targetInvention technologies

Washing machine conditioner supplying

Cirvumvented with Target Invention Idea Protecting technology

Preparatory stage

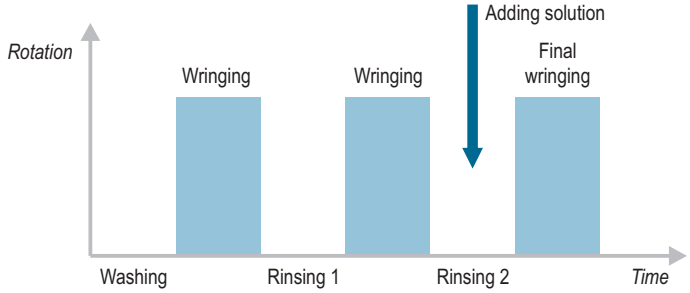
It is necessary to determine the prototype, that is, the patent to be circumvented

The goal was finding the circumvention versions for a patent on a device for supply of conditioner solution into the tank of a vertical drum type washing machine.

The housing of such a washing machine contains an open top drum that is rotated by an electric motor. At the drum bottom, there is a rotatable blade-type activator for washing and rinsing. In addition, the drum itself can also rotate quickly for removing water from the clothes.

The considered construction belongs to the economic class, therefore its manufacturing cost should be minimal. Such machines have a strict technological cycle. It includes one washing cycle and two rinsing cycles. For presetting the required intensity of these processes, the user can only change the duration of each cycle and the activator motion character. After every washing and rinsing, clothes are wrung out and water is discharged from the washing machine due to the fast rotation of the drum together with the activator.

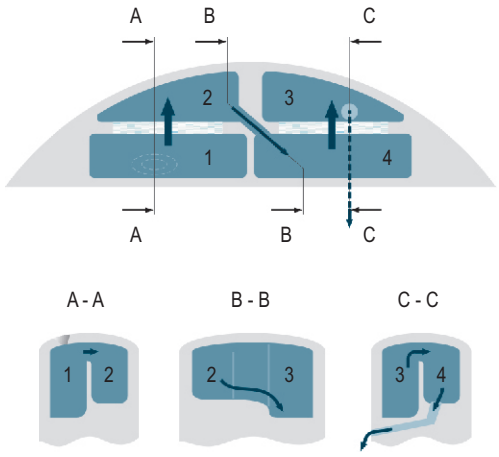
Before washing, detergent powder is poured into the washing machine tank and a conditioner solution that must get into the tank during the last rinsing cycle is poured into a special vessel located on the drum. The conditioner solution supply system is located directly on the drum, it its upper portion.



Step 1

Determining the function, composition and structure of the technical system covered by this patent

The design of the device for conditioner solution supply into the washing machine drum is shown in the figure.



There are several recesses molded within the hollow drum: 1, 2 3 and 4. Pairs 1-2 and 3-4 have common walls and are located so that recesses 1 and 3 are positioned closer to the inner wall of the drum while recesses 2 and 4 are situated closer to the outer wall. Recesses 1 and 3 have a greater depth that recesses 2 and 4. In addition, recesses 2 and 3 are connected by an inclined channel. Over recess 1, there is an opening for pouring a solution. The bottom of recess 4 has an opening for discharging the solution into the tank. The device employs the centrifugal force that occurs during fast rotation of the drum.

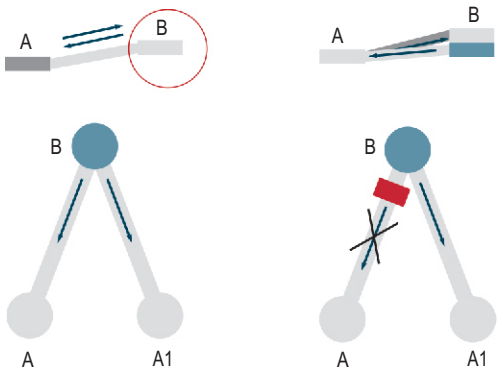
The device works in the following manner.
• The solution poured in before washing first gets into recess 1. During washing, when the drum is motionless and only the activator rotates, the solution remains in this recess.
• When the drum starts to rotate for wringing out the clothes, the centrifugal force makes the solution flow into a shallower recess 2. During the drum rotation, the solution remains pressed against the wall in the second recess.
• Then follows rinsing, the drum stops and the solution flows through the channel from recess 2 into recess 3.
• Further the drum starts rotating quickly again to rinse the clothes. The solution flows into recess 4 and remains pressed against the wall until the rotation is finished.
• The drum stops for the second rinse, the solution flows down to the bottom of recess 4 and then flows through the channel into the tank.

