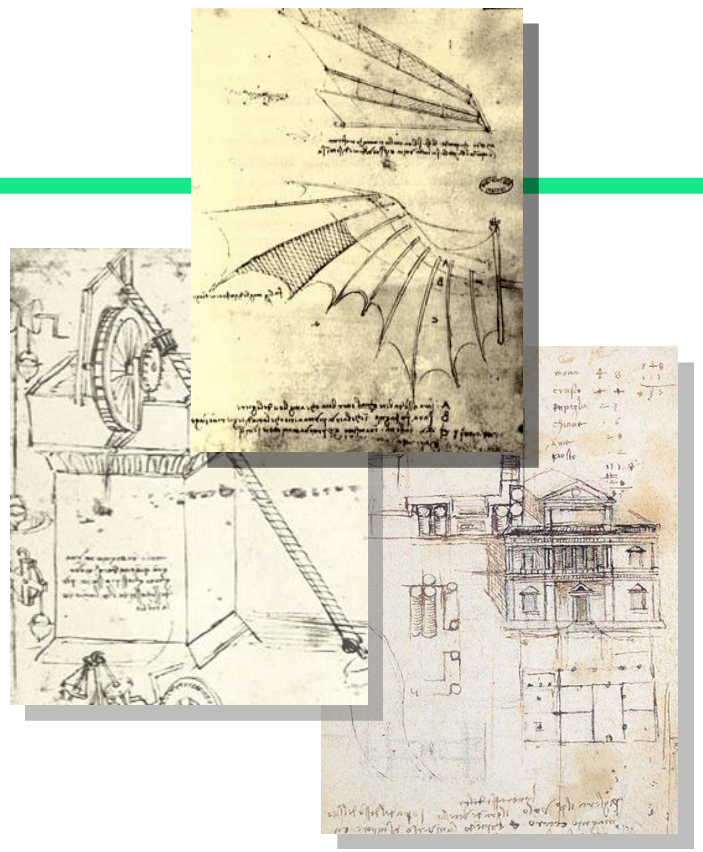
TRIZ CASES FROM AROUND THE WORLD



ICG Training & Consulting

www.xtriz.com

Cases in this presentation were collected from various sources available publically. Use this document for internal training or presentation activities only.

Case 1: Hollywood Studios Crane (The Netherlands / USA)

Disney's HOLLYWOOD STUDIOS

IDpartners
DESIGN FOR INDUSTRY

PROBLEM

A crane which is used to move a camera during a movie shoot is required to have a strong arm: its long segments should not bend or vibrate. To meet these requirements the long-armed crane becomes rather heavy; and to move its arm, a more powerful motor is required. How to improve this situation?

USING TRIZ

		Weight of moving object	Weight of immobile object	Length of moving object	Length of immobile object	Area of moving object
		1	2	3	4	5
1	Weight of moving object		-	15, 8, 29,34	-	29, 17, 38, 34
2	Weight of immobile object	-		-	10, 1, 29, 35	-
3	Length of moving object	8, 15, 29, 34	-		-	15, 17, 4
4	Length of immobile object		35, 28, 40, 29	-		-
5	Area of moving object	2, 17, 29, 4	-	14, 15, 18, 4	-	
6	Area of immobile object	-	30, 2, 14, 18	-	26, 7, 9, 39	-
7	Volume of moving object	2, 26, 29, 40	-	1, 7, 4, 35	-	1, 7, 4, 17
8	Volume of immobile object	-	35, 10, 19, 14	19, 14	35, 8, 2, 14	-
9	Speed	2, 28, 13, 38	-	13, 14, 8	-	29, 30, 34
10	Force	8, 1, 37, 18	18, 13, 1, 28	17, 19, 9, 36	28, 10	19, 10, 15
11	Tension, Pressure	10, 36, 37, 40	13, 29, 10, 18	35, 10, 36	35, 1, 14, 16	10, 15, 36, 28
12	Shape	8, 10, 29, 40	15, 10, 26, 3	29,		
13	Stability of object	21, 35, 2, 39	26, 39, 1, 40	13		
14	Strength	1, 8, 40, 15	40, 26, 27, 1	1		
15	Durability of moving object	19, 5, 34, 31	-			
16	Durability of immobile object	-	6, 27, 19, 16			

TRIZ proposed to solve the problem by using a combination of Inventive Principles: Segmentation and the Use of Composites. A new camera crane was created that consists of telescopic segments made from carbon-reinforced composite material.

SOLUTION

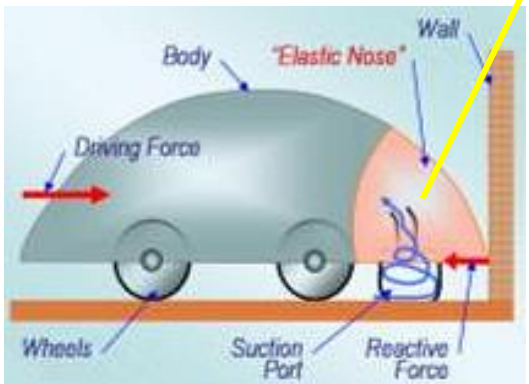
Xtreme T12 crane can move a camera with a weight of up to 60 kg without vibration and the telescopic mechanism allows extending and contracting the arm with the speed of 1,6 m/s to the height of 12 m. Currently used at Hollywood studios.

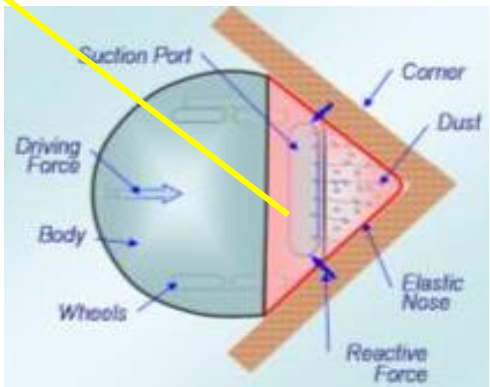
Case 2: Vacuum Cleaning Robot (Korea)

Vacuum Cleaning Robot

Its frontal part is made of elastic rubber
to adjust to the corners

A Vacuum Cleaning Robot
(Samsung)





But dogs love to chew on rubber!
(and the robot gets quickly destroyed)

Contradiction

- We have a contradiction between two demands:
  - The frontal part has to be *flexible* (to adjust to the corners) and *rigid* (to avoid to be chewed on by a dog).
- How do the best inventors solve this type of the contradiction?

Inventive Principle

#1: SEGMENTATION

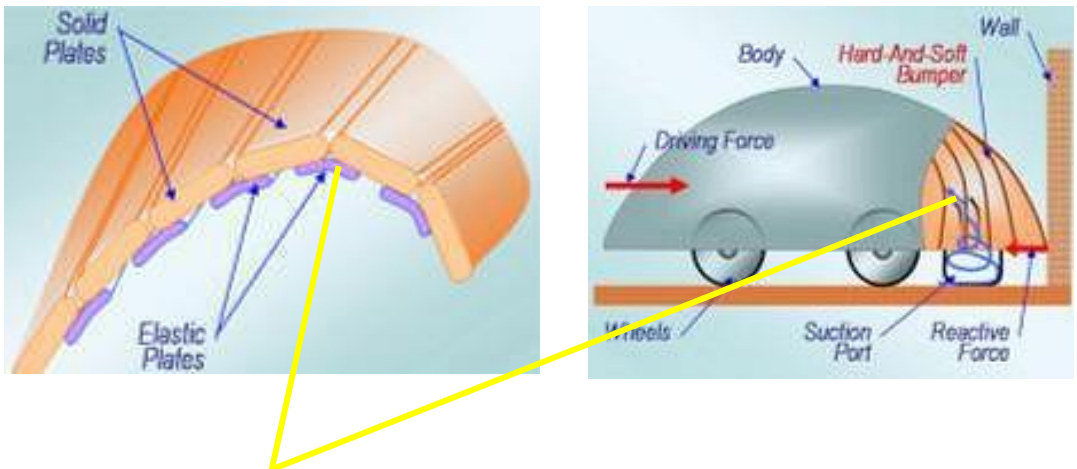
Strategies and recommendations

- ❑ Redesign a monolithic object by splitting it to two or more independent or connected parts.
- ❑ Increase the degree of the object's segmentation (fragmentation).
- ❑ Compose an object from a number of smaller objects, granules, powder, gel, liquid or gas.
- ❑ Compose an object from two or more parts so that some its part can be easily taken away (and brought back) when necessary.
- ❑ Break a process or one of its operations to smaller segments.
- ❑ Increase the degree of segmentation of a process or its operations.

Examples

- o *Short garden hoses can be joined together to form any length needed.*
- o *Folding wooden or plastic ruler consisting of segments.*
- o *Sectional furniture.*
- o *Using bricks to create a wall.*
- o *Segmented sailboat mast.*
- o *An airplane wing consisting of several segments that can change the overall wing geometry.*
- o *Segmented chocolate bars for easy breaking.*
- o *"Segmented" geometry of a knife's blade makes it possible to better cut through porous objects.*
- o *Design of a mobile phone as two connected parts.*
- o *A dish plate with sections for different types of foods.*
- o *Using gels instead of powder in cooking.*
- o *Using gels as a filament in a shoe sole.*
- o *Instead of a continuous process of polishing glass surface with a high force, a series of actions with smaller forces provides a higher quality and accelerates polishing.*
- o *Rock can be crushed more accurately by a series of micro-explosions.*

Applying the principle:



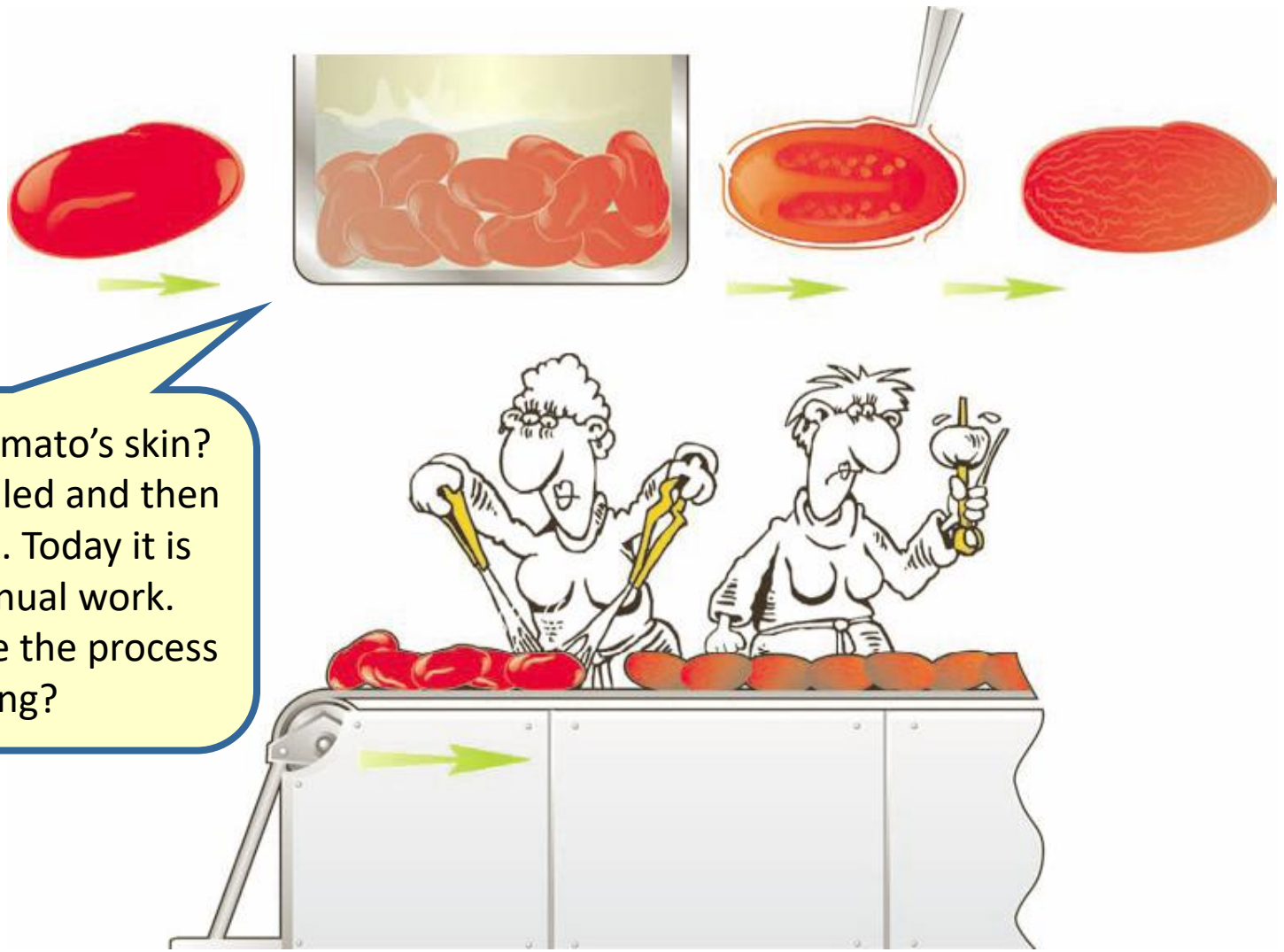
Solution: the frontal part made of solid plastic plates connected with flexible links (inside)

Source: The TRIZ Journal, June 2007

Case 3: Tomatoes Peeling (Italy)

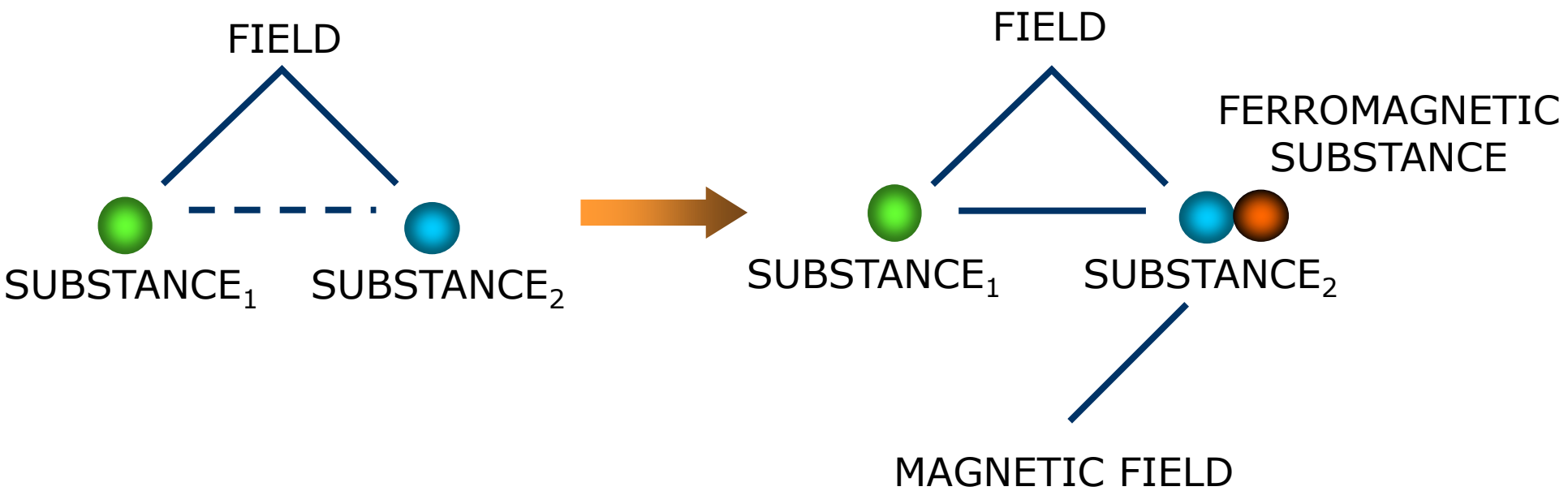
Problem

How to peel a tomato's skin? Tomatoes are boiled and then peeled by hand. Today it is still a hard manual work. How to automate the process of peeling?



