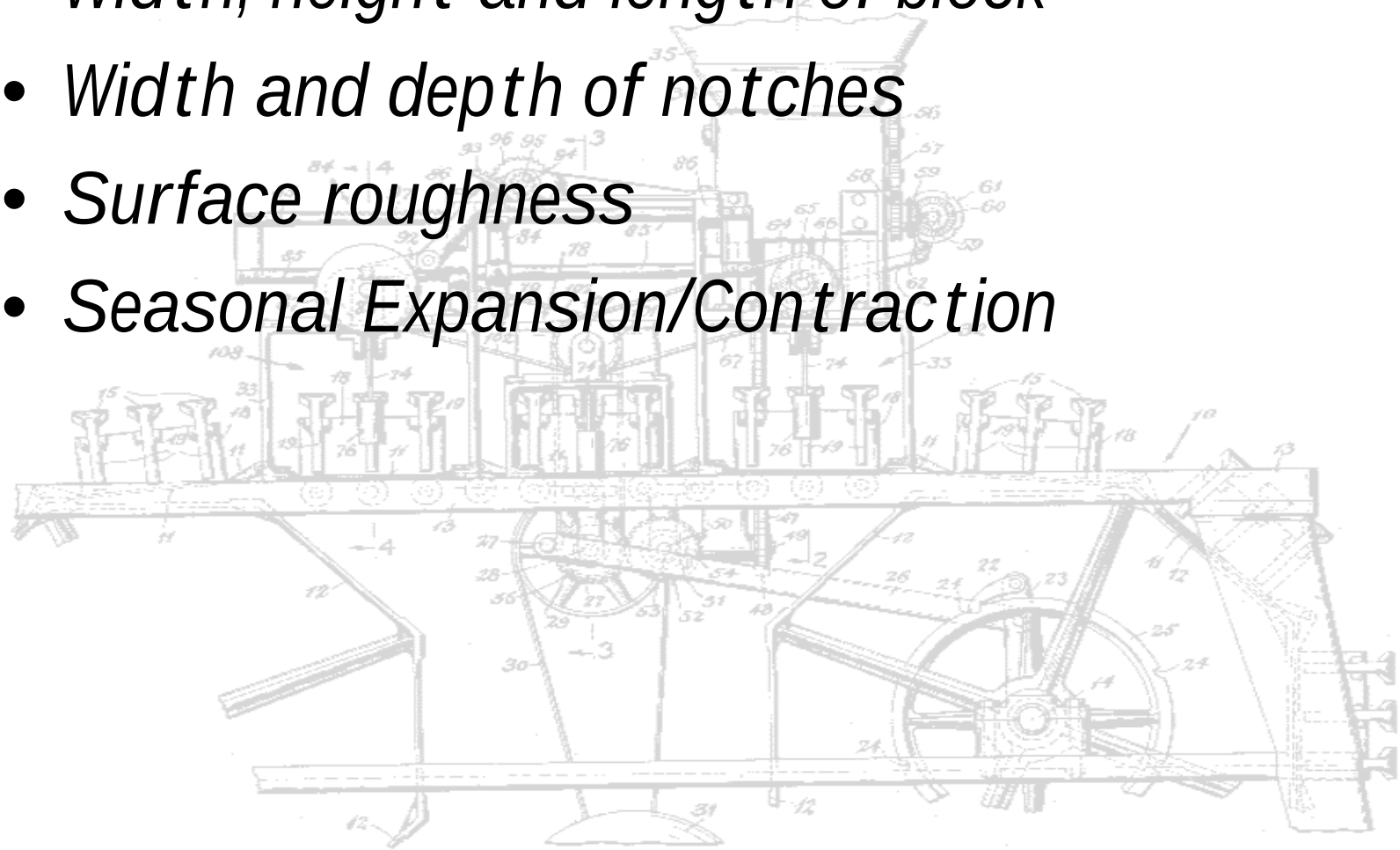
