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Proposal and verification of a creation technique by the antithetical analogy approach utilizing TRIZ

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Masao Oda
Head of Manufacturing Classroom
Talent Development Center
Mitsubishi Electric Corporation

三菱電機株式会社

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1. Introduction
2. Background of research
3. Creation technique by antithetical analogy approach
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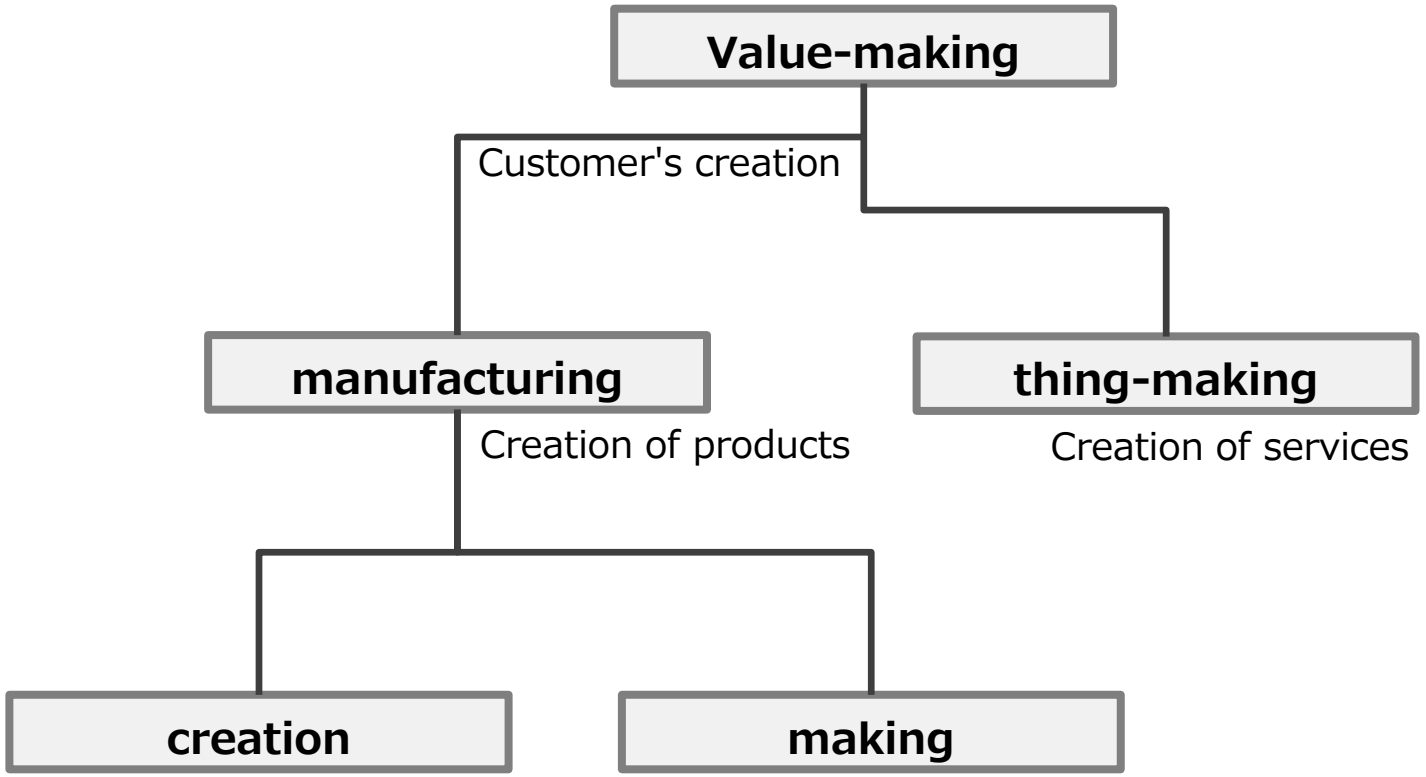
Value-making, manufacturing and thing-making



Technology

Performance, quality, and cost
Amount of capital investment and sale price
The decision

Skill

(processing, assembly, and inspection)