Solution Method

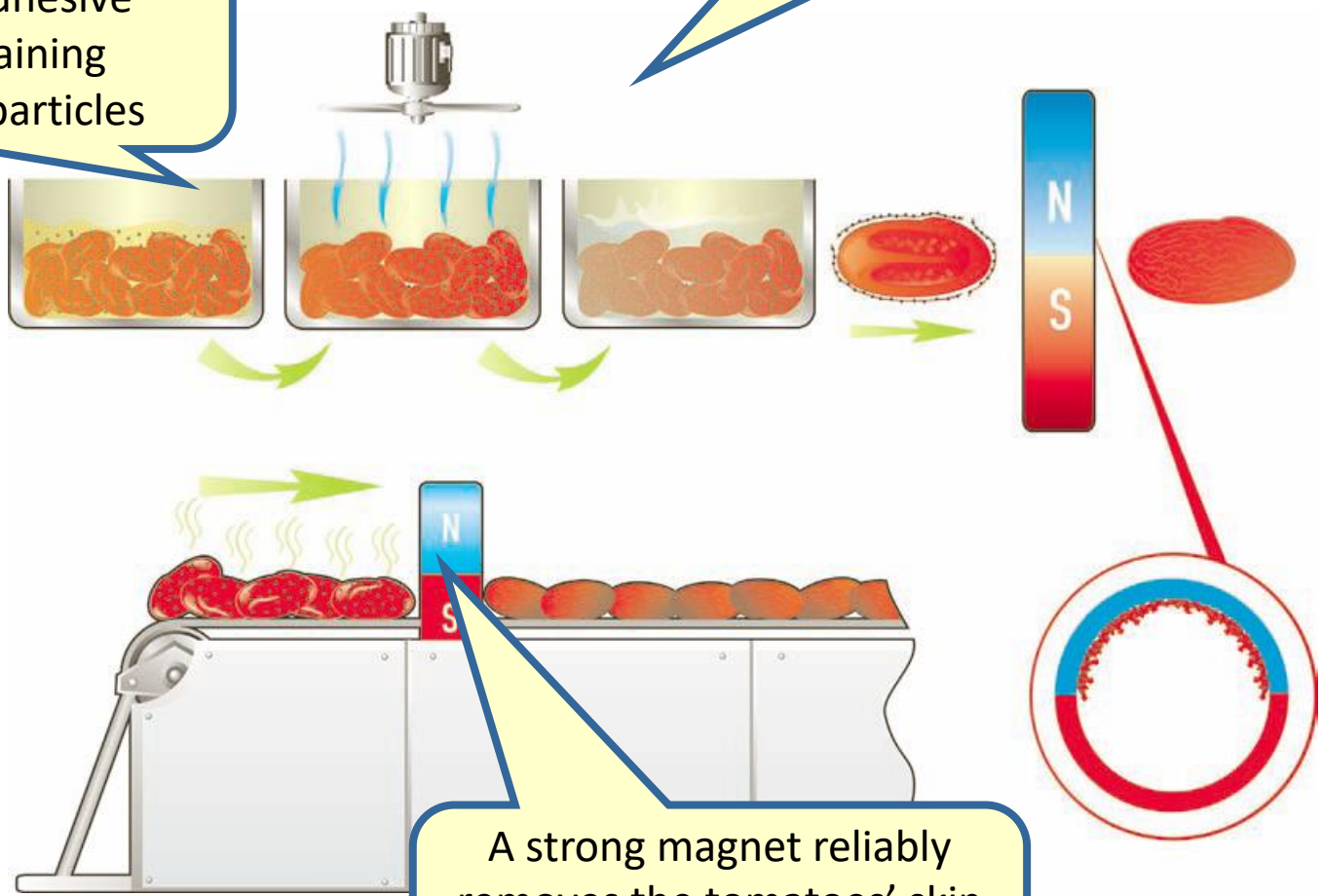
INVENTIVE STANDARD 2-4-5. If it is required to raise the efficiency of a system, and replacement of substances with ferromagnetic particles is not allowed, one has to compose internal or external complex ferromagnetic substance-field system by introducing ferromagnetic additives in one of the substances and magnetic field acting upon the additives.



Solution

The solution was implemented and drastically reduced costs

Tomatoes are placed into a tank with an adhesive solution containing ferromagnetic particles



A strong magnet reliably removes the tomatoes' skin without damaging to the tomatoes

Case 4: Flavia® Hot Drinks Machine (UK)

MARS

Tomorrow starts today

Flavia® Coffee Machine (UK)

Problems

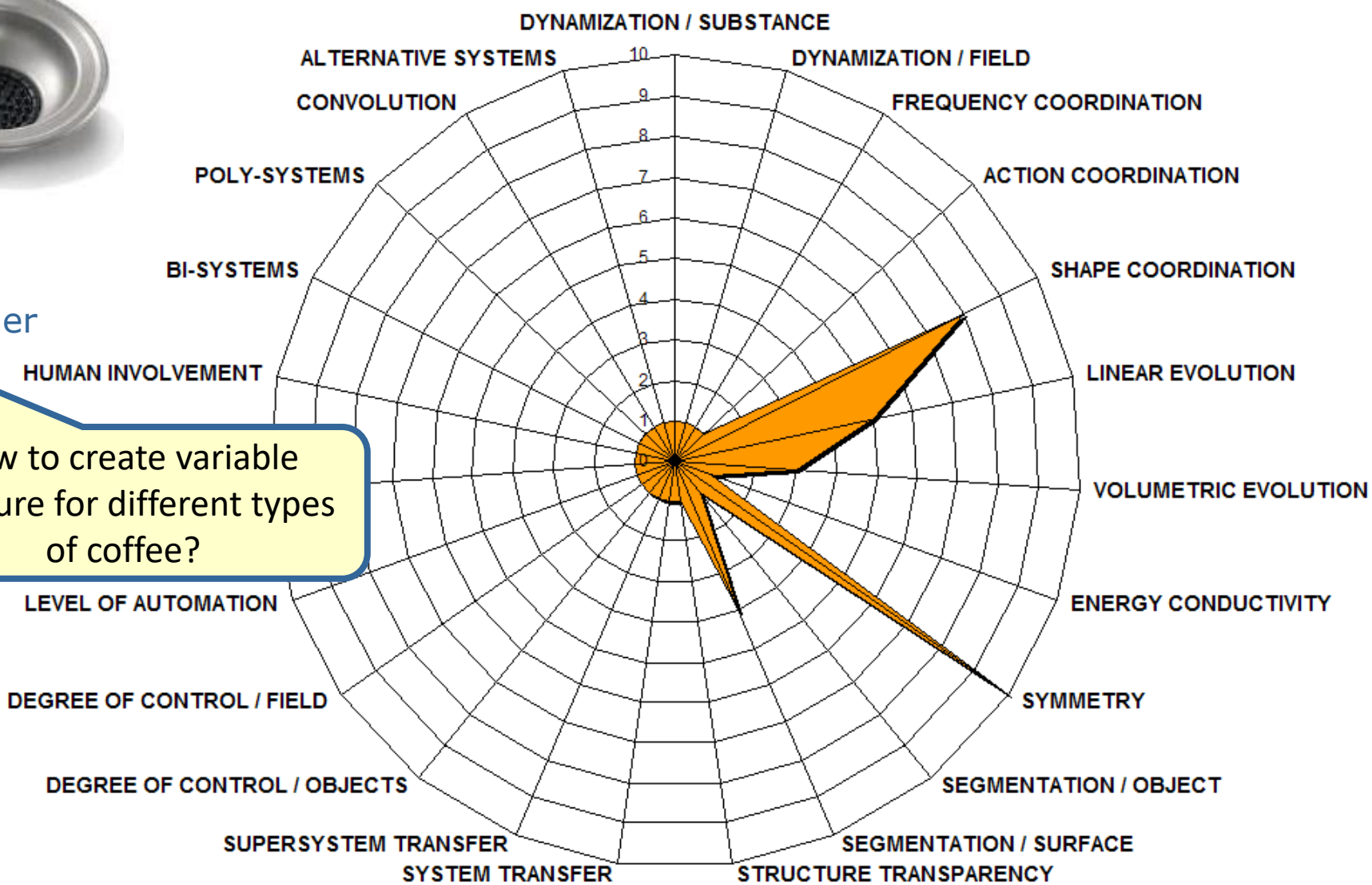
Problems:

- Existing variety of sachet or capsule-based coffee brewing systems is not adaptive to different types of coffee.
- Amount of coffee in espresso capsules cannot be varied.
- Cross-contamination between successive brews in espresso machines.
- A layer of hot milk foam is usually made separately because oils present in coffee have deleterious effect on foaming.
- Sachets and capsules are difficult to recycle.

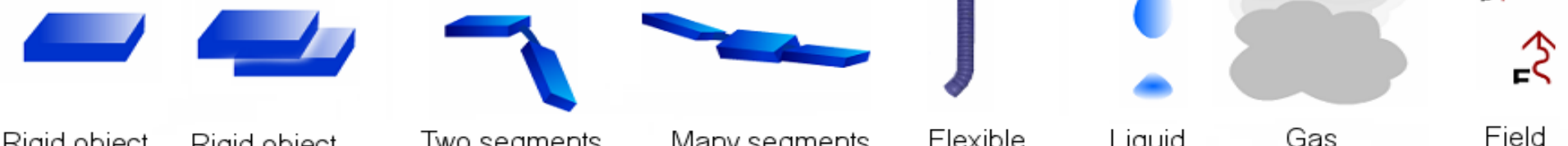
Evolutionary Potential Analysis

Sachet holder

How to create variable pressure for different types of coffee?



Trend of Increasing the degree of Dynamics



Traditional mobile phone.

Mobile phone with a sliding part which contains a microphone and protects keyboard.

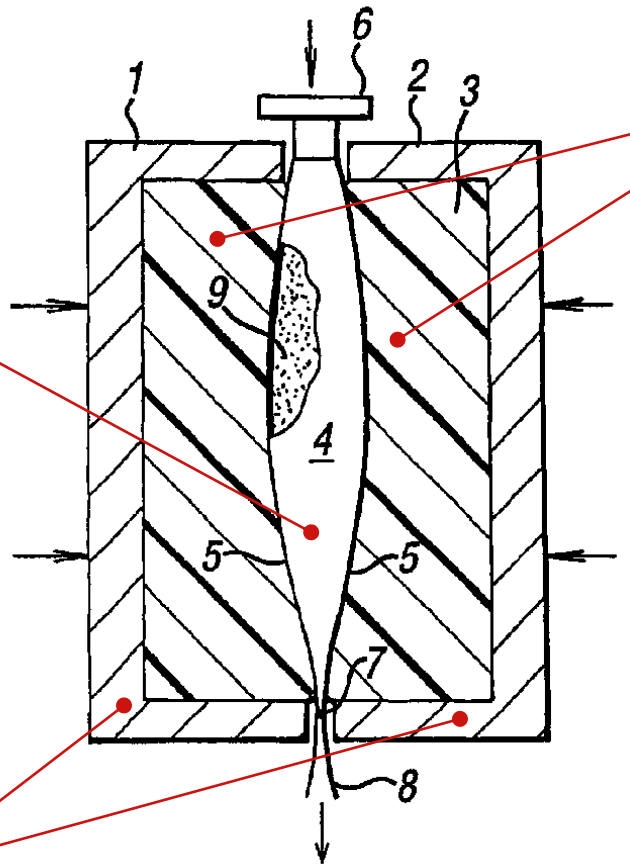
Flip-flop phone of two parts with a hinge.

Phone as a wrist watch: its bracelet is made of segments, which might contain different electronic parts.

A flexible LCD film with a touchpad, which can be rolled in and out and stored inside a plastic pen.

A projecting phone?

