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Some note of caution!

Since we changed a lot words to make the 40 IP more uniform, this may lead to different understanding of the IP!

If you doubt any formulation from below please check the original 40 Inventive Principles (from either references at the back). Please provide feedback if you notice any irregularities. It might be helpful to read our article on “Strengthening the 40 Inventive Principles”.

When starting to use these principles you should define which objects you call the system, subsystem en supersystem.

Full list of changed principles split up in resource and recommendation:

Principle 1. Segment

Resources: define the *sides and planes* of the system, define how you disassemble the system and look at the difficulties.

Operate to:

- A. Divide the systems into independent subsystems per plane.
- B. Make a system easy to disassemble .
- C. Increase the degree of fragmentation or segmentation.

Principle 2. Take out

Resources: define the interfering (sub)systems, define all properties for all the systems

Operate to:

- A. Separate the interfering subsystem(s) or properties from a system
- B. Single out the only necessary subsystem (or property) of a system.

Principle 3. Create local quality

Resources: Define the system(s) and super system. Define the function(s) of the system. Define all properties of the system and super system which are uniform (e.g. shape, form, strength, structure, electrical, temperature, visual, surface,..)

Operate to:

- A. Change a system's structure/super system from uniform to non-uniform
- B. Make each subsystem of a system function in conditions most suitable for its process.
- C. Place a different and useful function on a subsystem of the system
- D. Enable each subsystem to carry out a different (possibly directly opposite) and useful function

Principle 4. Create Asymmetry

Resources: Define the points, planes, volumes of symmetries of the system. Think about distances (x, y, z) and angles (α , β , γ). Define the asymmetries of the system.

Operate to:

- A. Change the shape/form of the system from symmetrical to asymmetrical.
- B. Increase its degree of asymmetry on the asymmetric subsystems.

Principle 5. Merge

Resources: Define all identical or similar systems in space and time.

Operate to:

- A. Bring closer together (or merge) identical or similar systems



- B. Assemble identical or similar subsystems to perform parallel processes.
- C. Make processes contiguous or parallel; bring them together in time.

Principle 6. Create universality

Resources: Define all systems. Define all functions of the systems.

Operate to:

- A. Transform functions from one subsystem to another, making a subsystem or system perform multiple functions
- B. Eliminate the need for other subsystems.

Principle 7. Nest

Resources: Define all systems. Define all cavitations in the systems, all spaces, not used directions, planes, volumes.

Operate to:

- A. Place one system inside another; place each system, in turn, inside the other.
- B. Make one subsystem pass through a cavity in the other.

Principle 8. Create Anti-weight

Resources: Define the systems that are heavy. Define all (super system, system specific) systems that provide lift (e.g. aerodynamic, hydrodynamic, buoyancy and other forces).

To compensate for the weight of a system, operate to:

- A. Merge it with other systems that provide lift.
- B. Make it interact with the super system.

Principle 9. Create Preliminary anti-process

Resources: Define the processes to perform with both harmful and useful effects. Locate all possible stresses in a system.

Operate to:

- A. Replace process with anti-processes to control harmful effects.
- B. Create beforehand stresses in a system that will oppose known undesirable working stresses later on.

Principle 10. Create Preliminary process

Resources: Define the (sub)systems in order of appearance when they come into process.

Operate to:

- A. Perform, before it is needed, the required change of a system (either fully or partially).
- B. Pre-arrange systems such that they can come into process from the most convenient place and without losing time for their delivery.

Principle 11. Cushion beforehand

Resources: Define the emergency means, define the systems.

For the relatively low reliability of a system, operate to:

- A. Prepare emergency means beforehand to compensate.

Principle 12. Create Equipotentiality

Resources: Define all the position changes of systems. Determine the operating conditions.

Operate to:

- A. Limit position changes in a potential field
- B. Change operating conditions to eliminate the need to raise or lower systems in a gravity field).



Principle 13. Invert

Resources: Define all the processes and functions, the systems and subsystems and the super system. Determine the orientations of all subsystems.

Operate to:

- A. Invert the process(es) (e.g. instead of cooling a system, heat it).
- B. Change from movable subsystems (or the external super system) to fixed, and from fixed subsystems to movable).
- C. Invert the position of the system (or process) 'upside down'.

Principle 14. Create spheroidality - Curve

Resources: Define all rectilinear subsystems (Think about distances (x,y,z) and angles (α , β , γ)), surfaces, or forms of the systems and subsystems of the super system. Define all linear motions

Operate to:

- A. Change from rectilinear subsystems, surfaces, or forms to curvilinear ones; change from flat surfaces to spherical ones; from subsystems shaped as a cube (parallelepiped) to ball-shaped structures.
- B. Use rollers, balls, spirals, domes.
- C. Change from linear to rotary motion, use centrifugal forces.

Principle 15. Dynamize

Resources: Define all systems, the properties of the system, external super system, or process. Find all fixed and inflexible systems or processes

Operate to:

- A. Allow (or design) the properties of a system, external super system, or process to change to be optimal or to find an optimal operating condition.
- B. Divide a system into subsystems capable of movement relative to each other.
- C. Change a system(or process) from rigid or inflexible to movable or adaptive.

Principle 16. Create partial or excessive processes

Resources: Define the systems, properties.

If 100 percent of a property of a system is hard to achieve using a given solution method then operate to:

- A. Increase and decrease 'slightly less' or 'slightly more' the property

Principle 17. Use another dimension

Resources: Define all sides, directions of the system. Think about distances (x,y,z) and angles (α , β , γ). Define all planes. Define the arrangement with other systems.

Operate to:

- A. Change the system from one to two- or three-dimensional space.
- B. Use a multi-story arrangement of systems instead of a single-story arrangement.
- C. Tilt or re-orient the position system, lay it on its side.
- D. Use 'another side' of the system.