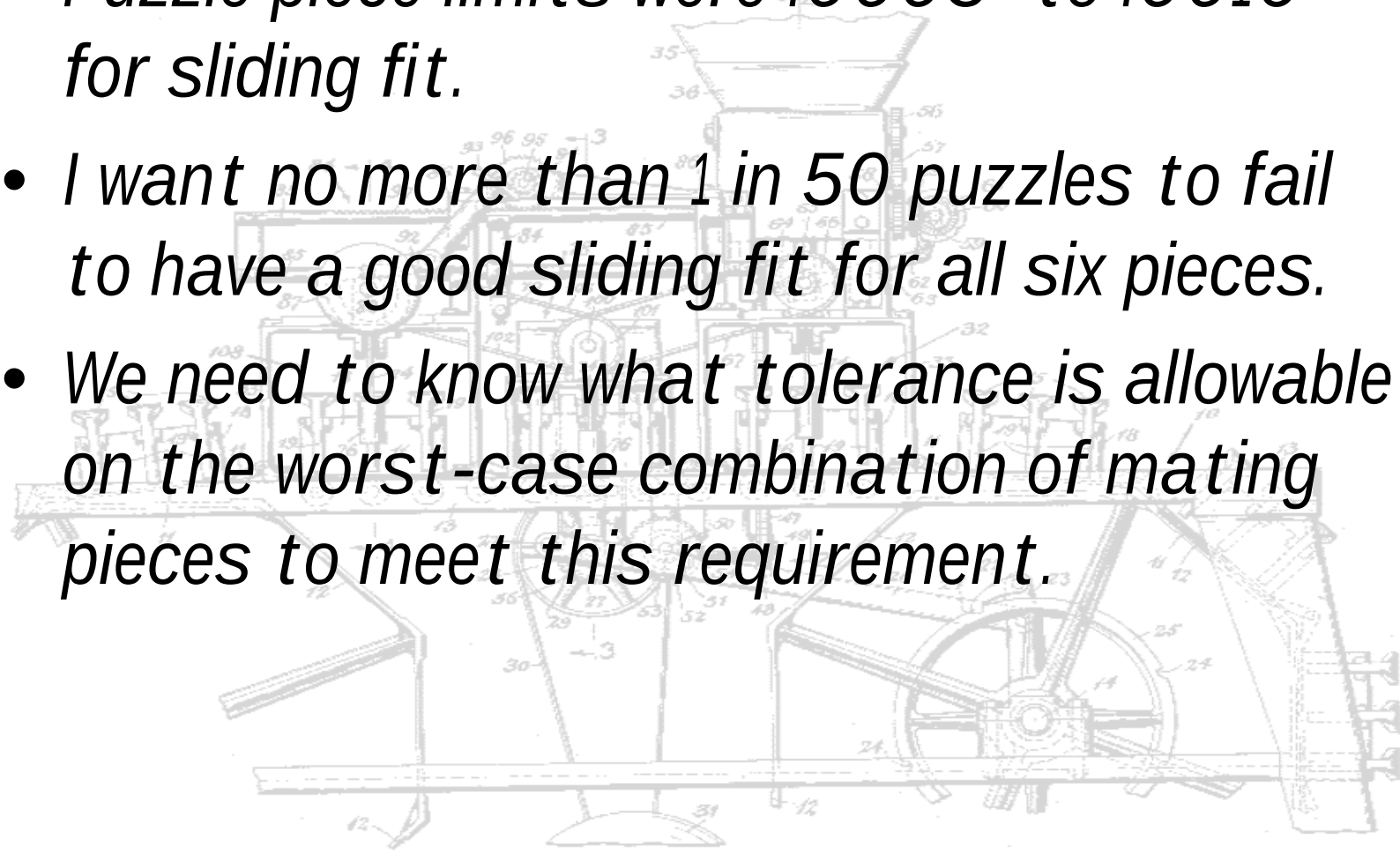
Dimensional Tolerance

