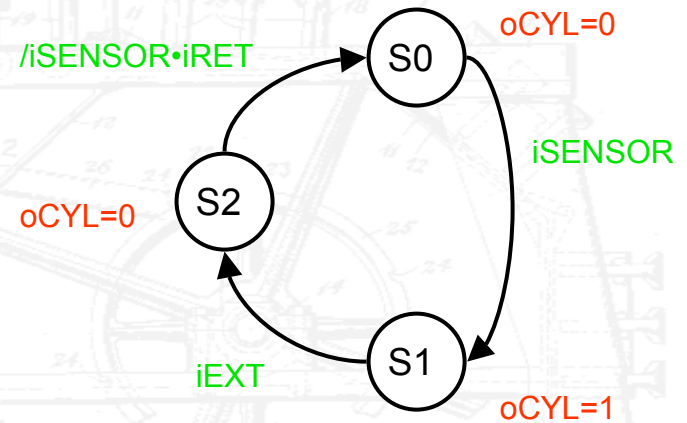
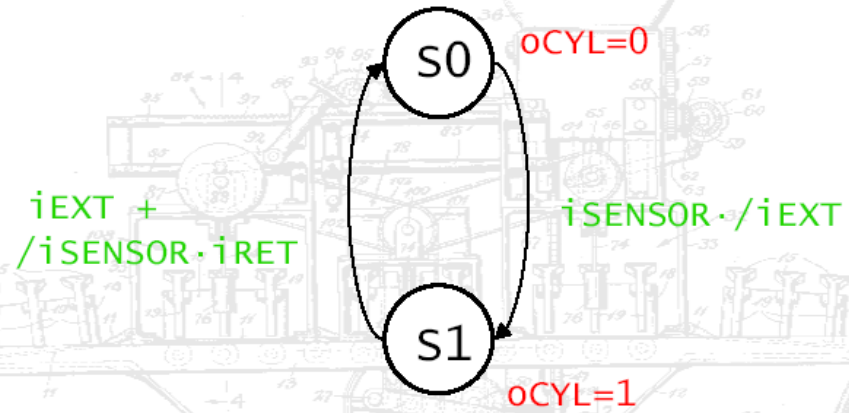
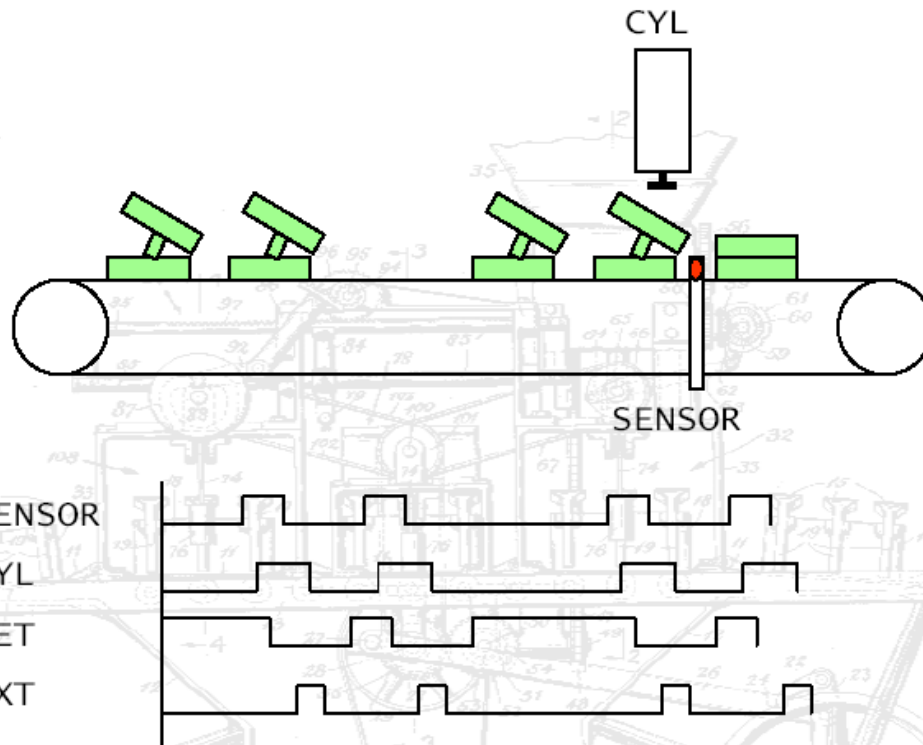
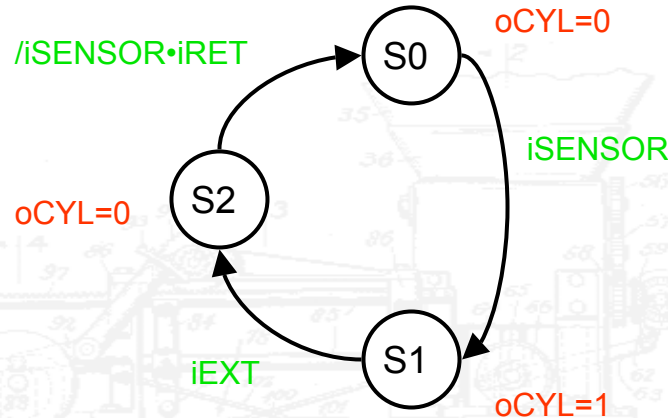


