Title: Design of Gears in Semi-Automatic Dish Washing Machine

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Abstract— This Paper discuss about design of gears in semi-automatic dish washing machine. Why semi-automatic dish washing machines are more popular in India as compared to fully automatic dish washing machine, Automatic dishwasher uses large amount of water, time and is costly. And because of all these reasons, the usage of automatic dishwasher in our country is very less. Use of semi-automatic dishwasher, we can reduce time as well as efforts of human also.

Key words: Automatic Dish Washing Machine

I. INTRODUCTION

We all know that dish and utensils washing are most difficult and time consuming work. But if it is done by Automatic dish washing machine, it become costly for every person. So, that we introduce Semi –automatic dish machine. Washing dishes is most commonly done activity in the world, in most of families people wash dishes by hand which is straining to muscles and detergent is chemically harmful. As far as manual process is concerned in houses of India, washing is done by hand scrubbing which is straining to the muscles through its energy and postural requirements. It may also lead to clinical, anatomical disorders and back pain which may affect the operator‘s health. Many of their household chores are performed by the women and some can be very physically challenging and time -consuming. So in several ways in which we can improve their lifestyle, and one aspect that we can improve on is the way they wash their dishes. Currently the chore of washing dishes is performed by the women, and can be very labor intensive as it is done for up to several hours each week. The same can be experienced in marriage ceremony with caterers. In today‘s world of Automation Era it is barely possible to find any field that implemented atomization which reduces.
Human effort, improves Production rate and also increases Efficiency. Then it could be the biggest manufacturing industry, Pharmaceutical industry, Hospitality field and even Household or Kitchen automation. But still our country is not getting enough benefits from automation and the reason behind this limitation is less Knowledge about automatic products, High device cost, and kind of nascence feeling about atomized devices. However this fear is not seen in the product which does not involves much Sensors, Complex Electronic Circuits, and simple easy User Friendly devices.

II. SEMI-AUTOMATIC DISH WASHING MACHINE

Main objective of semi-automatic dishwashing machine is to reduce the cost of fully automatic dish washing machine and giving good cleaning Performance.

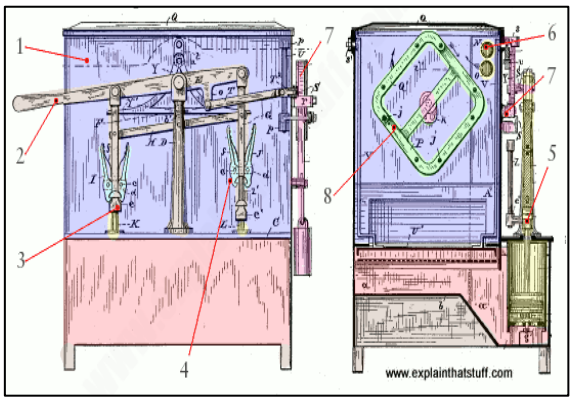

Fig. 1: Mechanism in semi-automatic dish washing machine

III. HISTORY

Dishwashers were invented by a woman: Josephine Cochran of Shelbyville, Illinois in the United States of America. She applied for her patent (with Jacob Krutch) on August 19, 1887 and it was granted on October 30, 1888

1) At the top of the machine, we have the washing compartment (blue) where you load your dishes into a rack, which Cochran called the grate. The lower part of the machine (red) is the water tank.
2) The handle has two vertical rods running down from its operating two independent pumps. One of the pumps is for washing the dishes and blasts hot soapy water around the washing compartment; the other pump is for rinsing the soap and dirt away with clean water. At any time, the pumping handle is connected to one or both of the pumps, but not both. The place marked is where you connect and disconnect the pumps.
3) You attach (or disconnect) the two pumps to the pumping handle, in turn, using the grip pliers (turquoise), which clamp the handle to the pumping rods underneath.
4) Now looking at the side-view diagram (on the right), we can see a cross-section of one of the pumps. Each time you heave the handle up and down, it draws in water (either hot and soapy or clean rinse water, depending which pump you're using) from the bottom and then pumps it up to the top of the machine.
5) The water sprays over the dirty dishes from two perforated pipes (yellow) at the top.
6) The pumping handle is also connected to a ratchet and wheel mechanism on the side of the machine that rotates the grate inside.
7) The grate (green), filled with crockery and cutlery, slowly rotates all the time you're washing, so that (as Josephine put it) "each renewed spray will dash against the contents of the gate in every position they may assume" (in other words, ensuring everything gets ahead shed and cleaned from all directions).

