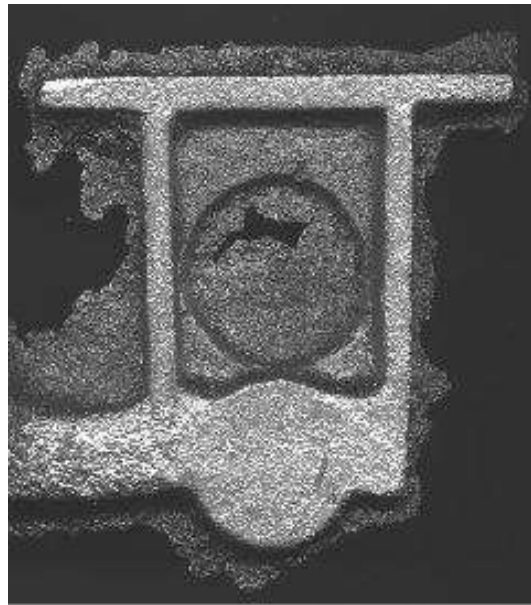


# Solidification Defects

## Casting

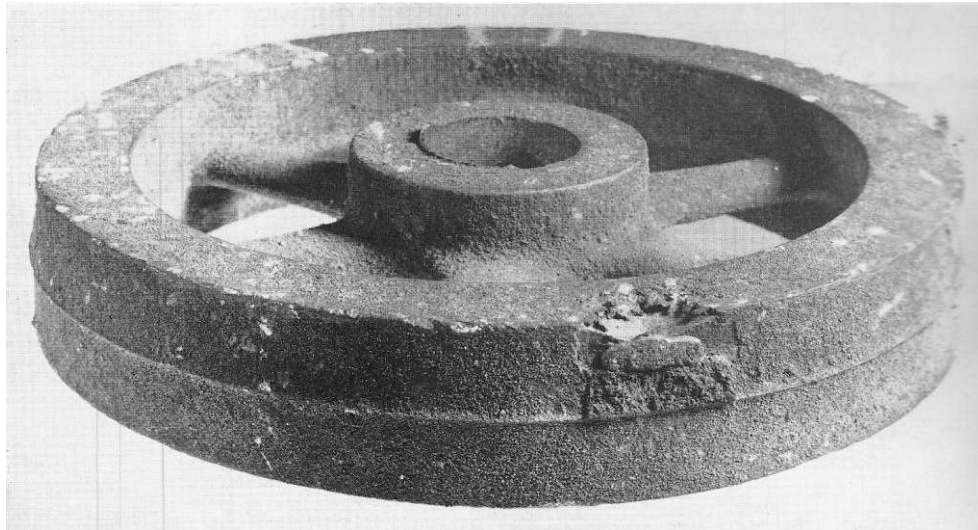
# Casting Defects

- Metallic projections
  - Flash: excess metal solidified outside mold cavity
    - *Causes*: insufficient clamping force, improper parting line, excess molten metal
    - *Remedies*: higher clamping force, redesign parting line



# Casting Defects

- Cavities (voids)
  - Shrinkage cavities: voids inside casting
    - *Causes*: contraction during solidification, improper gating and risering
    - *Remedies*: use similar (V/A) ratios, use gradually increasing section modulus toward riser, proper gating/riser design, use of chills



