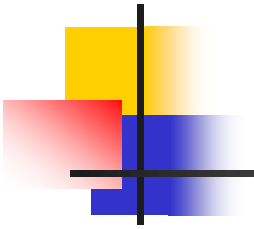


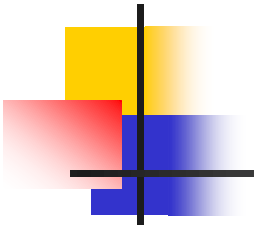
Defining and Solving Design Problems

- Designing products and process plants
- Product anatomy
- Components: standard vs. special purpose
- Process plant anatomy
- Component decomposition diagrams
- Types of design
- Tinkering
- Summary

Imagine designing the following products

automobile
baseball bat
bicycle
canoe paddle
coffee maker
commercial jet
fishing reel
inflatable kayak
laser printer
leaf rake
paper clip
paper cup
penlight
power lawn mower
toaster oven
vacuum cleaner

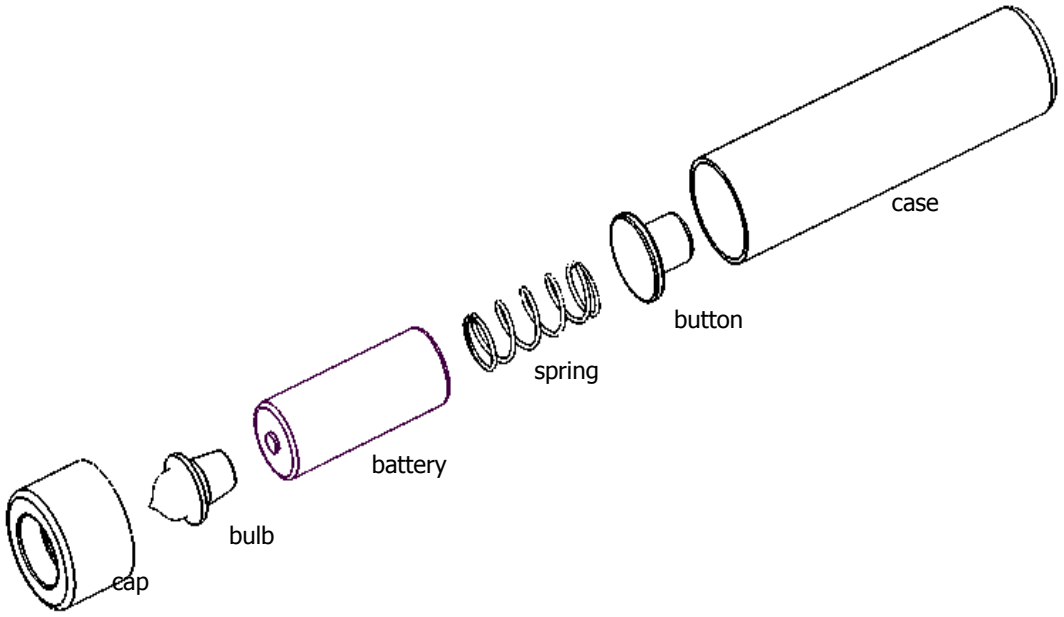
Are all design problems the same?