Worth noting is the extreme simplicity and functionality of this device. It has no moving parts, valves, energy supply; it is only necessary to pour in a solution before washing. For the given conditions, this system may be considered close to ideal. Unfortunately, this “ideal system” had one serious disadvantage: it had been patented by competitors. Purchasing a license seemed the only way out.
Then the question of circumventing the patent came up. The problem was that the simple and effective prototype selected by designers fully suited them and changing the principle of operation was undesirable. We had a classic version of a patent obstacle: the system was fully satisfactory but it could not be produced and sold for legal reasons.

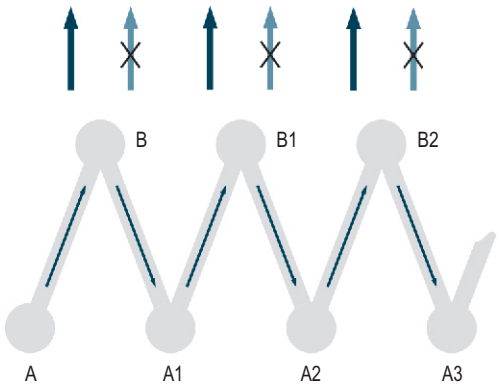
Step 2

Determining the patent features which need to be changed

Before making a move toward the circumvention of the patent, it was necessary to select a patent feature to be analyzed using the Evolution Tree. For this purpose, a simplified model of the device for conditioner solution supply was built.
The simplest model will be a device comprising three chambers connected with each other by inclined channels. One of the chambers (A) is filled with liquid and located closer to the center of rotation, the other one (B) is empty and is located at a greater distance from the center of rotation. The third chamber A1 is located similarly to the first one and connected with the chamber B by a channel.



It is apparent that at fast rotation and due to the action of the centrifugal force, the liquid starts flowing into the second chamber and remains there until the rotation ceases. Then the liquid starts flowing through the inclined channels into the first and third chambers.
To prevent this, the channel inlet should be located in the upper portion of the second chamber and the outlet in its bottom portion. Then the liquid will not be able to go back during rotation and will flow into the next chamber. This suits us excellently because it is necessary to direct the liquid to the next chamber without permitting it to go back.
Thus, to move the liquid by one step corresponding to the fast rotation of the drum, it is necessary to have a module comprising three chambers arranged in a certain manner. Connecting several such modules in series may produce a device providing a step-by-step (according to the number of fast revolutions of the drum) motion of the solution from the first chamber to the subsequent level A chambers in some direction.



This model allows better understanding of the peculiarities of the device operation and determining the patent features to be analyzed.
Limitations imposed on the change of this technical solution are very severe. It is not allowed to complicate the key diagram of the device, introduce valves or gates controlled by the washing-machine computer. In addition, the chamber parameters (the tilt angles and surface properties of the walls, size and depth of the chambers and channels) are well optimized. Changing these parameters can negatively affect the device operation. It would seem that the drum rotation frequency may be used as liquid movement control parameter. However, the drum rotates with the maximum speed during wringing and increasing that speed turned out to be impossible.
Thus, there only remains one patent feature that can be changed: the layout of three-chamber modules.

In the existing design, three-chamber modules are arranged in echelon under the upper surface of the drum in the rotation direction. Properly speaking, we are dealing here with the linear structure transformations that may be described by the Evolution Tree using the following evolution patterns:

- **Coordination of the chamber arrangement with the drum rotation direction,**
- **Geometrical evolution of a linear structure**

