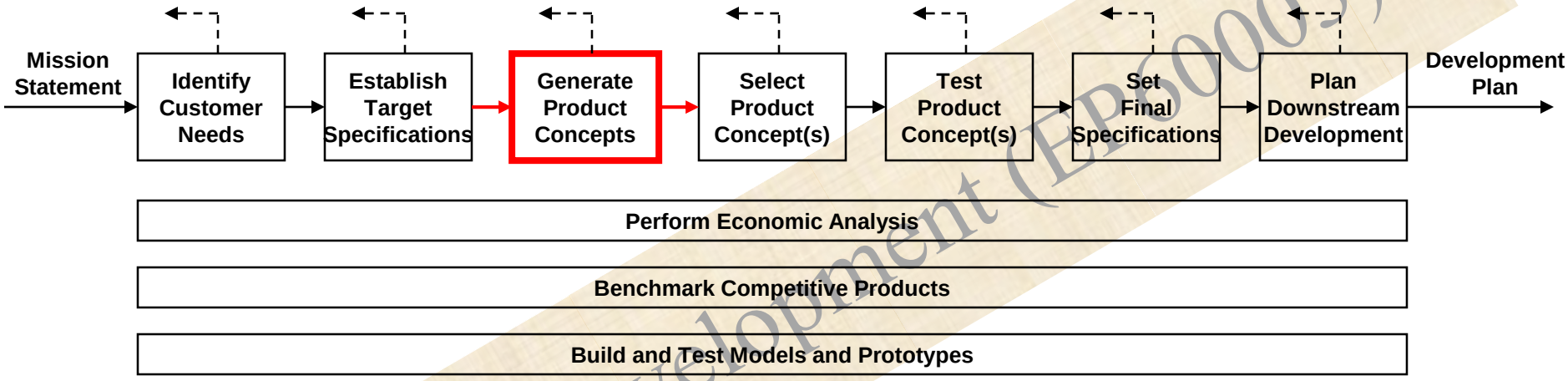
Concept Generation

Concept Development Process



Concept Generation Example: Power Nailer

Questions

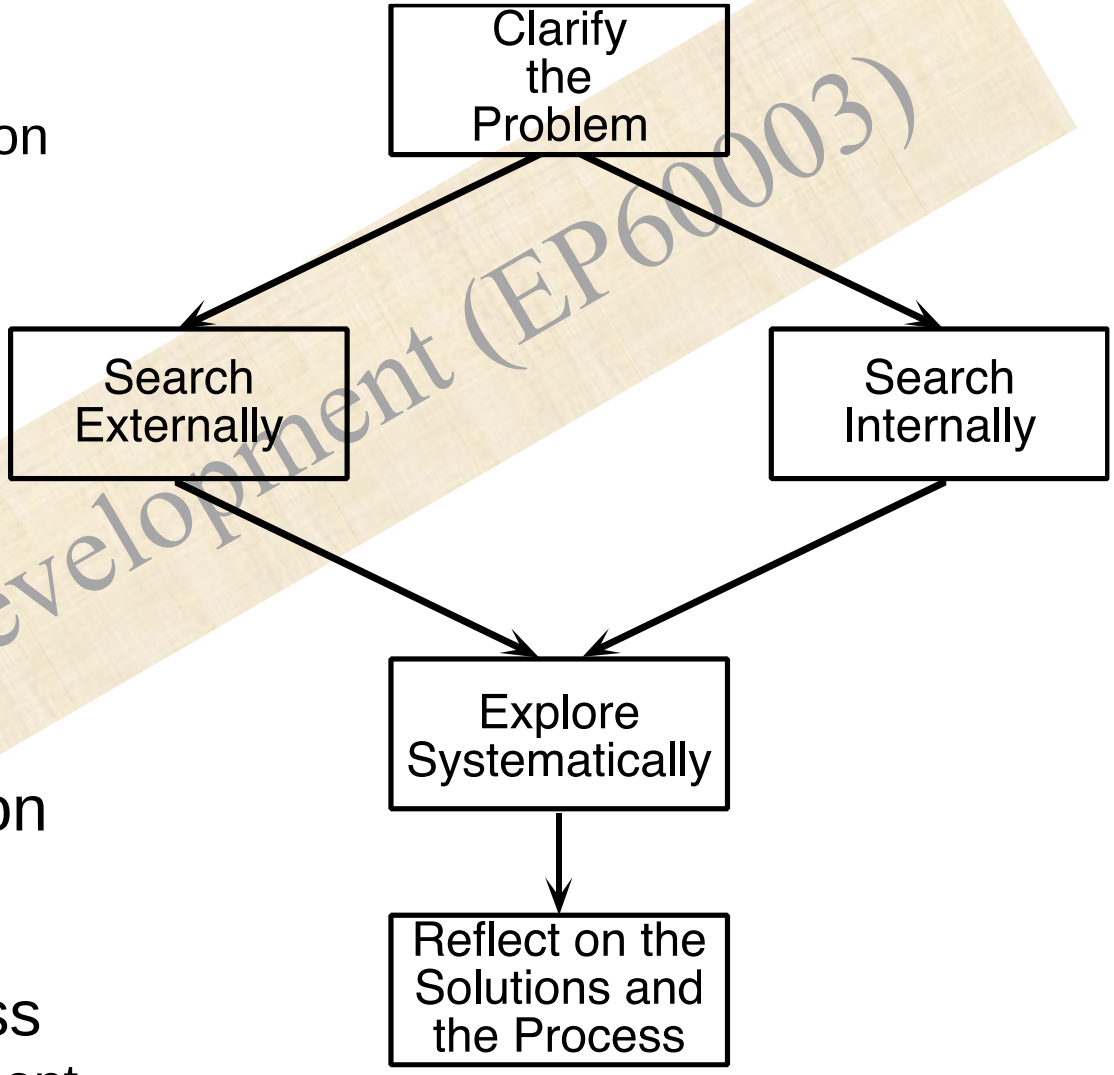
- What existing solution concepts, if any, could be successfully adapted for this application?
- What new concepts might satisfy the established needs & specifications?
- What methods can be used to facilitate the concept generation process?

