

Application of I-TRIZ for invention enhancement :

Improvement of patent quality
through secondary problem solving

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What is a secondary problem solving?

Primary problem solving

→ Problems with a prior art

Secondary problem solving

→ Underlying problems in the present invention solving primary problem

What is a secondary problem solving?

A primary problem



It is difficult to shake a pot.

What is a secondary problem solving?

To solve the primary problem,

the pot got a handle extended outward.

(This is called a frying pan.)

a handle extended outward



***But,
a secondary problem***

The handle will be hot.

What is a secondary problem solving?

A wooden grip is attached to the handle.

→ A secondary problem solving



Advantages of Secondary problem solving

Quality of patents

1. Economic value
2. Inventive step / non-obviousness
3. Enablement requirement
(Written description)

Inventive step

Prior art : A

Present invention

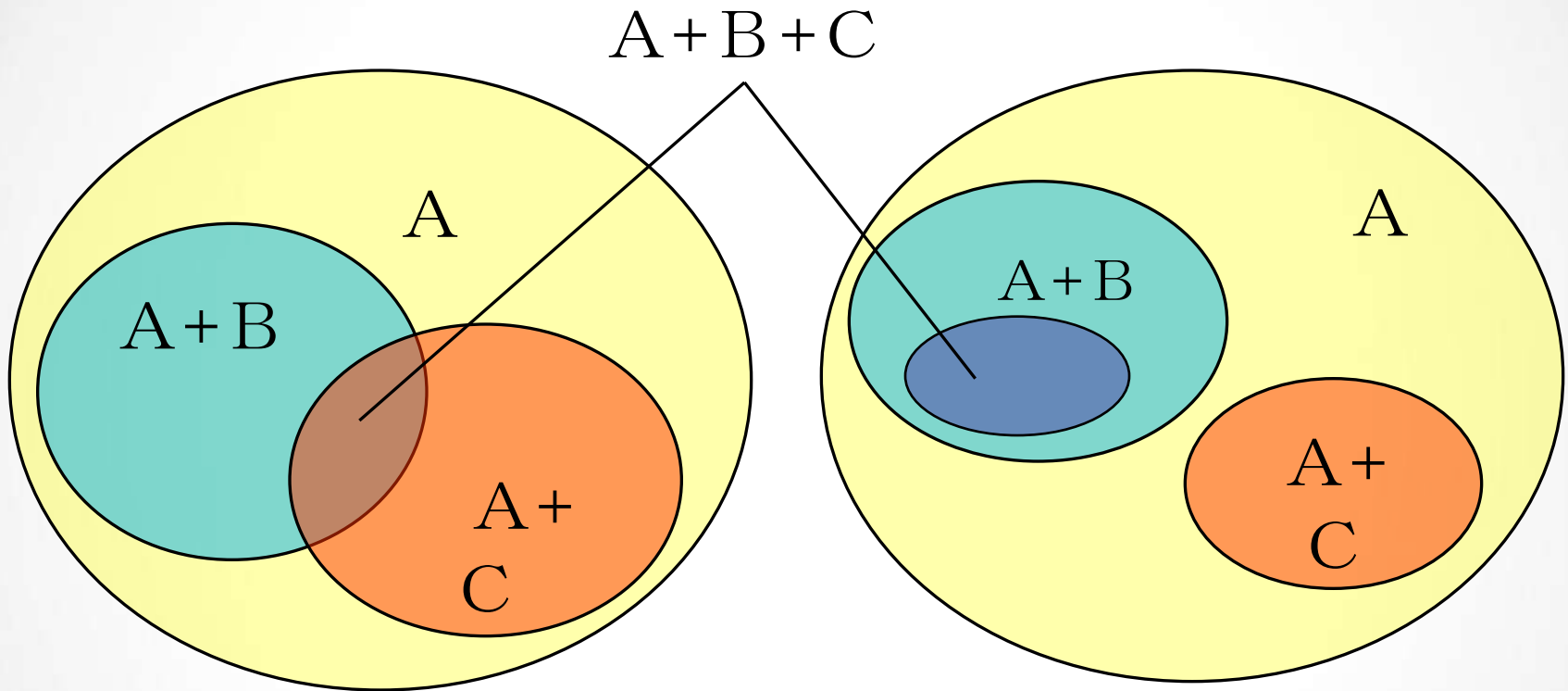
Claim 1 : $A + B$ (Means for a primary problem solving)