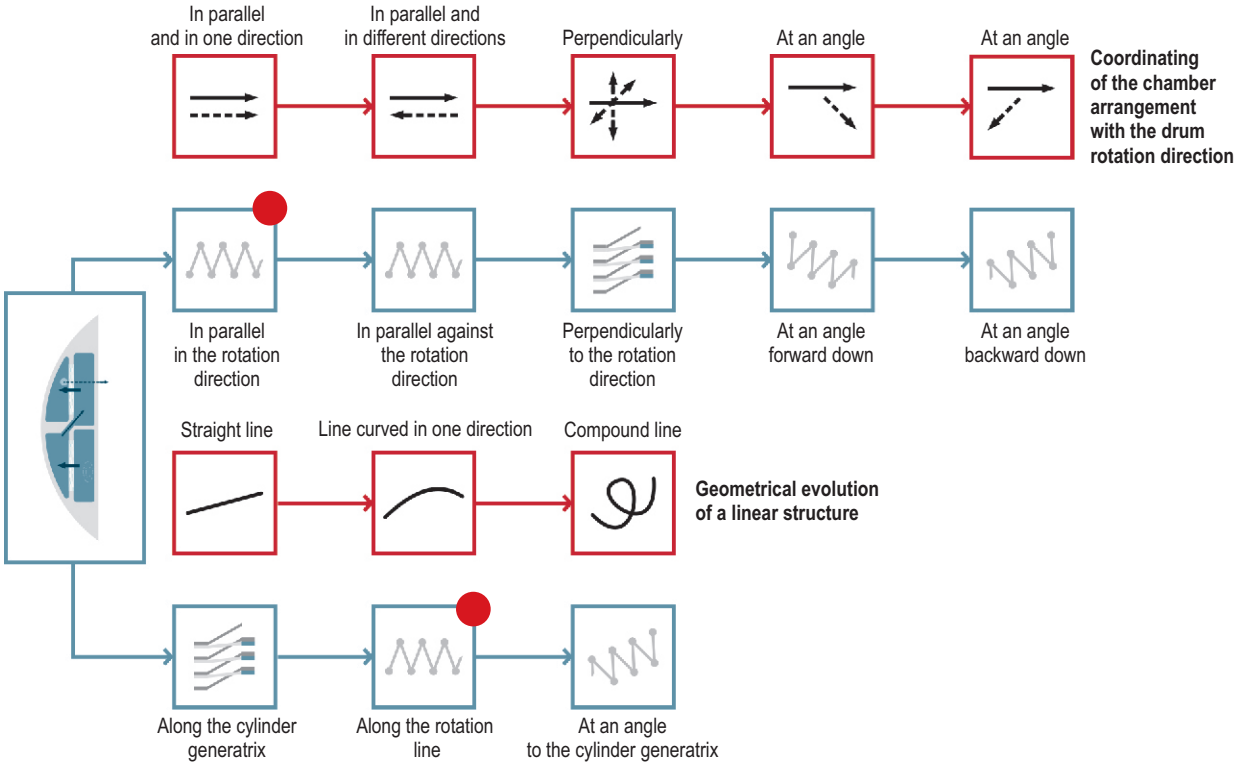
To transform this device modification, we can try to use the basic Evolution Tree fragment that includes these evolution patterns. The generalized transformation versions are arranged in the following manner.

The evolution pattern **"Coordinating of the chamber arrangement with the drum rotation direction":**

- *in parallel with the rotation direction, in one direction;*
- *in parallel with the rotation direction, in different directions;*
- *perpendicularly to the rotation direction, toward the drum center;*
- *perpendicularly to the rotation direction, away from the drum center;*
- *perpendicularly to the rotation direction, down along the drum generatrix;*
- *perpendicularly to the rotation direction, up along the drum generatrix;*
- *at an angle to the rotation direction.*

The evolution pattern **"Geometrical evolution of a linear structure":**

- *straight line;*
- *line curved in one direction;*
- *compound line.*



The Evolution Tree fragment for a real system – a solution supply device – will look as follows.

The evolution pattern **"Coordinating of the chamber arrangement with the drum rotation direction":**

- ***in parallel with the rotation direction:***
  - *in the rotation direction*
  - *against the rotation direction*
- ***perpendicularly to the rotation direction:***
  - *top down;*
  - *bottom-up;*
  - *inside the drum;*
  - *outside the drum;*
- ***at an angle to the rotation direction:***
  - *forward down;*
  - *forward up;*
  - *backward down;*
  - *backward up.*

Step 4

Building an Evolution Tree for the system under analysis

The evolution pattern **"Geometrical evolution of a linear structure":**

- ***straight line:***

— along the cylinder generatrix;

- ***line curved in one direction:***

— along the rotation line;

- ***compound line:***

— at an angle to the cylinder generatrix.

Step 5

Identifying transformation versions which are not covered by patents by comparing the basic and specific Evolution Trees

After considering possible module layout versions, we can draw a conclusion that there is some choice (patented layout charts of three-chamber modules are marked with red circles in the figure and the remaining ones may be used to build alternative technical solutions).