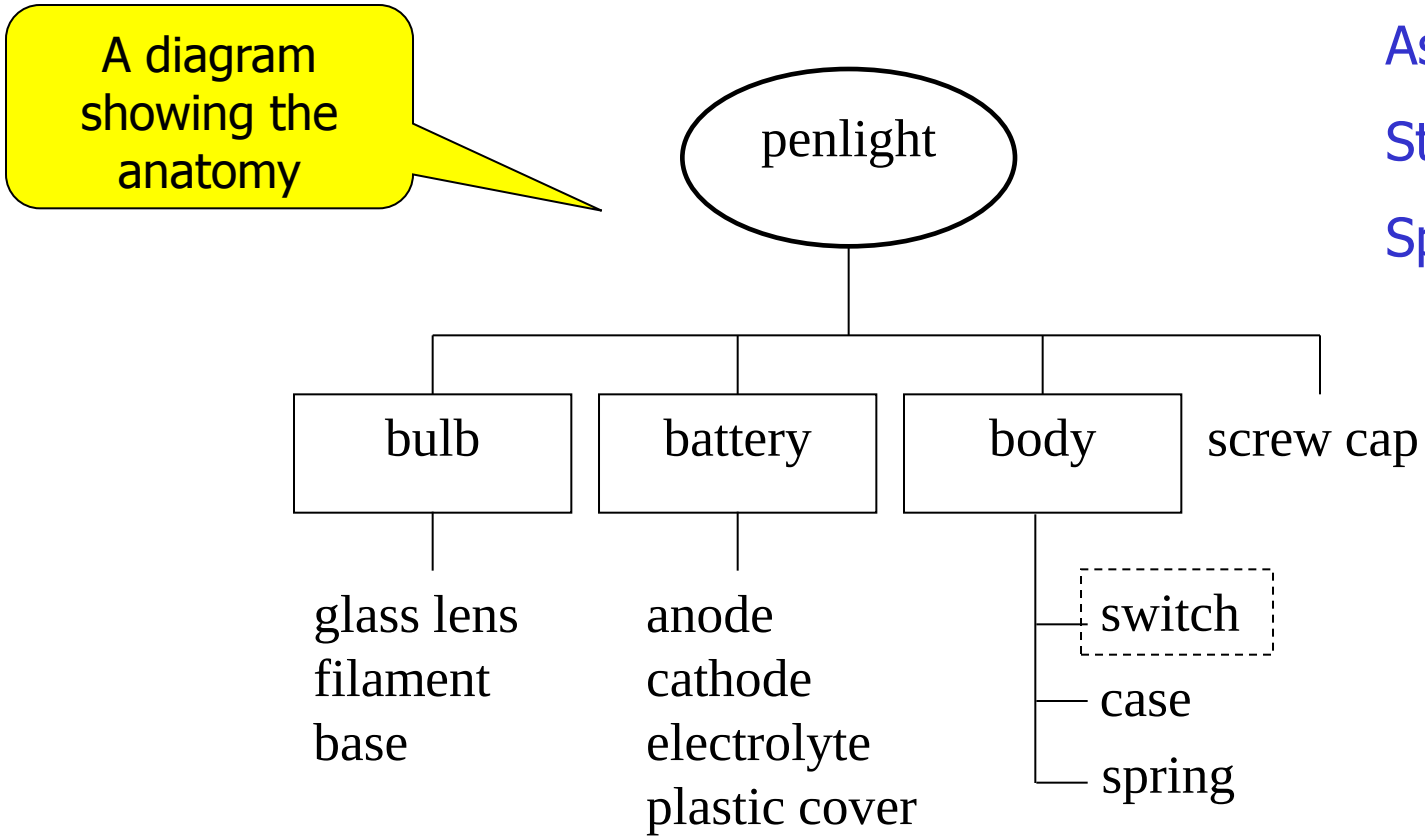
Let's start with product design

A *product* is an item that is purchased and used as a unit (Dixon and Poli, 1995)

Example product…. Penlight has “components”