Embodiment : $A + B + C$ (Means for a secondary problem solving)

Cited invention 1 : $A + B$

Cited invention 2 : $A + C$

Inventive step



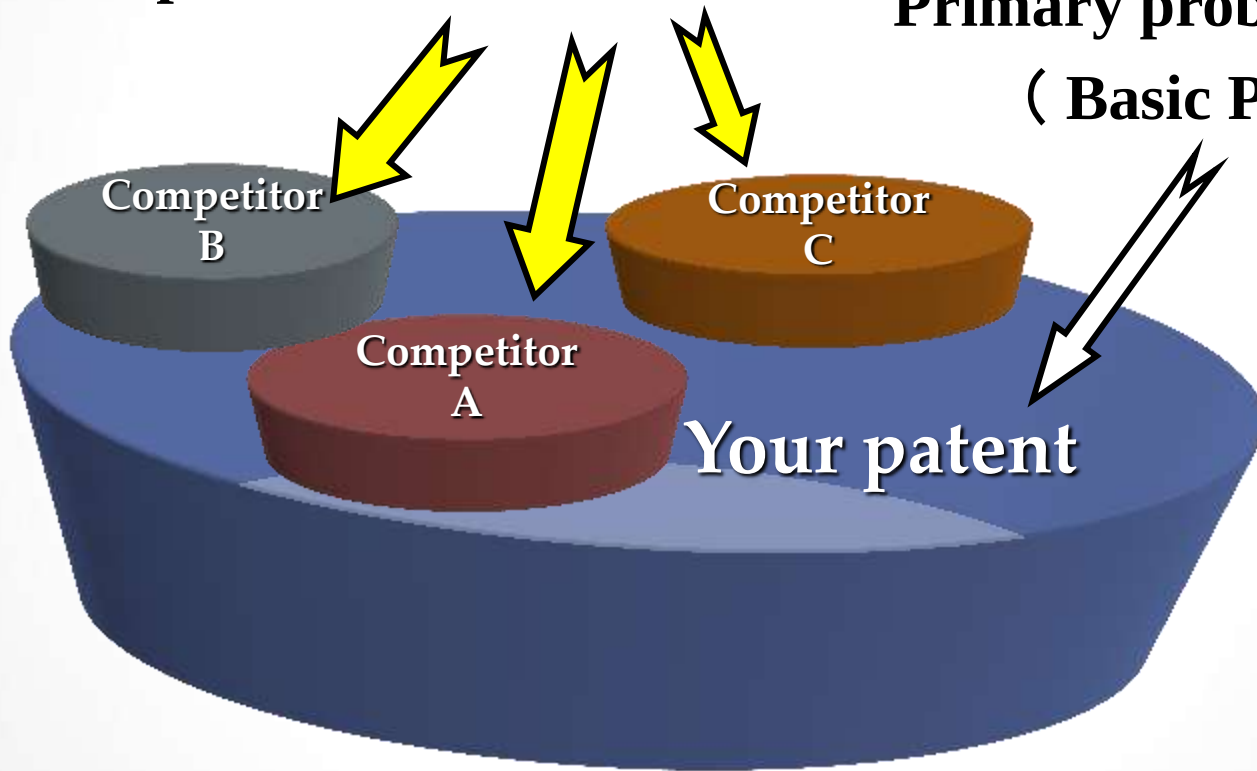
Pattern 1 : Remarkable effect

Pattern 2 : Teach away

Economic value

**Secondary problem solving
(Improvement Patents)**

**Primary problem solving
(Basic Patent)**



Competitors can brake into your Basic Patent “Fort”

Advantages of TRIZ for Patent Attorneys

Patent Attorneys have:

- the Notion that “Invention = Combination of Structural / Functional Elements” ; and
- Broad Knowledge over various Technical Fields.