Dynamization



Silicone elastomer

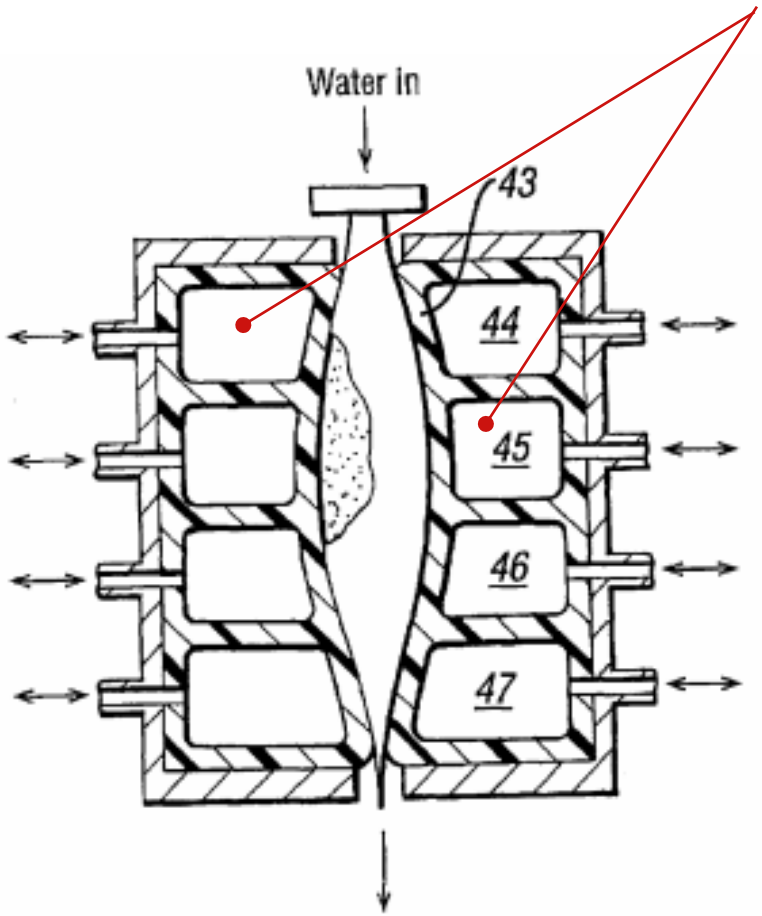
Sachet

Rigid clamps

Using elastic material

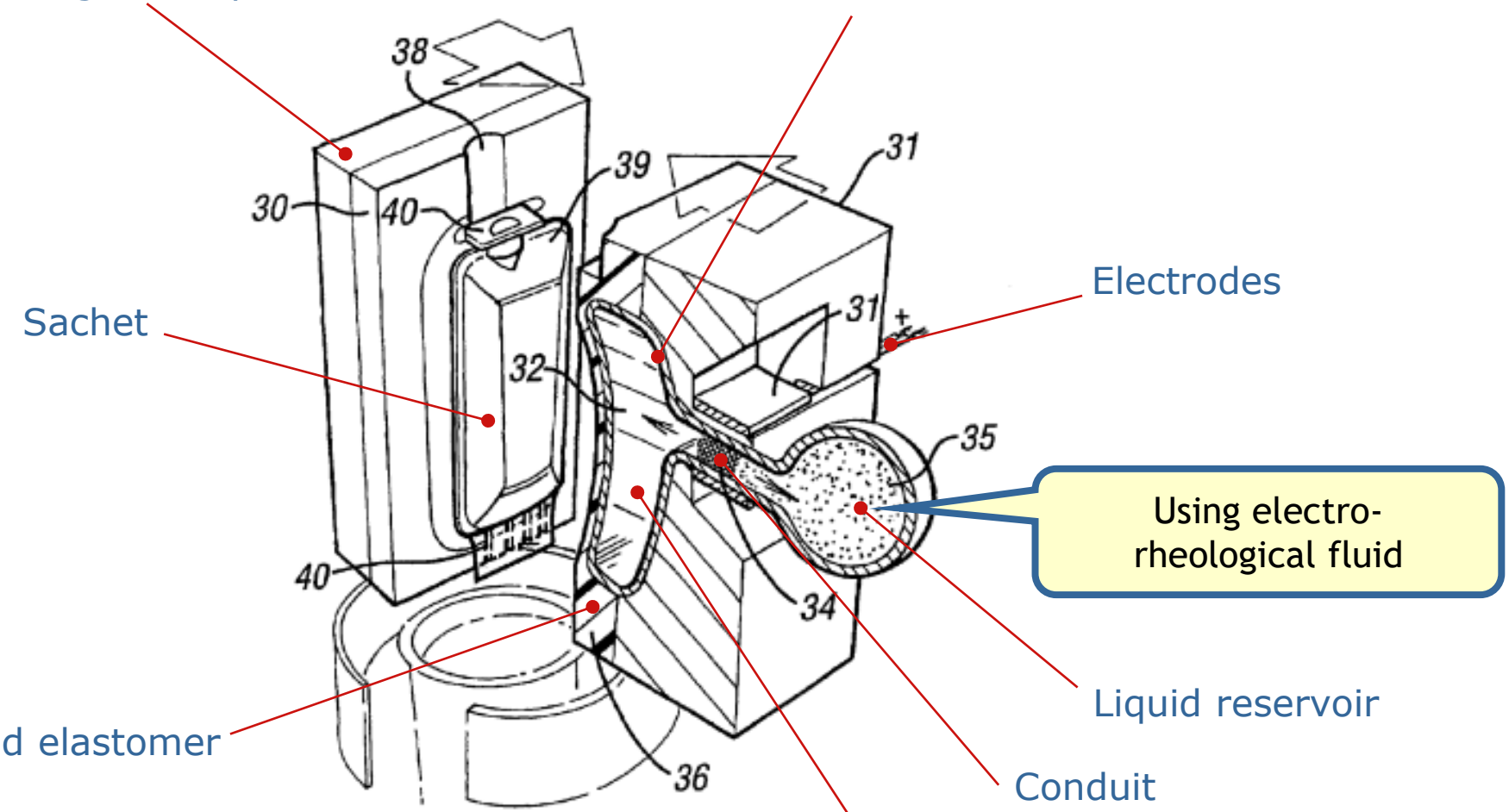
Introducing periodicity

Chambers with variable pressure



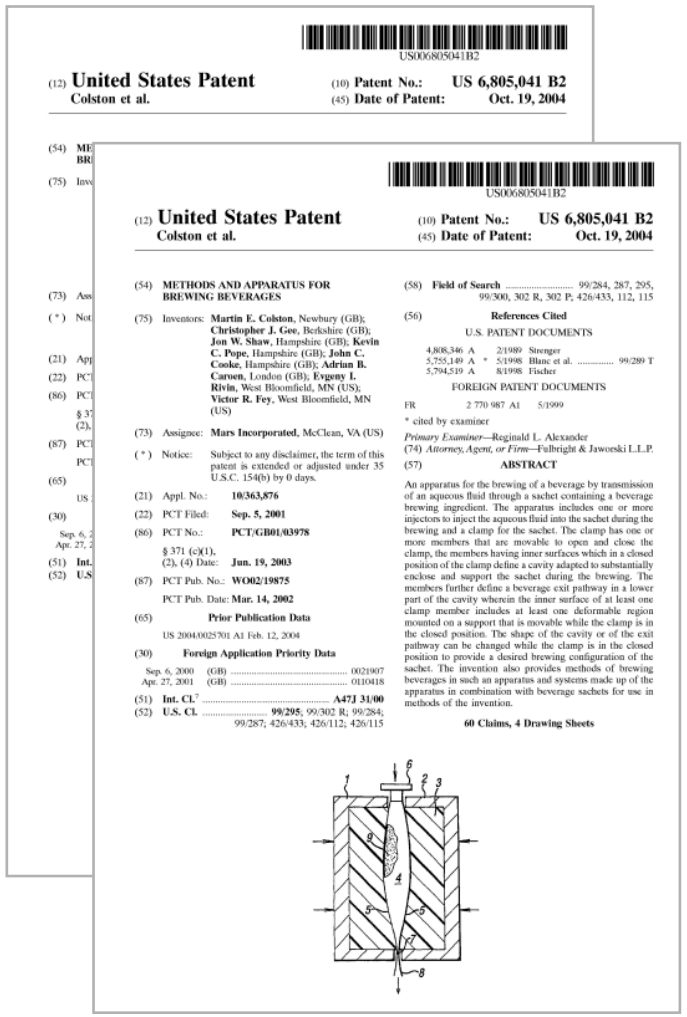
Using sectioned air pressure chambers

Using physical effects



Results

- Different types of beverages can be brewed from a single sachet.
- Supplies water at a range of 0.1-20 bar.
- Adapts sachets of different sizes.
- *"The TRIZ Group has helped my company solve a number of previously `impossible´ problems."*
- Six solutions, considered by Mars Inc. as radical innovations, were internationally patent-protected and incorporated into a unique coffee brewing system that delivers coffee shop quality across a complete cafe menu.



US006805041B2

(12) **United States Patent**
Colston et al.

(10) **Patent No.: US 6,805,041 B2**
(45) **Date of Patent: Oct. 19, 2004**

(54) **METHODS AND APPARATUS FOR BREWING BEVERAGES**

(75) Inventors: **Martin E. Colston**, Newbury (GB); **Christopher J. Gee**, Berkshire (GB); **Jon W. Shaw**, Hampshire (GB); **Kevin C. Pope**, Hampshire (GB); **John C. Cooke**, Hampshire (GB); **Adrian B. Carwen**, London (GB); **Evgeny I. Rivin**, West Bloomfield, MN (US); **Victor R. Fey**, West Bloomfield, MN (US)

(73) Assignee: **Mars Incorporated**, McClean, VA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/363,876**

(22) PCT Filed: **Sep. 5, 2001**

(86) PCT No.: **PCT/GB01/03978**
§ 371 (c)(1),
(2), (4) Date: **Jun. 19, 2003**

(87) PCT Pub. No.: **WO02/19875**
PCT Pub. Date: **Mar. 14, 2002**

(65) **Prior Publication Data**
US 2004/0025701 A1 Feb. 12, 2004

(30) **Foreign Application Priority Data**
Sep. 6, 2000 (GB) 0021907
Apr. 27, 2001 (GB) 0110418

(51) **Int. Cl.**[7] **A47J 31/00**
(52) **U.S. Cl.** ..... **99/295**; 99/302 R; 99/284; 99/287; 426/433; 426/112; 426/115

(58) **Field of Search** ..... 99/284, 287, 295, 99/300, 302 R, 302 P; 426/433, 112, 115

(56) **References Cited**
U.S. PATENT DOCUMENTS
4,808,346 A 2/1989 Strenger
5,755,149 A * 5/1998 Blanc et al. ..... 99/289 T
5,794,519 A 8/1998 Fischer
FOREIGN PATENT DOCUMENTS
FR 2 770 987 A1 5/1999
* cited by examiner

Primary Examiner—Reginald L. Alexander
(74) *Attorney, Agent, or Firm*—Fulbright & Jaworski L.L.P.

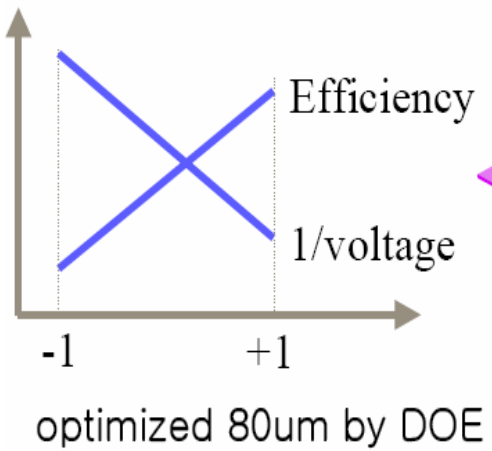
(57) **ABSTRACT**

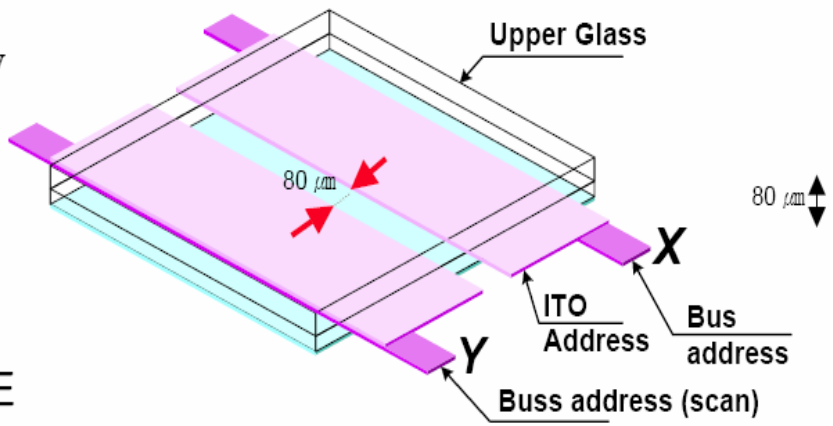
An apparatus for the brewing of a beverage by transmission of an aqueous fluid through a sachet containing a beverage brewing ingredient. The apparatus includes one or more injectors to inject the aqueous fluid into the sachet during the brewing and a clamp for the sachet. The clamp has one or more members that are movable to open and close the clamp, the members having inner surfaces which in a closed position of the clamp define a cavity adapted to substantially enclose and support the sachet during the brewing. The members further define a beverage exit pathway in a lower part of the cavity wherein the inner surface of at least one clamp member includes at least one deformable region mounted on a support that is movable while the clamp is in the closed position. The shape of the cavity or of the exit pathway can be changed while the clamp is in the closed position to provide a desired brewing configuration of the sachet. The invention also provides methods of brewing beverages in such an apparatus and systems made up of the apparatus in combination with beverage sachets for use in methods of the invention.

60 Claims, 4 Drawing Sheets

Case 5: LCD Screen (Korea)

PROBLEM





A problem involved a contradiction with a gap between light generating electrodes in an LCD panel. The gap had to be wide to increase light efficiency and short to decrease the needed voltage.