Component decomposition diagram - penlight



Parts

Assemblies

Standard

Special purpose

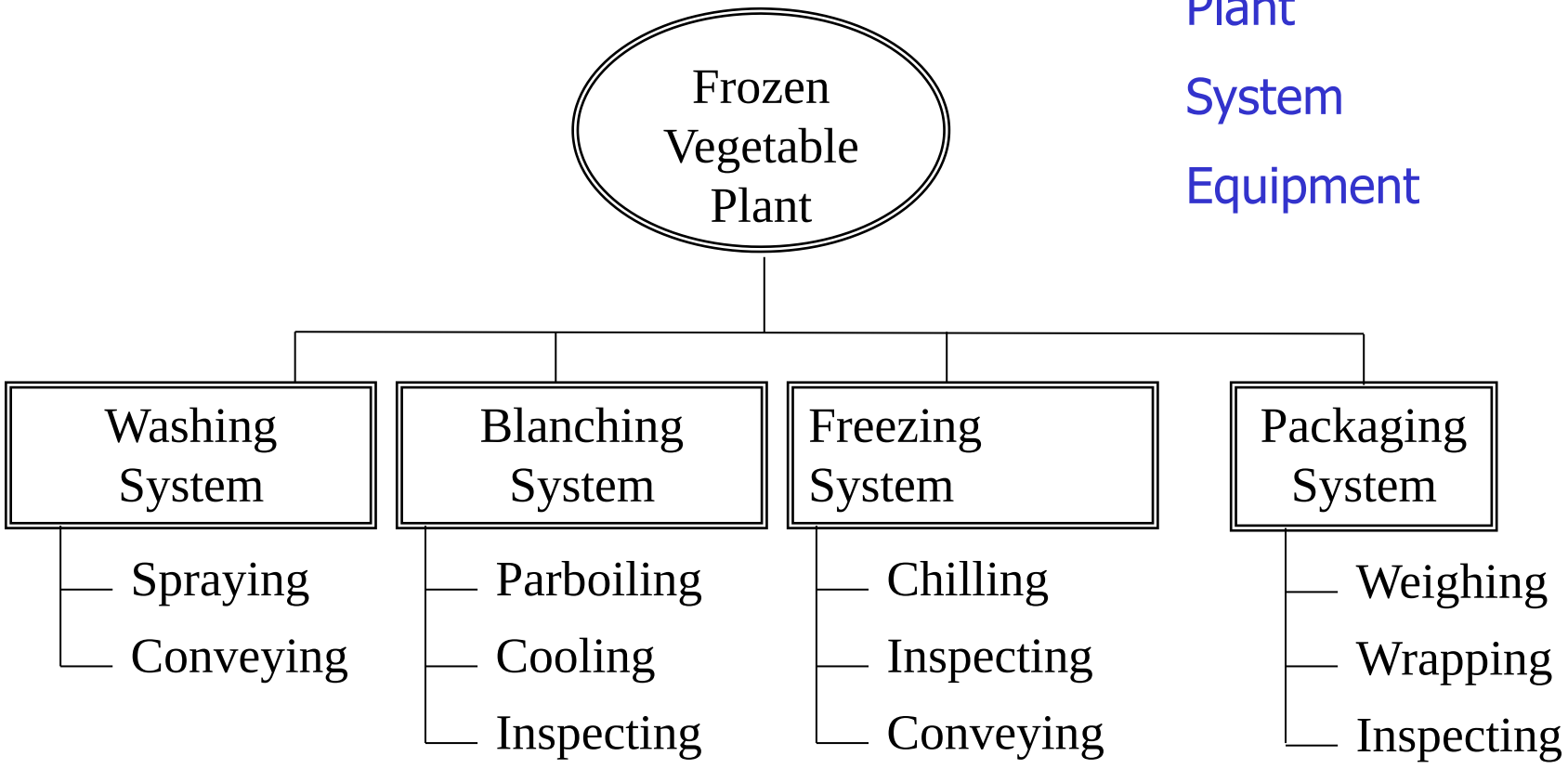
Other example components

Standard Parts	Standard Assemblies	Special Purpose Parts
bolt, nut	pump	housing
screw	electric motor	cover
rivet	clutch	bracket
key	chain/sprocket	link
gasket	heat exchanger	support
gear blank	brake caliper	shaft
lubricant	ball bearing	
seal	power screw	

