if any, the amount of perspiration, your age, the area of electrical contact, and the path the current takes through your body.

If the skin is broken or cut, the resistance may be as low as 300 ohms. Although resistance varies from moment to moment and from person to person, 500 ohms is generally considered to be the maximum resistance that you can count on. At 500 ohms, you cannot safely touch more than 9 volts!

For shock to occur you must be part of a closed circuit in which current can flow. This is most likely to happen if you touch a hot wire while grounded yourself. It can also happen if you touch both wires of an energized circuit. With a high resistance of 100,000 ohms, about 1 mA will flow through your body if you complete a circuit across 120 volts. Most people can feel such a current and will voluntarily let go.

As the resistance decreases, the current increases. Between 1 and 6 mA you may receive just a "tingle" or perhaps an uncomfortable or painful shock, but not a fatal one. Any death from such a shock would be indirect; for example, by being startled you might fall off a ladder. At currents above 6 mA, the situation becomes deadly serious. The pain becomes intense and you may not be able to turn loose of the circuit. In effect you are frozen to it.

Experiments performed by Charles F. Dalziel at the University of California at Berkeley and W. R. Lee at the University of Manchester show the average "let-go" ac currents to be 16 mA for men and 10.5 mA for women (see Figure 2-2). As a result of their experiments, the *safe* let-go currents are now considered to be 9 mA for men and 6 mA for women.

If you are frozen to a circuit, your resistance may start decreasing and it's possible, if you are in the circuit long enough, for the current to rise to a fatal level. At 25 mA your muscles can go into violent contractions. If you're lucky, the contractions will be so great that you will be thrown clear of the circuit.

When the current through your body is between 50 and 200 mA, your heart can be thrown out of rhythm (ventricular fibrillation occurs, as shown in Figure 2-3) or stopped altogether, or your breathing can stop before your heart is affected. In some cases you could be revived by closed-chest cardiac massage and mouth-to-mouth resuscitation, provided fibrillation does not occur and provided that resuscitation is given promptly by a person sufficiently trained in such techniques. When such procedures fail, death occurs within a few minutes.

Such currents may not be fatal, however, if the duration of current flow is kept short enough. This principle is used in ground fault interrupters, which typically allow the current to flow for a maximum of 25 milliseconds. In this time period, the current does not have enough time to electrocute you.

The effect or severity of the shock depends also on the current's path through your body. If it flows from one finger to another finger on the same

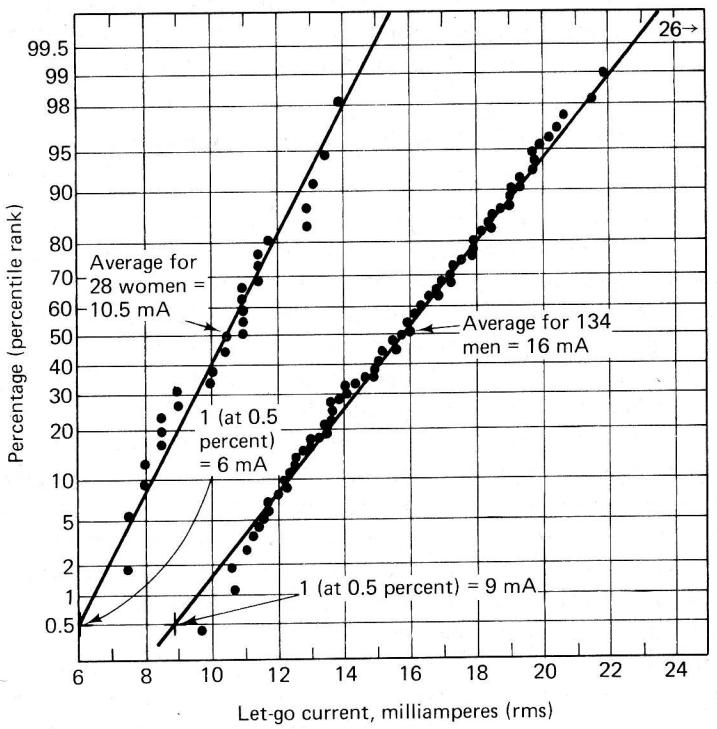

Figure 2-2. Let-go current distribution curves for men and women (at 60-Hz commercial alternating current). (Courtesy of © *IEEE*. From Charles F. Dalziel and W. R. Lee, "Lethal Electric Currents," *IEEE Spectrum*, Feb., 1969, p. 44.)

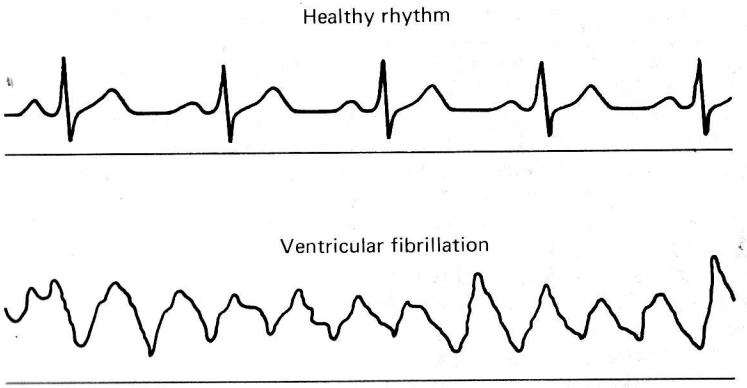

Figure 2-3. Heart patterns.