- *Width, height and length of block*
- *Width and depth of notches*
- *Surface roughness*
- *Seasonal Expansion/Contraction*

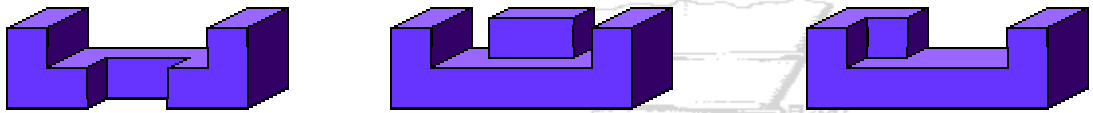


Manufacturing Tolerance

- *Puzzle piece limits were .0003” to .0016” for sliding fit.*
- *I want no more than 1 in 50 puzzles to fail to have a good sliding fit for all six pieces.*
- *We need to know what tolerance is allowable on the worst-case combination of mating pieces to meet this requirement.*



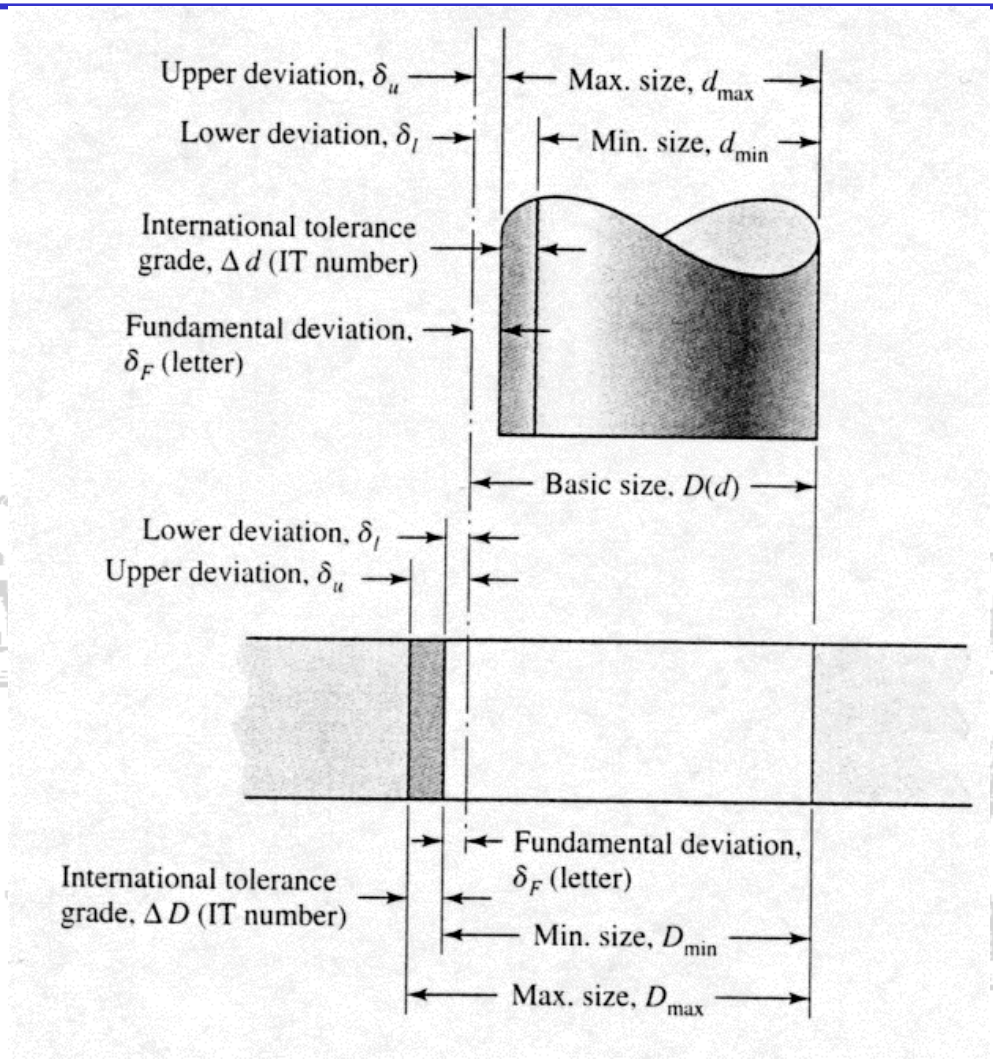
Notchable, Machinable, and General Pieces