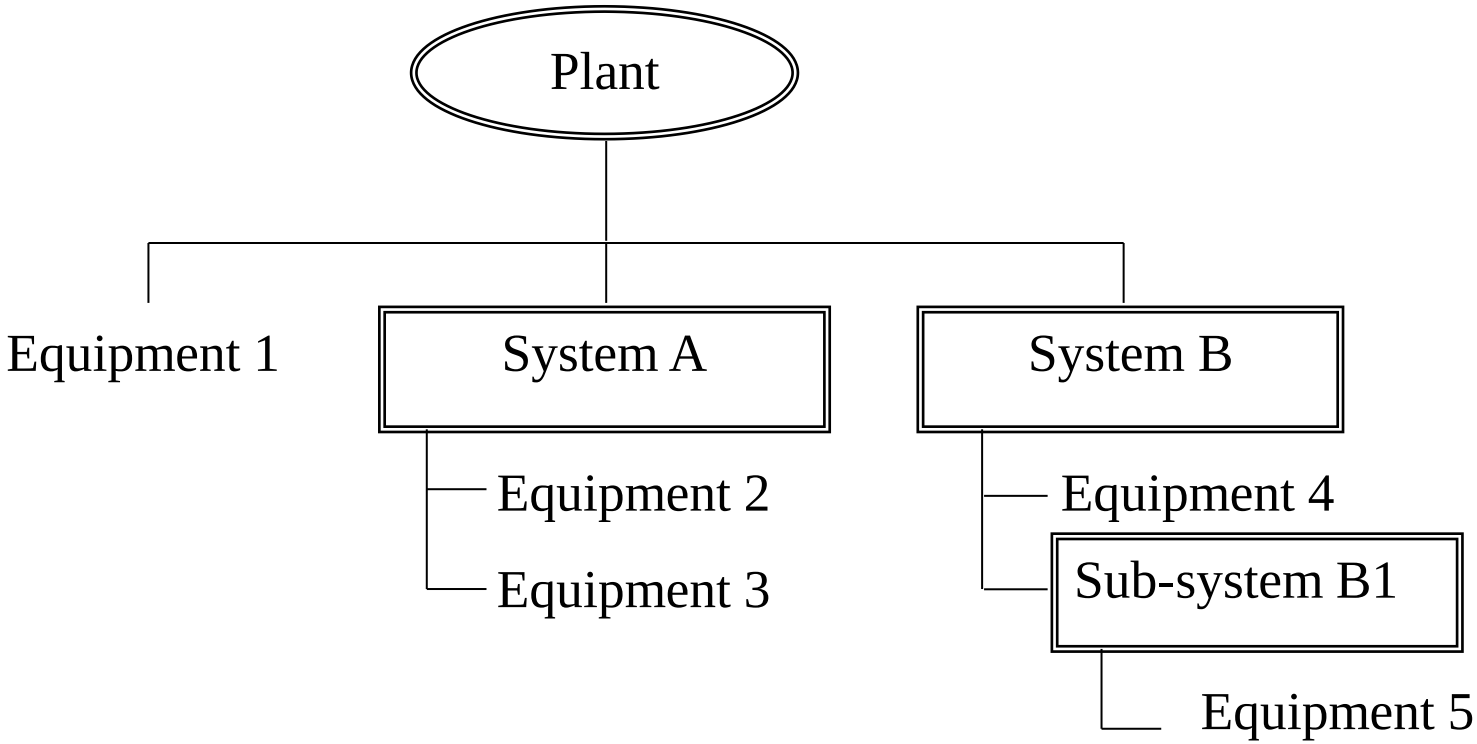
Process plant - definition

A *process plant* is a combination of systems used to process energy or materials (both organic and inorganic).

Component decomposition of a frozen food processing plant



Component decomposition of process plant



Why bother preparing *Component Decomposition Diagrams*?

- Understand the interaction between components

- Consider standard parts versus special purpose parts (buy vs. make)

