

## 2 PROBLEM: AN UMBRELLA. (IGOR KAIKOV)

### 1 Possible solution

Everyone is familiar with this situation. A big umbrella protects well against rain.

It is also possible that two persons go under one umbrella... But strong gusts of wind turn it inside out. Sometimes they break it. The small umbrella withstands the gusts of wind better,



but protects against rain worse. Certainly, we can make a very big and sturdy umbrella with thick spokes, thick and durable fabric. But it will be difficult and inconvenient to carry the umbrella in this case even for two persons. In such moments it is necessary to keep it firmly in the hands. What can we do? Come up with a new design of an umbrella that will have a big dome and protects well against rain, will not be broken when the strong gusts of wind blow, and is comfortable to carry.

*Fig.1*

### \* Typical mistakes (made before problem solving)

- Usually it is offered to «strengthen» an umbrella. Make it more substantial: with thick spokes and a solid fabric. Contrast this solution with the first solution in the previous problem of a crash-proof key (see: Typical Mistakes made before the problem solving). Have you noticed the similarities in the logic? Traditional logic prompts us a bad solution, a solution «in the forehead». The wind could be so strong that the stronger spokes and fabric will not help to escape the problem... The paradox of dialectical logic that is the base of TRIZ is just the opposite. We need to «weaken» the umbrella, make it more pliable, flexible.

- One of the famous solutions is – The SENZ Umbrella – that overcomes partially the problem. «The SENZ Umbrella has been designed to directly fill a need - to prevent a strong wind from turning an umbrella inside out. The SENZ team has redesigned the umbrella to be both stronger and more aerodynamic». (Fig.2)



*Fig.2.* <http://www.moreinspiration.com/Innovation.aspx?id=1473>

However, this umbrella has a significant disadvantage. The dome of the umbrella has an asymmetric shape. It is necessary to travel with them like a boat, directing its narrow part towards wind. Now according to the inventor, an umbrella is less susceptible to gusts of wind. In addition to the complexity of the use of such umbrella, there are problems with its manufacture. The spokes have different lengths and must be coordinated with an asymmetrical dome during assembly. In addition, the diameter of the manufactured umbrella is of the small size, it's impossible to use it in two persons and the side wind would be undesirable in any case!

- Another kind of ideas for «strengthening» a design of the umbrella is to add additional elements to help the spokes to withstand the pressure of the wind. Of course, use such an umbrella is extremely inconvenient. You have to disclose an umbrella properly (Fig.3).



*Fig.3.*

- Another famous solution is a flexible dome of the umbrella. During a gust of wind, it is not broken, it turns inside out. But in the inverted position it does not protect against rain. In addition, the owner of an umbrella should return the umbrella dome in the initial state every time after a gust of wind.
- From despair some are ready to «surrender» to a task and say: let's make the umbrella of such size that protects against rain a bit and does not break when the weak wind blows. And in the rain and strong wind, we'll stay at home ... For some, this decision may be good. But not for us!

### **Prompt-1**

IFR:

An umbrella protects itself against the gusts of wind, does not worsen its function to protect against rain without the design complexity.

### **3 Prompt-2**

Contradiction 1:

An umbrella must be large in order to defend from rain well.

But an umbrella must be small in order to prevent that wind breaks it up.

## Contradiction 2:

An umbrella must have holes to prevent that wind breaks it up.  
But an umbrella must not have holes in order to defend from rain well.

## Contradiction 3:

An umbrella must have a special form in order to be protected from wind gusts, and the umbrella must have a normal shape to make it easier to produce.

## Contradiction 4:

An umbrella must be specially shaped in order to be protected from wind gusts, and an umbrella must have a normal form, the form of a hemisphere, in order to protect from rain uniformly.

## 4 Tool

### IFR:

An umbrella protects itself against the gusts of wind, does not worsen its function to protect against rain.

## “Tongs” Model

1. IS – Initial Situation description: Undesirable (negative) situation (Negative Effect – NE).  
What would we like to change? :

A big umbrella protects well from rain. But the strong gusts of wind turn it inside out. But sometimes they break it. A small umbrella withstands gusts of wind better but protects against rain much worse.

2. Imagine that magic wand is in your hand (MDR):

The umbrella protects a person from rain well and is not broken by the gusts of wind.

The umbrella protects itself against the gust of wind, does not worsen its function to protect from rain.

3. Barrier (Contradiction) that prevents us from overcoming the negative effect (NE=IS) and obtain the MDR:

A large dome of the umbrella acts as sails in the gusts of wind; i.e. the wind gusts directed inside the dome of the umbrella, are the most dangerous. Indeed, they turn the umbrella inside out and break it. The external wind gusts «slide» along an umbrella.