Target performance and quality
The targeted cost was filled.
Product making

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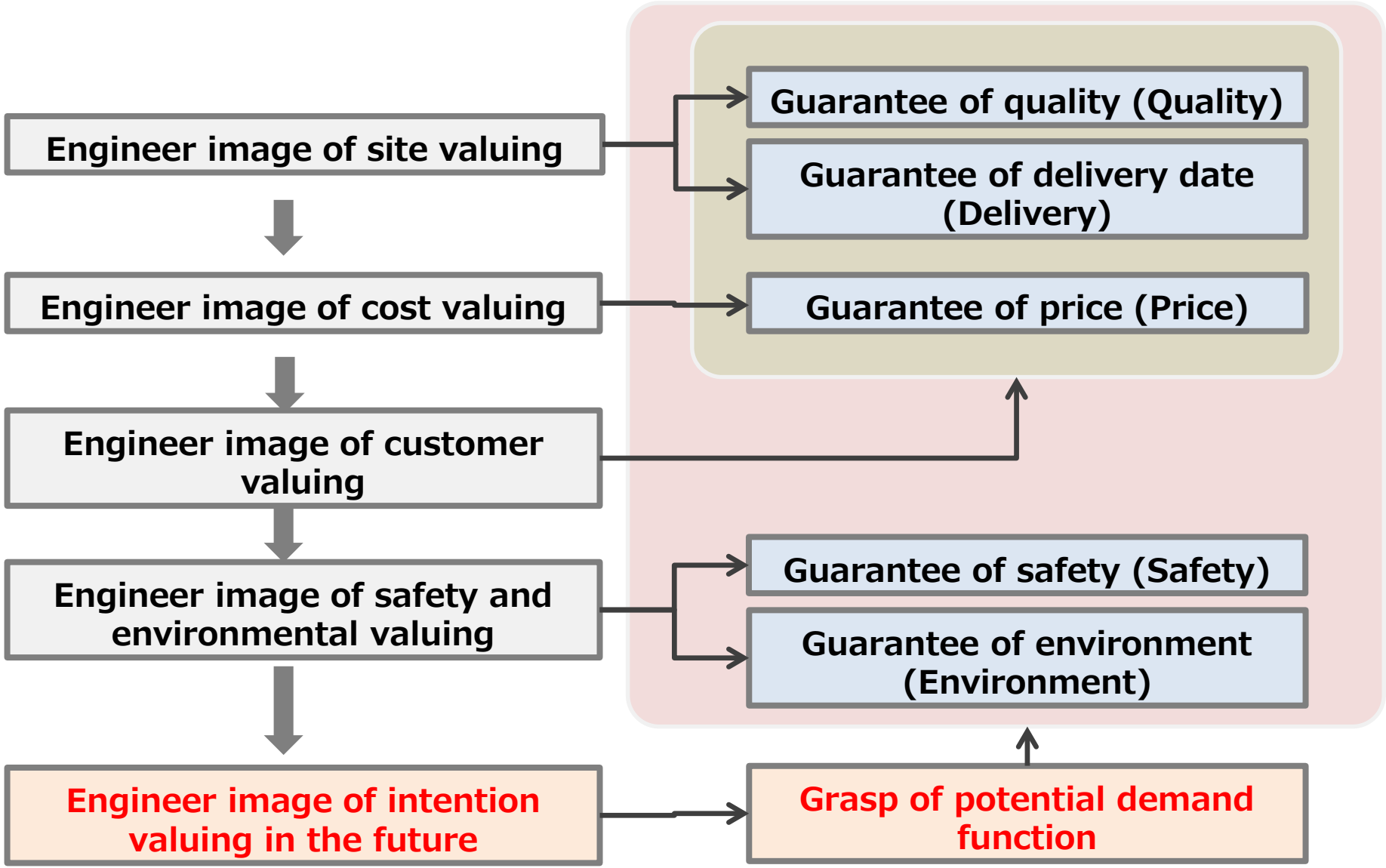
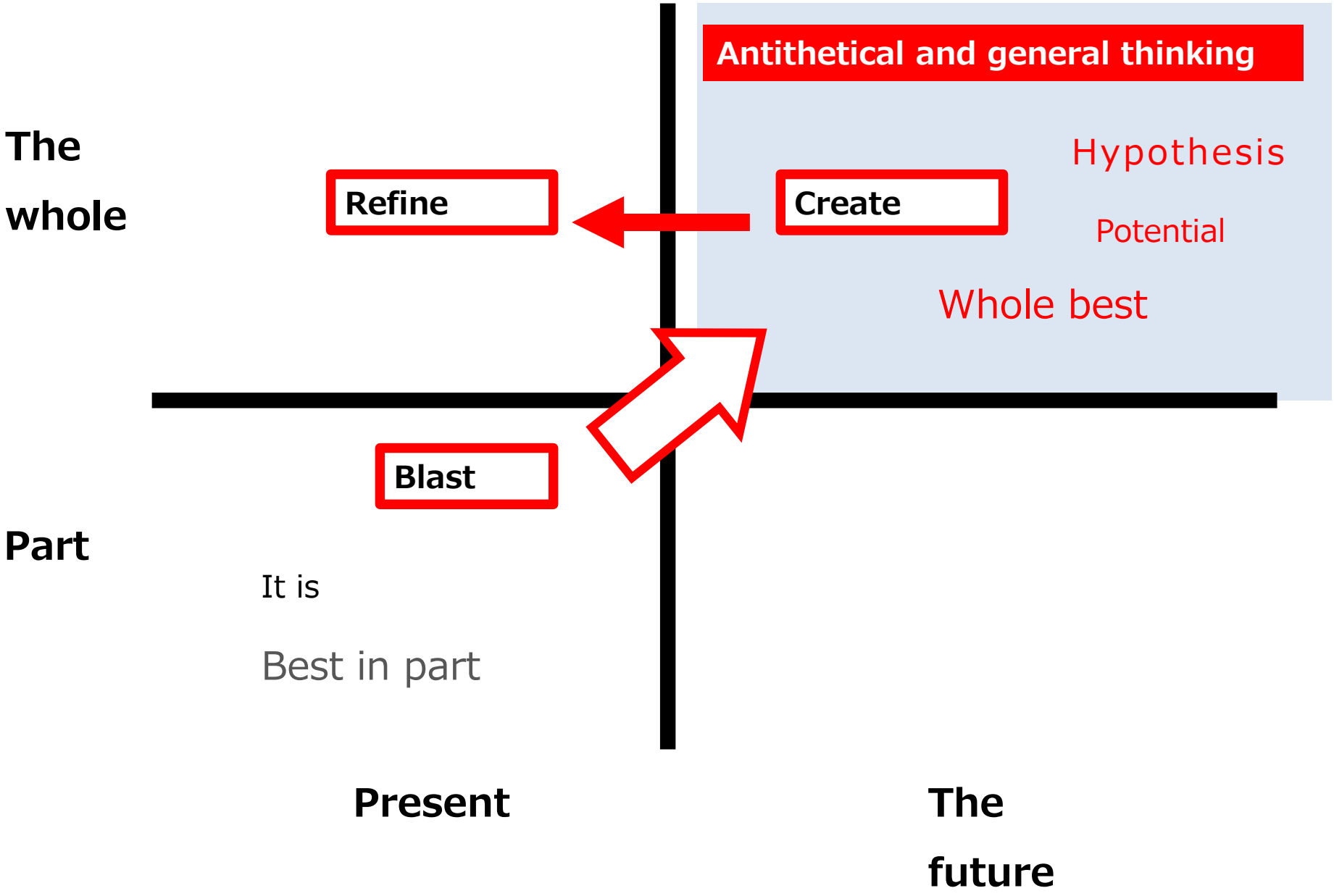
Related chart of item and customer satisfaction element that engineer should value