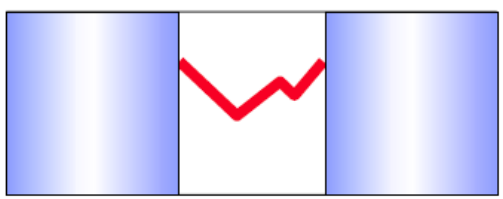
A Problem

Contradiction

TC-0: If gap between electrodes is wide, light efficiency is high(good), but discharge voltage is high.(bad)

Gap between Electrodes : TRADE-OFF

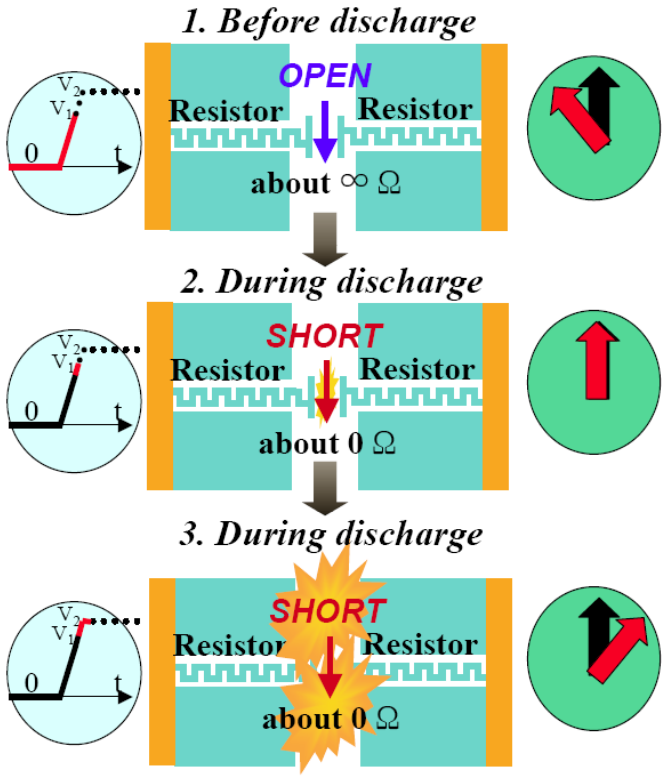
- Gap distance of electrodes should be long.
  To increase light efficiency (CTQ)
- Gap distance of electrodes should be short.
  To decrease ignition voltage (CTQ)



TC-1: If gap between electrodes is narrow, discharge voltage is low enough(good), but light efficiency is low(bad).

Source: Samsung

USING TRIZ

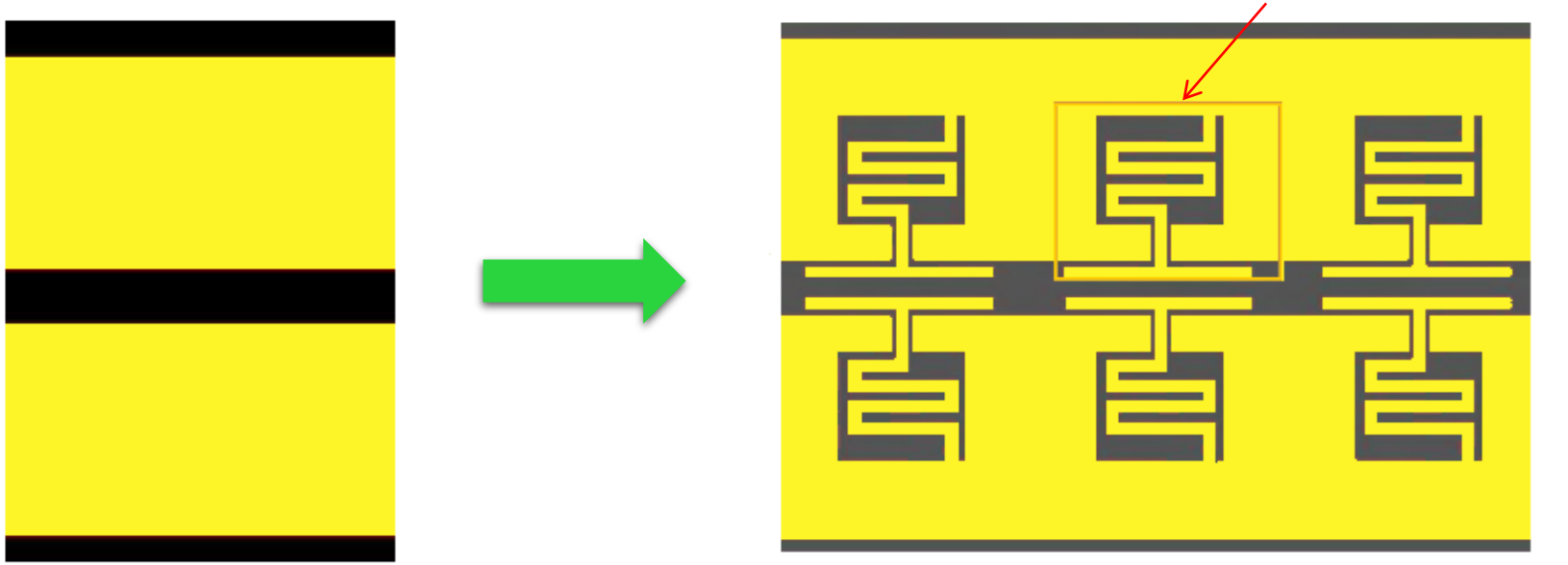


◆ separation by space : long gap, short gap at the same time

◆ separation by time : first time short gap electrodes operate, after ignition long gap electrodes operate.

A solution found was to use the TRIZ Inventive Principles to separate conflicting requirements in time and space similar to how it is done in a car igniter plug

SOLUTION

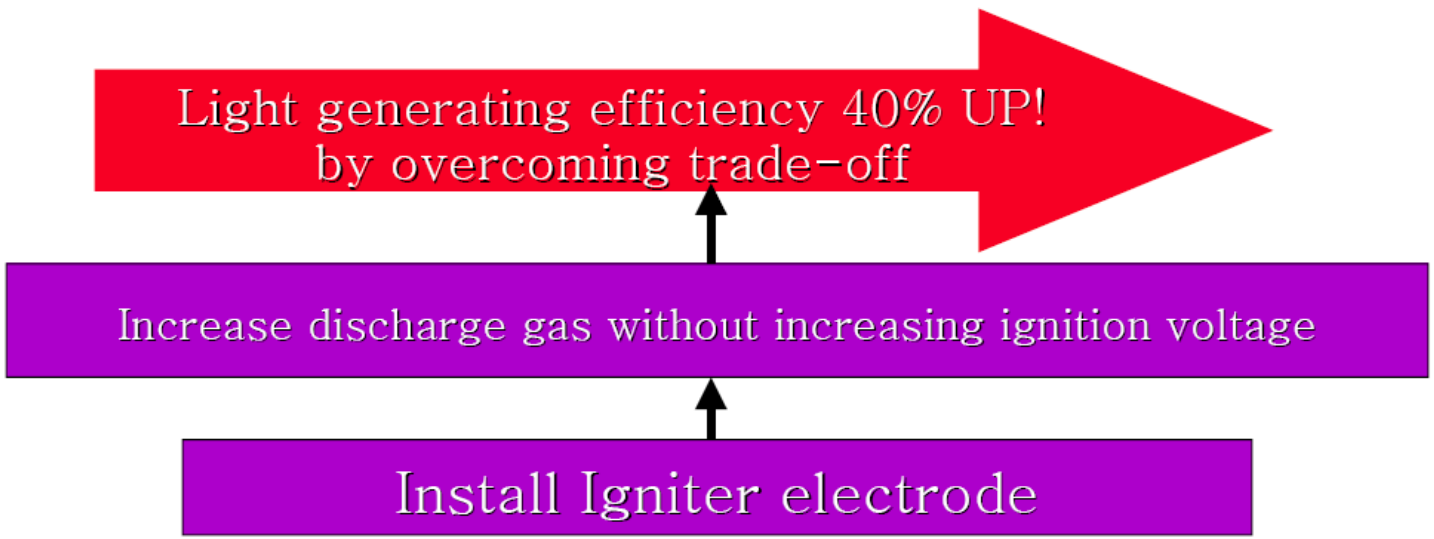


Solution is that separate igniter electrodes are located much closer to each other than light generating electrodes. As a result the light efficiency grew 40% with the same ignite voltage used.

Case Study

Concept Development & Result

	Without igniter electrode (Xe 10%)	With Igniter electrode (Xe12%)
Voltage(Vs	205V	205V
Light efficiency	1.210 lm/W	1.722 lm/W



Source: Samsung

Case 6: Teeth Whitening (USA)

Crest Whitestrips™

- Proctor & Gamble (P&G), owner of the Crest® brand and other oral-care products had a problem: its competitor Colgate-Palmolive launched a toothpaste with whitening agents, and spawned a market that grows to $500 million in about three years time. Meanwhile, sales of Crest steadily decline.

- The scientists on the whitening project figured the best way to compete with Colgate was to change the paradigm of applying whitener with a brush - to make hydrogen peroxide gel stick to teeth longer than it would during a brushing cycle. But how?

Solution

- By using TRIZ, P&G developed a clear adhesive film that was made into narrow strips of whitening gel that could be attached to teeth. The concept was taken from attachable nicotine films.
- Problem solved, and without the negative consequences of tray-based whitening methods that tended to cause irritation due to overexposure of hydrogen peroxide to gums. In other words, Whitestrips are a more exacting method of sticking the whitening agent to teeth, and only to teeth.
- The ultimate solution came in the form of the Whitestrips® product, which, about a year after its introduction generated $200 million in revenue and close to 90 percent market share.

Case 7: Chemical Distillation (Russia)

Linas distillation

- Although during 50 years no radical changes in industrial chemical distillation were made and experts decided that it could not be improved any further, a new technology for chemical distillation was developed by Russian company Linas.
- In addition to solving several fundamental problems of distillation, a new plant is at least twice cheaper to manufacture and operate, consumes less energy, and occupies 3-5 times less space than traditional distillation plants.
- There is no need any longer to build very high columns; the new plant can be even placed in an ordinary living room.

Traditional distillation column

Problem

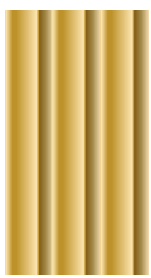
- **Linas technology** is based on the modified very much film distillation. Indeed, the conventional film distillation has several attractive advantages such as simple construction, the very low flow resistance and good separation ability. The film distillation has the lowest height of the theoretical tray (equal 5 mm) among all distillation technologies, but only if vapor velocity is around 1 cm/s. Therefore applications of the film distillation are very limited and not really applicable in a large scale industrial distillation. At high velocity of vapor along vertical surfaces a film ceases to be uniform and heat and mass exchange processes become unstable and all advantages of film rectification are not realized.
- This main problem of the conventional film distillation was solved by Linas by using a number of TRIZ methods, including segmentation and transition to a poly-system.

Solution

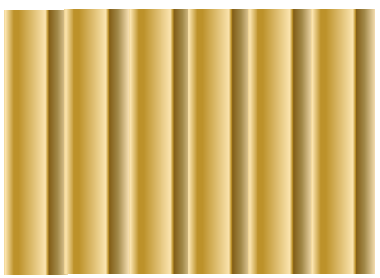
- Linas technology is based on vertical tubes with a length from 0.5 m till 3 m and a diameter 6-25 mm.

Linas rectification sector including in a pilot plant with the capacity 80 MTY
Height = 1.5 m
Diameter = 0.05 m
1 tube

Linas rectification sector including in a rectification tower for the oil refinery with the capacity 10000 MTY
Height = 1.5 m
Diameter = 0.5 m
127 tubes



Linas rectification sector including in a rectification tower of the oil refinery with the capacity 50000 MTY
Height = 1.5 m
Diameter = 0.9 m
621 tubes



- The basic element of above described rectification part is the single Linas distillation tube and the capacity of Linas rectification towers can be increased by the number of the tubes. There is no difference in parameters of distillation processes between one tube with a capacity 80 MTY and 621 tubes with a total capacity 50.000 MTY. It means that the design of any industrial unit can be done very fast if there is data for one distillation tube

New plant

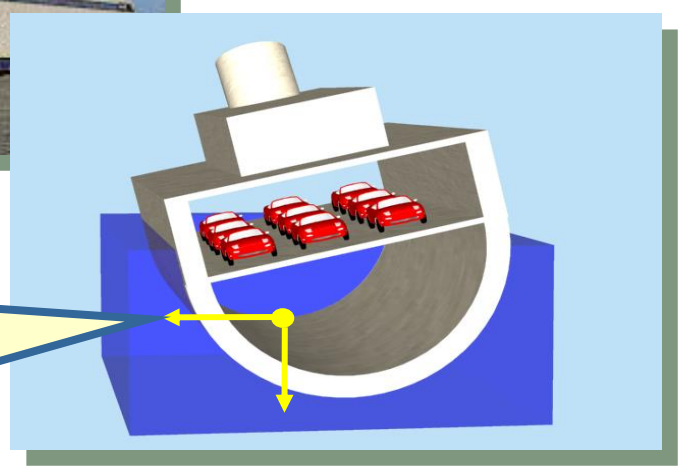
Linas oil refinery:

http://www.linas.ru/english/index_e.htm

Case 8: Ferry Safety (Sweden / The Netherlands)

Case: Accident during a sea ride

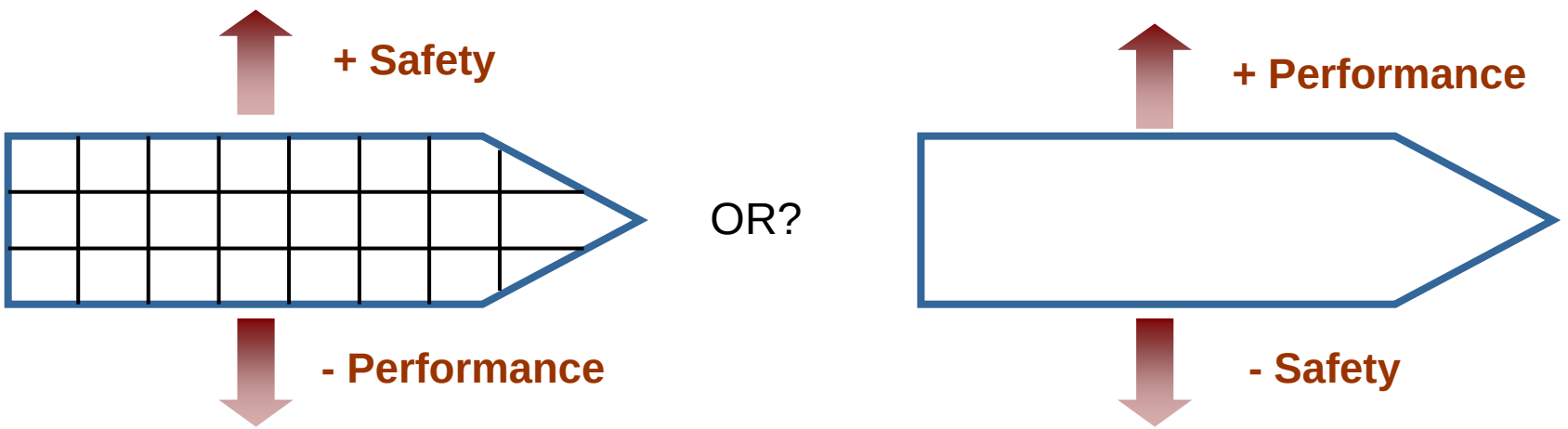
In 1994, the ferry “Estonia” capsized and sank in Baltic Sea. About 850 people died.