Dysfunctions during Concept Generation

- Consideration of only one or two alternatives, often proposed by the most assertive members of the team
- Failure to consider carefully the usefulness of concepts employed by other firms in related & unrelated products
- Involvement of only one or two people in the process
- Ineffective integration of promising partial solutions
- Failure to consider entire categories of solutions

Concept Generation Process

- Clarify the Problem
  - Problem Decomposition
- External Search
  - Lead Users
  - Experts
  - Patents
  - Literature
  - Benchmarking
- Internal Search
  - Individual Methods
  - Group Methods
- Systematic Exploration
  - Classification Tree
  - Combination Table
- Reflect on the Process
  - Continuous Improvement



Understanding the problem of the hand-held nailer

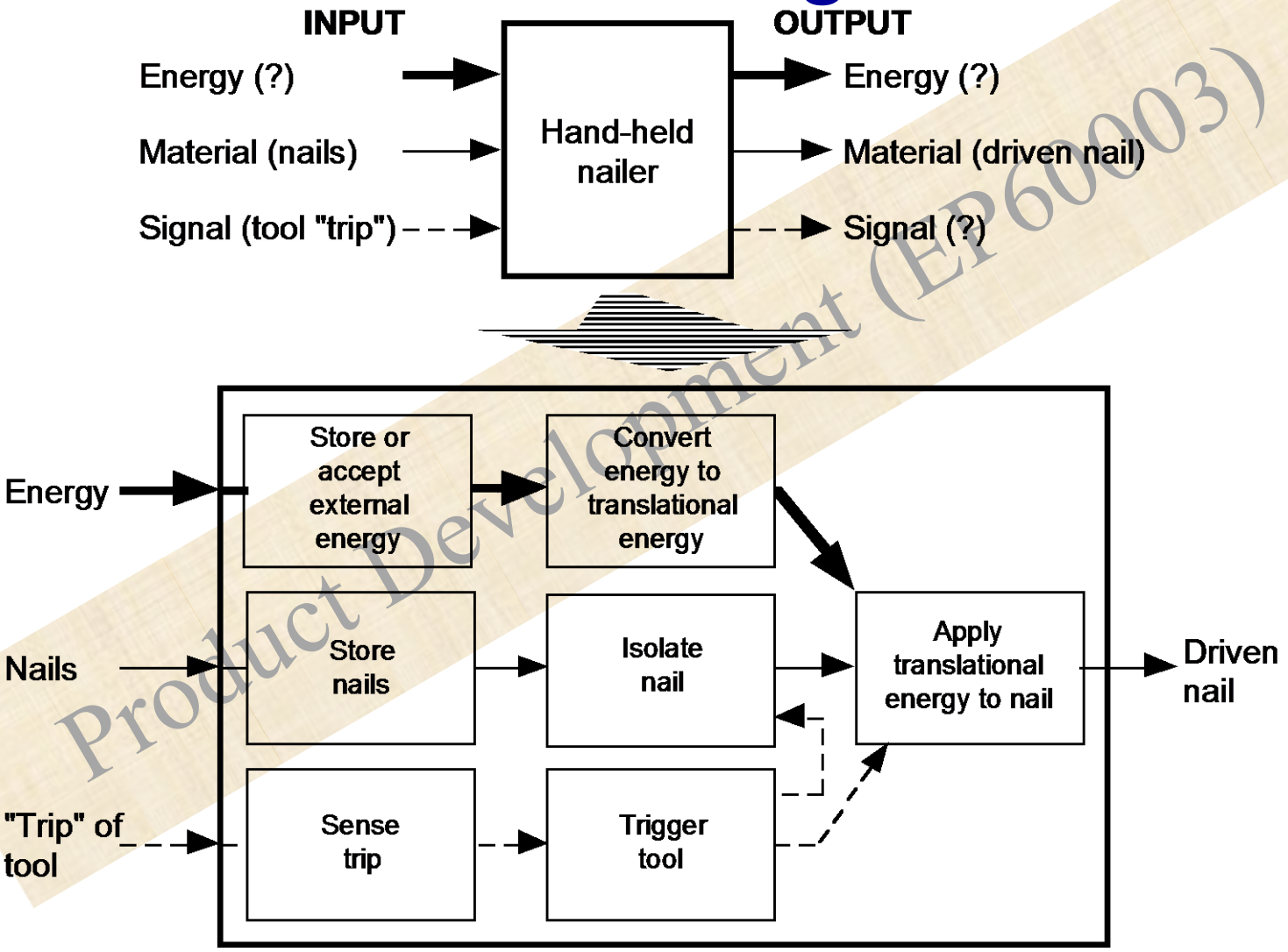
- **Assumptions in the mission statement:**
  - The nailer will use nails
  - The nailer will be compatible with the nail magazines on existing tools
  - The nailer will nail thro roofing shingles into wood
  - The nailer will be hand-held

