

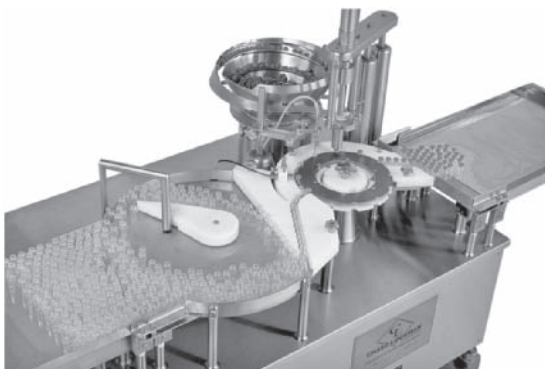
## LIQUID FILLING

There are three main methods for filling liquids into containers with high accuracy: volumetric filling, time/pressure dosing, and net weight filling. Volumetric filling machines employing pistons or peristaltic pumps are most commonly used, for example, the Chase-Logeman filling machine (Fig. 19-2). This filler is best suited for small batch filling of 2 mL vials (13 mm openings) to 100 mL vials or bottles with 20 mm openings. Filling speeds for 2 to 20 mL vials are usually 80 to 120 vials filled per minute.

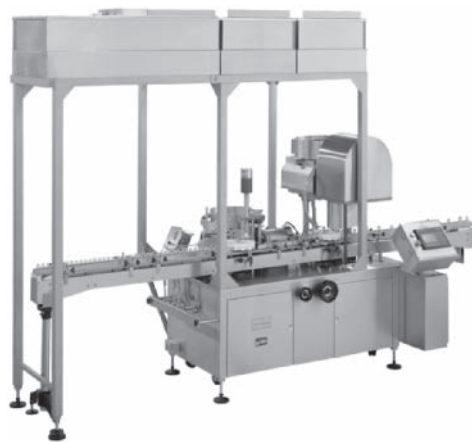
Stainless steel syringes are required with viscous liquids because glass syringes are not strong enough to withstand the high pressures developed during delivery.

When high-speed filling rates (now up to 800 per minute for vials and 60,000 per minute for 0.5–1.0 mL long syringes) are desired, but accuracy and precision must be maintained, multiple filling units can be joined together and electronically coordinated. When the product is sensitive to metals, a peristaltic pump filler may be used because the product comes in contact only with silicone rubber tubing. While there might be some sacrifice of filling accuracy ( $\pm 3\%$  with  $<0.5$  mL fill volumes), technology now uses 100% check weighing of filled containers so that filling accuracy is still quite good.

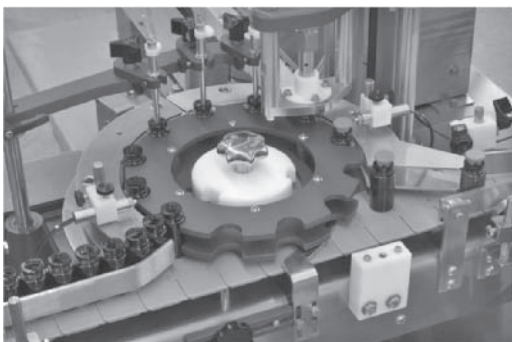
Time–pressure (or time–gravity) filling machines are gaining in popularity in filling sterile liquids. A product tank is connected to the filling system that is equipped with a pressure sensor. The sensor continuously measures pressure and transmits values to the programmable logic control (PLC) system that controls the flow of product from tank to filling manifold. Product flow occurs when tubing is mechanically unpinched and stops when tubing is mechanically pinched. The main advantage of time/pressure filling operations is that these filling apparatuses do not



Model FS-2205 Small Scale Liquid Filling and Stoppering Compact Monoblock



Model NwFSAS12 Liquid Filling, Stoppering, and Crimp Sealing Monoblock with HEPA Filtration Unit



Model FSTS Production Liquid Filling, Stoppering, and Automatic Tray Loading

**Figure 19-2** Examples of a commonly used sterile filling machines. *Source:* Courtesy of Chase-Logeman Corporation.