## Comments on Example 10–4

In this example the size of the conductor was treated as a continuous variable. Actually, the conductors available are discrete sizes, increasing by a geometric progression at the rate of $1.123^2$ for the cross-sectional area. The fact that there are specific sizes of wire available and that tables giving the resistance, weight, and cross-sectional area are also available makes another method of solution attractive.

In Table 10–2 five successive wire sizes that might be used for this application have been selected and the annual cost of each size was computed. The table shows that wire size No. 1 gives the lowest annual cost. This table also emphasizes the fact that one type of cost increases as the other decreases, as happens in many problems involving multiple alternatives. Furthermore, note that at the most economical alternative the investment charges approximately equal the cost of lost energy. This is characteristic of problems in which the total costs can be represented by the equation

$$y = ax + \frac{b}{x} + c$$

It was first pointed out by Lord Kelvin in 1881 that the economical size of conductor is that for which the annual investment charges just equal the annual cost of lost energy. This is well known in electrical engineering as Kelvin's Law. The costs in Figure 10–1 illustrate its application.

## Some Comments about the Use of Mathematical Models in Engineering Economy

Many mathematical models have been developed to guide decisions among investment alternatives. General statements may be made that are applicable to many