IV. DESIGN OF COMPONENTS

A. *Materials for construction*

The following materials were carefully chosen for the construction of the dish washing machine. These were:

1) Metal steel
2) Stainless steel
3) Electric motor
4) Reduction gear
5) Water tap
6) Shaft
7) Switches
8) Drainage hose
9) Sealing (soft) brush
10) Transformer (240V)
11) Regulator

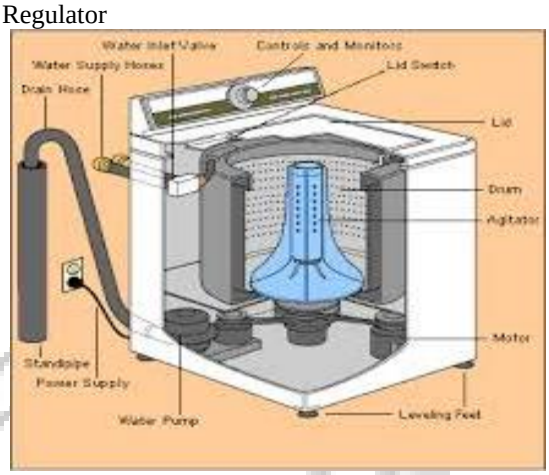

Fig. 2: components in semi-automatic dish washing machine

B. *Design of Components*

The title semi-automatic is because it involves both the machine work with very less human effort. The design will Consist of one rectangular plastic casing and will be

1) The very first compartment will contain the dish, cutlery or crockery utensil‘s cleaning. This compartment will be filled with detergent water up to 50% height to avoid splashing. There will be two rotating brushes with negligible clearance between them. A stand will be fixed at the bottom so that the dishes can rest on it and there will be no need to hold the dishes while they are being washed.
2) The second compartment which is middle one will function same as that of first one. The only difference is that this compartment will be filled with clean water for rinsing the detergent, and instead of rotating brushes, rotating sponges will be fixed at both the sides of the dishes. So that there won‘t be any possibility of food stains or detergent remnants on the dishes.

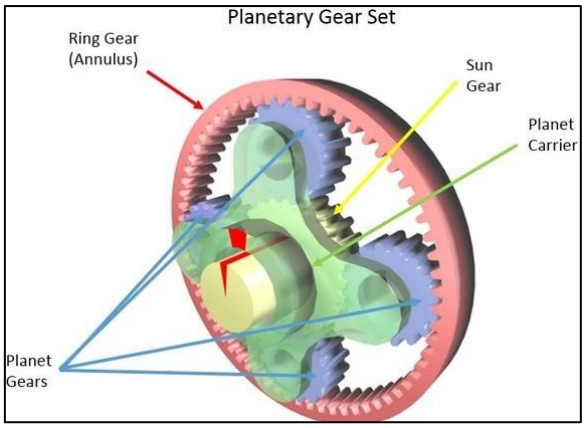

Fig. 3: Planetary Gear Set

3) The third and last compartment will comprise again detergent water, but now for the glass cleaning. This compartment will contain inner rotating brush and outer fixed brush. And to rotate all this brushes there will be single motor shaft which will by mounted with 4 pulley for belt drive. 2 pulleys to drive 2 rotating brushes in first compartment , 2 pulleys to drive 2 rotary brushes in second compartment and at the end of a bevel gear to drive the vertical rotary brush in third compartment

C. *Gear Design*

1) *Motor Power:*

The power required for the transmission of torque required was calculated

P = V x I x 1.732 or

P = (T x N) / 5250

Where:

P = Motor power (Hip / Watt); V= Voltage (V); I = Current (A); T = Torque (N-m); N = Speed of rotation (p.m.)

The earlier is to be used for estimating the power input to the motor while the latter is for estimating power output. The difference is wasted energy, which manifests itself as heat produced by the motor. Assuming the input voltage is

240V and current of 1.345A,

P= 240 x 1.345 x 1.732=559.5w

2) *Design of Worm Gear*

Speed of worm is taking as the speed rotation of the motor = 1000 r.p.m.

The speed is expected to be reduced to 12:1, i.e. velocity ratio (V.R) = 12

Let

N= Speed of the worm gear in r.p.m.

From velocity ratio relation,

N=1000/12=85RPM

T=p*60/2*pi*N=559.5*60/(2*pi*85)

T=44.794N

Sr No o	No of Plate s	Water used in washing(lit s) for machine	Water used in washing(lit s) for manual	Time used in washin g (sec) For machin e	Time used in Washin g (sec) For manual
1	15	1	2.5	30	60
2	35	2	3.5	90	150
3	65	3	4	180	240

4	90	4	5.5	240	400
5	100	4	5.5	260	400

Table 1: difference in manual washing and machine washing

The Dishwashing Machine

The entire body of the dishwasher i.e. the outer surface was made of metal sheet which is of dimension 90cm by 60cm by 75cm. Dishwasher (metal sheet): Length = 90 cm; Breath = 60 cm; Width = 75cm

