

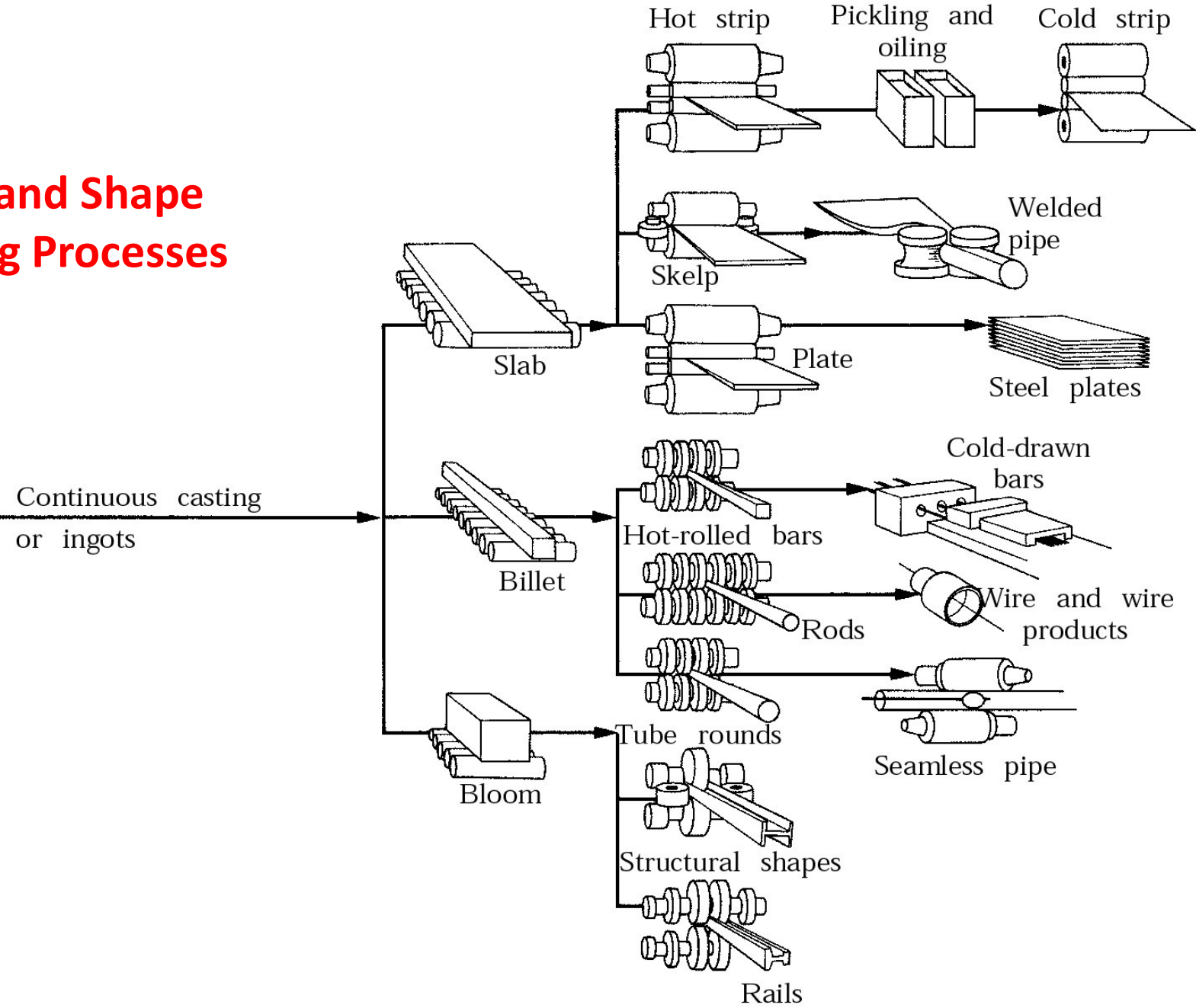
Rolling of Metals

- Rolling – reducing the thickness or changing the cross-section of a long workpiece by compressive forces applied through a set of rolls
- Developed in late 1500s
- Accounts for 90% of all metals produced by metal working processes
- Often carried out at elevated temperatures first (hot rolling) to change coarse-grained, brittle, and porous ingot structures to wrought structures with finer grain sizes and enhanced properties