Another Example



Example #2 State Diagram

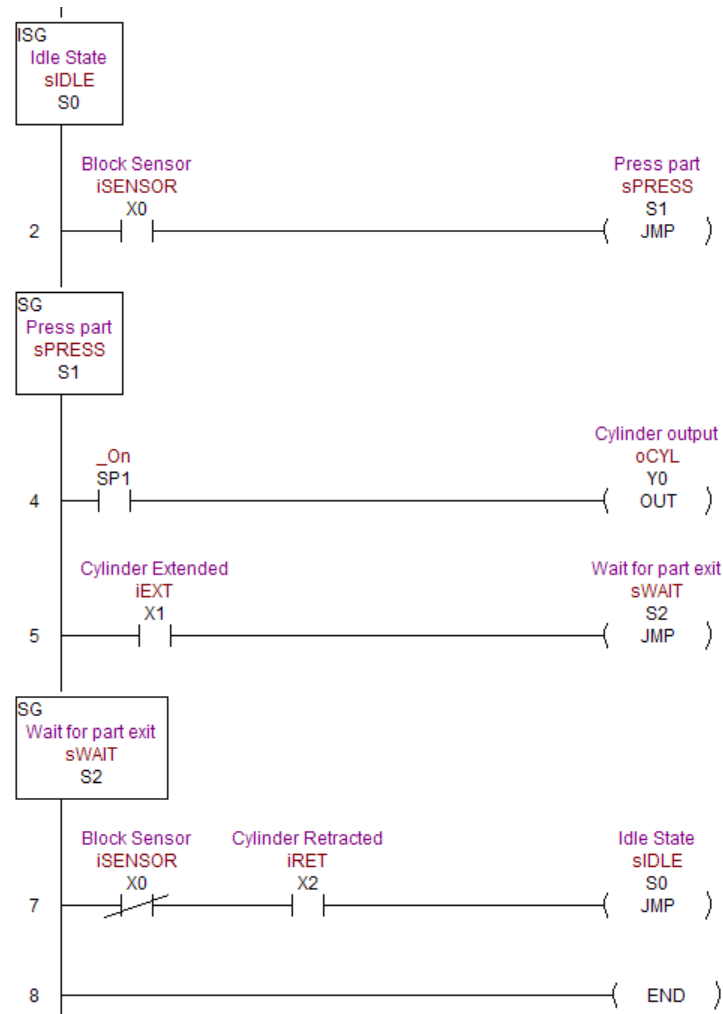
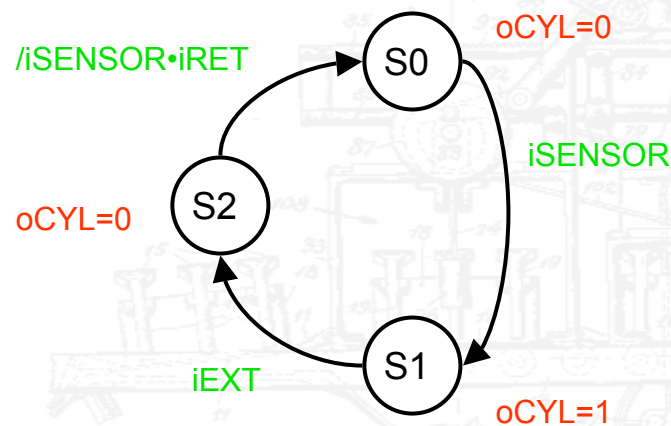