Since cargo decks in ferries have no compartments (unlike ordinary ships), accumulating water was moving from one side to another and finally the center of buoyancy shifted too much

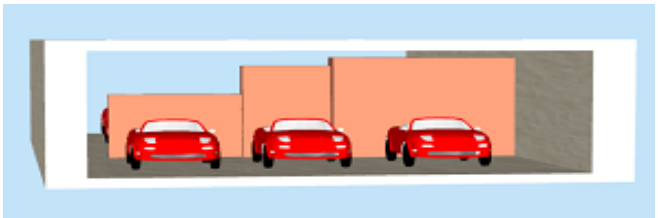
Conflict: the ferry case

- How to prevent ferries from this accident?
- Possible idea: to use sealed compartments, like in classic ship design
- Leads to the conflict:
  - The ferry must have sealed compartments to enable safety
  - The sealed compartments will make it not possible to enable bulky cargo storage and transportation

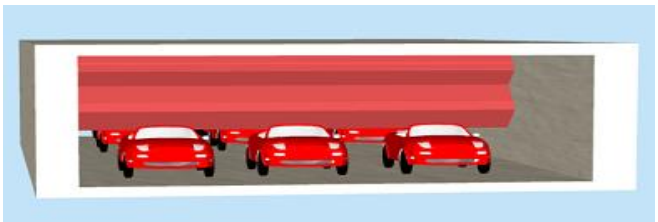


Problem solving in standard ways

Introduce compartments in a cargo deck and using the solution principle of “Segmentation” (Patents by Kvaerner)



Segmented doors



“Accordion”- type doors

Foldable doors

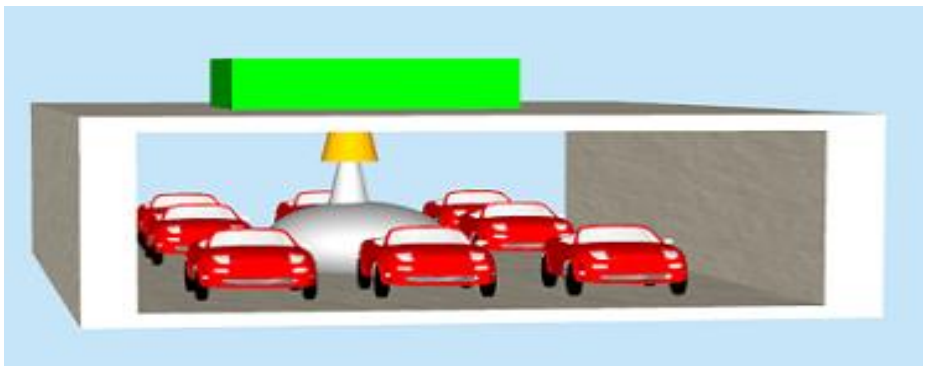
Was it a right problem?

- However, any solution with partitions causes another problem: extra time is needed to open, close, and seal the compartment doors. Ferries become highly inefficient.
- Selecting another problem: “How to ensure that open space does not allow water to move?”
- The root conflict:
  - Empty space must be in the cargo bay to allow bulky cargo and easy cargo transportation
  - Empty space should not be in the cargo bay to avoid water accumulation and movement

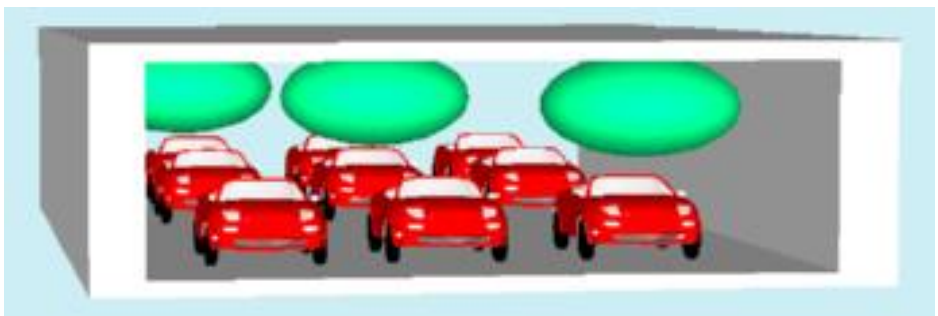
Solving conflict with TRIZ

Using the TRIZ solution principle: “Separation of conflicting demands in time”

- A new problem formulation: empty space in the cargo bay must disappear only in case of emergency.



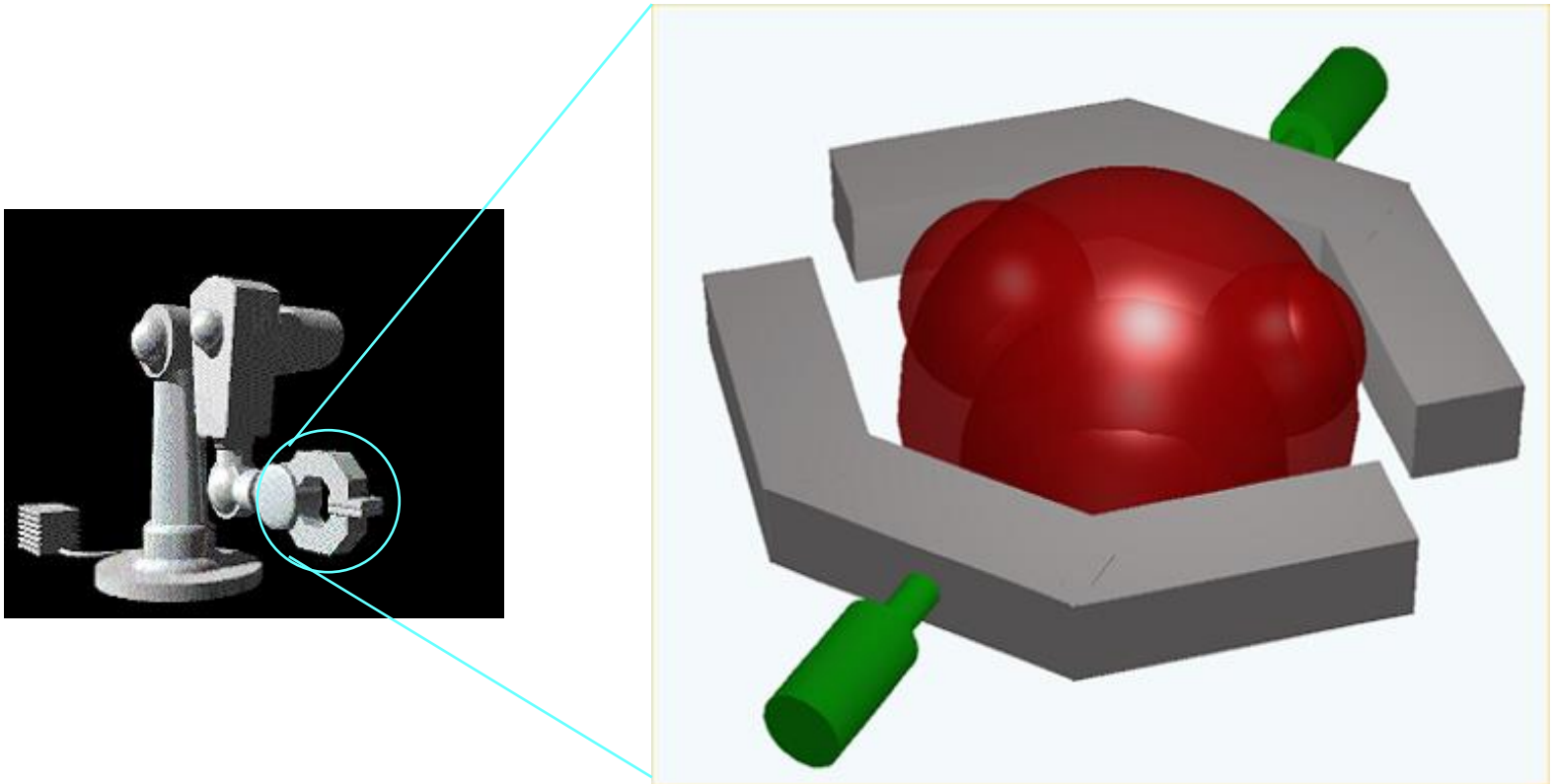
Container with liquid plastic foam which solidifies after being spayed



Air bags (balloons) which are deployed and stay inflated in case of emergency. They not only prevent water from accumulating but also increase floating of a ferry.

Case 9: Robot’s Gripper (The Netherlands)

Robot’s gripper

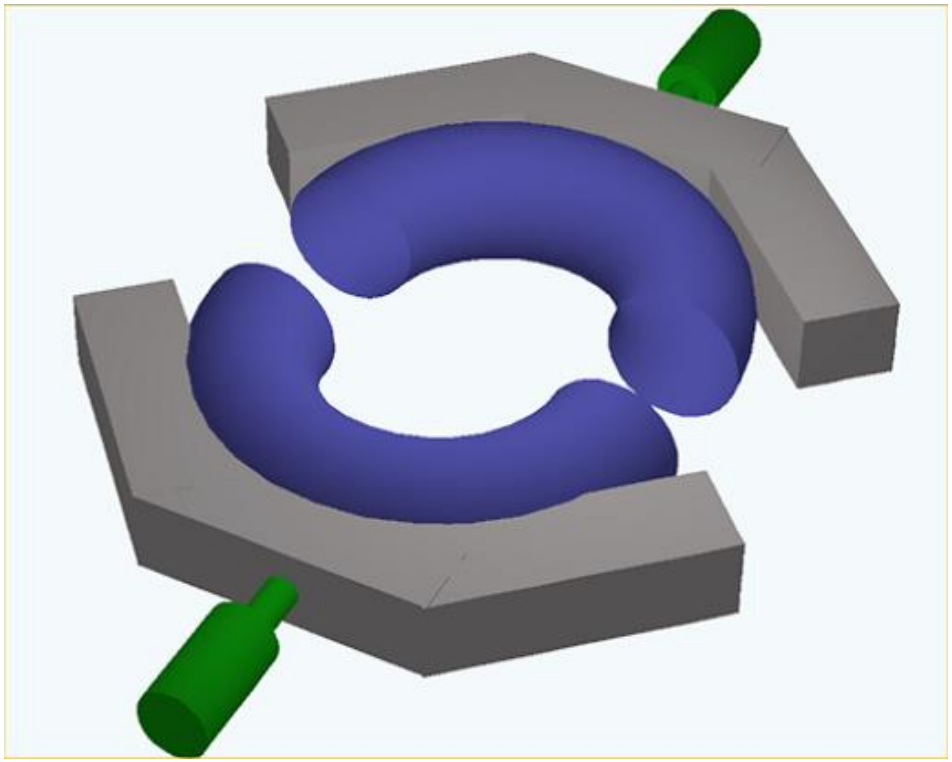


A problem: How to avoid breaking a fragile object moved by a robot’s gripper while the object has irregular shape, weights 40 kg, and is heated more than 1000 ^{o}C?
A standard gripper does not provide even pressure distribution.

Situation

- 10% of products are broken which results in significant yearly loss.
- Re-design and adaptation of the robot in a traditional way by the robot supplier would cost Euro 400.000, as estimated by the supplier.
- A new robot will be delivered in 6-12 months.
- Decision was made to use TRIZ to see if there are alternative ways to overcome the problem.

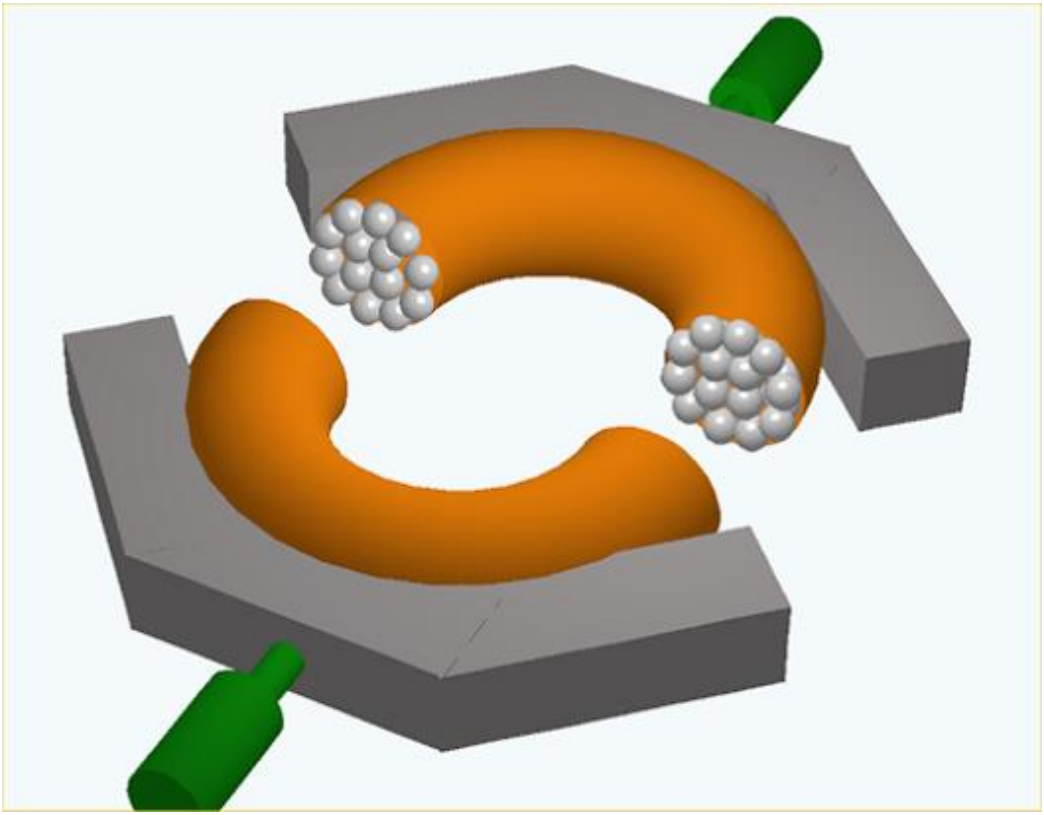
Use rubber? But T > 1000 °C



A possible solution: to use rubber coating to distribute pressure evenly. But rubber loses elastic properties at high temperature.

