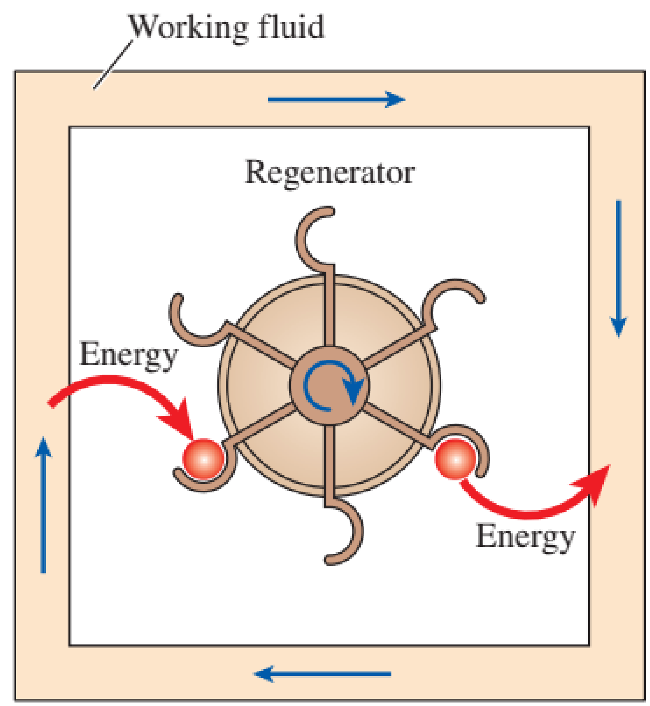
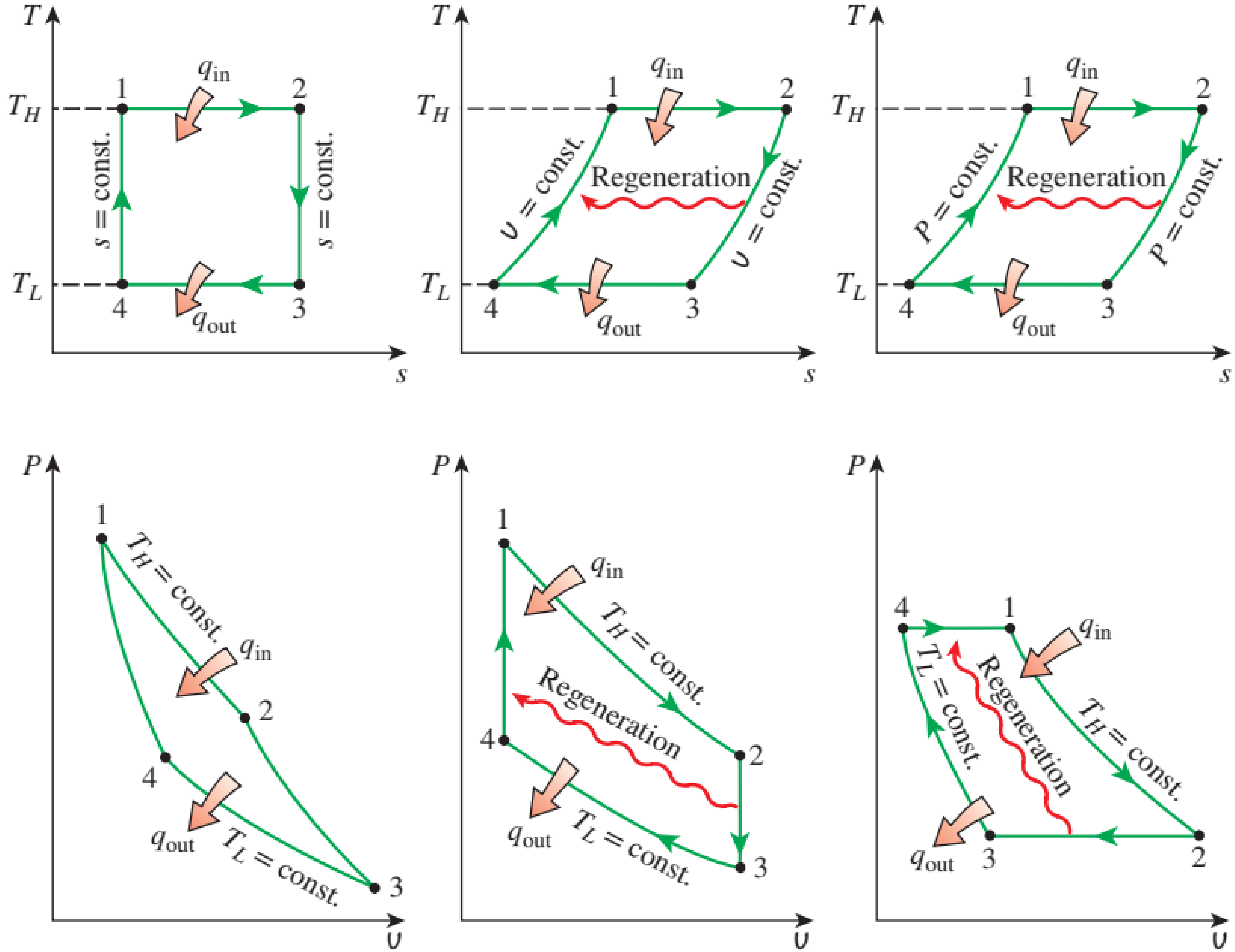
STIRLING AND ERICSSON CYCLES

- They differ from the Carnot cycle in that the two isentropic processes are replaced by two constant-volume regeneration processes in the Stirling cycle and by two constant-pressure regeneration processes in the Ericsson cycle.

