Design And Development Of Mini Washing Machine

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Abstract- *The concept of twin tub was a novel concept where the washing of cloths was taken place in one tub and drying of them in another tub. Still the innovations were carried out further in the washing machine and the twin tub concept was overcome by a single tub. This makes the machine completely automatic with zero human efforts. However the automation in the area of automatic water requirement and time required for washing has been introduced in the washing machine using microcontroller control. So the automatic washing machines available now are sophisticated with the complete automation of washing the cloths. The automatic washing machines presently available are large in capacity from 6 kg onwards. In order to wash small quantity of cloths, then these large machine may not be useful or may not perform up to mark. In such cases if the automatic washing machine of 2 kg(Wet load) capacity is developed, then it will handle such small items to be washed. So, the main aim of the project is to develop a small capacity top loading washing machine which is capable of washing small cloths having capacity up to 2 kg (Wet load). The advantages of top loading washing machine over front loading machines is that, it is more efficient, it is cost effective, it is more reliable. In front loading washing machine there is a maximum chance of water leakage due to faulty door seals. In case of breakdown the top loading machines can be easily repaired because they use common parts and mechanism. The important features of this machine are, it can be accommodated in less space, consumes less power and operates at less head. This machine is mounted on the wall. It gives good quality washing and it contains low noise motor which reduces the noise of system while working. The main aim is of washing the cloths which are unable to be washed with the regular cloths. The machine requires less human effort. Cloths such as shirts pants T shirts which in single in number can be washed in one stroke and less time.We have done a market survey on materials and components required for our project. We have designed components like shaft ,v-belt ,pulley. The cost of our project is 25000. We have prepare the plan for manufacturing of project. The components and materials to be used in manufacturing has been tested. The details about the design, working, construction and development will be discussed in this project.*

I. PROBLEM DEFINATION

When problem is associated with washing the cloths it is necessary that all the cloths to be washed should be taken together in a bulk and washed together but there are certain restrictions to certain cloths that cannot be washed with the common cloths like the one which are used for cleaning the floor and for cleaning the kitchen, also cloths that spreads colors after coming in contact with water. Such types of cloths should be hand washed as there is no other option available. Also for an individual human working in a very busy schedule cannot use regular washing machine for washing single pair of cloths as regular washing machine will consume more power compared to mini-washing machine.Hence we came with a new design of compact size of mini-washing machine with a small washing load capacity of about 2kg which is able to wash the cloths separately effectively efficiently and quickly. Hence the aim of the project is to reduce the drawbacks being faced by a society due to regular washing machine. The mini-washing machine also has the advantage that it is compact in size and light weight. Hence due to this features it can be hanged on the wall.

II. AIM AND OBJECTIVES

1. To collect data of existing designs through product study, visual design exploration, user study andmarket study.
2. To develop a simple mini sized machine with same features as of the bigger machine and to ensure that it satisfies the prescribed design.
3. To design components of right sizes and material to make the machine strong and reliable at an affordable cost
4. To design and to make the machine compact and to attain a satisfactory rate of production
5. To fabricate the machine and inspect it.

III. DESIGN DIMENSIONS

Design of inner drum:We are considering the machine of capacity 2kg.

Hence calculating the parameters accordingly to the mass as 2kg .

Input load :- 2kg

Diameter of drum = 200mm = 0.2 m

IV. THEROTICAL ANALYSIS

1. *Calculating the centrifugal force as*

$$F = mr\omega^2$$

$2. Pressure\ P = \frac{F}{A}$

Material Selection:–
Selecting of Material C – 45. (PSG DATA BOOK)
Yield Strength $= 360\ N/m^2$.
Tensile Strength $= 130\ N/m^2$.
Hoop Stress $\sigma_t = \frac{pd}{2t}$

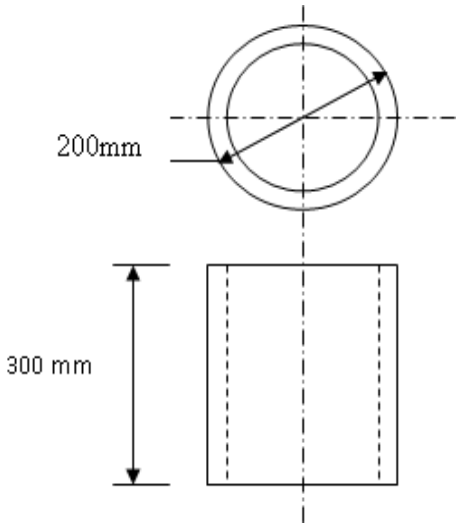

Figure 1.

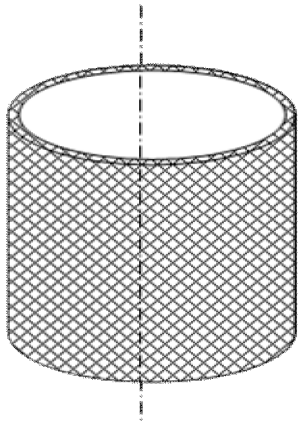

Figure 2.

