The *filament* design is critical in setting up the operating characteristics of the lamp. The length of the filament wire is largely determined by the supply voltage, whilst the thickness of the wire is determined by the operating current of the lamp. The filament is coiled to reduce heat convection to the filling gas. There are various forms of filament coiling with the coiled coil being one of the most common (see Figure 3.12).

Figure 3.12 A coiled coil filament

The *filament* must be robust enough to withstand the shocks and vibration that the lamp receives during its life and at the same time be rigid enough so that it does not droop. Support wires can help prevent the filament from drooping but they conduct heat away from the filament and thus reduce the efficiency of the lamp. Therefore normal service lamps are made with hard brittle filaments that only need a few support wires. Lamps for rough service are made with a softer more malleable filament but have several support wires.

The *bulb* is generally made of a soft soda glass and its size is set so that it does not get too hot and the tungsten that evaporates from the filament during the life of the lamp does not blacken the bulb too much.

The *gas filling* of the lamp is present to reduce the rate at which the tungsten evaporates and thus make the lamp last longer. To minimise the heat losses from the filament noble gasses are used as the primary fill gases. Most lamps have argon based filling but some high performance lamps use krypton. In addition to the noble gas filling most mains voltage lamps have a small percentage of nitrogen added to the filling to help suppress arcing at the end of life.

There are many variations on this basic lamp type. They are designed to run on voltages between 1.5 and 415 volts at wattages between 1 and 1,000 watts. There is also a wide variety of bulb shapes including lamps with built in reflectors.

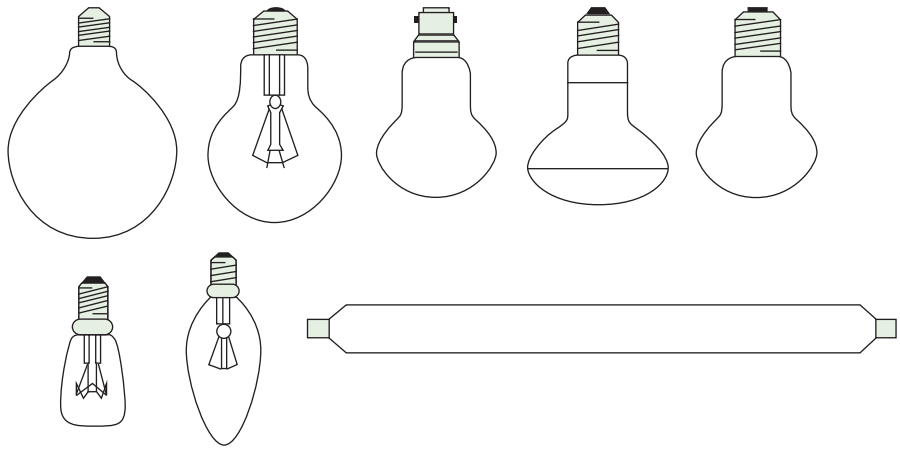

Figure 3.13 Forms of incandescent lamp