$$cS0 = cS2 \cdot /iSENSOR \cdot iRET + cS0 \cdot /iSENSOR + /cS0 \cdot cS1 \cdot cS2$$

$$cS1 = cS0 \cdot iSENSOR + cS1 \cdot /iEXT$$

$$\begin{aligned} cS2 &= cS1 \cdot iEXT + cS2 \cdot (/iSENSOR \cdot iRET) \\ &= cS1 \cdot iEXT + cS2 \cdot (iSENSOR + /iRET) \end{aligned}$$

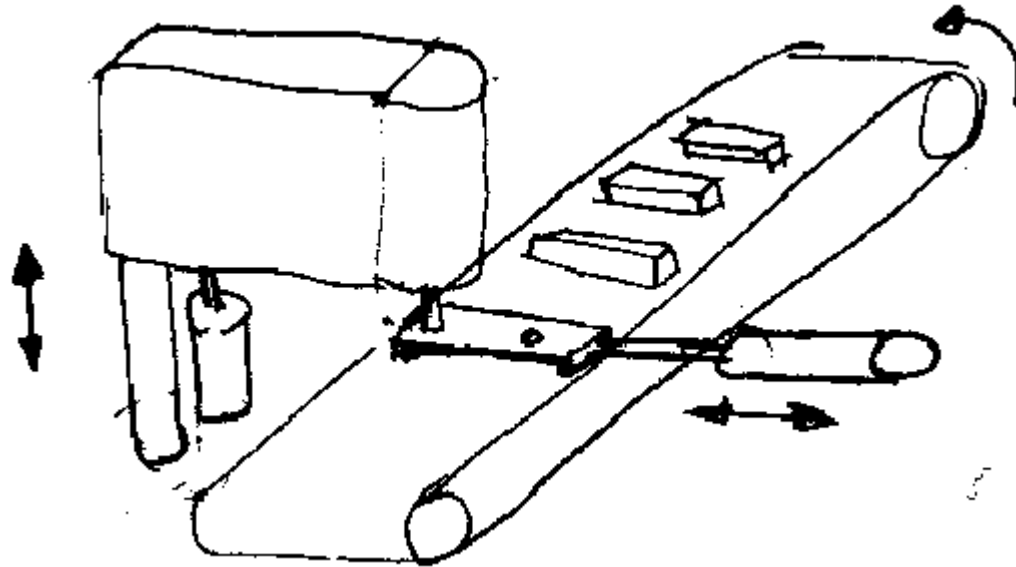
Ex #2 - RLL-Plus Stages



State Machines in Ladder Logic

- Pure relay logic - traditional design:
 - 2 states = 1 coil
 - 3-4 states = 2 coils
 - 5-8 states = 3 coils, etc.
 - difficult to debug, modify and document
- Pure relay logic - “one-hot” design
 - 1 coil per state
 - easier to debug, modify, and document
- RLL-Plus
 - “Stages”
 - JMP “coils”
 - easiest to write and maintain
 - not available in all brands of PLC's

