

Design and Development of Utensils Washer

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Abstract—This paper represents the new design of utensils washer machine. In this, the adjustable racks containing utensils tend to rotate, so that all sides can be washed properly. Racks are rotated by using separate motors to both. Two racks are placed around a single sprinkler. The sprinkler is stationary. This leads to made the design more simpler than the present dishwashers.

Keywords- *utensils-washer, adjustable racks, sprinkler, stationary, simpler design*

I. INTRODUCTION

The It is a machine that cleans, rinses and dries the dirty utensils.

Working :- After loading & switching on the program, the utensils washer draws water & sprays water through jets to rinse the utensils. It then releases the detergent & the utensils are cleaned with soapy hot water. Once the cleaning process is done the dishwasher rinses the utensils again. Post this cycle the dishwasher dries the utensils..

In the first decades of the XX century the electrical technologies began to spread in many hand operated and controlled applications. That permeation opened new design perspectives, widening machine capabilities and reducing human efforts, as it has happened to several home appliances such as the dishwasher. Since from its first appearance in Western countries, the dishwasher has been seen as a welcome help and its importance has increased significantly in recent years influenced by new social trends that have made it an essential home appliance. Nowadays, under an engineering design perspective, a dishwasher can be considered as a complex system, since it integrates mechanical, electrotechnical and electronic features, whose interaction highly influences the cleaning performances of the product. That cleaning effect is the result of 3 physical actions such as: the mechanical impact of water on the load (e.g. pans, plates, cutlery, etc. placed on the two racks); the chemical action of the detergent; the thermal action of the water. While the mechanical effect depends on the rotation speed of the two sprayer arms and then on the water pressure (since it strongly influences the rate of mechanical removal and the solubility of soil and detergent during the washing phase), the detergent component chemical reactions are activated by the water thermal energy, electrically heated up at a temperature that depends on the selected washing cycle (from 50-52°C in case of energy saving cycles, until 65°C for the intensive ones with an average consumption of 1,1÷1,2 kWh, even if there is a strong push to decrease such value). At the end of each washing cycle, a pump drains the water up. During the drying phase the water is heated up at about 65÷67°C; that cycle is then the most energy-intensive and for this reason manufacturers are now investing a lot of efforts to make this

phase more energy saving. The hot water in turn heats dishes and their heat capacity enables the evaporation of the water film on them. Steam condensation occurs on the tub surfaces and the liquid is then collected and exhausted by the drain pump.[1]

II. History

In this section, a quick survey of the principal milestones that characterize the dishwasher historical evolution is proposed.

A. The birth of the first dishwashers

The Houghton patent [2] is the first, which one can find in literature, searching for machines that can wash dishes. It is worth noting that this patent refers to “a novel machine”, while all the immediately subsequent patents refer to “improvements” of existing machines. The Houghton’s machine was completely manually operated. Practically it consisted of a vessel that could be filled with hot water and a basket to hold the dishes. The basket was manually rotated by means of a crank handle. Mrs. Cochrane, in 1886, greatly improved this machine since she introduced the sprays while the water pump and the dish basket were still manually operated [4].

B. The first electrically powered dishwashers

In 1917, Mrs. Cochrane came out with an improved solution: she introduced an electric motor to operate the centrifugal water pump [5]. In this solution she also introduced the spraying arms, rotated by the reaction force of the water exiting through spray nozzles placed in these arms. In that model, the rinse phase was also introduced.

In the same period (1921), the Walker Brothers Company patented a dishwasher machine [6] where an electrically operated impeller, totally immersed in water, was used to toss around the water and throw it on the dishes.

C. Towards automatic dishwashers.

In the 1950s, the automation began to appear in dishwashers. Even if these machines did not clean dishes well, their technological level started to improve quickly so that the transition from hand to automatic washing begun. The introduction of electric appliances in modern kitchens, has determined the born of a new era and the dishwasher manufacturers have seen a rapid increase of the production

volumes for this appliance. From the historical point of view, in 1949 Apex Electrical Manufacturing Co. introduced a dishwasher called DISH-A-MATIC. It was one of the first models of the post-war economic boom. In this model an electro-mechanical automation was introduced: a knob was used to control the washing cycle of the machine. In 1954, Apex introduced another model. The dishes were washed by means of an impeller rotated by an electrical motor and the entire cleaning cycle (washing, rinsing and drying) was controlled by means of an electro-mechanical timer (based on several cams). In this model, electrical resistors were used to warm up water. In the related patent [7], that technical solution is motivated by the reduction of thermal energy dispersion in the hot water pipeline. In parallel, during these years, one can assist to the growth of dishwashing detergent producers that started to work in collaboration with appliance manufacturers and, specifically, with their technical departments: the relation among the detergent chemical action and the thermal and mechanical effects of the water were already known by experts [8].

