CE 407 Notes
Shanks process

Consider an extraction battery with six tanks. Initially (see Fig. 1) tanks 1 through 5 contain both liquid and solid, and tank 6 is entirely empty. Tank 5 contains the most recently added solid and the most concentrated liquid solution. Tank 1 contains the most thoroughly extracted solid and the most recently added solvent. Thus, tank 5 has the highest solute concentration in both liquid and solid phases and tank 1 the lowest.

Step 1: Drain the liquid from tank 5. Transfer the liquid from tank 4 to tank 5, the liquid from tank 3 to tank 4, the liquid from tank 2 to tank 3 and the liquid from tank 1 to tank 2. Add fresh (completely unleached) solid to tank 6. The battery is now in the state illustrated in Fig. 2.

Step 2: Transfer the liquid from tank 5 to tank 6, the liquid from tank 4 to tank 5, the liquid from tank 3 to tank 4 and the liquid from tank 2 to tank 3. Add fresh solvent to tank 2. Remove the solid from tank 1. The battery is now in the state depicted in Fig. 3.

Notice that the final state (Fig. 3) is identical to the initial state (Fig. 1), except for the numbers of the tanks. In going from the initial to the final state, one tank load of concentrated solution has been removed at the high-concentration end (Step 1) and one tank load of fresh solvent has been added at the low concentration end (Step 2). Also, one tank load of unleached solid has been added at the high-concentration end (Step 1) and one tank load of the most completely leached solid has been removed at the low-concentration end (Step 2). This is countercurrent flow. The Shanks process achieves countercurrent contact without transfer of the solid from one tank to the next. In essence, it corresponds to a standard countercurrent process viewed in a reference frame that moves with the solid. In this reference frame, the liquid travels "twice as fast" in the opposite direction. That is why one cycle involves two liquid transfer steps.

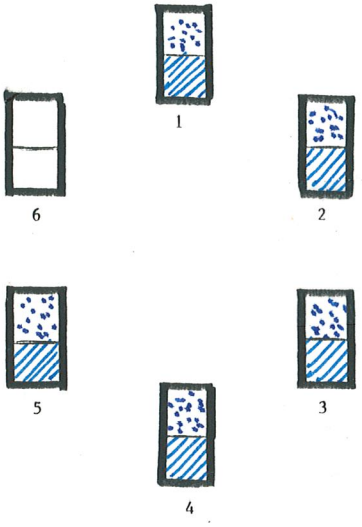


Figure 1.

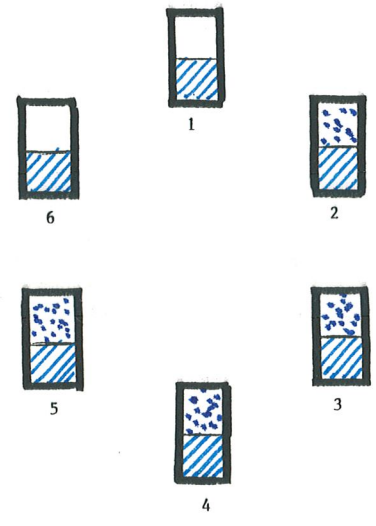


Figure 2.