Source: Sawaguchi study: Latest Japanese style thing-making engineering introductory innovation creation type VE/TRIZ and this [tomokan] 2015

Part, present, and the whole and the future



Aim of research

The individual finds the customer's potential demand at the project stage, and the creation technique to obtain a new idea is constructed.

It is difficult to create a basic idea to satisfy the customer's potential demand at the project stage of the one-making.

(1)There is no clue of the conception.

(2)The expansion of creativity of the project stage by the group is difficult.

(3)Power to form the problem is insufficient.

These difficulties are overcome, the individual finds the customer's potential demand, and the creation technique to obtain a new idea is constructed.

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Blast·Create·Refine

Blast of Blast·Create·Refine is important to find the customer's potential demand.

The creation technique by the antithetical analogy approach is a method for **Blast** connected with Create.

Blast

- A general view is excluded.
- The aspect is changed.
- The viewpoint is raised.

Create

- Down shot
- It thinks by zero base.

Refine

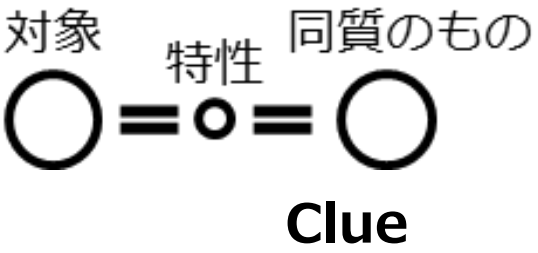
- It piles it up in land with a cleared surface.