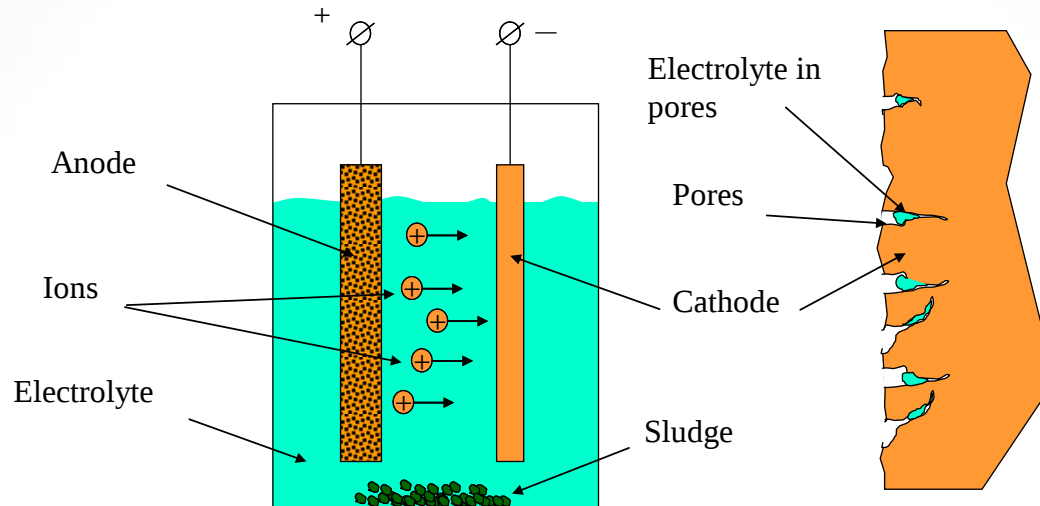
→ Thinking skill suitable for utilizing TRIZ and Solving Secondary Problems of Original Invention.

Solving Secondary Problems is Very Effective for:

- Obtaining Strong Patents; and
- Blocking Competitors

Case Study

Producing Pure Copper



In a electric refining process, electrolyte enters the small pores that have developed on the surface of the copper sheets.

In storage, the electrolyte evaporates from the pores, interacting with moisture presenting in the ambient air leaving unsightly spots on the surface of the copper.

To avoid this, the sheets **are washed** prior to storage. **It increases cost and requires additional time.**

Process of Solving Problem with I-TRIZ (1/2)

◆ **Project Initiation**

1. Project Objectives
2. Importance of Situation

◆ **Innovation Situation Questionnaire (ISQ)**

1. Brief Description of Situation
2. Systems Approach
3. Resources, Constraints and Limitations

◆ **Problem Formulation and Brainstorming**

Constructing Cause-Effect Diagram (PF#1) of Whole Situation

Eliminating Harmful Elements, Improving Useful Elements, and Resolving Contradictions.

Process of Solving Problem with I-TRIZ (2/2)

◆ **Sorting Ideas** (Building PF#2)

1. Grouping Ideas from the standpoint of functions.
2. Grouping Ideas from the standpoint of parts.
3. Identifying and solving Secondary Problems of Concepts (Building PF#3)

◆ **Combining Ideas into Concepts**

◆ **Evaluating Results**

Case Study (Project Initiation)