Rolled Metal Thicknesses

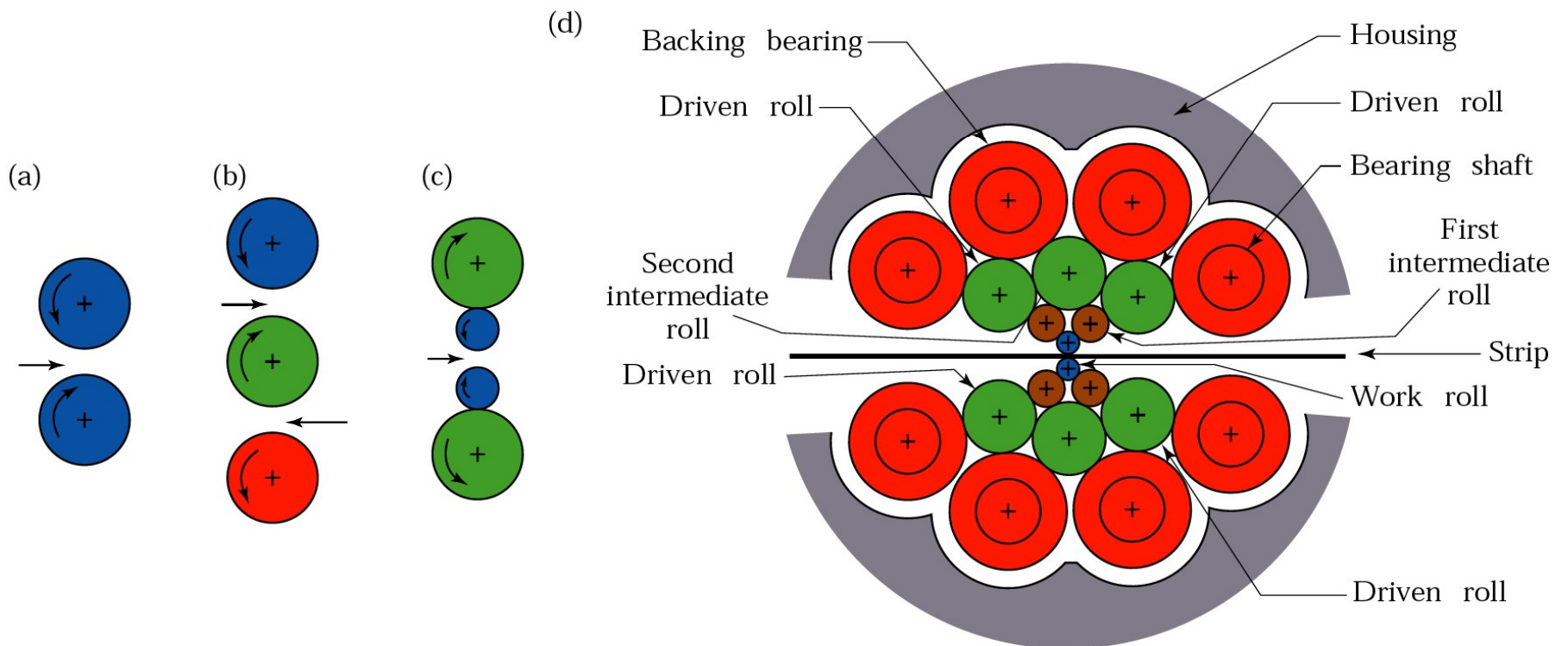
- Plates – thickness greater than 6 mm (1/4 inch);
 - boiler supports (0.3 m, 12 inch)
 - reactor vessels (150 mm, 6 inch)
 - battleships and tanks (100-125 mm, 4-5 inch)
- Sheets – less than 6 mm thick; flat pieces, strips, and coils for beverage containers, automobile and aircraft bodies, appliances, kitchen and office equipment
 - Boeing 747 skin thickness – 1.8 mm (0.071 inch)
 - Lockheed L1011 skin thickness – 1.9 mm (0.075 inch)
 - Aluminum beverage cans – start as sheets that are 0.28 mm (0.011 inch) thick; later reduced to 0.1 mm (0.004 inch) by deep drawing
 - Aluminum foil – 0.008 mm (0.0003 inch)

Flat and Shape Rolling Processes



Type of Rolling Mills

Figure Schematic illustration of various roll arrangements: (a) two-high; (b) three-high; (c) four-high; (d) cluster (Sendzimir) mill.



Defects in Rolling

- Surface defects – scale, rust, scratches, gouges, pits, and cracks
- Wavy edges – due to roll bending
- Alligatoring – complex phenomenon that may be due to non-uniform deformation or defects in the billet

Figure shows Schematic illustration of typical defects in flat rolling: (a) wavy edges; (b) zipper cracks in the center of the strip; (c) edge cracks; and (d) alligatoring.