- **Customer needs based on assumptions:**
  - The nailer inserts nails in rapid succession
  - The nailer is lightweight
  - The nailer has no noticeable nailing delay after tripping the tool

Understanding the problem of the hand-held nailer

- **The target specifications:**
  - Nail lengths from 25 mm to 38 mm
  - Maximum nailing energy of 40J per nail
  - Nailing forces upto 2000 N
  - Peak nailing rate of 1 nail per second
  - Average nailing rate of 12 nails per minute
  - Tool mass less than 4 kg.
  - Maximum trigger delay of 0.25 second

Problem Decomposition: Function Diagram



Techniques for constructing a function diagram

- Create a function diagram of an existing product

- Create a function diagram based on an arbitrary product concept already generated by the team or based on a known sub function technology.

- Follow one of the flows (e.g. material) and determine what operations are required. The details of the other flows can be derived by thinking about their connections to the initial flow

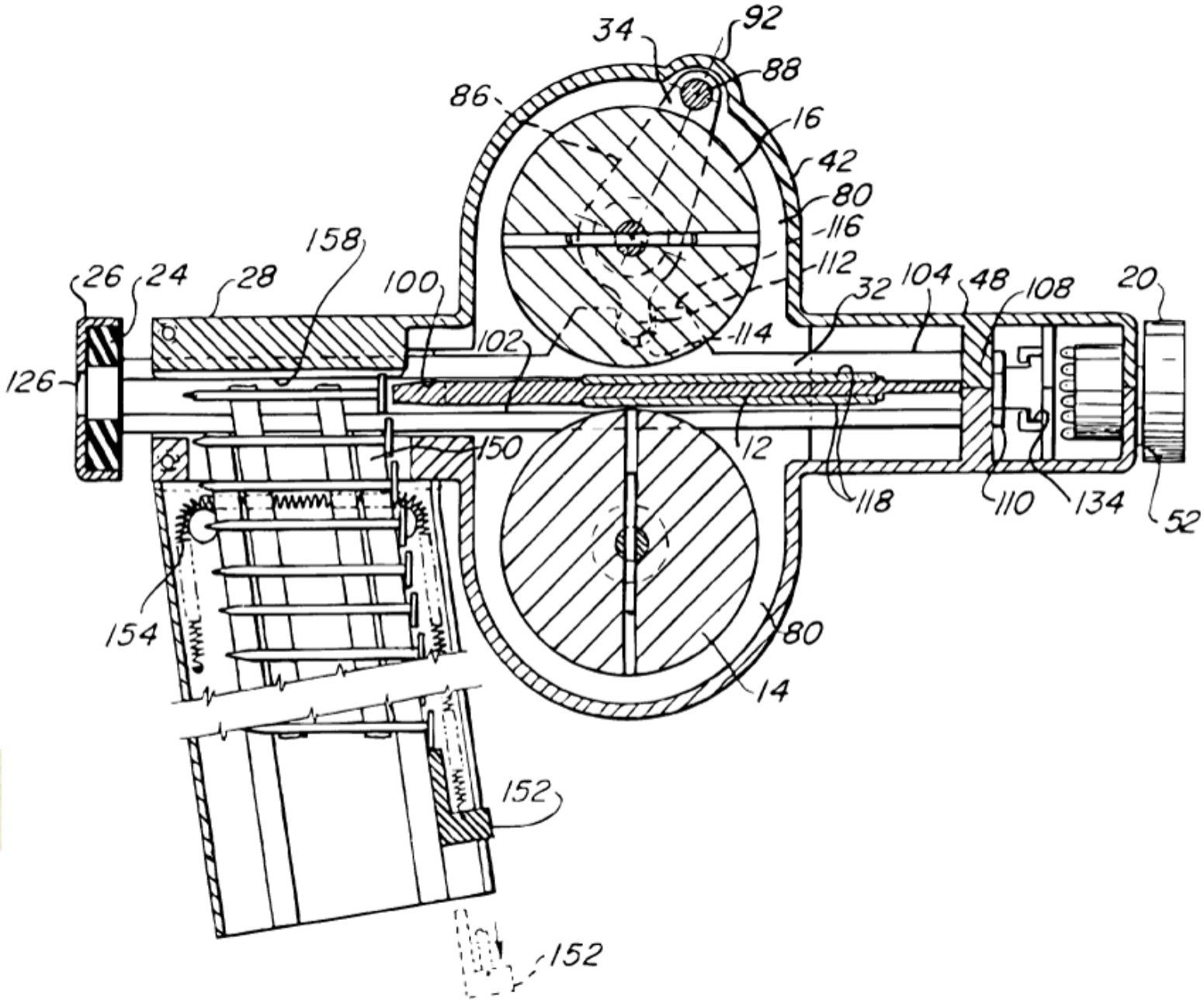
Other Approaches

- ***Decomposition by sequence of user action***
  - Moving the tool to the gross nailing position
  - Positioning the tool precisely
  - Triggering the tool