D. Dishwashers from the 1980s to present

Starting from the 1980s, several improvements were introduced. Loading systems have evolved in an ergonomic direction as described in the advertising campaigns of that period. Two racks have been introduced in order to accommodate a higher number of kitchenware and make easier the loading phase. More rotating sprayer arms have been introduced to improve washing efficiency. Detergents and rinse aid evolved to obtain a better result, forcing the dishwasher producer to adapt the machines to use the new products; tablets are a typical example: their use required a complete revision of the washing cycle and the introduction of adequate systems. Besides these mechanical and chemical improvements, electronic control systems were also introduced in this period allowing a more effective control of the washing cycle, and enabling the storage of more predefined programs. Starting from that technological level, manufactures have then begun to explore new distinctive features thanks to a deeper understanding of the users' needs: changes in the way people interact with the dishwasher have been implemented together with the study of new cleaning/drying technologies.

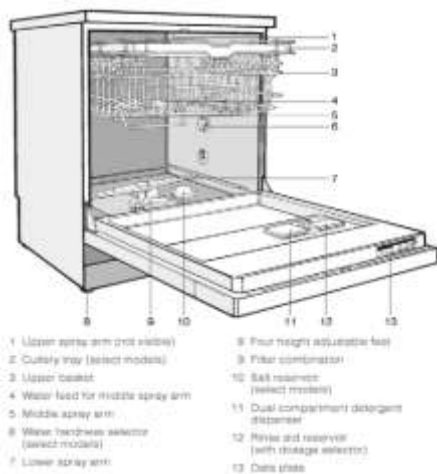


Fig. 1. Schematic of present dishwasher[9]

III. Design of Utensils washer

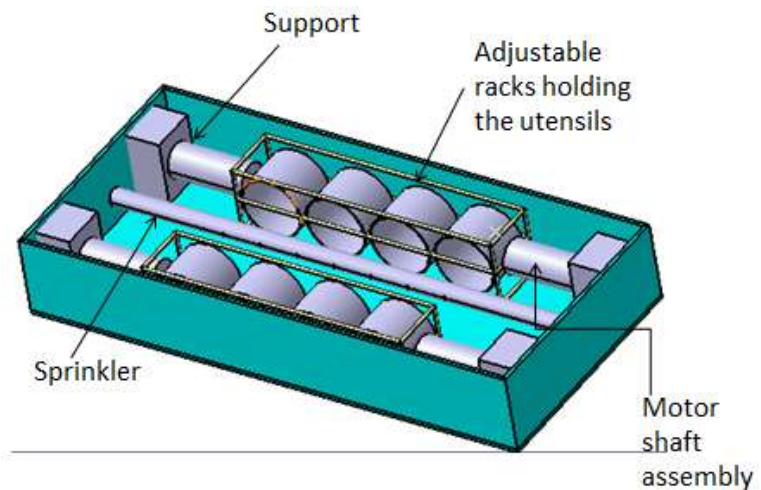


Fig. 2. Schematic of utensils washer

The fig2. shows the design of the utensils washer. The utensils washer mainly contains two adjustable racks, a sprinkler, two motors etc. The racks are joined to the motors with the help of shaft at one end and the support is provided so that the bending of the shaft is restricted. When the motor starts, the shaft attached to the rack is rotated due to which the racks are placed to rotation.

The motors are selected as,

$$\text{Torque} = \text{Force} * \text{Perpendicular distance}$$

Where,

$$\text{Force} = (\text{load applied on the rack} + \text{mass of shaft}) * \text{gravitational force}$$

Let,

The average load applied on the rack will be 1.2kg,

The mass of the rack be 0.8kg and

The mass of shaft be 1kg

We get,

$$\text{Force} = (1.2+0.8+1) * 9.81 = 29.43 \text{ N}$$

Also,

$$\text{Perpendicular distance} = 120 \text{ cm} = 1.2 \text{ m}$$

Therefore,

$$\text{Torque} = 29.43 * 1.2 = 35.316 \text{ Nm}$$

Now,

$$\text{Power} = 2\pi NT / 60000$$

Where,

N – Speed in rpm – 15 rpm (Assume)

T = Torque in Nm = 35.316 Nm

Therefore,

$$\text{Power} = (2*3.14*15*35.316) / 60000$$

$$\text{Power} = 0.05545\text{kW}$$

Dimension

For four utensils on one rack,

Rack size,

Length = 70 cm

Width = 14 cm

Height = 17 cm

Outer case size,

Length = 120 cm

Width = 60 cm
Height = 25 cm

Pressure of water

The water pressure required is 20 PSI (pound per square inch)

1 PSI = 0.0689475729 bar

Therefore,

20 PSI = 20* 0.0689475729 = 1.379 bar

IV. CONCLUSION

This design of utensils washer can be used to wash probably any type of utensils very cleanly and with the ease. As the motors selected can consume much less power so it will be the electricity effective. Also there is a need of a machine which washes the utensils automatically. Manual wash is usually done with cold water whereas a utensils washer uses hot water to wash the utensils; this helps to kill harmful germs during the washing cycle. And The utensils come out dry which means that there is no need for drying them manually afterwards or leaving them out for drying them – which reduces dust accumulation on the utensils.

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