Physical contradiction: coating must be elastic to provide process, and non-elastic to resist the high temperature.

Solution: tiny steel balls



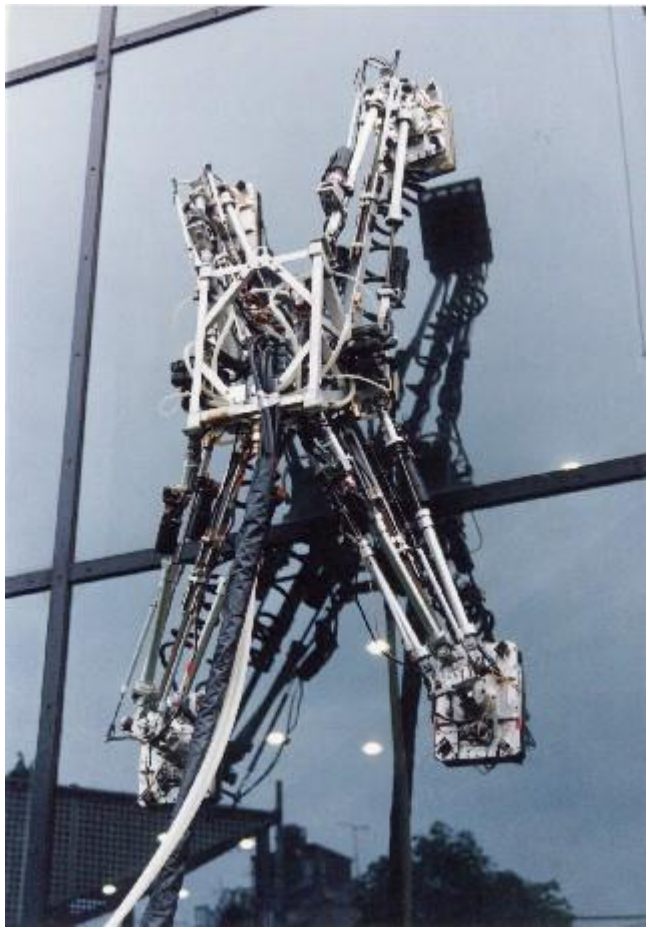
Solution found with TRIZ: Separate conflicting properties in space.
Tiny metal balls in the heat-resistant flexible sleeves solve the physical contradiction

Results

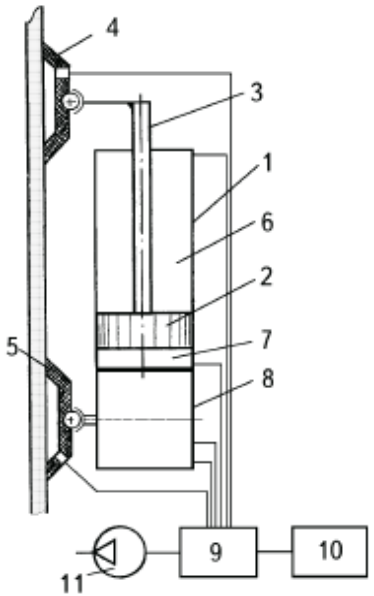
- No product loss any longer.
- Euro 400.000 and six month for robot redesign were saved.
- TRIZ Project took 2 days.
- Solution was implemented within one day by using materials available at the production facility.

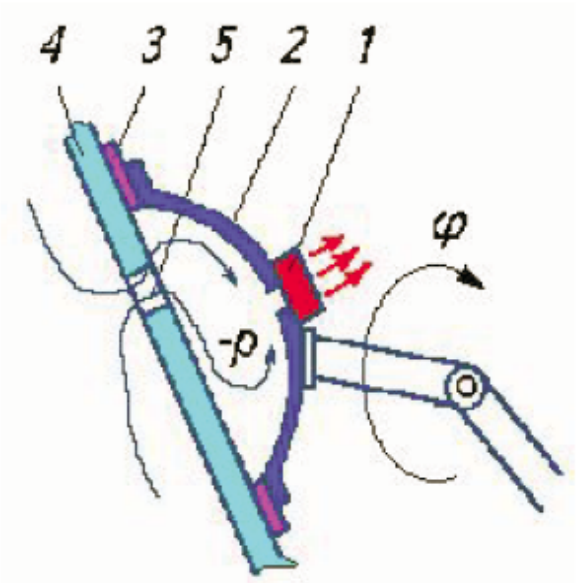
Case 10: Glass Cleaning Robot (USA)

Wall Climbing Robot (US)



A problem





PROBLEM DESCRIPTION

The vacuum foot is most responsible element for safety of whole robot. The small-sized vacuum pump 1 (lower picture) is located on the foot body 2 which one has elastic seal 3. Seal 3 contacts with a glass surface 4. Vacuum is generated under foot and holds a robot.

If the glass surface doesn't have any defects then vacuum foot operates good. But if there is a defect 5 (crack, orifice, irregularity, etc.) in a glass surface then the efficiency of gripper is dropped because gripper is depressurized.

Typically, for compensation of the leaking high-power vacuum pump is used. But in this case the overall dimensions and robot weight are essentially increased.

MAIN TASK

It is necessary to save an existing vacuum method of the work and to propose a solution for a described above problem.

Contradiction

1.1. MINI-PROBLEM

The climbing robot for washing window includes the vacuum pump, foot body, elastic seal, glass surface, crack on the surface, cylinder, rotary drive

TECHNICAL CONTRADICTION 1

If we use high-power vacuum foot in our design, it provides a good vacuum adhesion of the foot to a cracked glass surface but increases overall dimensions and mass of the vacuum pump

TECHNICAL CONTRADICTION 2

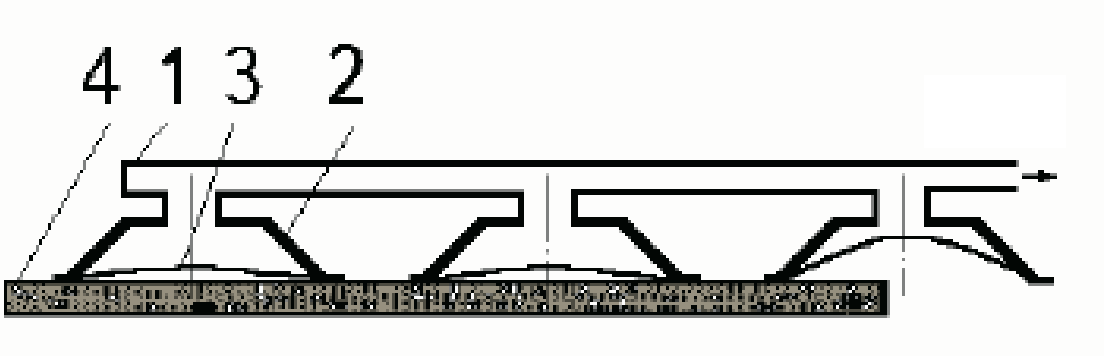
If we use low-power vacuum foot in our design, it does not increase dimensions and mass of the vacuum pump but it does not produce the required vacuum value under foot and adhesion during work with a cracked glass surface

It is necessary with minimum modifications of existing system to provide reliable adhesion of the vacuum foot to the cracked glass surface and to keep the small dimensions and mass of the vacuum pump

Inventive Principle

#1: SEGMENTATION	Examples
	o *Short garden hoses can be joined together to form any length needed.* o *Folding wooden or plastic ruler consisting of segments.* o *Sectional furniture.* o *Using bricks to create a wall.* o *Segmented sailboat mast.* o *An airplane wing consisting of several segments that can change the overall wing geometry.* o *Segmented chocolate bars for easy breaking.* o *"Segmented" geometry of a knife's blade makes it possible to better cut through porous objects.* o *Design of a mobile phone as two connected parts.* o *A dish plate with sections for different types of foods.* o *Using gels instead of powder in cooking.* o *Using gels as a filament in a shoe sole.* o *Instead of a continuous process of polishing glass surface with a high force, a series of actions with smaller forces provides a higher quality and accelerates polishing.* o *Rock can be crushed more accurately by a series of micro-explosions.*
Strategies and recommendations	
❑ Redesign a monolithic object by splitting it to two or more independent or connected parts. ❑ Increase the degree of the object's segmentation (fragmentation). ❑ Compose an object from a number of smaller objects, granules, powder, gel, liquid or gas. ❑ Compose an object from two or more parts so that some its part can be easily taken away (and brought back) when necessary. ❑ Break a process or one of its operations to smaller segments. ❑ Increase the degree of segmentation of a process or its operations.	

Segmentation!



SOLUTION

The new foot has body 1, designed as a frame. Within the frame are located numerous vacuum sectional mini-feet 2. Each mini-foot is supplied with elastic diaphragms 3 and are connected by common vacuum pump.

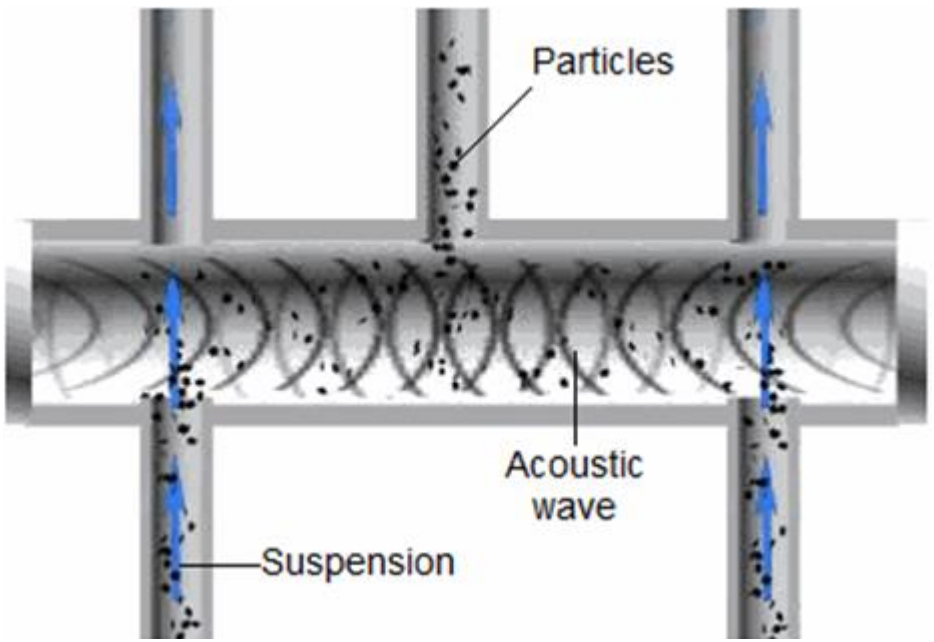
Case 11: Fine Particles Removal (The Netherlands)

Particle separation

- At a chemical company a problem was how to extract very fine particles from suspension in a fast and reliable way with a large capacity and speed.
- A number of methods are known to separate particles from a suspension, most of them are based on filtering technologies. However, none of them offer sufficient separation efficiency for fine (on the order of 1 mkm) particles.

Solution

- A solution was found in the TRIZ database of physical effects by using physical effect of "*Acoustically driven particle separation*".
- A suspension is fed into a cylinder through two pipes. Acoustic waves are sent into each end of the cylinder. The sum of the acoustic waves causes cavitation in the suspension. Strong pressure pulses drive particles to the center of the cylinder, where they can be removed.



Case 12: Scale Prevention (Korea)

Steel Manufacturing (Korea)

posco TRIZ

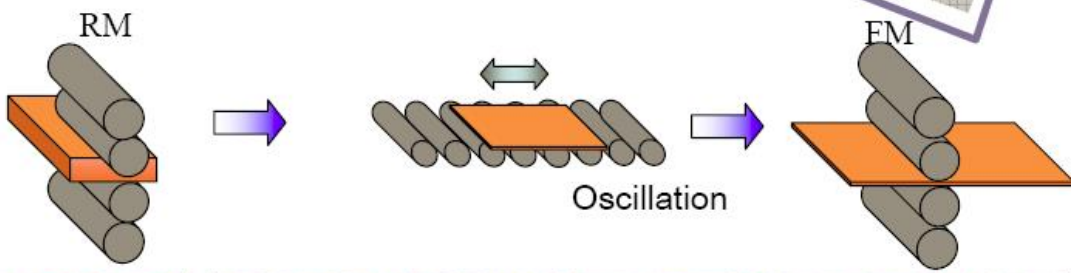
A process

plate making process

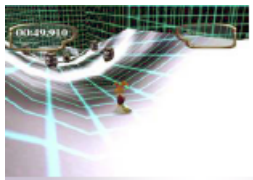
Make Innovation Happen!

posco TRIZ

Oscillation Zone



Problem formulation #1



Make Innovation Happen!

posco TRIZ

Problem Situation
Steel plate (thickness : 40-60mm) deformed (above 5 mm) due to temperature difference between upper and bottom area of plate after ACC process.

temperature diff.	Type of deformation
in upper/bottom (Gutter)	

Problem formulation #2

Make Innovation Happen!

Problem description (I)

What we want	Current state
Temperature diff. within 25°C between upper and bottom area of plate	Temperature difference: 50°C

How to reduce temperature gradient between upper and bottom area of steel plate ??