1. Project Objectives

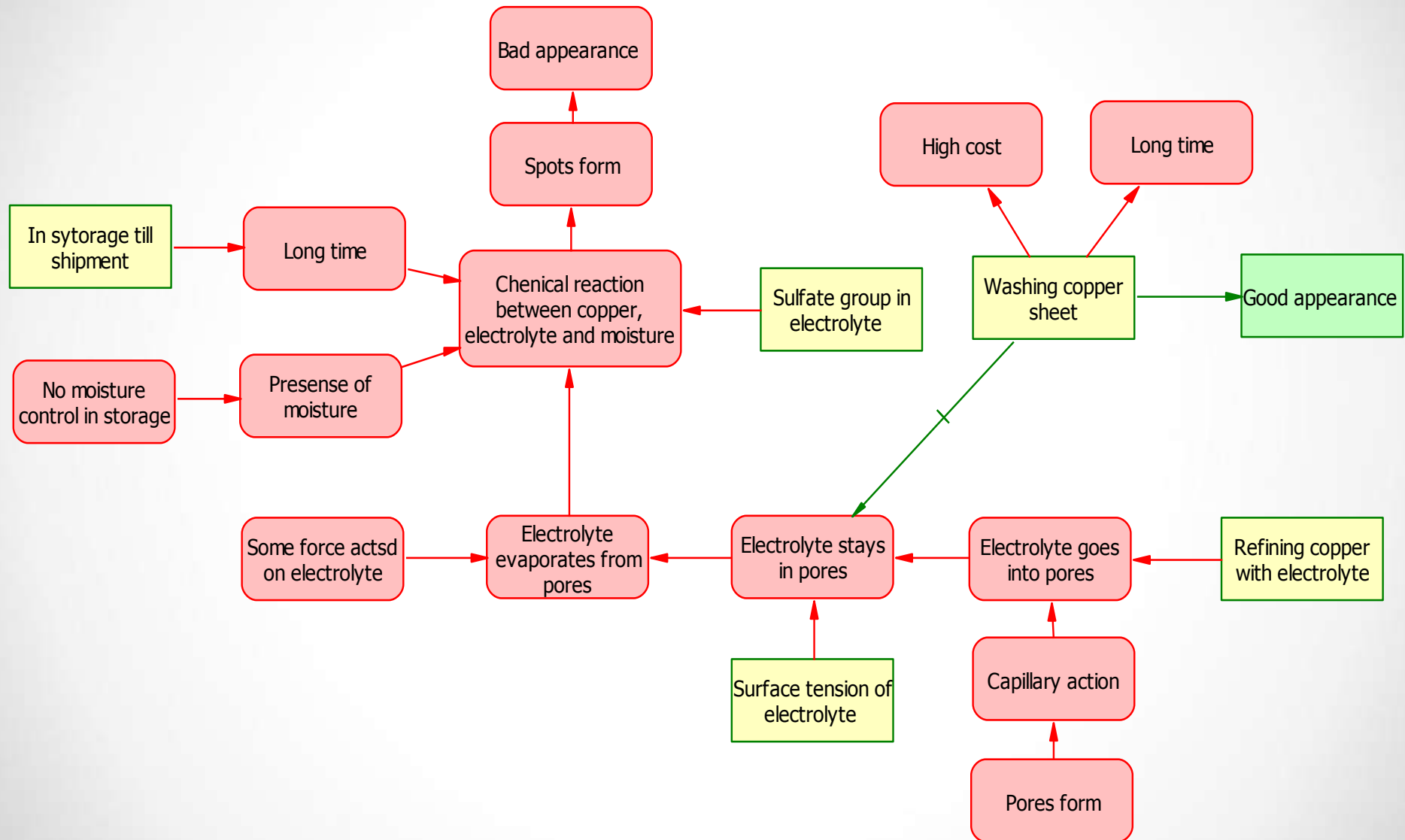
To keep the appearance of copper sheets beautiful.

2. Problem to be Solved

To prevent spots on the surface.

To reduce time and cost for washing.