- **Decomposition by Key Customer Needs**
  - Fires nails in rapid succession
  - Nailer is Light weight
  - Has a large nail capacity

External Search:
Hints for Finding Related Solutions

- ***Lead Users***
  - benefit from improvement
  - innovation source
- ***Benchmarking***
  - competitive products
- ***Experts***
  - technical experts
  - experienced customers
- ***Literature***
  - technical journals
  - trade literature
- ***Patents***
  - search related inventions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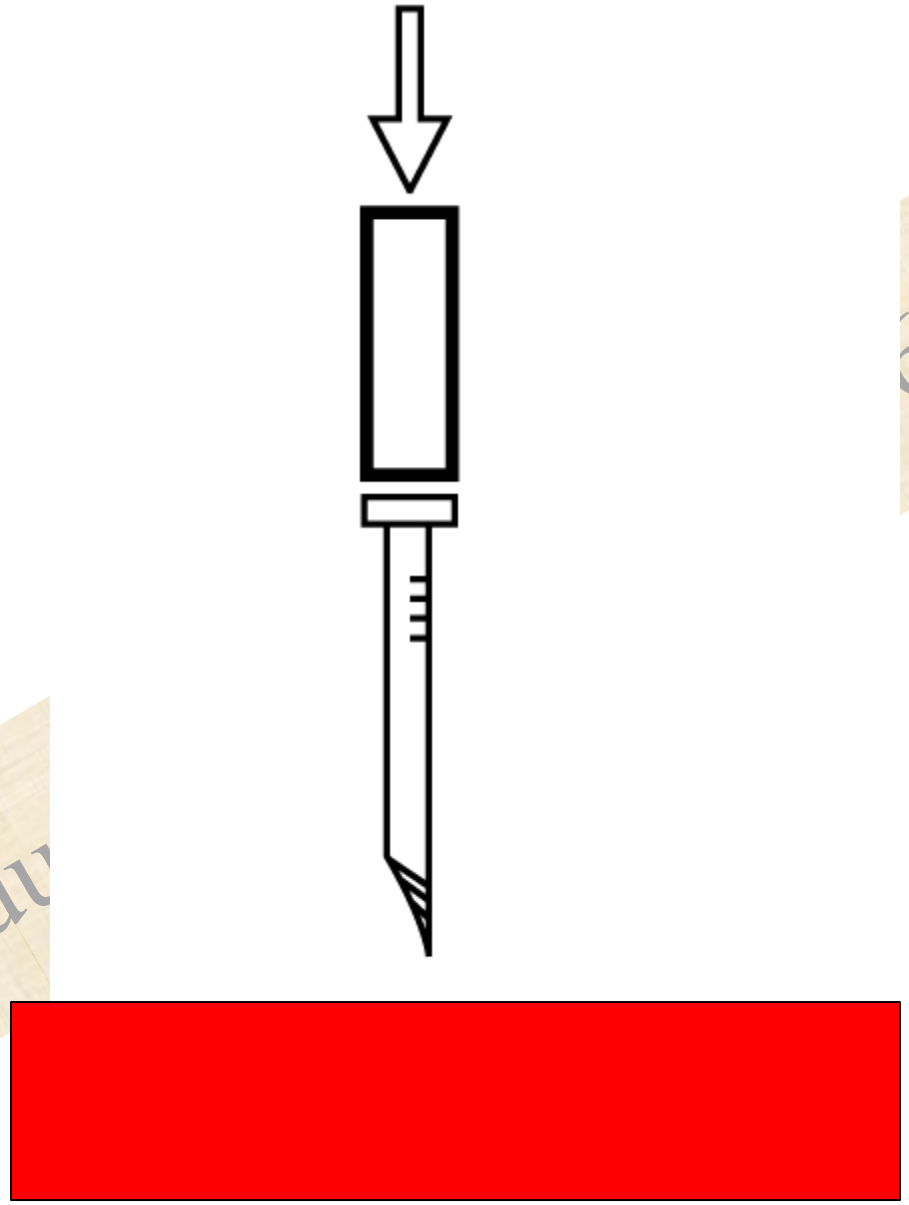
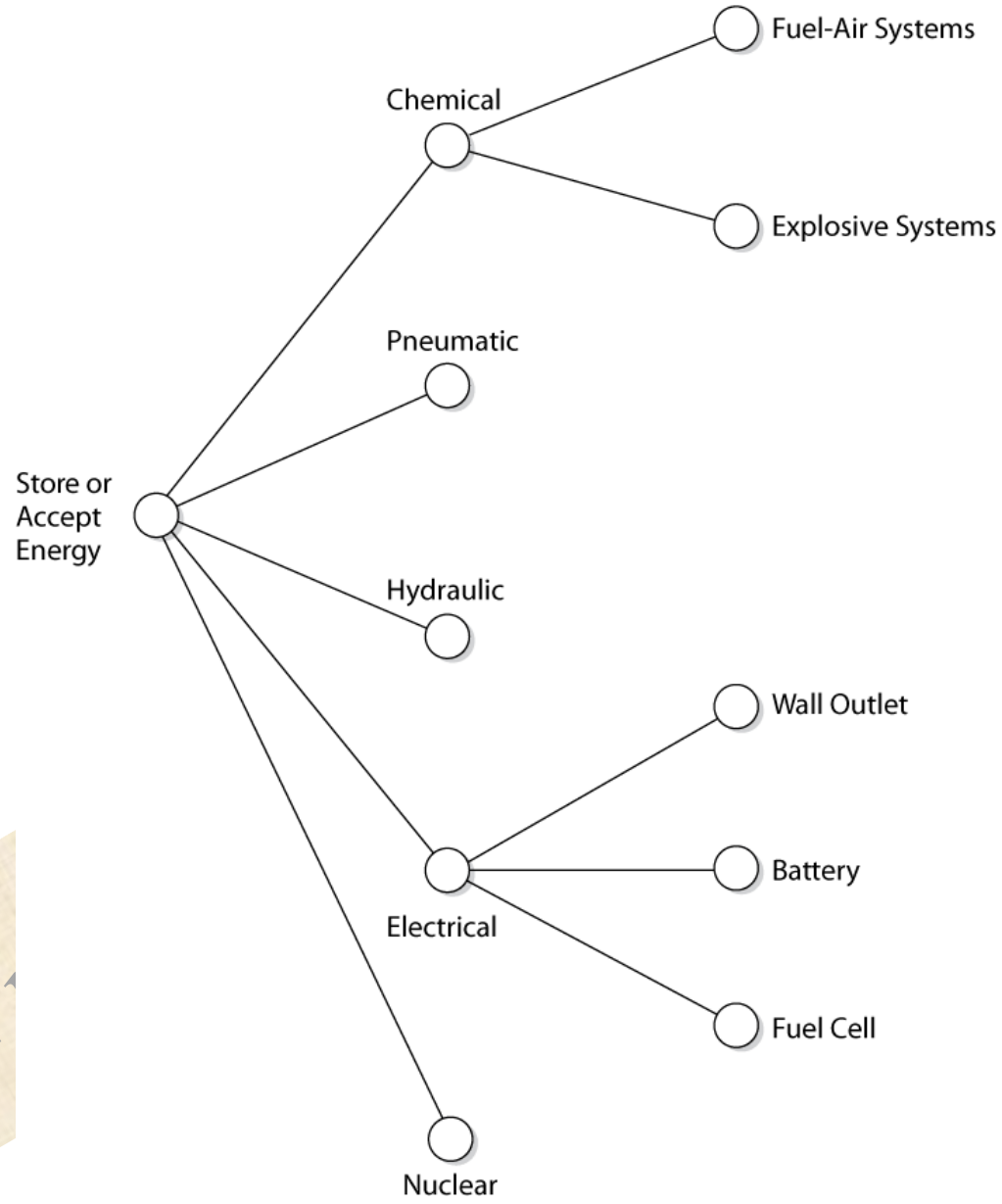
Internal Search:
Hints for Generating Many Concepts

