Figure 9.4 shows the basic 'usage' circuit of one of the improved second generation OTAs of the LM13600, which is almost identical to that of the CA3080 except for the addition of linearizing diodes D_1 and D_2, which are integrated with Q_1 and Q_2 and thus have characteristics matched to those of the Q_1 and Q_2 base-emitter junctions. In use, equal low-value resistors R_1 and R_2 are wired between the inputs of the differential amplifier and the common supply line, and bias current I_D is fed to them from the positive supply rail via R_3 and D_1–D_2 and, since D_1–D_2 and R_1–R_2 are matched, divides equally between them to give R_1 and R_2 currents of $I_D/2$.

The circuit's input voltage is applied via R_4 (which is large relative to R_1) and generates input signal current I_s, which feeds into R_1 and thus generates a signal voltage across it that reduces the D_1 current to $(I_D/2)-I_s$. The I_D current is, however, constant, so the D_2 current rises to $(I_D/2)+I_s$.

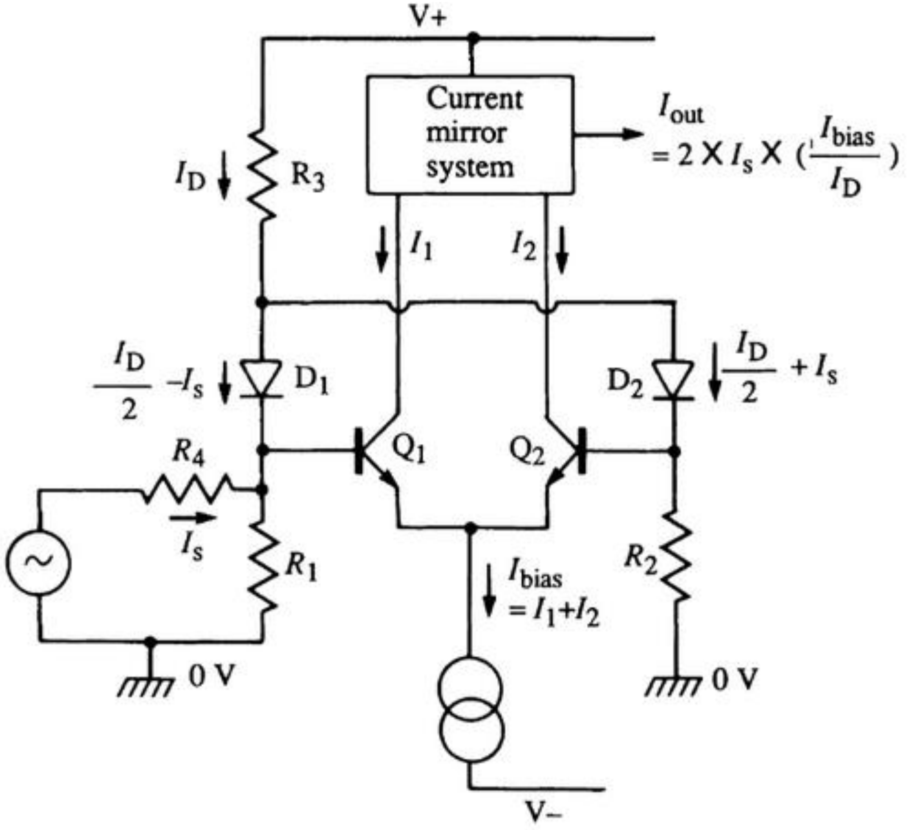

Figure 9.4 *Simplified usage circuit of an LM13600 OTA*

Consequently, the linearizing diodes of the *Figure 9.4* circuit apply heavy negative feedback to the differential amplifier and give a large reduction in signal distortion. If I_s is small relative to I_D, the output signal current of the circuit is equal to $2 \times I_s \times (I_{bias}/I_D)$; the circuit's gain can thus be controlled via either I_{bias} or I_D.