- *We only need to produce notchable pieces*
- *There are 59 notchable pieces, of which 25 are needed to make solid burrs.*
- *IBM Research – Buzz Puzzles site:*

  http://www.research.ibm.com/BurrPuzzles/

Dimensional Tolerance

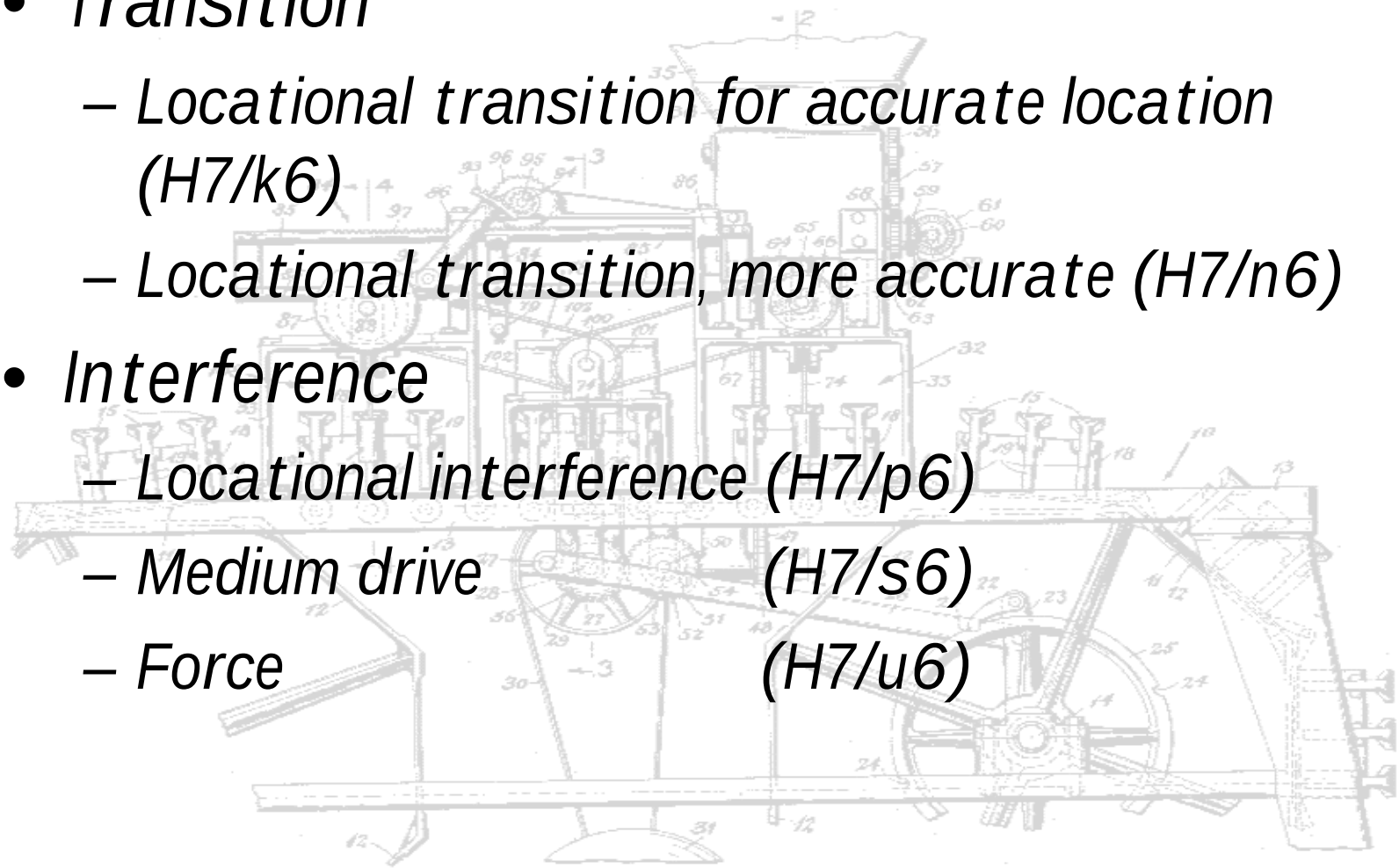


Limits and Fits - Type of Fit

- *Clearance*
  - *Loose running (H11/c11)*
  - *Free running (H9/d9)*
  - *Close running (H8/f7)*
  - *Sliding (H7/g6)*
    - *Parts are not intended to run freely, but must move and turn freely*
  - *Locational clearance (H7/h6)*
    - *Provides snug fit for location of stationary parts, but can be freely assembled and disassembled*