- Suspend judgment
- Generate a lot of ideas
- Infeasible ideas are welcome
- Use graphical and physical media
- Make analogies
- Wish and wonder
- Solve the conflict
- Use related stimuli
- Use unrelated stimuli
- Set quantitative goals
- Use the gallery method
- Trade ideas in a group

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Explosive Systems
Pneumatic
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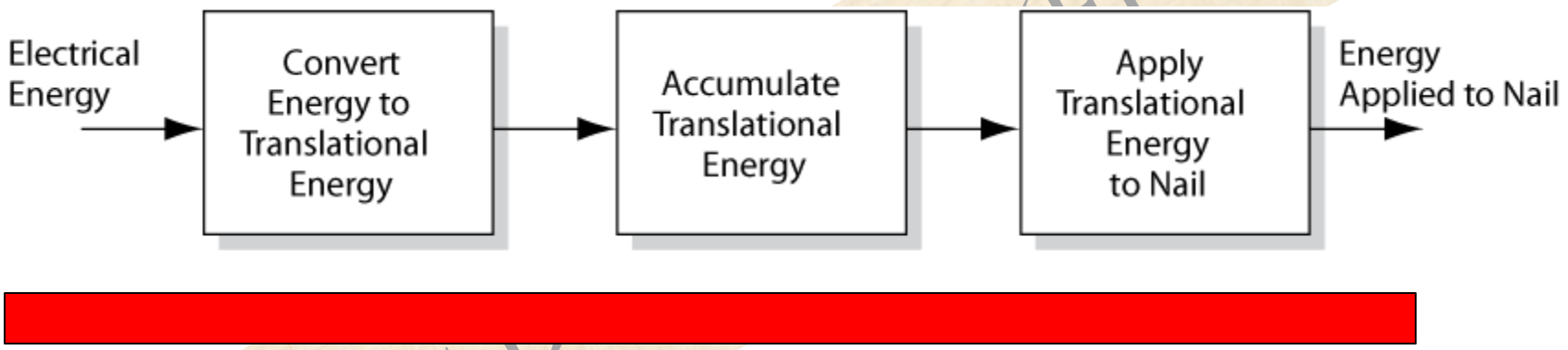
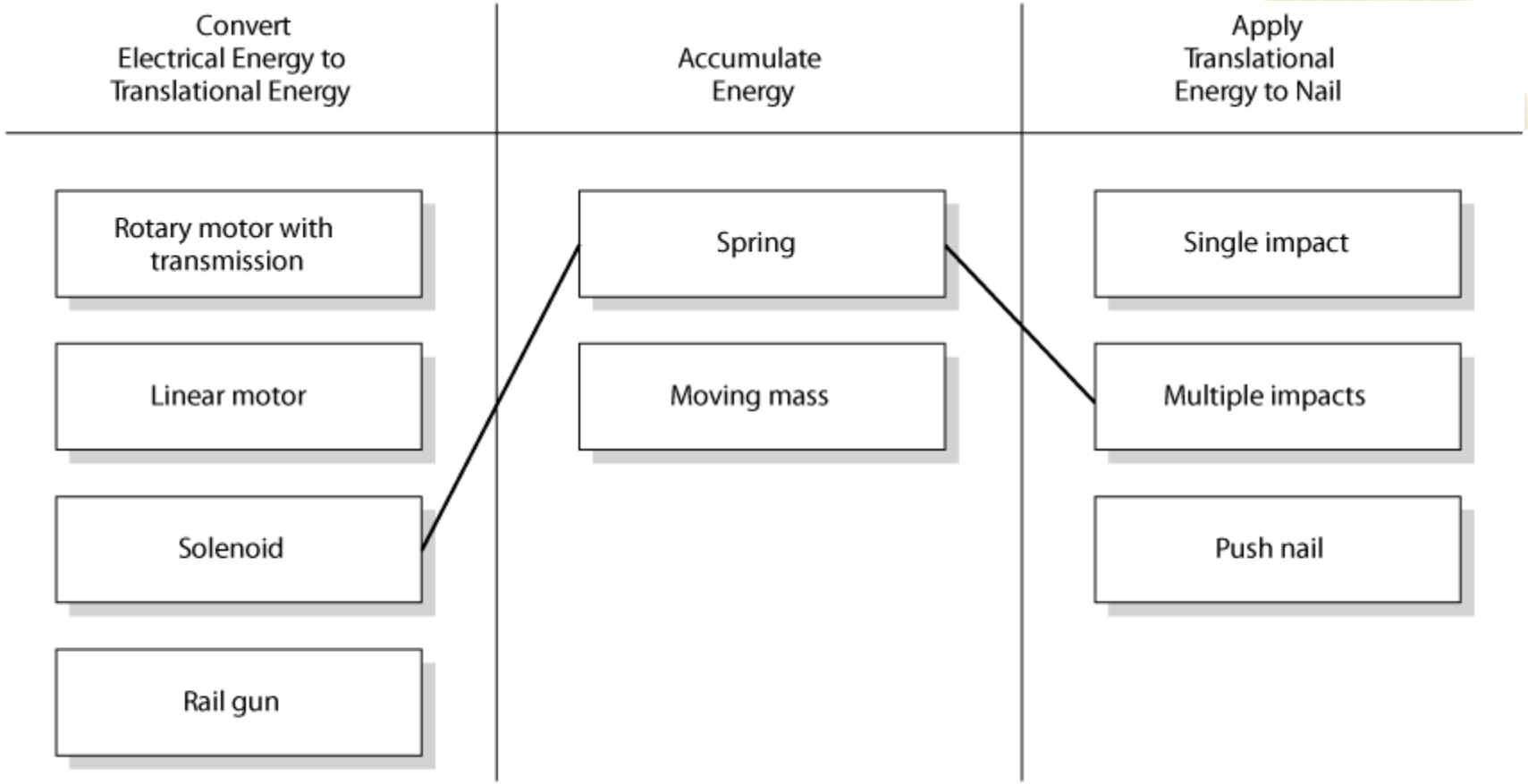
Accept
Energy
Hydraulic
Wall Outlet
Battery
Electrical
Fuel Cell
Nuclear