Again, a new problem

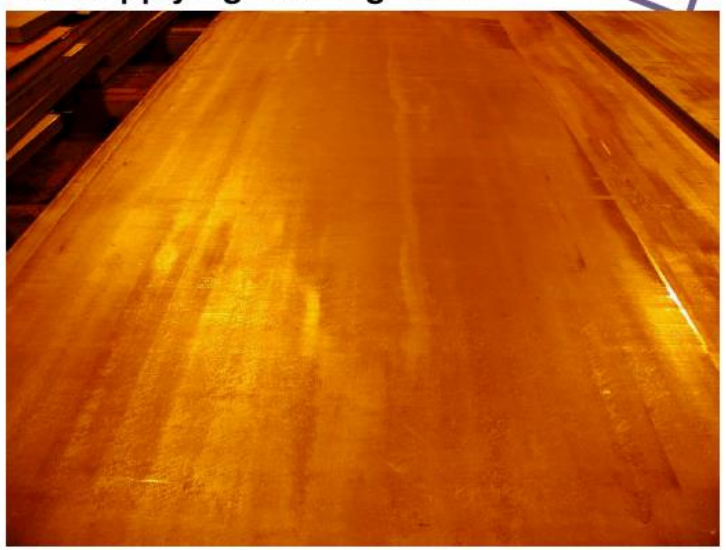
Surface of Bottom area of Plate

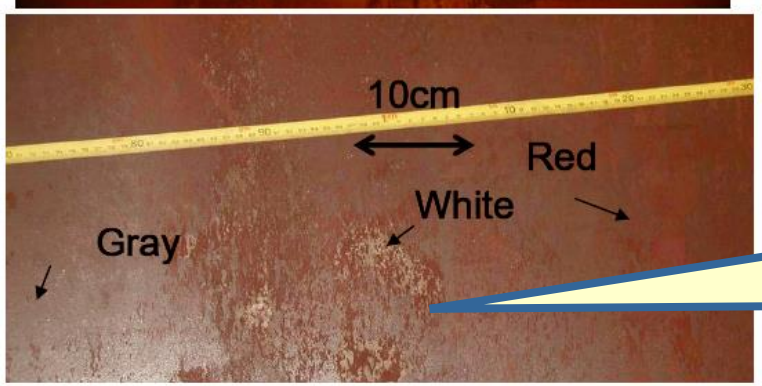
Make Innovation Happen!

posco TRIZ

Applying Cooling water

Not Applying Cooling water





If water is applied, scale forms on the plate's surface

Problem formulation #3

Problem description (II)

Make Innovation Happen!

What we want	Current state
Prevent scale formation in plate surface	Scale formed

How to prevent scale formation in plate surface?

Restrictions of Project

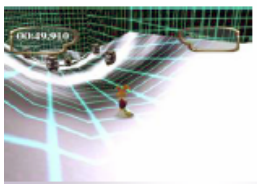
1) Roll temperature must be maintained less than 100C° all the time

2) The method for internal cooling of roll can not be applied due to high cost

Contradiction

- *When roll moves hot plate, plate heat the roll. Thus cooling roll by water.*
- *But water and vapor also corrode plate and make bad scale on plate surface.*
- *Scale should not appear.*

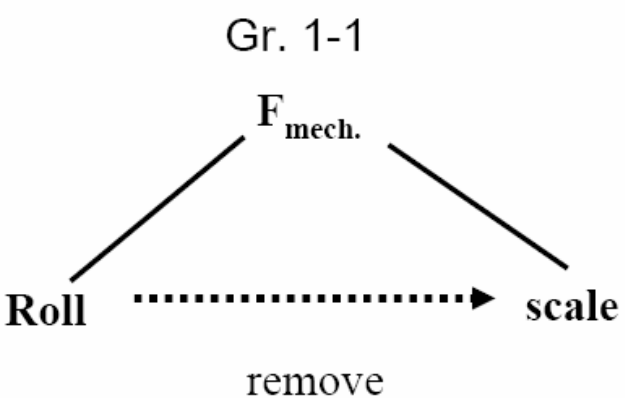
Inventive Standards



Make Innovation Happen!

Possible Solution Concept

Su-F Standard



Gr. 1-1

1-1-2 abrasive powder on roll

1-1-3 abrasive substance attaching on roll

Gr.2-2, 2-3

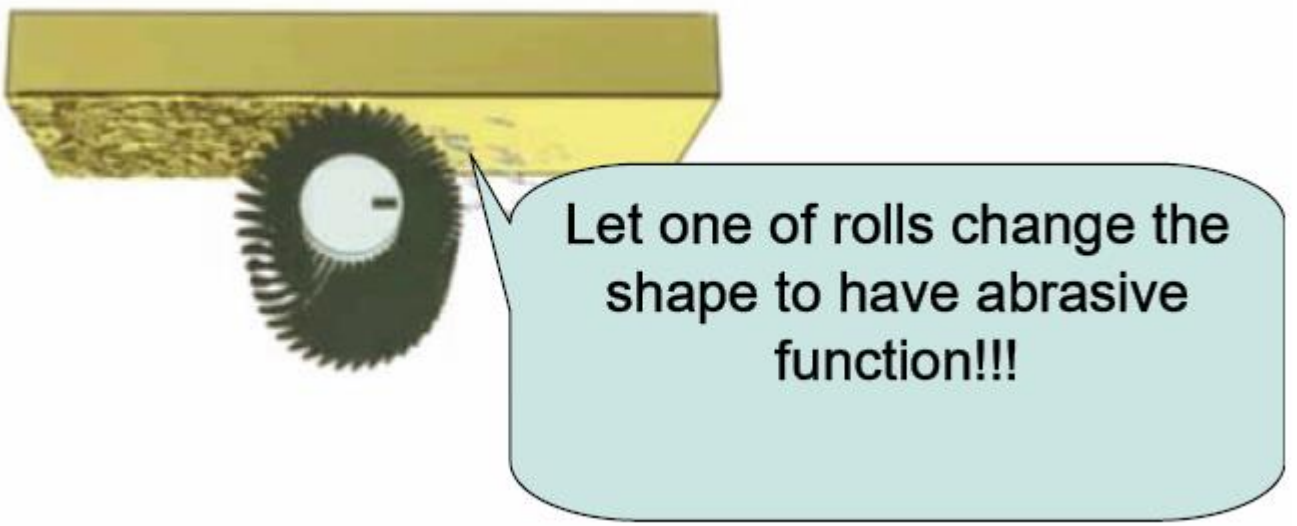
Evolution of Tool

-Fragmented roll

-Multiple cavities roll

-Flexible wire roll

Solution

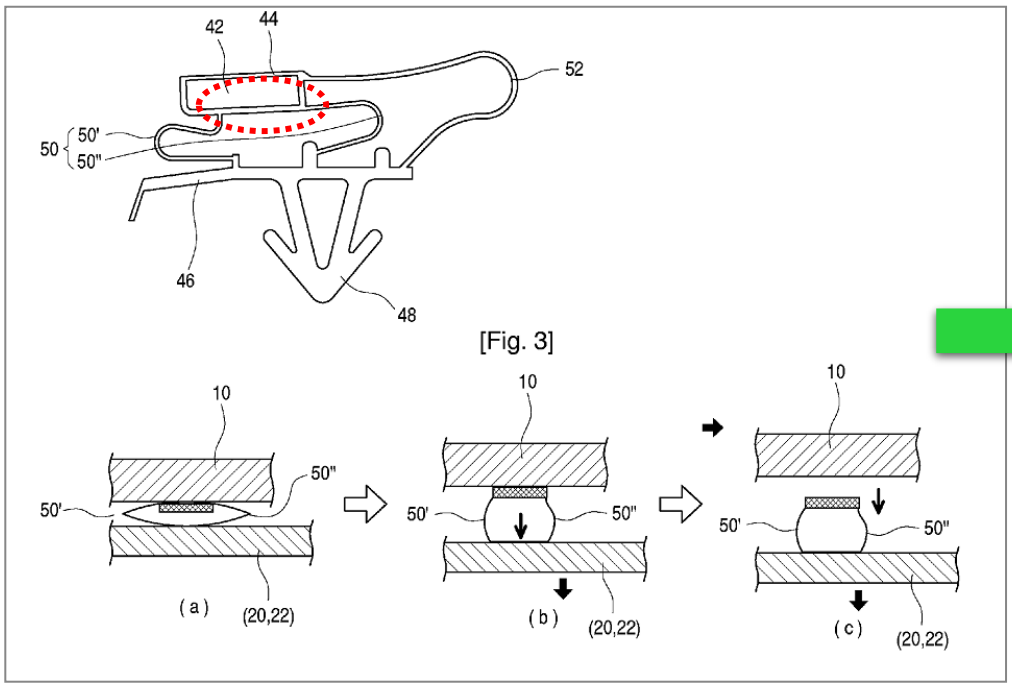


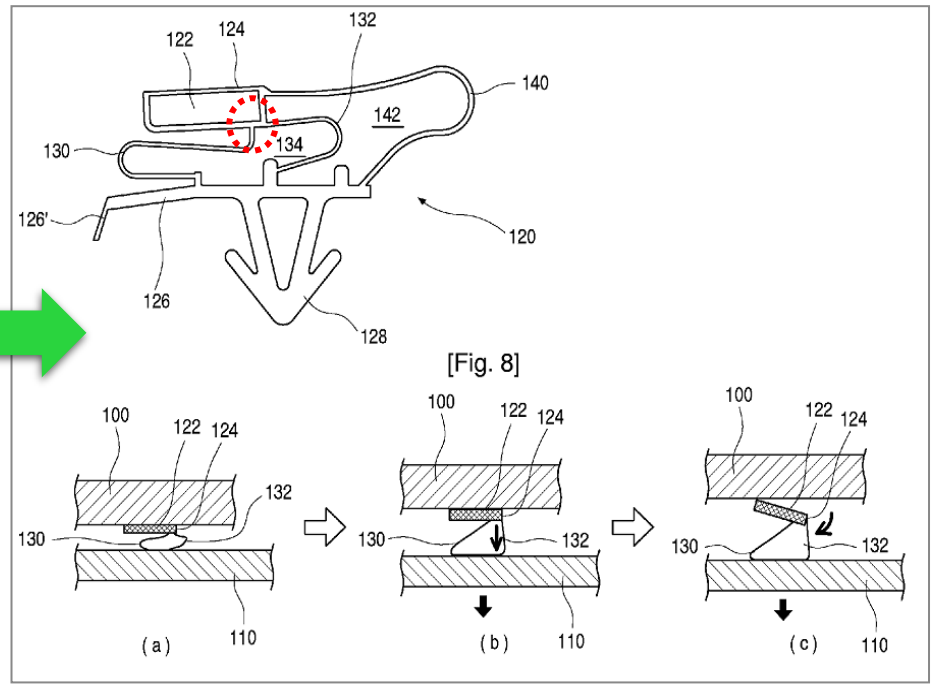
Case 13: French Door Refrigerator (Korea)

PROBLEM

The problem emerged at LG when designing a new refrigerator: for high energy efficiency the drawer sealing should be strong. But for easy opening it should be weak. The sealing force is provided by magnet.

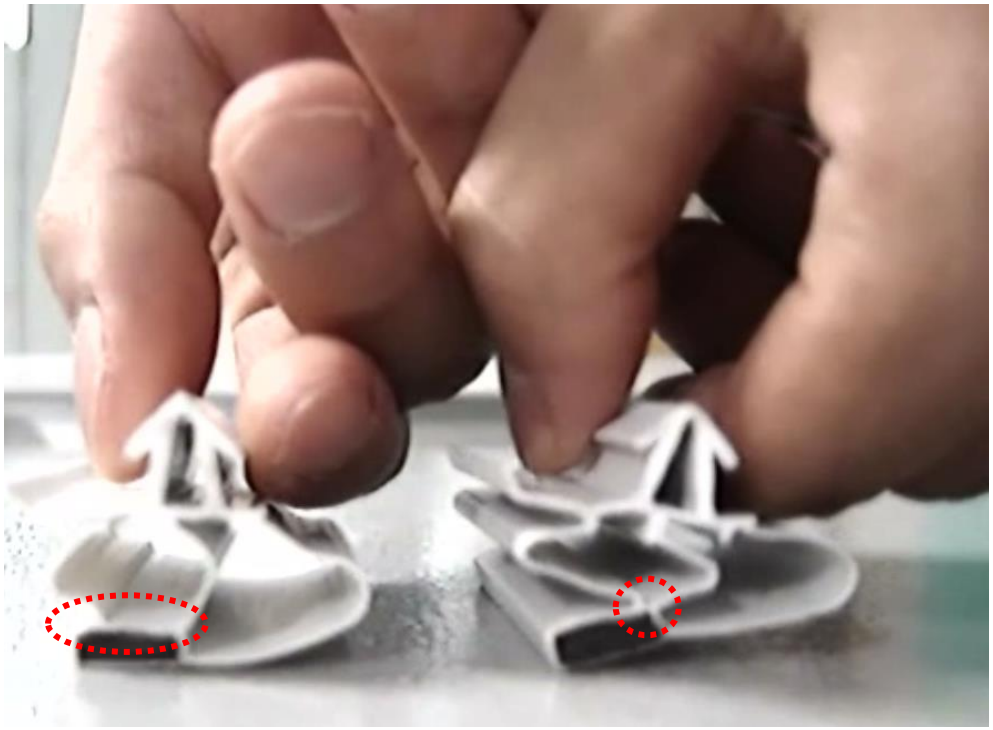
USING TRIZ





A solution found was to use the TRIZ Inventive Principle of Assymetry.

SOLUTION



gasket_test.mp4

A magnet is attached only to a small part of the gasket surface rather than along its all surface. The force needed to open the drawer is thus considerably reduced.