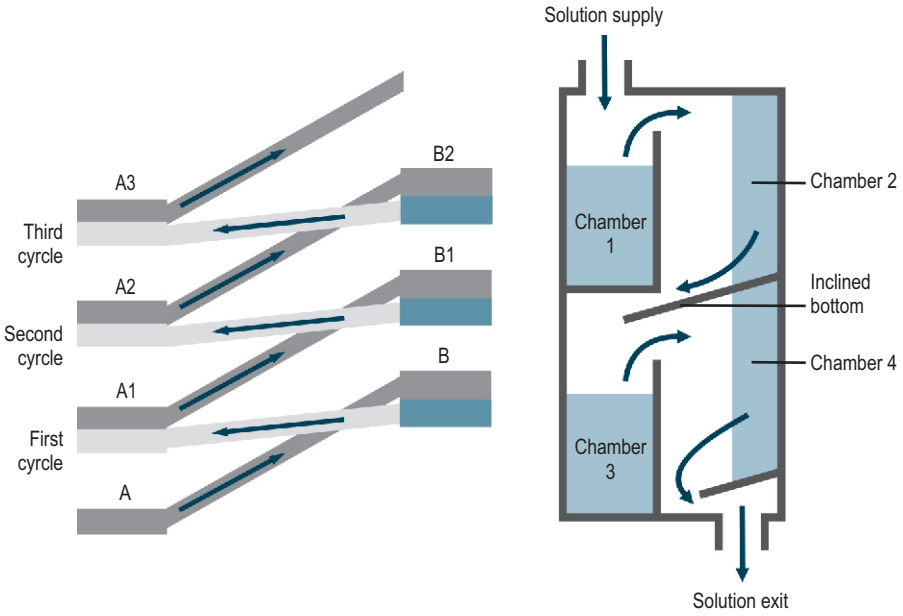
Step 6

Assessing the possibilities of using these versions in the system, selecting the most suitable ones

Placing the modules toward and away from the drum's center of rotation should be immediately excluded because it will be necessary to make the drum wall much thicker for placing the device composed in this manner. The variant of arranging the modules at an angle can also prove difficult to manufacture.

Placing the chamber against the rotation direction is equivalent to the initial patent. This version may be considered as a possible way of circumventing the patent, but requires advice of a patent agent concerning the scope of claim of the initial patent. It is legally easier to protect the top down arrangement of the modules along the cylinder generatrix and top down arrangement at an angle to the generatrix – backward and forward.

Technologically simpler is the top down module layout along the cylinder generatrix. We choose it as the alternative to the initial patent.



Step 7

Proposing of technical solutions based on these versions

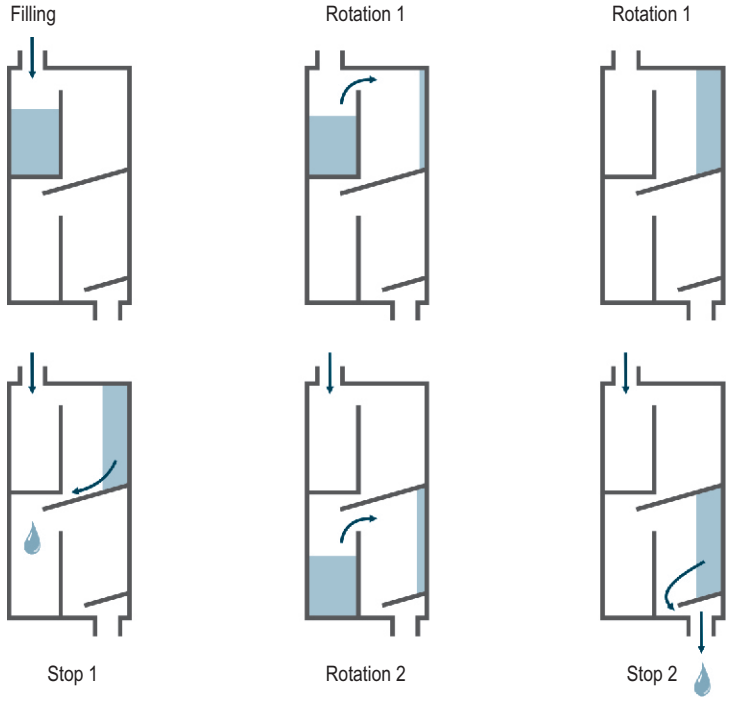
What can the structure of a device with a vertical arrangement of modules be like?

Chambers for solution are mounted on two levels. The internal and external chambers are arranged in pairs and have a common wall. Over upper internal chamber 1, there is an opening for pouring a solution. External chamber 2 has an inclined bottom. The lower portion of the chamber has a slit. A diverter made as a continuation of the slit directs the solution into internal chamber 3 of the lower level. The bottom of lower external chamber 4 has an opening for solution discharge into the tank.

This alternative device works in the following manner.

- Solution is poured into chamber 1 and kept there.
- The drum starts rotating to remove water. Centrifugal force makes the solution flows into chamber 2 where it remains pressed against the wall.
- The drum stops for rinsing and the solution flows on the inclined bottom and the diverter from the recess of chamber 2 into chamber 3.

• Then the drum starts rotating quickly for wringing the clothes. The solution flows into recess 4 and remains pressed against the wall until the rotations ceases.
• The drum stops for the second rinsing cycle and the solution flows to the bottom of recess 4 and through the channel into the tank.



Thus, using the Evolution Tree, we have obtained alternative technical solutions which offer new opportunities for circumventing the existing patent. For introducing into production, we have selected one, the most technologically advantageous version and proposed it for patenting. It should be noted that most of the described versions are operable and effective. They can also be successfully patented.