Conception from homogeneous, contrapositive and antithetical

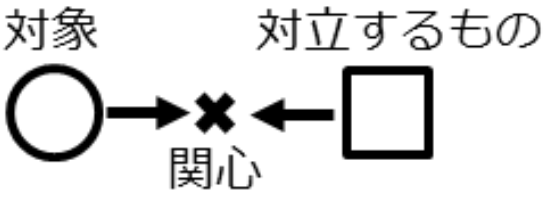
It becomes possible to obtain a different clue for the individual the indicator the concept of showing the relation to the object.

It is effective in the point for the concept of antithetical to bring the unpredictable quality.

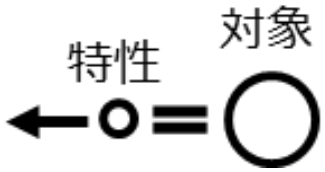
Homogeneous Both of the object and the clue have the same characteristic.

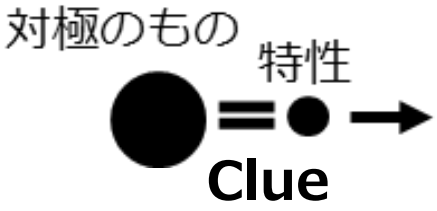


Contrapositive It is opposite and faces the concern that the object is the same as both of the clue.

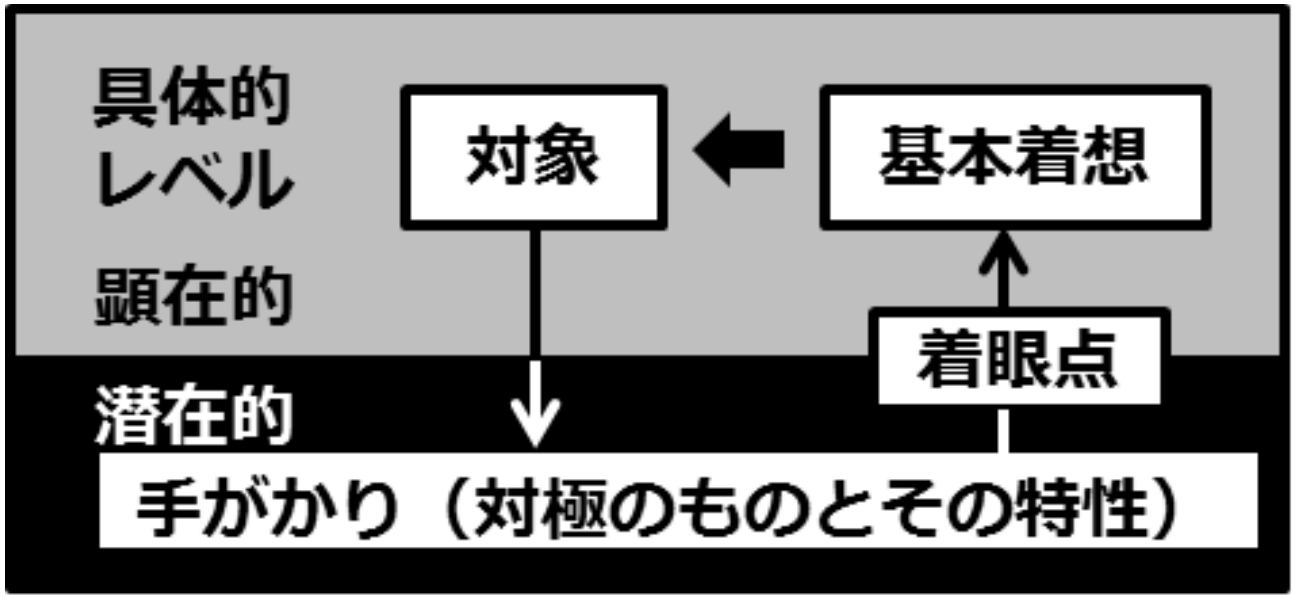


Antithetical The object and the clue have the characteristic that two extremes are far apart.





Creation of idea by antithetical approach



個人で類比により発想

対極類比アプローチによる創造手法

Object of development Consumer electronic recycling factory

Object of development

・Consumer electronic recycling factory

・A small-scale project group worked on the development of the product resolution line of the recycling factory.

Development of product resolution line

・The leader of the group privately corresponds to the specification meeting with the customer at the project stage.

・The leader obtained the clue of semiconductor plant that was quite different from the recycling factory because he or she conceived it because of the antithetical concept.

・An unexpected aimed point of watch/management of the clean room purify gave birth, and this rouse the customer’s potential demand

・The development design to achieve a basic idea of the development of the equipment that monitors the dust level of each place in the recycling factory etc. is executed in the project team.

A case study applying the creation technique by antithetical approach

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Creation technique by antithetical approach - effect -

1) The clue of the conception can be easily set.