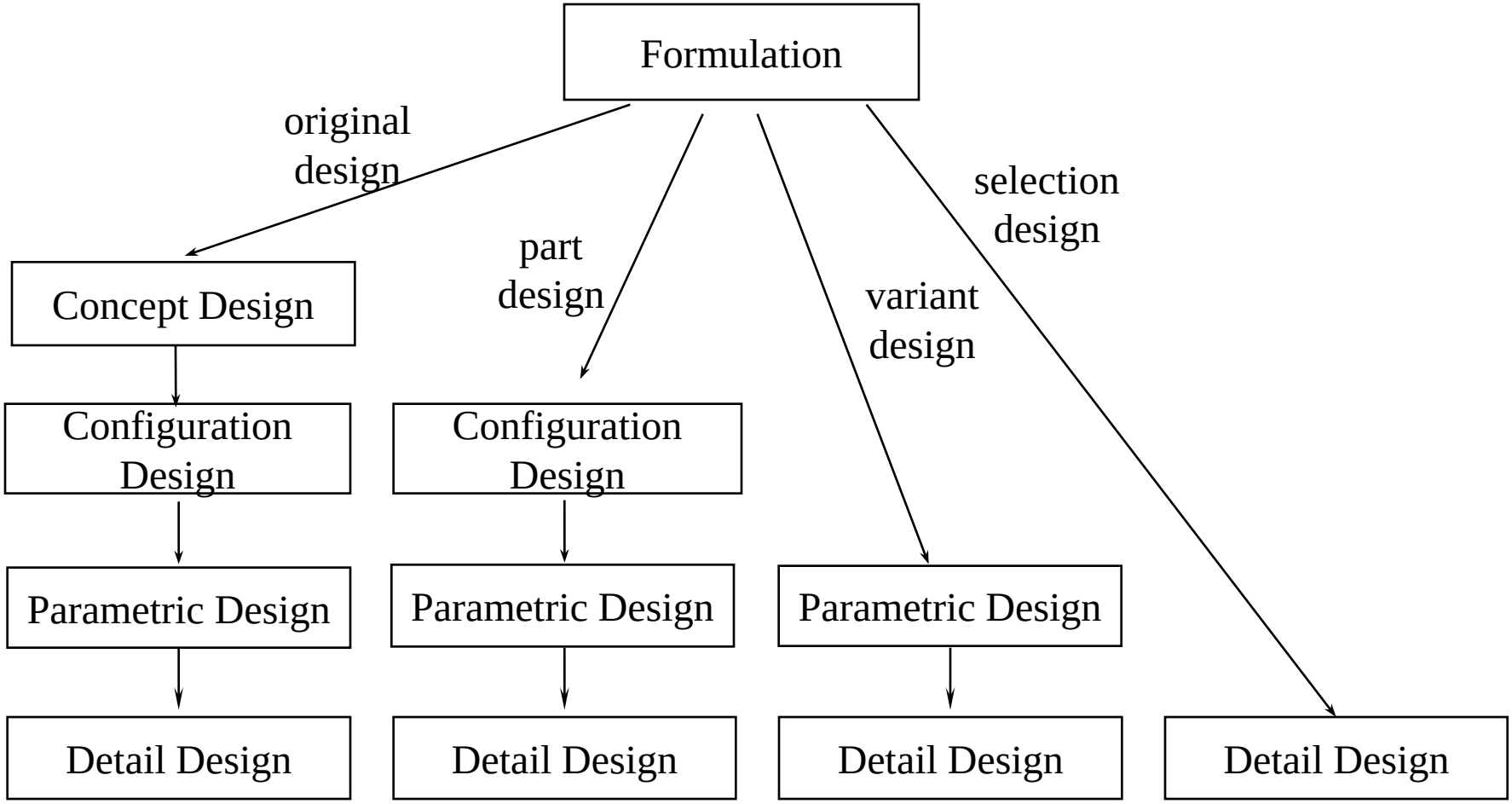
- Divide the design problem into separate sub-problems, i.e. *decisions.*

- Learn pros & cons of existing products or processing plants

Types of design (i.e. decisions and activities)

Redesign	–	modifying the "form"
Selection design	–	choosing from existing standard parts/subassemblies
Variant design	–	modifying existing part/subassembly, but keeping original concept
Adaptive design	–	adapting known solution to new task
Original design	–	new concept, part never existed before
Artistic design	-	modifying appearance or look

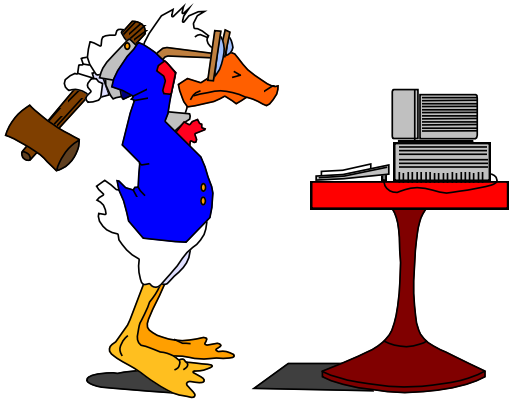
Types of design related to phase



"Tinker"

Date: 1592
---to work in the manner of a tinker; *especially* **:** to repair, adjust, or work with something in an unskilled or experimental manner**: to FIDDLE**

(http://www.m-w.com/cgi-bin/dictionary)



Real engineers do not tinker.

Real engineers predict how a product will perform before building it, reducing the need to "cut and try" or "fiddle."