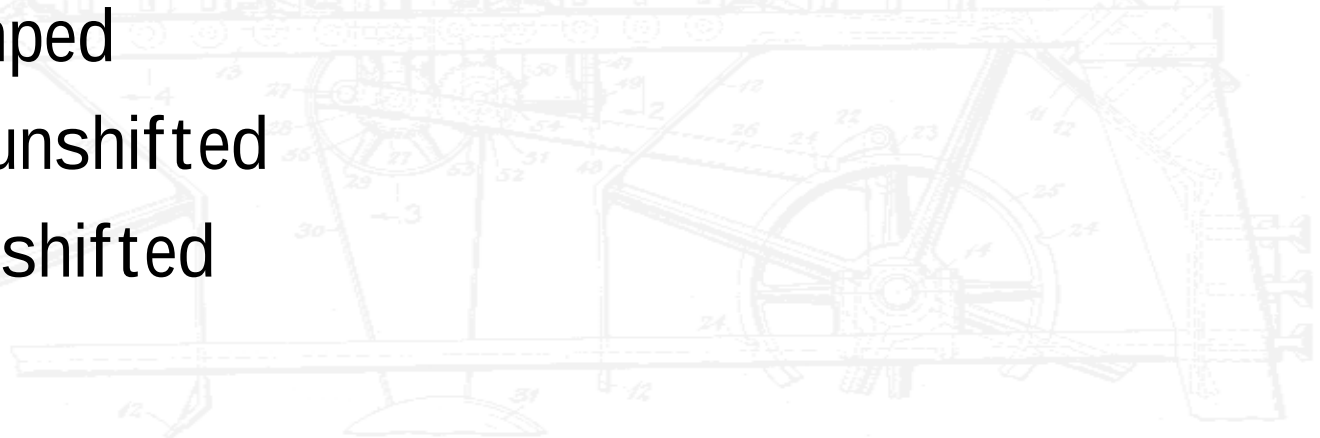
Multi-state Example



- When sensor detects block; clamp block, drill hole, shift, drill 2nd hole, shift back, release clamp

