



Figure 10.2. (a) Mechanically stirred 100,000-liter fermenter. (With permission, from S. Alba, A. E. Humphrey, and N. F. Millis, *Biochemical Engineering*, 2d ed., University of Tokyo Press, Tokyo, 1973.) (b; see p. 289) Installation of mechanically stirred fermenter: S, steam; C, condensate; W, water, and A, air. The steam lines permit in-place sterilization of valves, pipes, and seals. The input air can be sterilized by both incineration and filtration. (With permission, from W. Crueger and A. Crueger, *Biotechnology: A Textbook of Industrial Microbiology*, R. Oldenbourg Verlag, München, Germany, 1984.)

making them usable with sensitive cultures such as animal cells, while still being capable of giving excellent performance with viscous mycelial fermentations. Axial flow systems break up the compartmentalization often observed with multiple radial flow impellers on the same shaft. Combinations of axial flow and radial flow impeller systems are sometimes used. To augment mixing and gas dispersion, baffles are employed. A typical arrangement includes four baffles, the width of each being about 8% to 10% of the reactor