2) The point aimed at at an individual level with the unpredictable quality can be conceived.

Creation technique by antithetical approach - problem -

1) It has the fault of far parting from a technical content when the idea conception left to free association is assumed.

2) When such a fault appears, it is difficult to derive the fundamental design solution from the obtained idea when it is necessary to search for the principle of operation and the operation structure technically like the product development and the equipment development, etc.

Use of TRIZ

TRIZ　－Effect of TRIZ－

The 40 invention principles are derived from a great number of patent analysis.

1) The directionality that should be created is logically suggested.

2) A general idea conception is promoted.

3) It becomes an idea conception because of a technical viewpoint with high universality.

Proposal

Creation technique by extreme-opposite approach using TRIZ

1) The invention principles of TRIZ are used, overcoming the fault of the creation technique by antithetical approach, and improving the effectiveness of the technique.

2) Among the 40 invention principles of TRIZ, the invention principles to obtain ideas with unpredictable quality is selected and used. These invention principles contain antithetical concepts which derive characteristics that are quite different and far apart from the object. The number of these invention principles becomes ten, and are called the 10 antithetical invention principles.

40 invention principles

TRIZ 40 invention principles

1. Segmentation
2. Extract/Taking off
3. Local quality
4. Asymmetry
5. Merge
6. Universality
7. Nested-doll
8. Anti-weight
9. Preliminary counteraction
10. Preliminary action
11. Beforehand cushioning
12. Equipotentiality
13. The other way round
14. Curvature
15. Dynamics
16. Partial or excessive actions
17. Another dimension
18. Mechanical vibration
19. Periodic action
20. Continuity of useful action
21. Skipping
22. Blessing in disguise
23. Feedback
24. Intermediary
25. Self-service
26. Copying
27. Cheap short-living objects
28. Mechanics substitution
29. Pneumatics and hydraulics
30. Flexible shells and thin films
31. Porous materials
32. Color changes
33. Homogeneity
34. Discarding and recovering
35. Parameter changes
36. Phase transitions
37. Thermal expansion
38. Strong oxidants
39. Inert atmosphere
40. Composite materials

40 invention principles

TRIZ 40 invention principles in 3 types and 9 groups

Conceptual	Divide	1. Segmentation 2. Extract/Taking off 3. Local quality 4. Asymmetry
	Combine	5. Merge 6. Universality 7. Nested-doll 8. Anti-weight
	In advance	9. Preliminary counteraction 10. Preliminary action 11. Beforehand cushioning 12. Equipotentiality
Technical	Change shape	13. The other way round 14. Curvature 15. Dynamics 16. Partial or excessive actions
	Increase efficiency	17. Another dimension 18. Mechanical vibration 19. Periodic action 20. Continuity of useful action
	Eliminate harm	21. Skipping 22. Blessing in disguise 23. Feedback 24. Intermediary
	Labor saving	25. Self-service 26. Copying 27. Cheap short-living objects 28. Mechanics substitution
Material	Change of material	29. Pneumatics and hydraulics 30. Flexible shells and thin films 31. Porous materials 32. Color changes 33. Homogeneity 40. Composite materials
	Change of phase	34. Discarding and recovering 35. Parameter changes 36. Phase transitions 37. Thermal expansion 38. Strong oxidants 39. Inert atmosphere

Selection of Antithetical invention principles

Process of selecting 10 antithetical invention principles out of 40 Invention principles

Conceptual	Divide	1. Segmentation 2. Extract/Taking off 3. Local quality 4. Asymmetry
	Combine	5. Merge 6. Universality 7. Nested-doll 8. Anti-weight
	In advance	9. Preliminary counteraction 10. Preliminary action 11. Beforehand cushioning 12. Equipotentiality
Technical	Change shape	13. The other way round 14. Curvature 15. Dynamics 16. Partial or excessive actions
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	Labor saving	25. Self-service 26. Copying 27. Cheap short-living objects 28. Mechanics substitution
Material	Change of material	29. Pneumatics and hydraulics 30. Flexible shells and thin films 31. Porous materials 32. Color changes 33. Homogeneity 40. Composite materials
	Change of phase	34. Discarding and recovering 35. Parameter changes 36. Phase transitions 37. Thermal expansion 38. Strong oxidants 39. Inert atmosphere

Selection 2 : Eliminate 'Combine' and 'In advance' types (from 5 to 12)

Selection 3: Select invention principles which match the antithetical concept

Selection 1 : Eliminate 'Material type' (from 29 to 40)