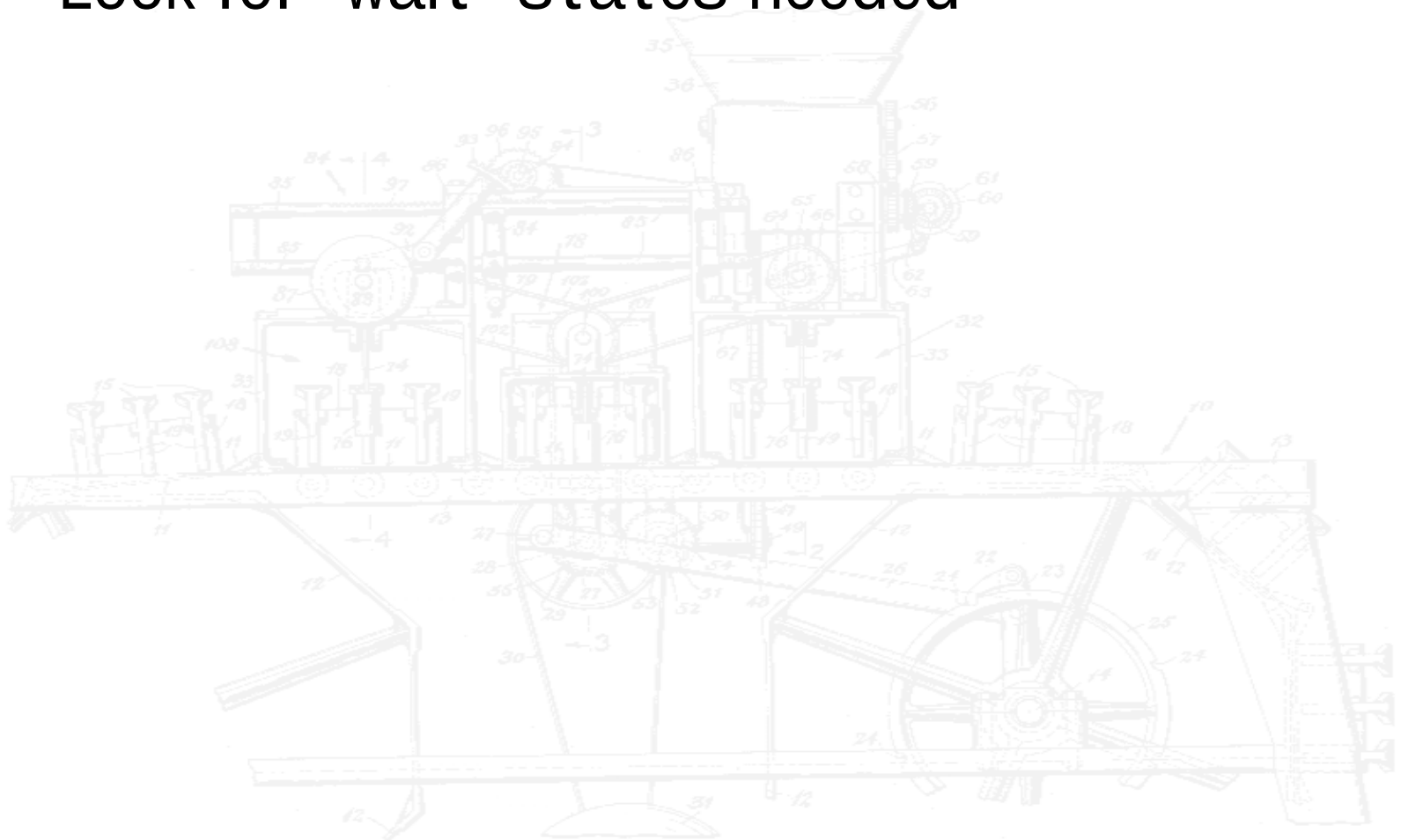
Inputs and Outputs

- iSENSOR block present
- iDRILLDN drill is down
- iDRILLUP drill is up
- iCLAMPED fully clamped
- iRELEASED fully unclamped
- iPOS1 unshifted
- iPOS2 shifted
- oDRILL start drilling
- oCLAMP activate clamp
- oSHIFT shift block holder