Limits and Fits - Type of Fit

- *Transition*
  - *Locational transition for accurate location (H7/k6)*
  - *Locational transition, more accurate (H7/n6)*
- *Interference*
  - *Locational interference (H7/p6)*
  - *Medium drive (H7/s6)*
  - *Force (H7/u6)*



Limits and Fits - Tolerance Grades

- *H7/g6 = Hole with tolerance grade of 7, and shaft of fundamental deviation "g" and tolerance grade 6.*
- *Hole limits*
  - *Maximum Material Condition (MMC) = basic size = D*
  - *Least Material Condition (LMC) = D + ΔD*
  - *For grade 7 and D=3/4", ΔD=0.0008", so D=0.7500", D+ ΔD=0.7508"*

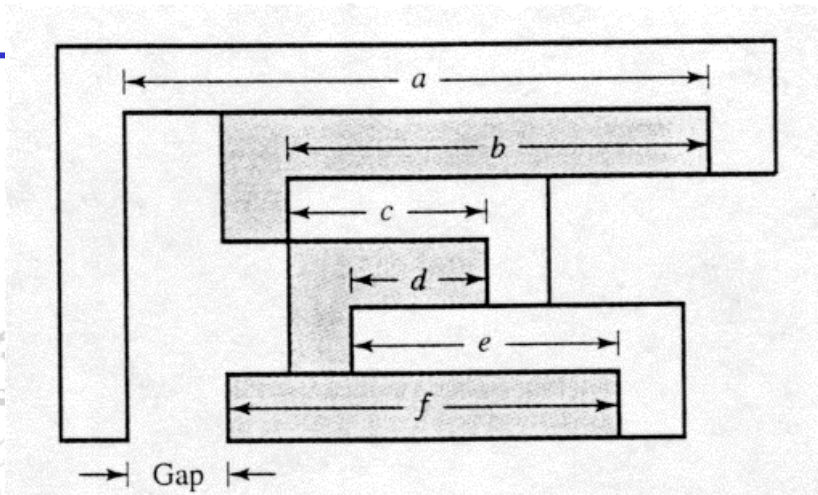
Limits and Fits - Tolerance Grades

- *Shaft Limits*
  - *Fundamental deviation class 'g', sliding fit, for basic size 3/4" = δ_F = -0.0003"*
  - *Tolerance grade for sliding fit is 6, for basic size 3/4", Δd = 0.0005"*
  - *MMC = d + δ_F = 0.7497"*
  - *LMC = d + δ_F - Δd = 0.7492"*
- *Max clearance = 0.7508-0.7492 = 0.0016"*
  Min clearance = 0.7500-0.7497 = 0.0003"

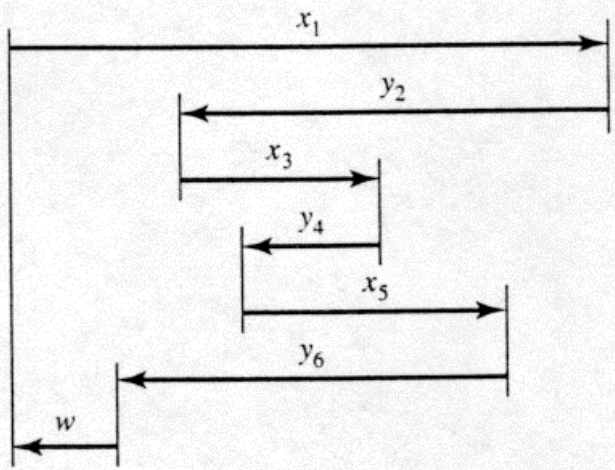
Manufacturing Tolerance

- *gap = additive parts - subtractive parts (Eq.2-13, Fig 2-7)*
- *mean gap = $\sum$ mean of additive widths - $\sum$ mean of subtractive widths*
- *tolerance = (max gap - min gap) / 2 = $\sum$ individual tolerances*
- *Find max allowable tolerance on block width/height and notch width/depth for a given pair of gap limits.*

Manufacturing Tolerance



(a)



(b)