4. Follow the ARIZ steps, or at least its intrinsic logic, to analyze the contradiction by identifying the operational zone, the operational time, the available resources and search for separation opportunities.

Follow the steps 1-3 of ARIZ as described in section 3 and then apply the separation principles as described in section 5.

Let's examine some inventive principles applied to the present contradiction.

## Inventive Principle № 1 “Segmentation“

- A) Divide an object into independent parts.
- B) Make an object easy to disassemble.
- C) Increase the degree of object fragmentation or segmentation.

### Comment

We examine the contradiction 1: an umbrella is big – small. The following idea arises: To divide the umbrella into two umbrellas, for example, to use two small umbrellas rather than a big one (Fig.4). The obvious drawback of this solution is the inconvenience in use.

Similarly, we should consider that two knives are not scissors yet.



**Fig. 4.** How to use two small umbrellas instead of one big?  
[http://www.dvorec.ru/reg/foto/11455\\_1153293970.jpg](http://www.dvorec.ru/reg/foto/11455_1153293970.jpg)

## Inventive Principle № 15 “Dynamics”

- A) Characteristics of an object (or outside environment) must be altered to provide optimal performance at each stage of an operation.
- B) Divide an object into elements capable of changing their position relative to each other.

### Comment

We examine the contradiction 1: an umbrella is big – small. The following idea arises: It rains constantly, so as long as it rains, the umbrella must be open. The gusts of wind blow inside the umbrella periodically. During a gust of wind the umbrella turns into a small, after the wind has passed, it turns into a big umbrella.

## Inventive Principle № 21 “Rushing Through” (Skipping)

Perform a harmful and hazardous operation or its stages at high speed.

### Comment

We examine the contradiction 1: an umbrella is big – small, and the contradiction 2: an umbrella has a hole to drain off a gust of wind and does not have a hole to protect from the rain. The following idea arises:

The hole occurs only when a gust of wind blows. The wind itself opens a «window». There is a new challenge: how can we protect ourselves from the rain during the opening of the hole? Although the time during which the hole in the umbrella is opened is small, during this time interval there is no good protection from the rain.

## Comment

This is a very important point. Some problems are solved in two steps. We have found a way of draining off a gust of wind from the inside of the umbrella dome, but we do not know how to protect ourselves from the rain at this point. This situation is already described in the form of the contradiction, it is important to find a way to resolve the contradiction.

## **Inventive Principle № 22: Convert Harm into Benefit (“Blessing in disguise” or “Turn lemons into lemonade”)**

- A) Utilize harmful factors – especially environment – to obtain a positive effect.
- B) Remove one harmful factor by combining it with another harmful factor.

## Comment

We examine the contradiction 2: an umbrella has a hole to drain off a gust of wind and does not have a hole to protect from the rain. The following idea appears:

A gust of wind creates excessive pressure inside the dome of the umbrella. The flow of air does not allow that drops of rain penetrate inside through the hole in the dome of the umbrella.

## **Inventive Principle № 25 “Self-service”**

- A) An object must service itself and carry out supplementary and repair operations.
- B) Make use of waste materials and energy.

## Comment

We examine the contradiction 1: an umbrella is big – small, and the contradiction 2: an umbrella has a hole to drain off a gust of wind and does not have a hole to protect from the rain.

The following idea arises:

The umbrella of large diameter has a hole in a form of valve. In a normal position the hole is closed. At the moment of a wind gust the air flow opens the valve in this hole. After passing of the air flow the valve closes automatically, for example, under the weight of the valve cover. The valve can be made in the form of cloth, imposed on the hole.

## **5 Possible solution**

The dome of the umbrella consists of two parts, superimposed on each other with a little overlap. A gust of wind creates an excessive pressure inside the dome of the umbrella. The edge of the upper part of the umbrella dome rises over the lower part, draining off the air. The gust of wind ITSELF opens this kind of valve in the umbrella dome. At the time when air passes through the umbrella becomes «an umbrella with a hole». The raindrops can not get into the space under the umbrella, because the excessive air pressure prevents it.

After the flow of air gust through the umbrella, the fabric of the upper part of dome falls under its own weight and re-adheres to the bottom of the dome, forming a coherent whole. The drops of rain, falling down the umbrella, can not get into the space inside the umbrella, since the upper part of the dome covers the edge of the lower part of a couple of centimeters. (It is like the tiles on the roof of the house). See Fig. 5 – Fig. 8.



**Fig.5.** (Photo by Kaikov I.)



**Fig.6.** (Photo by Kaikov I.)



**Fig.7.** (Photo by Kaikov I.)



**Fig. 8.** (Photo by Kaikov I.)