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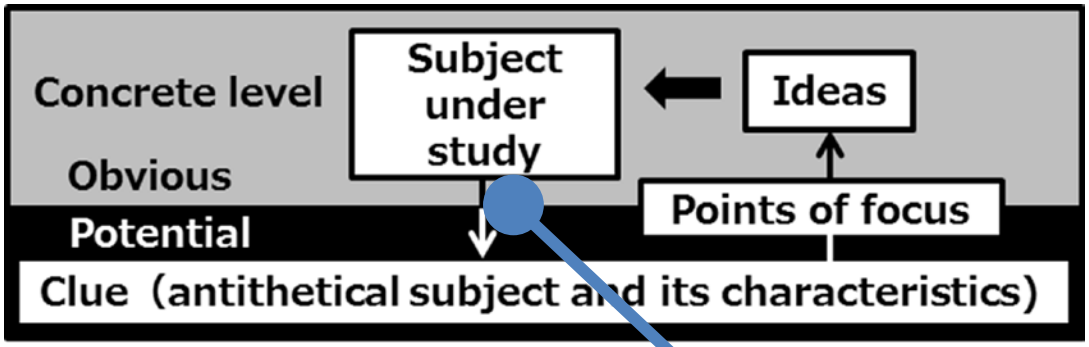
10 Antithetical invention principles and Characteristic of antithetical subject

No.	１０の対極発明原理 1 0 Antithetical invention principles	対極の特性 Characteristics of antithetical subject	
1	① 分割 Segmentation	Segmentation	Whole
2	② 抽出 Extract/Taking off	Extraction	Mixture
3	④ 非対称 Asymmetry	Asymmetrical	Symmetrical
4	⑬ 逆発想 The other way round	Reverse	Forward
5	⑭ 曲面 Curvature	Curvature	Plane
6	⑮ 可変性 Dynamics	Variable	Fixed
7	⑰ 他次元移行 Another dimension	Surface	Line
8	⑲ 周期的作用 Periodic action	Periodic	Continuous
9	㉒ 害益 Blessing in disguise	Disadvantage	Benefit
10	㉗ 使い捨て Cheap short-living objects	Temporary	Permanent

Use of the 10 antithetical invention principles

Antithetical analogical approach to creativity method with the use of TRIZ

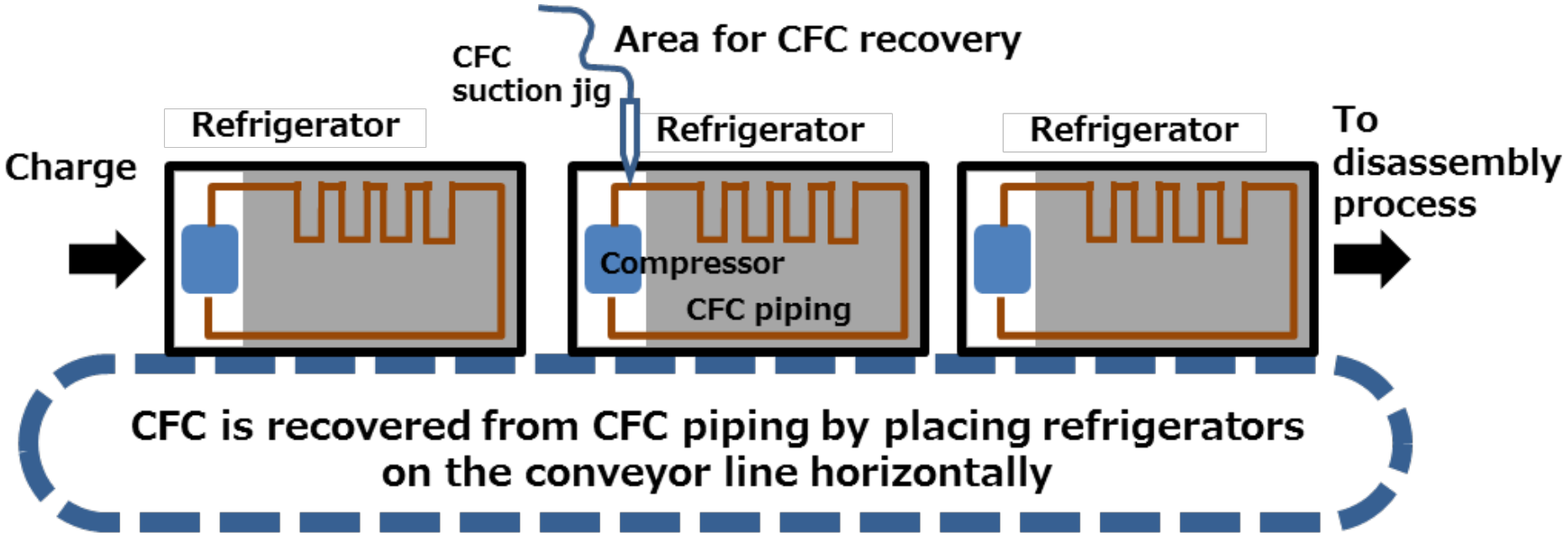


Apply all 10 antithetical invention principles one by one to the subject under study

