Homework #1

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ME 462: Manufacturing and Processes and Materials

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HW: Investigate the manufacturing process of a part that requires any of the process of the plastic deformation of the metal, extrusion, rolling, forging etc.

Manufacturing of seamless steel pipes, an example of extrusion/cold drawing

The plastic deformation of metals is an essential process in manufacturing. It can be in different forms, such as an extrusion, rolling, forging, drawing, etc. Metals are tough in nature and so these processes overcome these strengths in order to form them into a certain shape. Usually, this deformed metal will consist of the same amount of material before the process, if not less due to removal of some material. However, the shape will be different. For example a metal might end up being wider than the original but have a smaller thickness. This follows Poisson's ratio, that is if the volume of a metal stays the same when undergoing any type of strain or deformation, so if one dimensions changes, the other dimensions changes accordingly.

Firstly, steel tubes with a variety of sizes are ordered. To manufacture a pipe with a certain diameter and thickness, a pipe of a large radius and thickness must be chosen. One end of this tube is inserted into a machine that shapes the end of the pipe into a point, allowing it to fit through a die with a smaller diameter. In the other end of this tube, a steel bar is lubricated and inserted. The pointed end is inserted through a draw die. The protruding point is grabbed by a carriage, which draws the full length of the tube through the die and over the steel bar. The die reduces the tube to a smaller outside diameter while the bar sets the desired inside diameter. This causes the tube walls to thin out, causing it to elongate. The tube point end is then cut out. After this, the the tube is then put through a thorough clean and dry process, as well as a more precise cleaning

in the inside of the tube. The pipe then goes through a furnace, which softens it. This process of annealing essentially undoes the hardened state of the pipe due to cold drawing. The pipe then has to be straightened after it warps due to annealing. Finally, this entire process is repeated until the desired pipe diameter, thickness, and length is achieved.

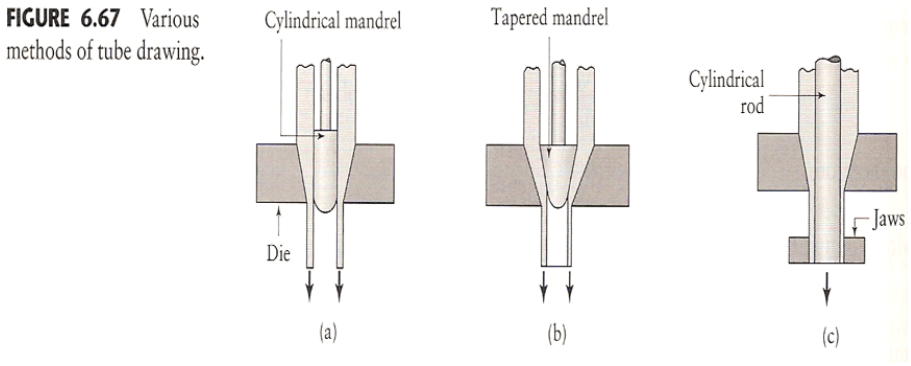

Figure 1: Cold Drawing technique[1]

"Wire drawing is very common in elongating and reducing the cross-section of a wire. Tubing is also a form of drawing"[1]. In this case, elongating and reducing the wall thickness of the pipe is a form of tubing and thus a form of cold drawing. This is also done at room temperature, hence the term "cold".

[1]Lecture 3