Systematic Exploration:
Concept Combination Table

Convert Electrical Energy to Translational Energy	Accumulate Energy	Apply Translational Energy to Nail
Rotary motor with transmission	Spring	Single impact
Linear motor	Moving mass	Multiple impacts
Solenoid		Push nail
Rail gun		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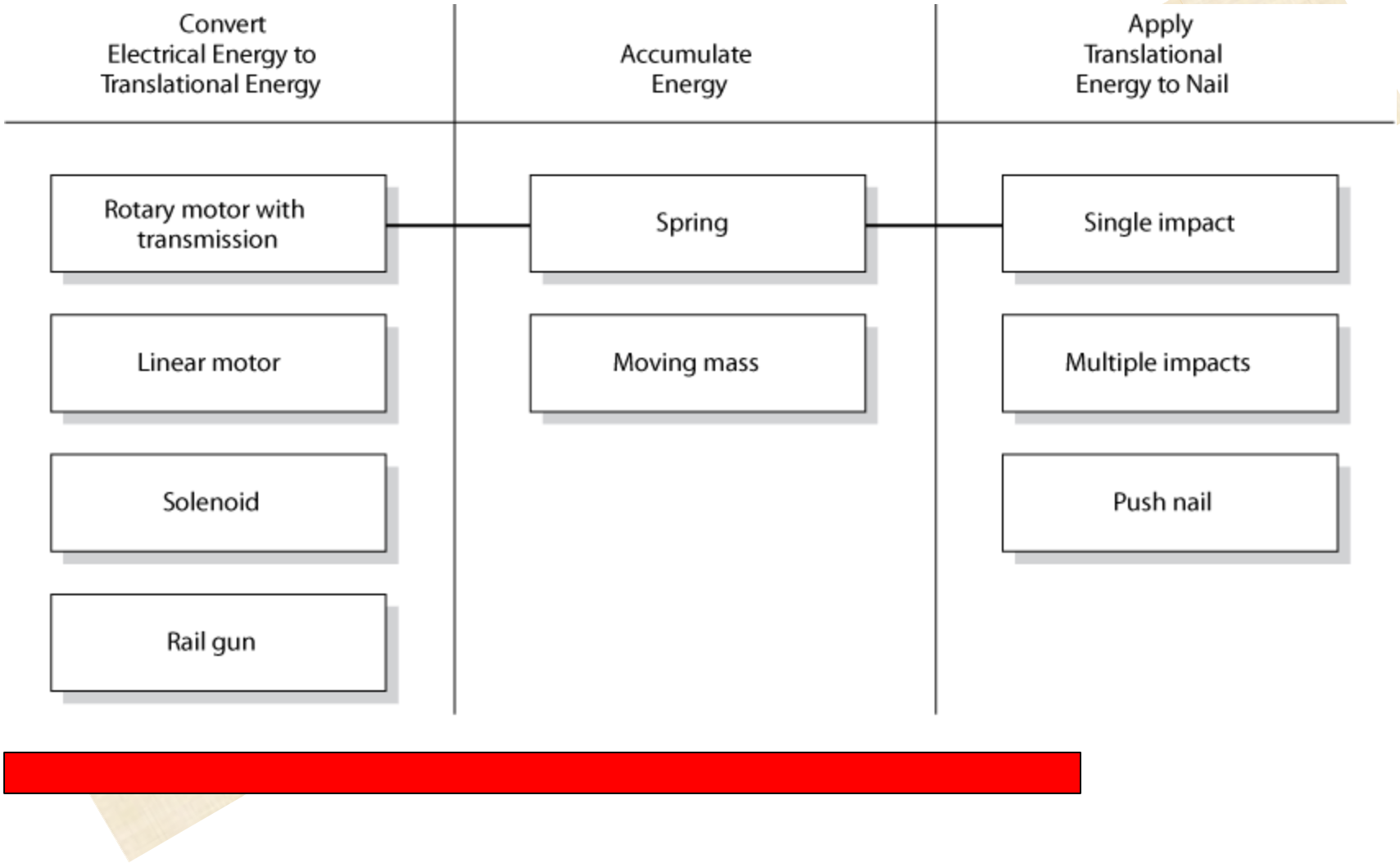
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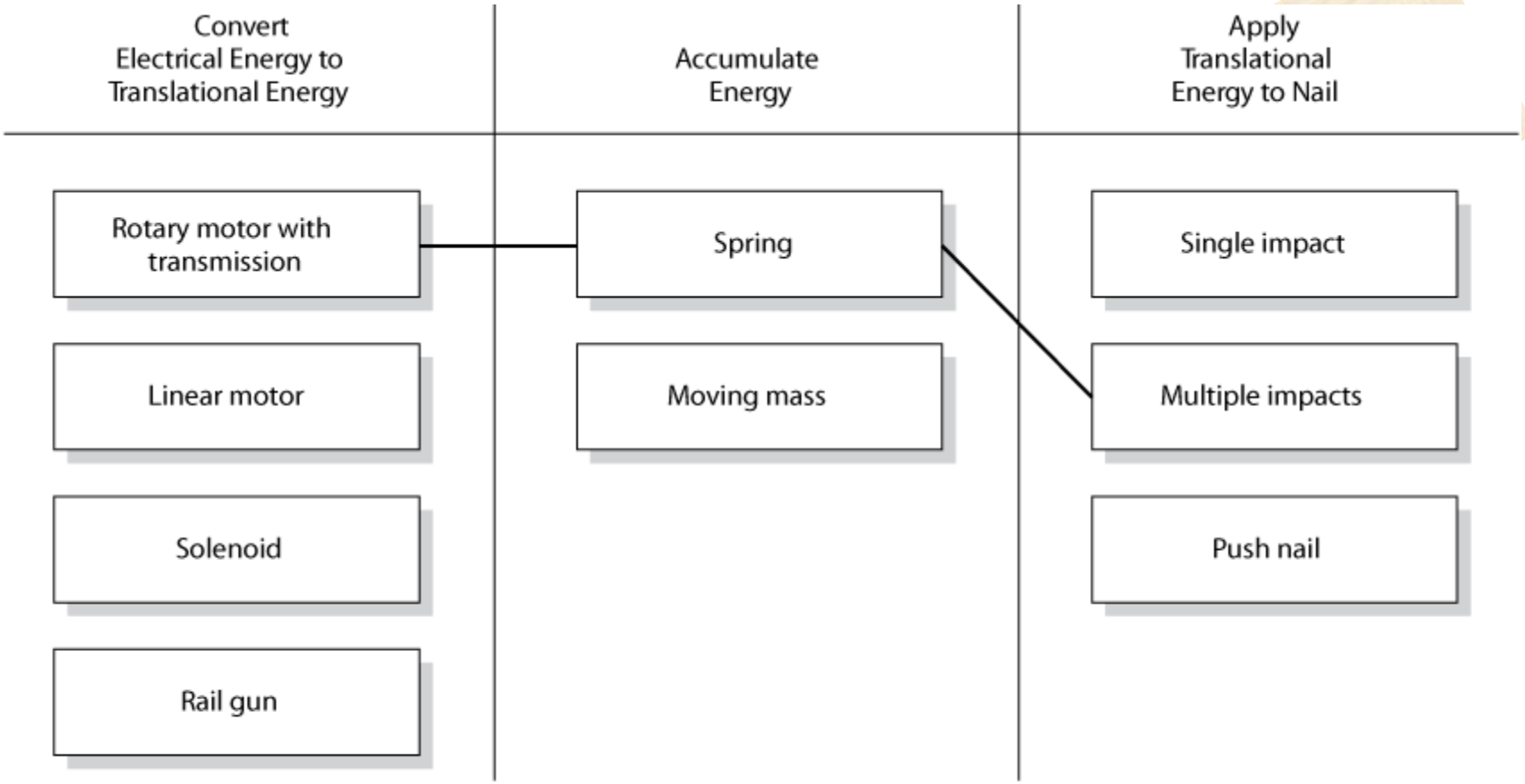
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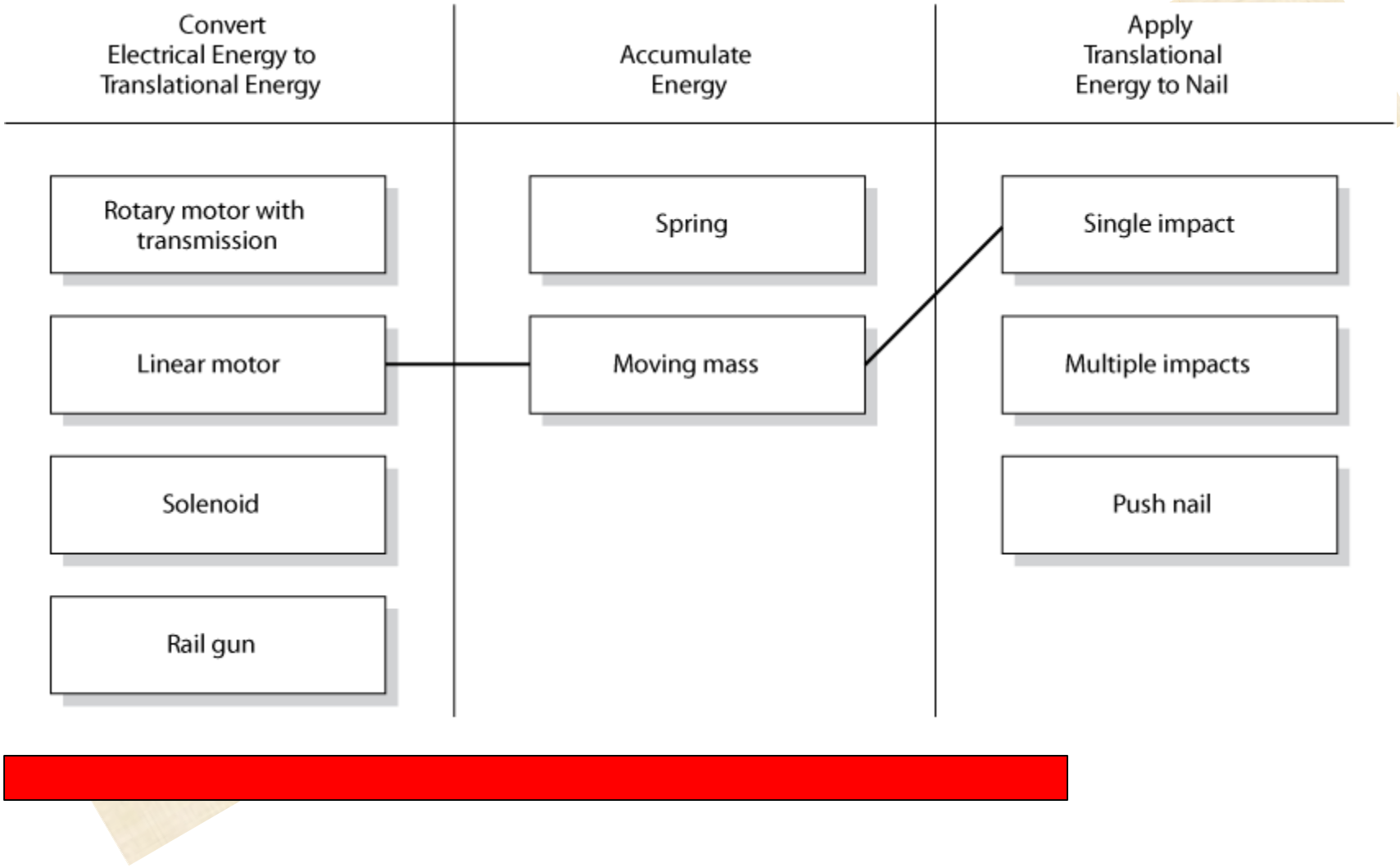
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