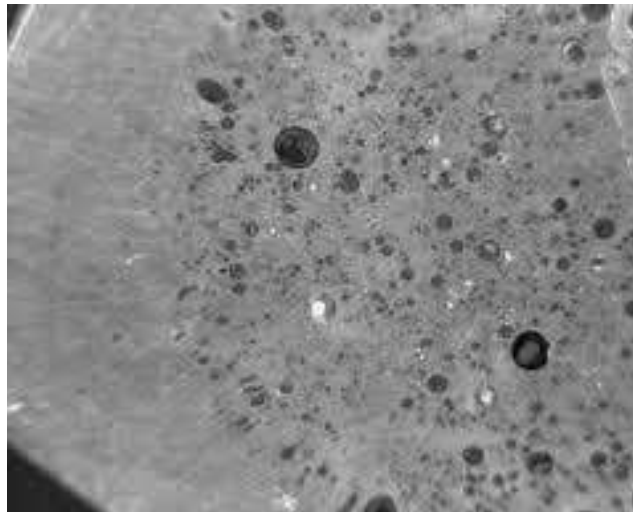
# Casting Defects

- Cavities (voids)
  - Blowholes: void on surface of casting
    - *Causes*: excessive gas entrapment, lack of adequate venting, too much moisture in sand mixture, insufficient permeability
    - *Remedies*: de-gas melt, add vents



# Casting Defects

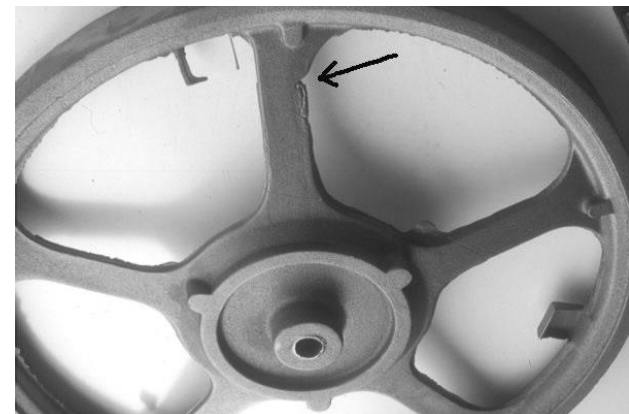
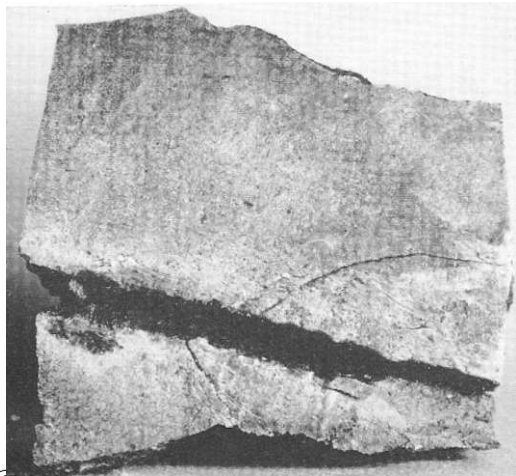
- Cavities (voids)
  - Porosity: entrapment of gases inside casting
    - *Causes*: excess dissolved gases in melt, insufficient permeability of mold, improper venting
    - *Remedies*: de-gas melt, increase permeability of sand mixture, add vents