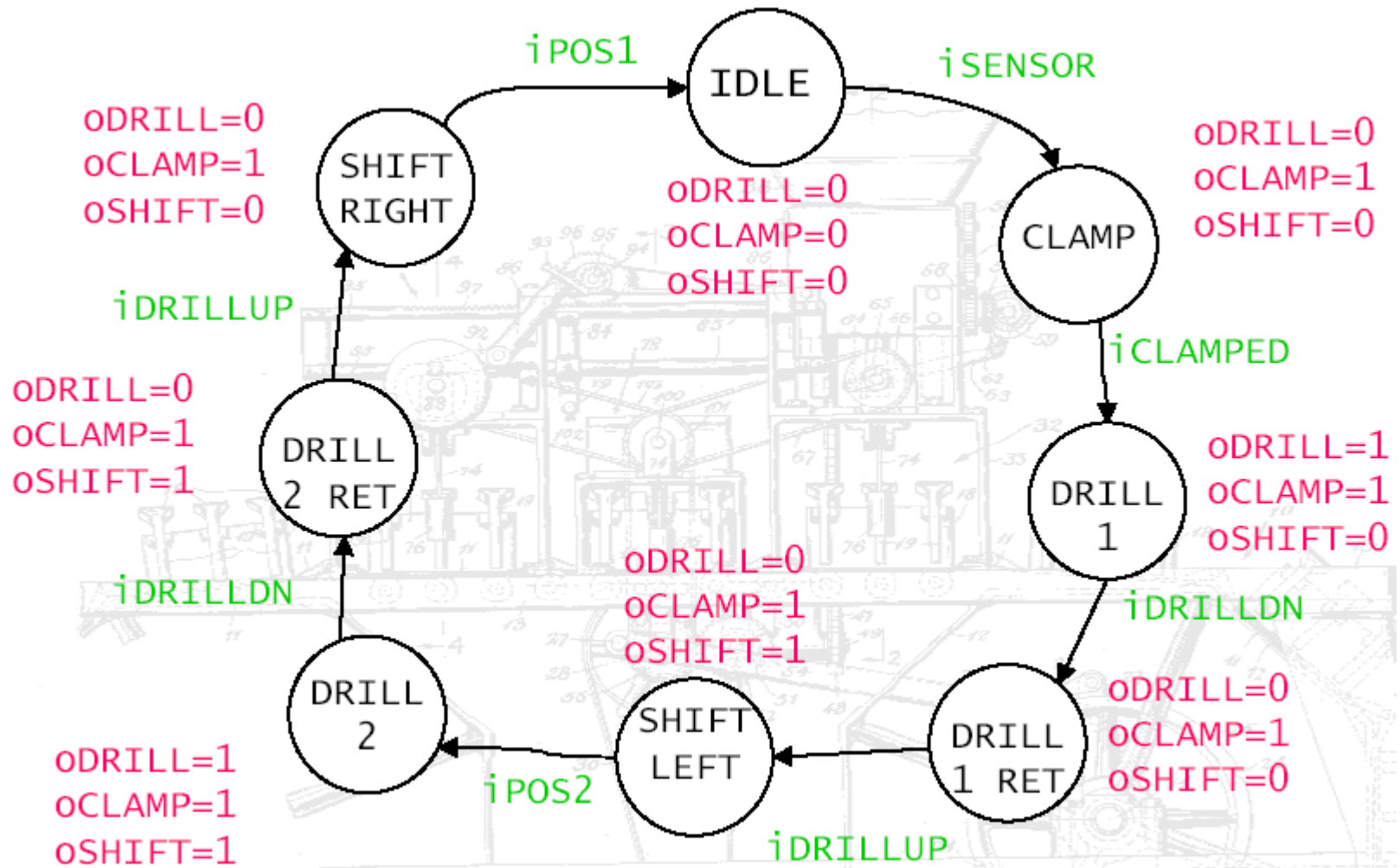


State Diagrams

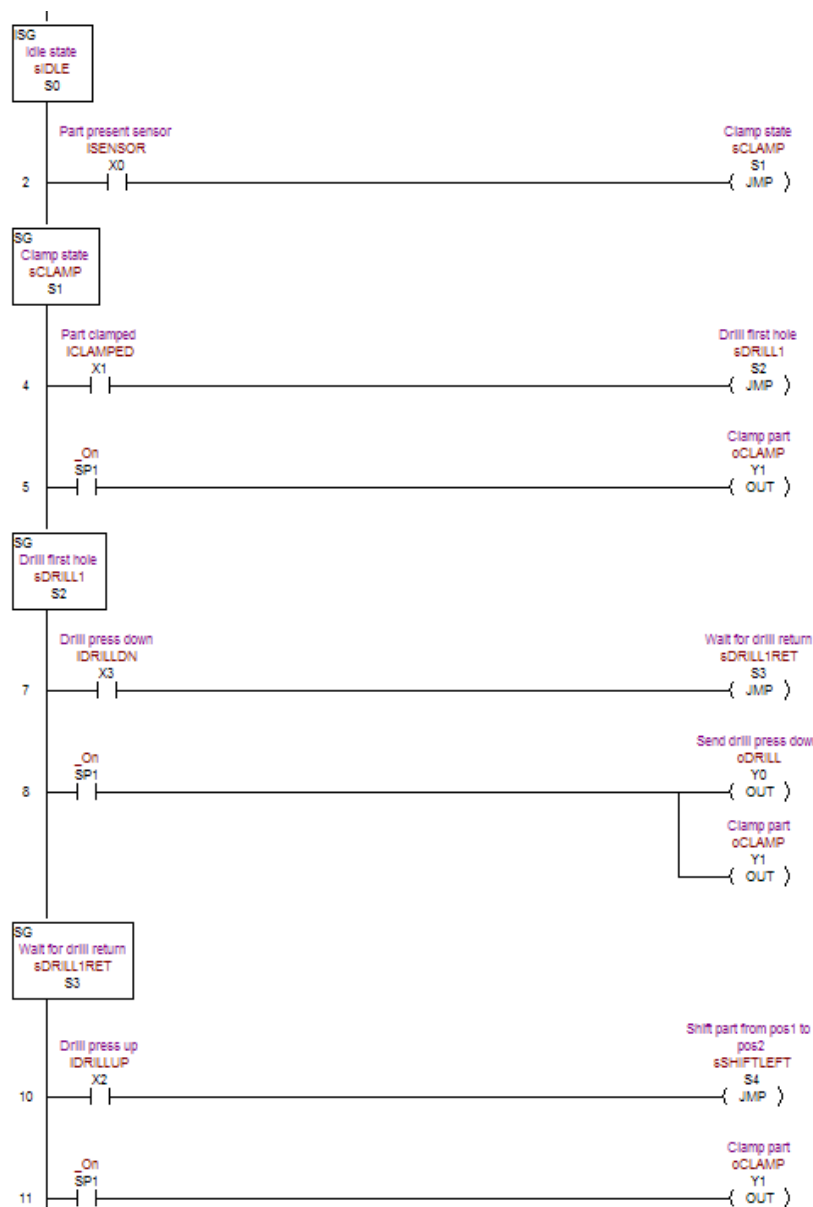
- One state per “action”
- Look for “wait” states needed