No.	10 Antithetical invention principles
1	Segmentation
2	Extract/Taking off
3	Asymmetry
4	The other way round
5	Curvature
6	Dynamics
7	Another dimension
8	Periodic action
9	Blessing in disguise
10	Cheap short-living objects

General CFC recovery method used in recycling plants

General CFC recovery method used in recycling plants



General method of recovering CFC

Application of the 10 antithetical invention principles

General CFC recovery method used in recycling plants

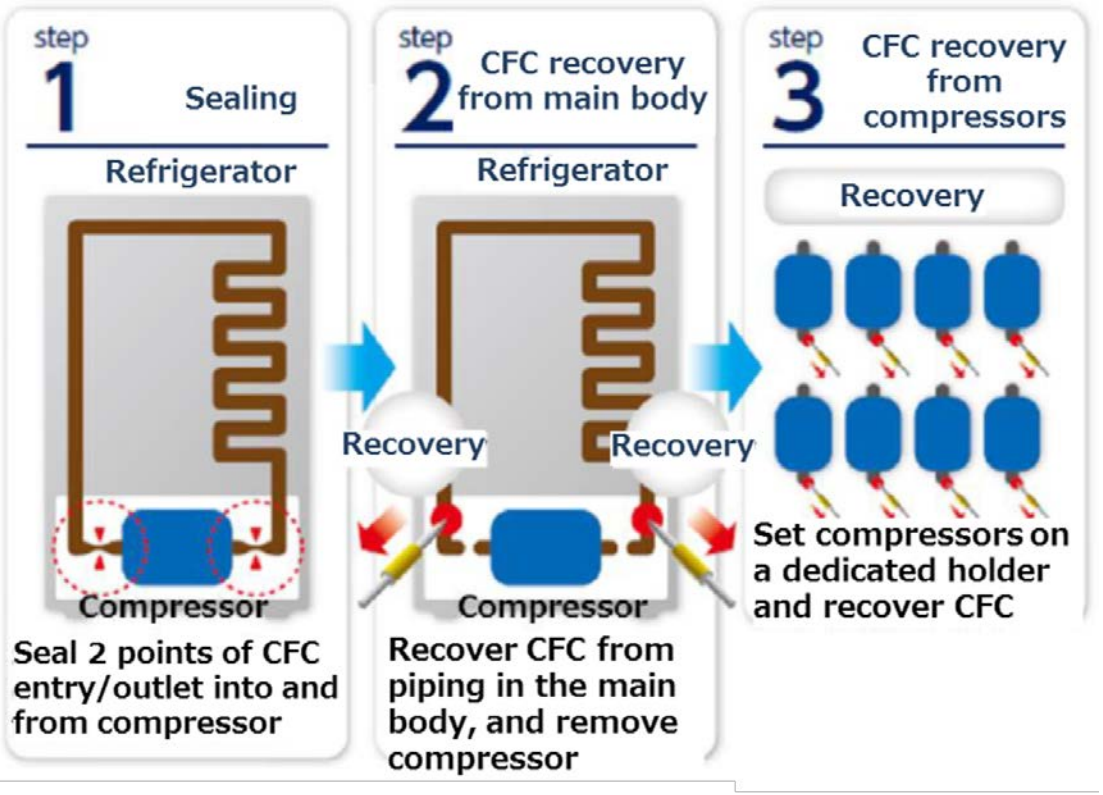
No.	10 Antithetical invention principles
1	Segmentation
2	Extract/Taking off
3	Asymmetry
4	The other way round
5	Curvature
6	Dynamics
7	Another dimension
8	Periodic action
9	Blessing in disguise
10	Cheap short-living objects