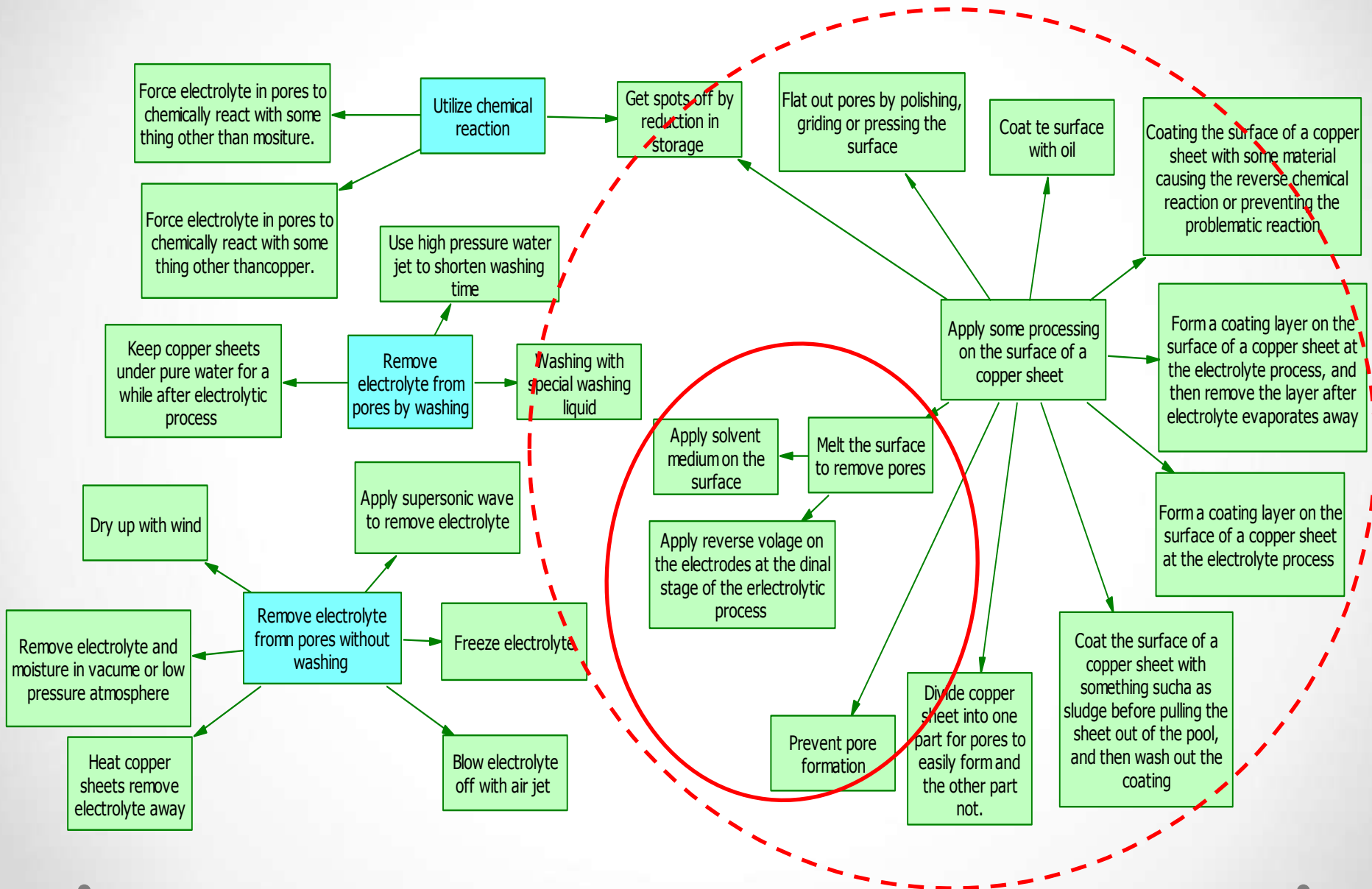
Case Study (Whole Situation Diagram PF#1)



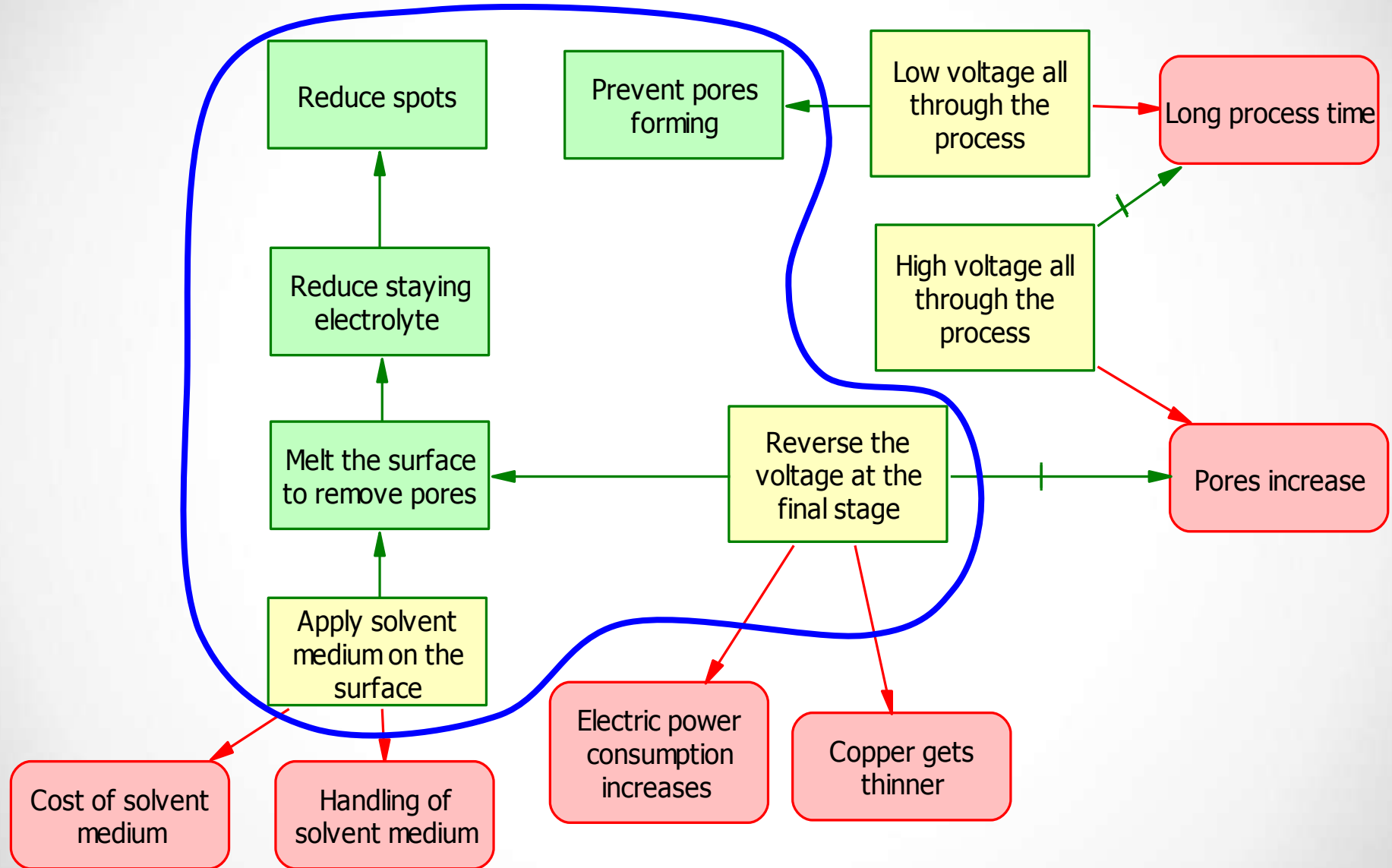
Case Study (Examples of Direction for Solving Problem)