- Both cycles utilize **regeneration,** a process during which heat is transferred to a thermal energy storage device (called a *regenerator)* during one part of the cycle and is transferred back to the working fluid during another part of the cycle

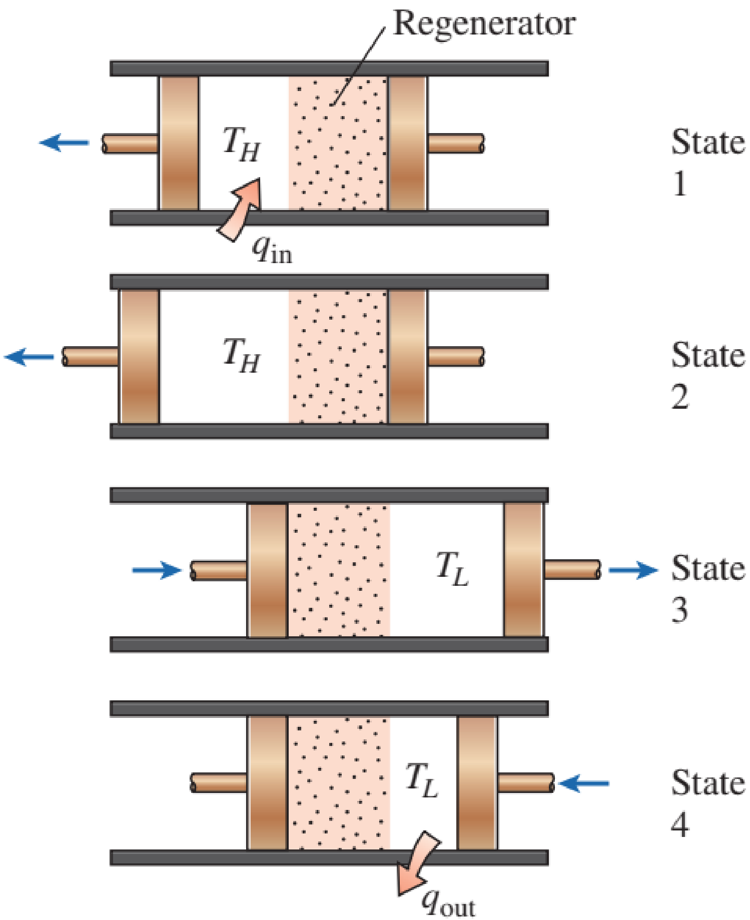
- **A regenerator is a device that borrows energy from the working fluid during one part of the cycle and pays it back (without interest) during another part.**





(*a*) Carnot cycle (*b*) Stirling cycle (*c*) Ericsson cycle

STIRLING CYCLE



1-2 $T =$ *constant* expansion (heat addition from the external source)

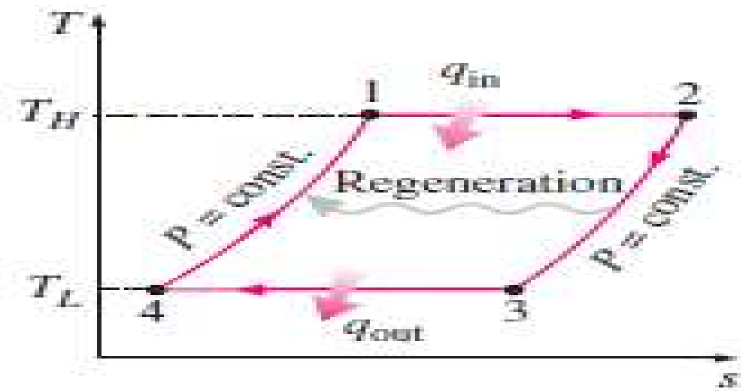
2-3 $v =$ *constant* regeneration (internal heat transfer from the working fluid to the regenerator)

3-4 $T =$ *constant* compression (heat rejection to the external sink)

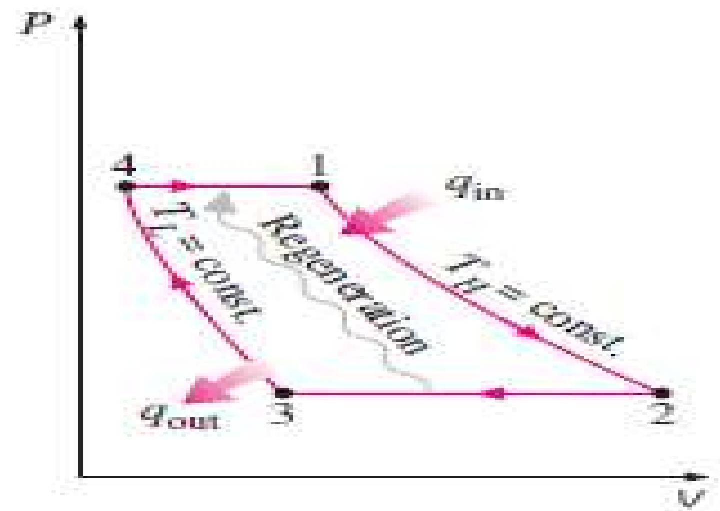
4-1 $v =$ *constant* regeneration (internal heat transfer from the regenerator back to the working fluid)

STIRLING AND ERICSSON CYCLES

- The Ericsson cycle is very much like the Stirling cycle, except that the two constant-volume processes are replaced by two constant-pressure processes.



- Both the Stirling and Ericsson cycles are totally reversible, as is the Carnot cycle, and thus according to the Carnot principle, all three cycles must have the same thermal efficiency when operating between the same temperature limits:



$$\eta_{\text{th,Stirling}} = \eta_{\text{th,Ericsson}} = \eta_{\text{th,Carnot}} = 1 - \frac{T_L}{T_H}$$