# Casting Defects

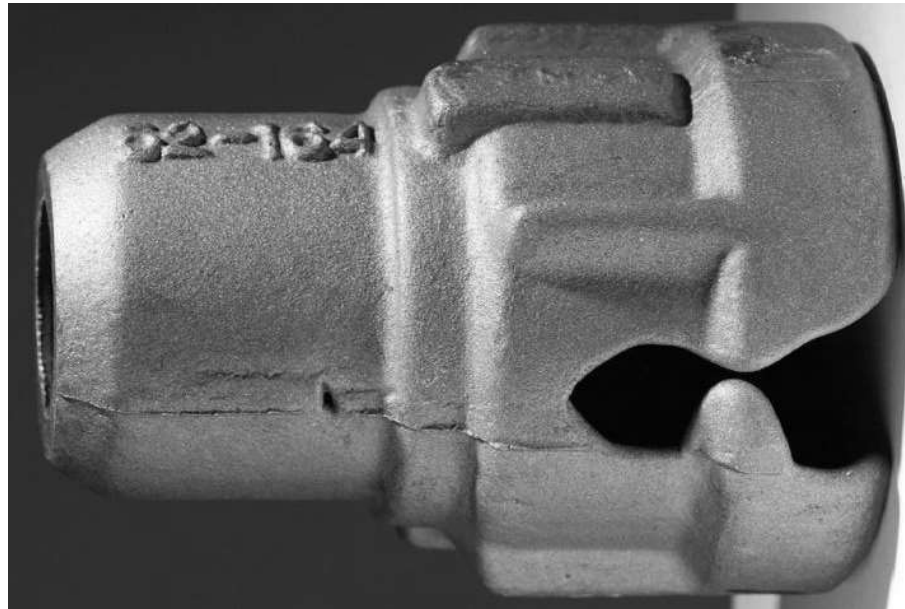
- Discontinuities

- Hot tears: inter-crystalline failure in casting that occurs at a high temperature within mold; usually forms in sections that solidify last and where geometrical constraints are present
  - *Causes*: large differences in section thickness, abrupt changes in section thickness, too many branching/connected sections, mold has high hot strength and stiffness
  - *Remedies*: through casting and mold redesign



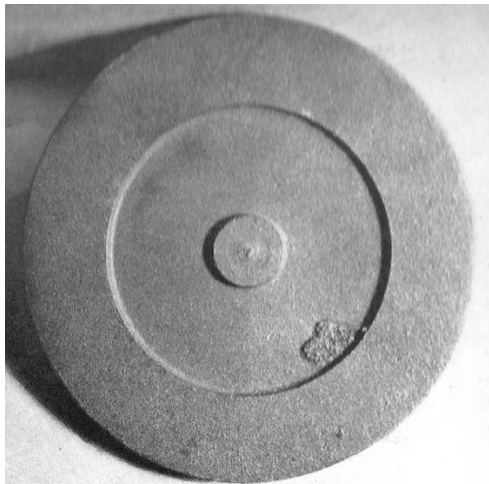
# Casting Defects

- Cold shut
  - incomplete fusion of two molten metal flows that meet inside the mold from opposite directions
    - *Causes*: insufficient superheat, inadequate risers
    - *Remedies*: increase superheat, add additional risers, proper gating



# Casting Defects

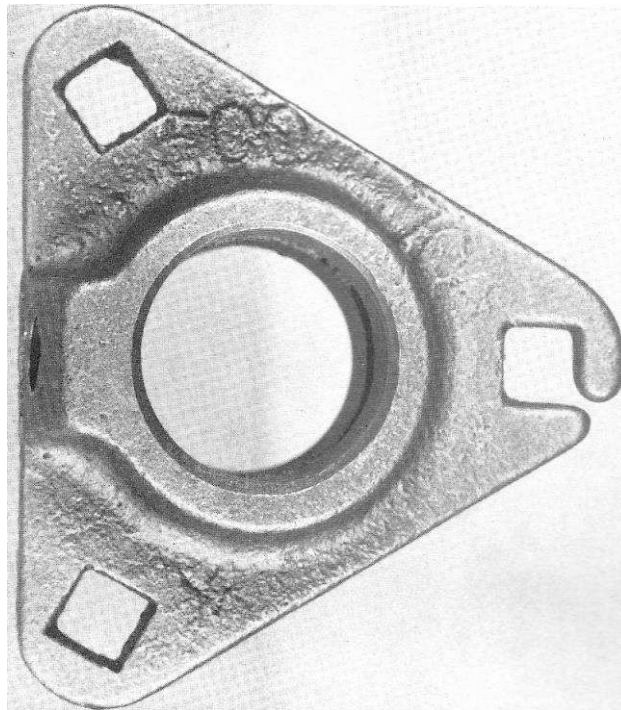
- Defective surface
  - Scabs: thin layer of molten metal that enters gaps in mold and solidifies
    - *Causes*: improper mold design, insufficient strength of sand mixture, uneven compaction of sand mixture, excessive pouring temperature
    - *Remedies*: increase strength of sand mixture, proper compaction of sand mixture, reduce pouring temperature





# Casting Defects

- Incomplete castings
  - Misrun: incomplete casting
    - *Cause*: insufficient superheat
    - *Remedy*: increase superheat



# Casting Defect

- Inclusions
  - *Causes*: erosion of sand by melt during pouring, impurities in melt
  - *Remedies*: increase strength of sand mixture, purify melt