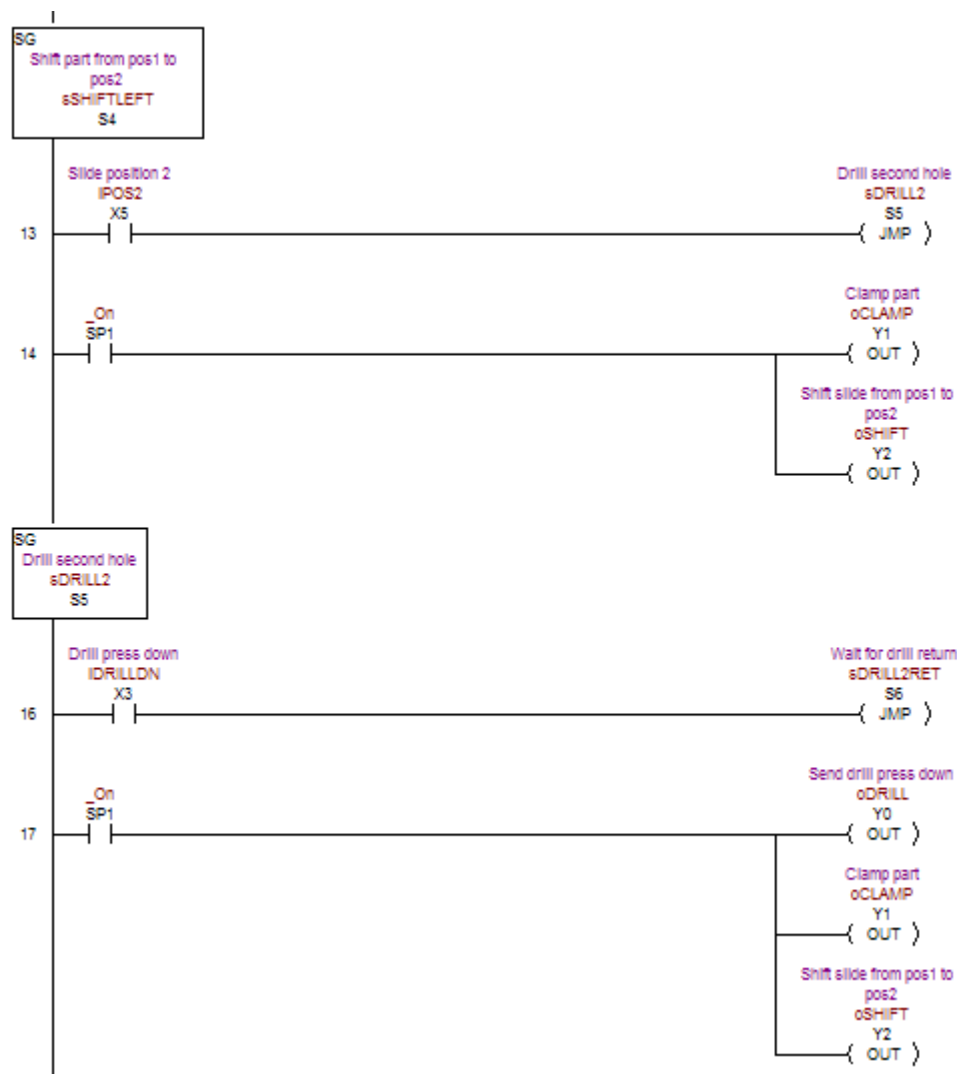
State Diagram



RLL-Plus



RLL-Plus



RLL-Plus