Ideas obtained by 10 antithetical invention principles

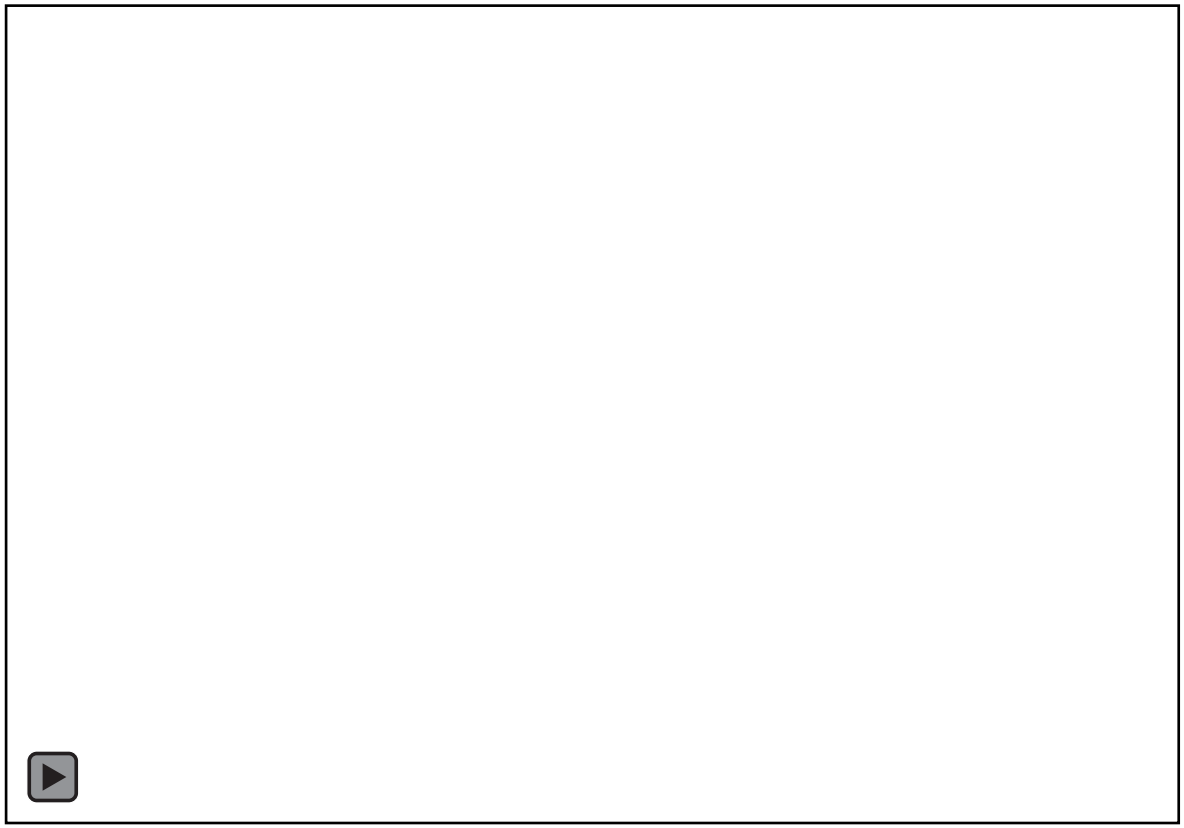
No.	Points of focus
1	Separate CFC piping and compressor
2	Remove compressor from refrigerator and recover CFC
3	Recover CFC by placing refrigerator vertically
4	Recover CFC after disassembling refrigerator partially
5	Form CFC recovery line in letter U shape
6	Recover CFC while keeping refrigerator in standstill condition
7	Separate lines for CFC recovery from CFC piping and compressor
8	Set the point of stopping CFC suction at the level where specified volume of CFC recovery is reached
9	Recover CFC for multiple compressors together
10	Standardize jigs, and make some jigs disposable

Method of collecting reformative fluorocarbon

Innovative CFC recovery



Method of collecting reformative fluorocarbon



Result and consideration

(1) Result

1)Development was able to completed by not the unreal one but the team design in a short term and to put an individual, new idea that composes each step to practical use though there was no basic idea of the fluorocarbon collection method that applies this creation technique and obtains it so far epoch-making.

2)As a result, the fluorocarbon collection efficiency at the highest level

in the country was achieved.

Result and consideration

(2) Consideration　Important point in creation process of new value

1)The problem of the general method to be developed was not made a starting point but the 10 antithetical invention principles were applied to a general method, and a antithetical analogy approach was applied.

2)A general method was invented, and the Blast doing and it were invented and an epoch-making method to put out the problem deflecting of the past as a result of working on Create and Refine in the starting point was able to be invented. .

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Summary

1)The solution and the improvement of a problem and technical contradiction of the method are important approaches so far. However, application of the improvement tool alone is not a role of TRIZ because it persists in the problem solving.

2)It thinks the creation of the touched value to be possible according to the use of TRIZ by watching a development of view of extension object and the previous customer in the society.