- 1. Find an alternative way to obtain *Washing copper sheet* that offers the following: provides or enhances *Good appearance* eliminates, reduces, or prevents *Electrolyte stays in pores* does not cause *Long time* and *High cost*.
- 13. Resolve the contradiction: *Refining copper with electrolyte* shouldn't be provided to avoid *Electrolyte goes into pores*.
- 16. Find a way to eliminate, reduce, or prevent *Pores form* in order to avoid *Capillary action*.

Case Study (Idea Categorizing Diagram PF#2)



Case Study (Working on Secondary Problems PF#3)



Case Study

(Example of Direction for Solving Secondary Problem)

1. Find an alternative way to obtain *Reverse the voltage at the final stage* that offers the following: provides or enhances *Melt the surface to remove pores* eliminates, reduces, or prevents *Pores increase* does not cause *Copper gets thinner* and *Electric power consumption increases*.
2. Resolve the contradiction: *Reverse the voltage at the final stage* should be provided to produce *Melt the surface to remove pores* and should be provided to counteract *Pores increase*, and shouldn't be provided to avoid *Copper gets thinner* and *Electric power consumption increases* .

Case Study (Refined Idea)

Electrolytic process

with high electric voltage during the main stage,
and low voltage at the final stage.

⇒ Preventing pores formation on the surface so that the electrolyte no longer stay on the surface,
to solve **the original problem.**

⇒ Preventing “getting thin” of copper sheets and electric power consumption loss,
to solve **the secondary problem.**

Case Study (What We Learned)

For Obtaining High Quality Patents:

Whole Situation Diagram (PF#) and Idea Categorizing Diagram (PF#2)

⇒ Having an **exhaustive set of elements** and **hierarchic structure covering different detail levels of elements** is important.

Diagram for Working on Secondary Problems (PF #3)

⇒ **Deep analysis on each element** is important

For Effective Cooperation of Patent Attorneys, Inventors and Staff Members of IP branches.

Strength of **Patent Attorneys**:

- The notion of “Structural / functional elements” , and
- Broad knowledge over various technical fields.

Strength of **Inventors**:

- Expertise in a specific technical field, and
- Skill of applying technologies in other fields on a specific product.

Strength of **Staff Members of IP Div.:**

- understanding of direction of the business, and
- knowledge on marketing.

Teaming up those three parties' strengths in a complementary or synergistic manner is important.