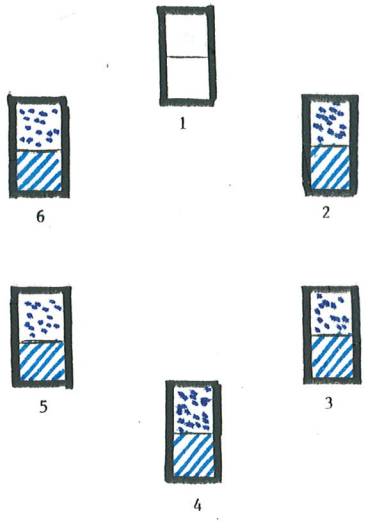
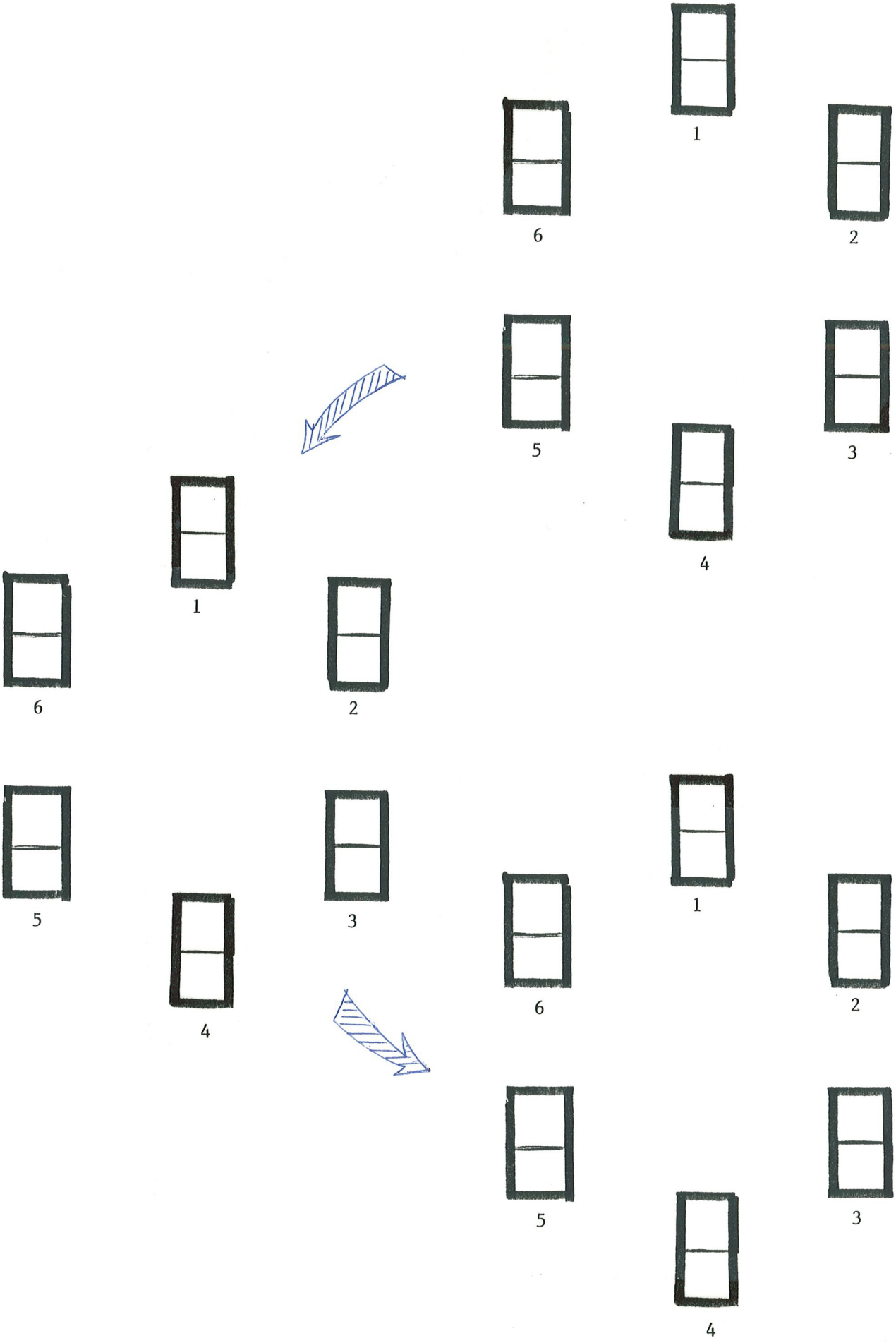


Figure 3.

Overflow (V) phase

Solid, containing underflow (L) phase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