The volume of the dishwasher = (90 x 60 x 75) cm=4050cm3

3) The Rinsing Basin

This is the second basin where the plates are rinsed with clean water after washing. The plate has these dimensions

Length = 55cm; Breadth = 25cm; Height = 25cm

Volume = (L x B x H) cm = (55 x 25 x 25) cm3 = 34375 cm3

D. Mechanism

This section gives a brief idea and analysis of the Semi-automatic dish washer machine

A) Mechanism -Dishes are washed in semi-automatic dish washer machine like any other machine mainly consisting two steps

1) Washing with soda water &scrubbing with brush
2) Rinsing with clean water

Fig. 4: semi-Automatic dish washing machine

1) Washing with soda water & scrubbing with brush

In traditional washing of dish, first Rowing boat is produced by step is to clear the wastage food on plate and then scrub it with detergent. Here also, we are following same first step in which the dirty dish which has to be wash is put in first washing chamber. Where scrubbing & washing of dish take Place.. The motor stops when dish enters in washing chamber. Universal motor is operated with delay of specific time interval and entire operation of system is controlled by using microcontroller. In this chamber, firstly pressurized spray of detergent water is throw on dish with the help of nozzles. The operation performed with help of water pump.

a) Pressurized detergent water clears dish with

The waste food. Simultaneously brush assembly operates which moves the brushes down and starts scrubbing of dish. The up & down movement of brush assembly is operated by DC geared motor Controlled according to logic program given to microcontroller. These Complete operations are to be carried out in stipulated Time span set by microcontroller. After that the conveyor

Belt moves again in forward directions automatically to move dish to second washing chamber.

2) Rinsing with clean water-The semi

-automatic dish washer incorporates the Mechanisms used in fully automatic washing machines as well as the one used in hand washing to ensure effective washing dishes with the delay provided by microcontroller.

Here pressured clean water Is spread on a dish with the help of another pump And dish is perfectly cleaned.

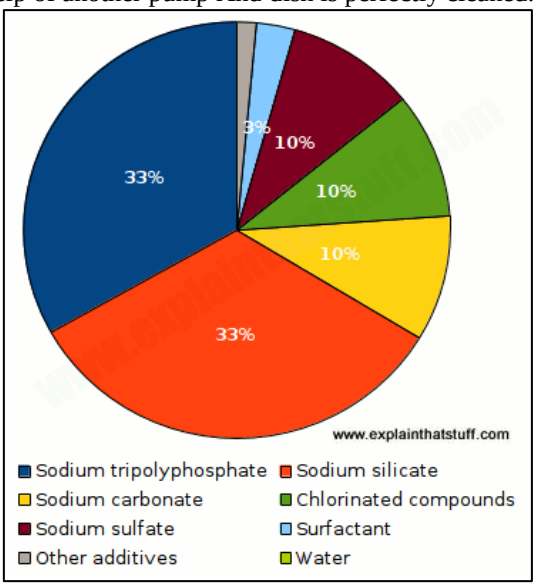

Fig. 5: Ingredients in typical dishwasher

E. Limitations of automatic dishwasher

1) Lower spray arm-

The spray arm is blocked by small items or food remains, due to that it faces difficulty. So, periodic Inspection is necessary

2) Remnants of detergent stuck inside dispenser-

Most of the time compartment of automatic dishwasher is damp when it was filled with detergent, but in actual practice it must be dry before detergent is added.

3) Water remains inside appliance-

If blockage or similar types of problems occurs in Automatic dishwasher then Automatic dishwasher then water gets stagnated in drum of dishwasher. If pump is jammed or filters are blocked due to some items then also water remains inside the drum.

4) It can't be open until the cycle is complete:

One of the limitations of this dishwasher is, it cannot be open until its full cycle is completed, and to complete one cycle it takes large time. If the water supply has been interrupted then automatic dishwasher stops suddenly.

5) White Stains

If the detergents which are used to wash the dishes Is used in excess quantity then white stains are An appeared on crockery. Due to excessive use glasses

G Salient Features

The semi-automatic dish washer offers a number of salient Features. Listed below are few of them.

– Environment friendly and non-polluting
– Efficient in operation.

- Less human efforts are required than conventional dish Washing techniques.
- Low cost as compared to machines available in market
- And affordable to all class of people.
- Robust in construction.
- Easy for operating and user friendly.
- Requires only one operator
- Easy to repair and maintainas components used are Easily available in market.
- Saves the valuable time by as time require to wash per Dish is less due to automation.
- Portable and light weight so that same can be placed Anywhere in home.
- Facility to store dirty water which does not to pollute the surrounding environment.

V. CONCLUSION

In India semi-automatic dish washing machines are used than fully automatic dish washing machine as it is cheap, preferably gears are used in these semi-automatic dish washing machine with belt drive for better life and high efficiency. Paper focused on design of gears used in semi-automatic dish washing machine

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