Principle 18. Vibrate mechanical

Resources: Define all the movement (linear or angular) of the systems.

Operate to:

- A. Cause the system to oscillate or vibrate.
- B. Increase its frequency (even up to the ultrasonic).
- C. Use the system's resonant frequency.
- D. Use piezoelectric vibrators instead of mechanical ones.
- E. Use combined ultrasonic and electromagnetic field oscillations.



Principle 19. Act periodic

Resources: Define all the movement of the systems.

Operate to:

- A. Change from continuous process, to periodic or pulsating processes.
- B. Change the periodic magnitude or frequency.
- C. Use pauses between impulses to perform a different process.

Principle 20. Continue a useful process

Resources: Define all the useful and idle or intermittent processes.

Operate to:

- A. Carry on work continuously; Change from all subsystems of a system work at full load, all the time.
- B. Eliminate all idle or intermittent processes.

Principle 21. Skip

Resources: Define all the processes that are destructible, harmful or hazardous.

Operate to:

- A. Conduct a process, or certain stages at high speed.

Principle 22. "Use harmful effects

Resources: Define all harmful processes of the systems or harmful effects of the super system or super systems.

Operate to:

- A. Use harmful function, property or object from the super system to achieve a positive effect.
- B. Adding the primary harmful to another harmful process to eliminate the primary.
- C. Amplify a harmful function, property to such a degree that it is no longer harmful.

Principle 23. Create Feedback

Resources: Define all processes where no feedback is present.

Operate to:

- A. Introduce feedback (referring back, cross-checking) to improve a process or process.
- B. Change its magnitude or influence.

Principle 24. Use 'Intermediary'

Resources: Define all possible intermediary carriers of processes

Operate to:

- A. Use an intermediary carrier object or intermediary process.
- B. Merge one system temporarily with another (which can be easily removed).

Principle 25. Create Self-service

Resources: Define all waste resources, energy or substances. Define auxiliary helpful functions.

Operate to:

- A. Make a system serve itself by performing auxiliary helpful functions
- B. Use waste resources, energy or substances.

Principle 26. Copy

Resources: Define unavailable, expensive, fragile systems.

Operate to:



- A. Instead of an unavailable, expensive, fragile system, use simpler and inexpensive copies.
- B. Replace a system or process with optical copies.
- C. Change from visible optical copies to infrared or ultraviolet copies.

Principle 27. Use cheap short-living systems

Resources: Define all inexpensive systems.

Operate to:

- A. Change from inexpensive system to a multiple of inexpensive systems, comprising certain qualities (such as service life, for instance).

Principle 28 Substitute mechanics

Resources: Define all (mechanical) fields.

Operate to:

- A. Change a mechanical field to a sensory (optical, acoustic, taste or smell) means.
- B. Use electric, magnetic and electromagnetic fields to interact with the system.
- C. Change from static to movable fields, from unstructured fields to those having structure.
- D. Use fields in conjunction with field-activated (e.g. ferromagnetic) particles.

Principle 29. Substitute solid

Resources: Define all solid systems.

Operate to:

- A. Change from solid subsystems to gas and liquid subsystems (e.g. inflatable, filled with liquids, air cushion, hydrostatic, hydro-reactive).

Principle 30. Use Flexible shells and thin films

Resources: Define all 3D structures of the systems.

Operate to:

- A. Change from three dimensional structures to flexible shells and thin films
- B. Isolate the system from the external super system using flexible shells and thin films.

Principle 31. Use Porous materials

Resources: Define the structure systems.

Operate to:

- A. Make a system porous or add porous elements (inserts, coatings, etc.).
- B. Use the pores to introduce a useful substance or function.

Principle 32. Use colour changes

Resources: Define the colour of the systems or its external super system.

Operate to:

- A. Change the colour of a system or its external super system.
- B. Change the transparency of a system or its external super system.

Principle 33. Use homogeneity

Resources: Define the a-identical properties of the systems .

Operate to:

- A. Make systems interacting with a given system of the same material (or material with identical properties).

Principle 34. Discard and recover

Resources: Define if the systems are useful after the process.



Operate to:

- A. Make portions of a system that have fulfilled their functions go away (discard by dissolving, evaporating, etc.) or modify these directly during process.
- B. Conversely, restore consumable subsystems of a system directly in process.

Principle 35. Change Property

Resources: Define the temperature, state, flexibility, concentration and consistency of all the systems.

Operate to:

- A. Change a system's physical state (e.g. to a gas, liquid, or solid).
- B. Change the concentration or consistency.
- C. Change the degree of flexibility.
- D. Change the temperature.

Principle 36. Use Phase transitions

Resources: Define possible phenomena (e.g. volume changes, loss or absorption of heat, etc.). during phase transitions .

Operate to:

- A. Use phenomena occurring during phase transitions

Principle 37. Expand thermal

Resources: Define the coefficients of thermal expansion or contra-process of the systems.

Operate to:

- A. Use thermal expansion (or contra-process) of materials.
- B. If thermal expansion is being used, use multiple materials with different coefficients of thermal expansion.

Principle 38. Use strong oxidants

Resources: Define quality of the air.

Operate to:

- A. Replace common air with oxygen-enriched air.
- B. Replace enriched air with pure oxygen.
- C. Expose air or oxygen to ionizing radiation.
- D. Use ionized oxygen.
- E. Replace ozonized (or ionized) oxygen with ozone.

Principle 39. Use inert atmosphere

Resources: Define the conditions of the super systems.

Operate to:

- A. Replace a normal super system with an inert one.
- B. Add neutral subsystems, or inert additives to a system.

Principle 40. Use composite materials

Resources: Define the composition of the systems.

Operate to:

- A. Change from uniform to composite (multiple) materials.



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