Radius of vessel $= 0.15m$
Height $= 0.2m$
Pressure of air $= 1.0\ bar$

$Head\ h = \frac{p}{\rho D}$
$\omega = \frac{2\pi N}{60}$
$y_1 = Height\ of\ parabolid$
$y_1 = \frac{\omega^2 R^2}{2g}$

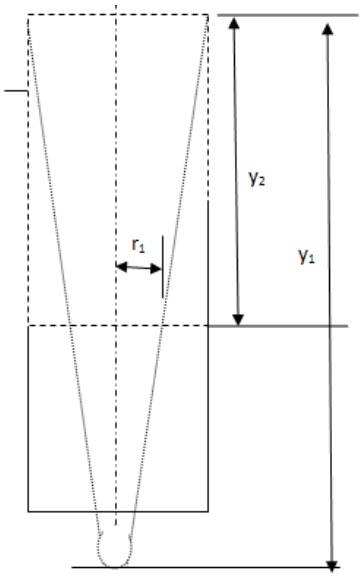

Figure 3.

Result of iteration

Table 1. Result of iteration

Iteration no	RPM	Diameter (meter m)	Length of drum	Y1- height of still water	Y2- height of parabolid
1	600	0.3	0.2	4.52	1.27
	300	0.3	0.2	1.13	0.608
2	600	0.40	0.45	8.04	3.83
	300	0.40	0.45	2.01	1.24
3	600	0.2	0.3	2.01	0.93
	300	0.2	0.3	0.502	0.48

Centrifugal force:

Centrifugal Force:–
$T = F \times r$ *(Inner drum radius)*

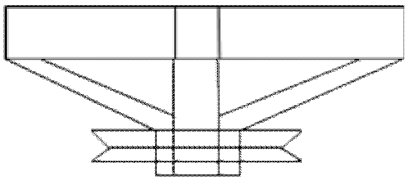

Figure 4.

Belt:

Selection of the V-belt of cross section A from the PSG data handbook

Since recommended pulley diameter d =75 mm (minimum)

d =75mm

Driven pulley diameter $= d \times \frac{N_1}{N_2}$

Pitch line velocity $V = \frac{\pi d N_1}{60000}$

Centre to center distance;-(psg-7.61)

$C = 1.1 \times D$

Length of belt;-(psg- 7.61)

$L = 2C + \frac{\pi}{2}(D + d) + \frac{(D-d)^2}{4C}$

Now actual length of belt

$C = A + \sqrt{A^2 - B}$

$A = \frac{L}{4} - \frac{\pi(D-d)}{8}$

$B = \frac{(D-d)^2}{8}$

We know that

$\frac{T_1}{T_2} = e^{\mu\theta}$

$P = (T_1 - T_2)V$

Shaft

We know the equation for Torsional stress is given by

$\frac{T}{J} = \frac{t}{r}$

Consider shaft material as C-50 (Carbon Steel)

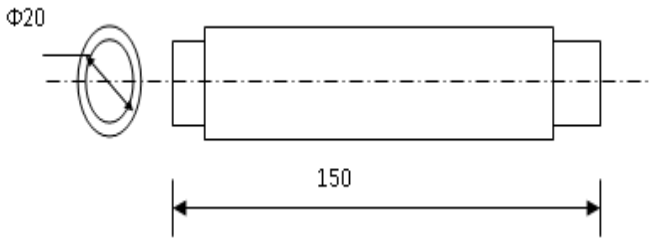

Figure 5.

V. RESULTS AND CONCLUSION

From the above calculations we conclude that the design for our project that is the mini washing machine is ready and safe for design.

The above calculations are done according to standard references and authors.

From the above calculation we conclude that the design for the mini washing machine is safe standard and ready to manufacture

Hence this kind of product can be launched in the market for mass production and a new machine may come into service for welfare of humankind.

Future Modification:

1. Can be Modified as a front loading mini washing machine of capacity 2kg wet load.
2. Can be made fully automated by using PLC circuits.
3. Overall weight of the machine can be reduced by using lighter materials like aluminium, plastic fibres, etc.
4. Mini front loading washing machine can be mounted on the wall, it can also be installed in bathroom, pantry, kitchen, and various locations.

Bill of material

Table 2. Bill of material

SR NO	COMPONENT	SPECFICATIONS	MATERIAL	QUANTITY
1	SHAFT	20mm DIAMETER	M.S	1
2	V- BELT		RUBBER	1
3	MOTOR	1 HP		1
4	WASH TUB	200MM DIA 300 MM LENGTH	PVC	1
5	BEARING	P204	CI	8
6	ANGLE FRAME	25*25*3	M S	1

REFERENCES

[1] Mintz Steven. “Housework in Late 19th century America”

[2] “Nathaniel Briggs of New Hampshire”, Feb 13, 2016

[3] “History of Washing Machines upto 1800”, oldandinteresting.com, 2011-04-14, retrieved 2012-06-01

[4] John B Durkee: “Management of Industrial Cleaning Technology and Processes” 2006, Elsevier, Oxford, United Kingdom ISBN 0-08-044888-7

[5] ASM International: Guide to mechanical cleaning systems, 1996, ASM Internationals, Materials Park Ohio USA

[6] ’Strength of Materials’: M D Dayal, Edition 5, 2013 pp 309

[7] P S G College of Technology; Design Data, Oct 2015, pp-5.45 to5.95

[8] P S G College of Technology ;Design data, Oct 2015; pp 7.58 to 7.61

[9] Fluid mechanics by R K Rajput ,pp 351

[10] S K F Industries (1991): 'Bearing Design Table' pp 9-10

[11] Badami, V V and Chibat N,W, "Home Appliances Get Smart " IEEE Spectrum v.35 n 8 ,August 1998 pp 36-43.