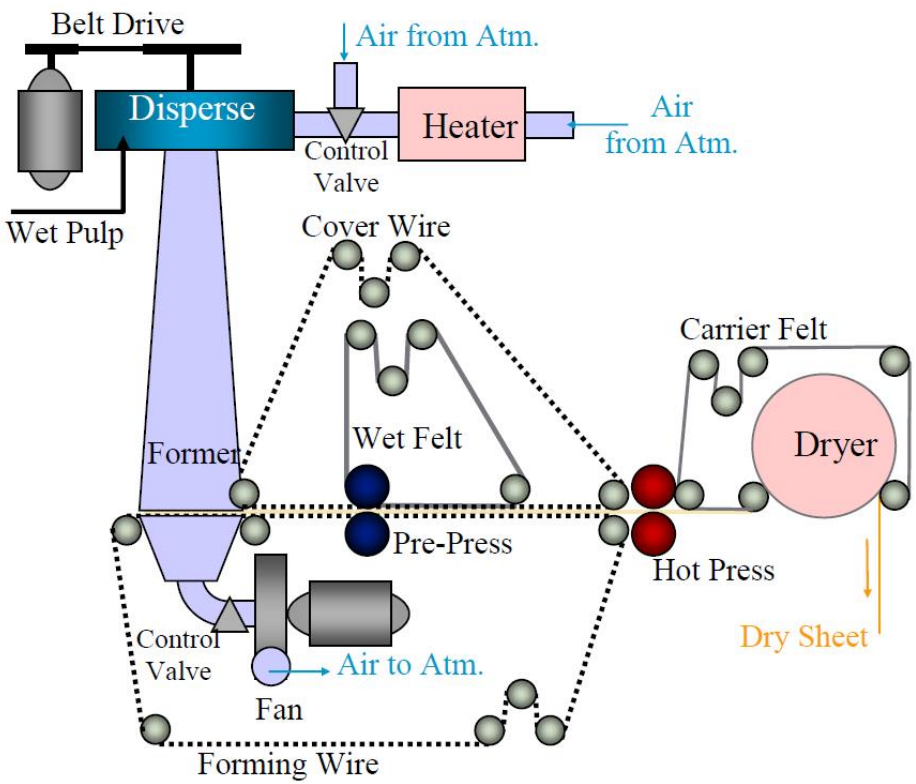
Case 14: Paper Manufacturing (Finland)

Paper Manufacturing

- GEN3 was asked to help a client reduce the amount of water used to make their paper products. Historically sanitary-hygienic tissue was produced using **1.000 kg of water** per every kilo of dry fiber. Water is needed for establishing hydrogen bonds between the molecules of the cellulose fibers contained in paper so wetting the fibers is a necessity.
- Historically water has also been used to transport these fibers to the web used for paper forming.
- This process was a very time consuming, energy-intensive process that also had significant sustainability disadvantages because of the aggressive chemical additives added to the water. Paper manufactured by this method was too expensive to successfully compete in the marketplace.

- GEN3 performed a Su-Field analysis, identifying the use of water in the transport of the fibers as detrimental. This analysis suggested that the key was to find *another substance* to perform the same function as the water, one without these harmful effects.
- However, the second function performed by water, promoting adhesion of the cellulose fibers, could not be eliminated as it was critical to the hydrogen bonding process mentioned above. In subsequent testing GEN3 discovered that the adhesion function could be achieved with as little as **one kilogram of water in the form of steam** per kilogram of fibers – a **1000X reduction** in water usage.
- This discovery opened the door to testing an alternative material to perform the transport function. To arrange slightly wetted fibers as a thin layer, GEN3 subsequently developed a fundamentally new technology, a low-moisture forming method based on using **air instead of water** to transport the fibers to the forming web.

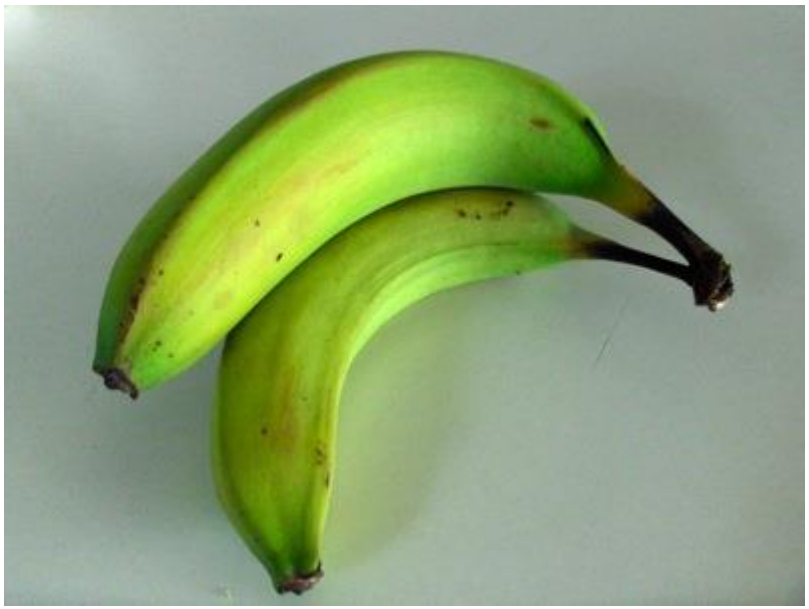
- Based on this technology, the client now manufactures very inexpensive disposable paper cloths, paper towels, tissue, and toilet paper which have a significant competitive advantage. Moreover, a reduction in energy consumption of almost 300% and a reduction in capital equipment costs by approximately 50% have enhanced their ability to compete successfully on price.



Case 15: Ready-to-eat Banana (USA)

A Problem

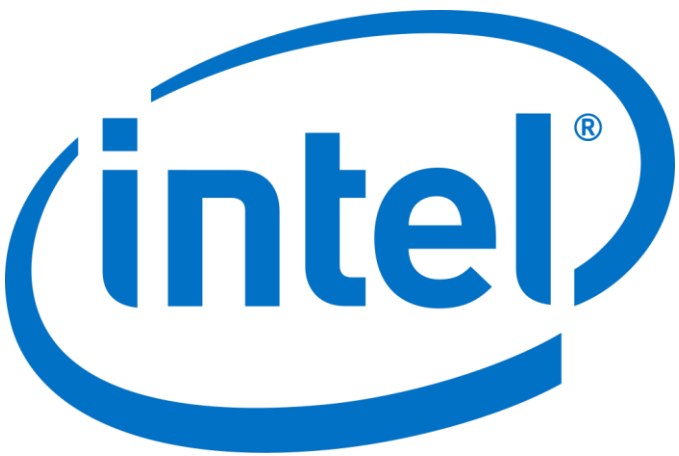
- Usually supermarkets face a contradiction: on one hand, bananas can be stored in a “semi-ready”-state, so their storage life considerably increases. On the other hand, consumers want to buy ripe, ready to eat bananas. However, these can’t be stored for a long time. What to do?



Solution

- The contradiction was resolved in time: bananas are stored while being green but become ripe exactly when they need to go to sales floor.
- A solution was obtained by suggesting to drastically accelerate the process of ripening with the use of ultrasound. When banana are about to go to the shopping area, they are subjected to ultrasonic radiation which makes them ripe within half an hour. This allows full control of sales and storage volumes. Taste and mouthfeel and other qualities do not change.
- The device is compact and can be used to quickly “prepare” individual banana as well.

Case 16: Champagne and microchips (USA)



Problem

- Before etching, microchip wafers made from silicon are coated with a layer of fluid protective compound. However the air bubbles which reside in the protective layer might create irrecoverable defects.
- It is necessary to find a technology of reliable removal of the air bubbles from the compound before etching.

Solution

- It was proposed to “copy” a technology of champagne wine makers: rotation of wine to let the air bubbles collecting in the middle where they can be easily removed.
- Application of this technology saves dozens of millions of US dollars per year.

Champagne making

A centrifugal machine for removing air bubbles from the protective compound

Sources: Intel; http://www.gen3.ru, last checked in July 2011

Case 17: Soap Cooling (USA)

Problem

- During production of crystal soap, cooling of the hot fluid soap with cold air creates a cork on a surface of the fluid. The formed cork drastically slows down the cooling process and decreases quality of a final product.
- How to crysalize the fluid soap homogeniously to avoid development of the cork?

Solution

- It was proposed to use a process of continuous casting known in steel parts manufacturing. A process of continuous casting uses ultrasonic vibrations which create crystallization centers through the entire volume of liquid steel. Thus the steel crystallizes immediately and homogeniously.

Contunous casting in steel casts making

Crystallization of soap

Source: http://www.gen3.ru, last checked in July 2011

Case 18: Diapers and a Gun (USA)

GEN3 PARTNERS

Problem

- In baby diapers, a thin plastic layer protects skin of a child. It must be liquid transparent, therefore the layer is made perforated. Currently, perforation of the plastic layer is made with many thin needles but this process creates quality problems. Laser perforation solves the quality problems but is more energy demanding and slower.
- It was necessary to invent an alternative perforation technology which will be fast and provide high quality of perforation.

Solution

- It was proposed to use a so-called “Powder gun” which was originally developed for testing materials of space stations to resist to micro-meteorites. The gun allows to evenly spread the powder and create perforation holes of a smaller diameter.

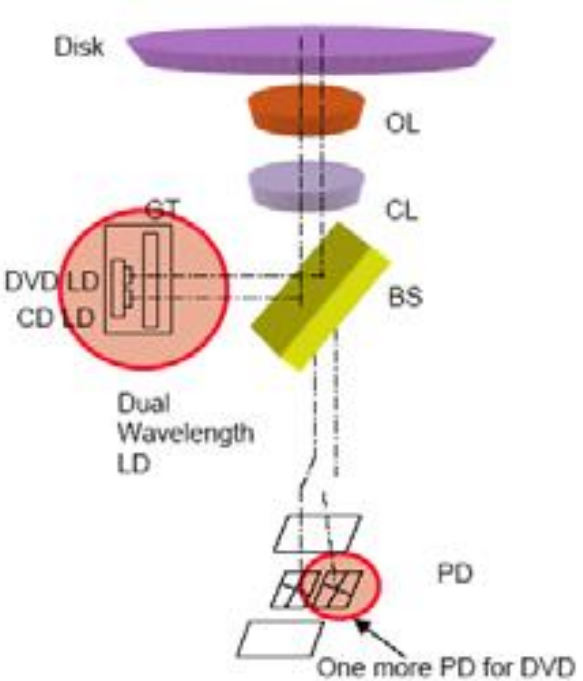
Holes produced by old technology

Microholes produced by new technology

Source: http://www.gen3.ru, last checked in July 2011

Case 19: Samsung DVD pick-up Costs Cut (Korea)

- In 2003, Samsung run a TRIZ project to analyze and innovatively redesign a DVD pick-up drive for computers and music players. As a result of this project, a new design saves Samsung over $100 million annually.
- In 2005, Hyo June Kim of Samsung Advanced Institute of Technology stated, "*During last 3 years, our TRIZ team did successful consulting activities. The economic benefit after applying is more than US$ 1 billion*."



Case 20: Boeing 767 Tanker (USA)

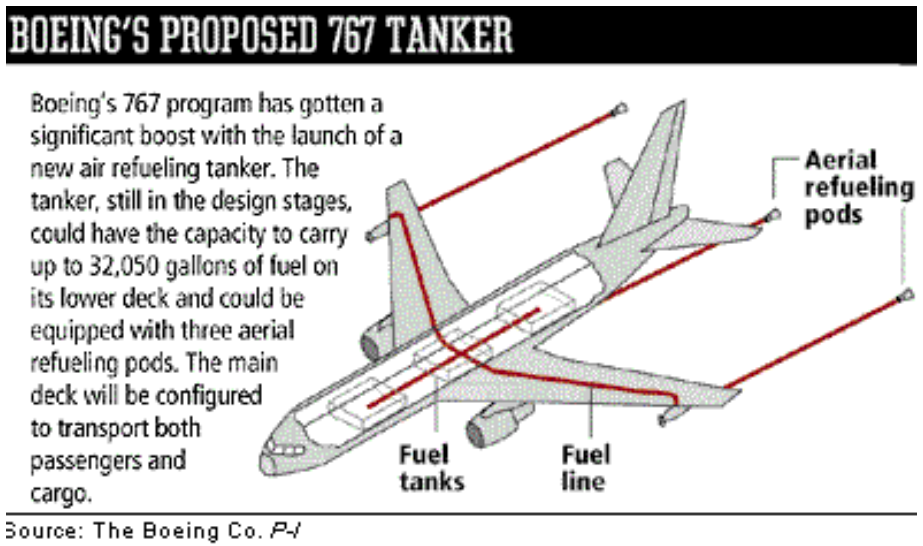
Case: Refueling 767 Air Tanker

- For John Higgs, 767 Tanker Transport chief project engineer at Boeing, the five-day TRIZ seminar refocused the thinking about a technical problem that had stumped a crew of top Boeing engineers for three years.
- The Tanker Transport program presented what chief engineer Higgs calls a classic conflict. The 767, “the word’s most efficient airplane,” is a two-engine airplane and, by design, has no excess hydraulic power. Yet it must be capable of pumping fuel at 900 gallons a minute at the boom-nozzle interface, flying at 15,000 feet altitude at 300 knots.

Solution

- The results, according to Higgs, have put Beoing ahead in our race to reconfigure the 767 into a combined tanker and transport for military use.
- TRIZ solutions developed and applied to the 767 Tanker Transport Project were critical in winning eight orders worth $1.500 million from the governments of Italy and Japan.

- Source: www.trizconsulting.com



Case 21: Dow Plastics (USA)

Case: Dow Plastics

- A Dow Plastics business found itself responding to meet the ever more rigorous needs of a cost-driven marketplace, for a technology tuned over decades. It convened a group of technical experts to redesign its "most effective" standard process technology for manufacturing facilities for this family of products. To stay competitive in costs, they needed to drastically reduce the capital needed to build future plants. The process, being decades old, had technology and equipment systems considered highly optimized – and it was a cause of psychological inertia.
- An overall Ideal Final Result helped outline the zones of conflict / pathways to innovation so that sub-groups could divide and attack each opportunity with the most appropriate TRIZ tools. Substantial use of technical contradictions and inventive principles helped address trade-offs. A Pugh concept selection matrix helped narrow the candidates to four for which the intermediate level of detail enabled cost estimations. Elements of IFR contributed to the evaluation criteria.
- Breakthrough was achieved in control of monomer residuals, handling of raw materials, and reactor design. The reduction amazed even the project team, when the capital cost of a plant built to the new standard dropped by more than 25 percent, from nearly $110 million to < $80 million.

Source: The TRIZ Journal

Contact

ICG Training & Consulting

Willem-Alexanderstraat 6

7511KH Enschede

The Netherlands

Phone: +31-53-4342884

E-mail: info@xtriz.com

Web: www.xtriz.com