Design and Fabrication of Ultrasonic Utensil Cleaning Machine

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Abstract- *Now a days, Ultrasonic Technology has changed the way of cleaning. This paper is about the "Design and fabrication of ultrasonic utensil washing machine" which will be more efficient and economical than the existing machine.Ultrasonic waves are generated by means of transducers which will introduce cavitations bubbles into the solvents.These cavitation bubbles will implode on the surface and creates energy due to this contaminants on surface will be removed. Rinsing mechanism is provided with the help of centrifugal force created by rotation of utensil for more effective cleaning.*

Keywords- Ultrasonic transducer, Cavitation bubbles, Electric motor, Rinsing.

I. INTRODUCTION

Ultrasonic cleaning techniques are new and used for cleaning expensive metal components in the industry.It can clean many different types of objects, including jewelry, lenses and other optical parts, surgical instruments, tools, coins, fountain pens, golf watches, dental and clubs, fishing reels, window blinds, firearms, car fuel injectors, musical instruments, gramophone records, industrial parts and electronic equipment. Existing dish washer requires lot of power and uses complicated mechanism and a small damage to the component can lead to the failure of system. The dishwasher has made cleaning and drying dishes much easier and more efficient.The machine has less cycle time, less energy consumption,less water required as compare to the manual machine.

II. LITERARURE SURVEY

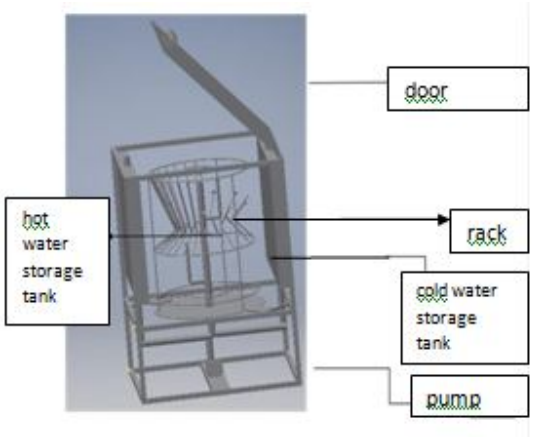
[1] ZhuChangping: This paper presents a fruits and vegetables washing machineusing ultrasonic technology. The pesticide residues on fruits orvegetables can be peeled off by ultrasonic waves effectively. Thewashing machine produces two frequencies ultrasonic, 140 kHzfor washing fruits or vegetables and decomposing pesticides, 80kHz for other cleaning such as dishes.Electrical conductivityand pH values of deltamethrin washing water are also measured at last to show the cavitation intensity during process.

[2]J. G. GOCHRAN- "Dish washing machine" : This paper gives brief idea described about improvement of dishwashing machine. It related to improvement in machine washing a dishes in which a continuous stream of either soap-soda or clean water is supply to crate holding the rack or cage hot water is supply to crate is rotate so as to bring the greater portion thereof under water.

In this research paper improvement of designing elevation of machine and it part. The author builds the machine and measures the dishes and inside wire compartment each specially designed to fit either plate's cups or saucer. The wire chamber placed inside a wheel that lay flat inside a copper boiler. A motor turned the wheel while hot soap water squirted up from the bottom of boiler and rained down on the dishes.

III. SYSTEM DESCRIPTION

CAD SETUP



IV. WORKING & DESIGN

- The working of the system depends on the frequency of ultrasonic waves(25khz).
- Lavegianpzt transducers are used for frequency generation.

- Epoxy resin is used as a reinforcing medium between drum and transducer.
- Input to the transducer is provided by self tuned ultrasonic frequency generator.
- Transducers pass ultrasonic frequencies through drum to the water and then to the component.
- Stainless Steel (SS304) is used for effective transfer of vibrations to the system as a drum material.
- Cleaning takes place by implosion of bubbles on the surface of the components.

Calculations:

1) Selection of motor

We know,
Power =(2πNT)/60000
Where,
P = Power in kW,
N = Speed in rpm,
T = Torque in Nm
We have,
Where,
Force = (Load applied on the rack + Mass of shaft) x Gravitational force
Let, the average load applied on the rack will be 10kg, the mass of rack will be 4kg and mass of shaft be 1kg. Torque = Force x Perpendicular distance.

We get,
Force = (10 + 4 + 1) x 9.81 = 147.15N
Perpendicular distance = 20cm = 0.2m ∴ Torque = 147.15 x 0.2 = 29.48
Therefore, select standard motor as 0.5hp.

5.3 Dimensions of Water Storage Tank

The entire body of water storage tank is made of plain sheet G.I. which is of dimension, Length = 70cm, Height = 50cm and Width = 5cm.
Therefore,
Volume of Water storage Tank = 70 x 50 x 5 = 17500 cm3 = 17.5 liters.

5.4 Dimension of rack

Height of the rack = 50cm =0.5m
Diameter of outer ring = 45cm = 0.45m
Area of outer ring A = 0.1590m2
Diameter of inner ring = 15cm = 0.15m

5.5 Electricity Consumption

Given
Powers- Pump = 0.3875 KW = 0.5 hp
Metal Heating Element = 2 KW
Dispenser = 0.025 KW
Total Power Used = 0.3875 + 2 + 0.025 = 2.39785
For 5 plates,
Power=(2.397855×(45+30))/3600
=0.04995 kw
For 10 plates,

power=(2.39785×(45+60))/3600
=0.06993 kw

For 15 plates,
Power=(2.39785×(60+90))/3600
=0.0999kw

For 20 plates,
Power=(2.39785×(100+120))/3600
=0.1465kw

VI. CONCLUSION

- By using the ultrasonic technology the performance of conventional dish washer is improved.
- Cycle time is reduced from 60min to 20min.
- Power consumption is reduced by 20%.
- System is capable of cleaning hard stains more effectively.

Overall performance of the system is improved.

VII. FUTURE SCOPE

- To commercialize the system on a big scale for household and industrial purposes.
- To replace existing dish washer by ultrasonic technology.
- To revolutionize washing technology.

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