible states. We shall enumerate the accessible states of two model systems and then study what characterizes the systems when in thermal contact. We first solve in detail the problem of thermal contact between two spin systems, 1 and 2, in a magnetic field which is introduced in order to define the energy. The numbers of spins N_1, N_2 may be different, and the values of the spin excess $2s_1$, $2s_2$ may be different for the two systems. All spins have magnetic moment m. The actual exchange of energy might take place via some weak (residual) coupling between the spins near the interface between the two systems. We assume that the quantum states of the total system $\mathcal{S}$ can be represented accurately by a combination of any state of $\mathcal{S}_1$ with any state of $\mathcal{S}_2$. We keep N_1, N_2 constant, but the values of the spin excess are allowed to change. The spin excess of a state of the combined system will be denoted by $2s$, where $s = s_1 + s_2$. The energy of the combined system is directly proportional to the total spin excess:

$$U(s) = U_1(s_1) + U_2(s_2) = -2mB(s_1 + s_2) = -2mBs. \tag{5}$$

The total number of particles is $N = N_1 + N_2$.