

Design and Performance Evaluation of Pedal Operated Ice-cream Making Machine

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Abstract— In this developing world, small business sector established in rural areas are facing different problems such as power and economical crises due to which the productivity of several items is decreased. Power operated machines exist, but they are impractical in rural regions because the electric are expensive or unavailable. Hand operated machine are available but they required more time and required more effort than pedal operated machine. In this regard attempts have been made to develop or to enhance human powered equipment for ice-cream making which energized by pedal operated bicycle. Pedal operated ice cream making machine consists of a chain drive and gear amplification mechanisms that turns dasher in a large stainless steel container surrounded by another wooden container filled with the mixture of ice and salt, where ice cream ingredients are stirred and blended.

Keywords— Pedal operated, Ice-cream making machine, Human powered

I. INTRODUCTION

Making ice-cream with traditional way (Hand operated machine) or electric machine is bigger problem for the small sector businessmen living in rural area in India. The villagers required quality of ice-cream at their respective place. Since the sole aim of our project is to make ice-cream available to the people living in village as well as can fulfill the earning source of small sector businessman. we are deeply focusing on making ice-cream by pedal operated bicycle mechanism. Essentially, the machine consists of three sub-systems: (1) the energy unit (2) transmission mechanism (3) the process unit. The energy unit consists of a conventional bicycle mechanism, the transmission unit consists of a drive train; a chain drive mechanism running over a pair of speed-increasing gears and the process unit coupled with transmission mechanism that turns dasher in a large stainless steel container surrounded by another container filled with the mixture of ice and salt, where ice cream ingredients are stirred and blended. They require ice, rock salt (which lowers the temperature of the ice) and plenty of physical stamina to pedaling the bicycle that rotates the dasher. They usually take 25 to 30 minutes to make 2 Kg of ice cream.

II. NEED OF DEVELOPMENT OF MACHINE

In the present scenario most of the ice-cream making machines are electrically driven. Machine with electric motor are faster but that are costly as well as required electricity. The unit operating by means of electricity has limited applications in the rural area. In remote and interior places like in our Vidharbha where there is no facility of electricity as well as in urban areas, while in the duration of load shading or during electrical power-off timings, this type of human power operated unit will have very extensive

utility. Therefore this human powered machine is having extensive utility in such areas.

Traditional methods that is hand operated machine of making ice cream by the rural people taking much more time and required more energy effort than pedal operated machine.

III. BASIC CONCEPT OF MACHINE

A person can develop power four time more power (1/4 hp) horsepower by peddling than by hand cranking. At the rate of (1/4 hp), continuous peddling can be done for only short periods, about 10 minute. However pedaling at half this power (1/8 hp), can be sustained for around 60 minute (David Gardon Wilson). Most people engaged in delivering power continuously for an hour or more will be most efficient when pedaling in the range of 50 to 70 rpm and an average power produced a man is approximately 75 watt (0.10 hp) (Alexandrove 1981) If any operation, process required more than 75 watt (0.10 hp) that can also be possible with human power by applying “*Human Power Flywheel Motor Concept*”

According to this concept machine system divided in to three subsystems namely (i) Energy Unit: Comprising of a suitable peddling mechanism, speed rise gear pair and Flywheel conceptualized as Human Powered Flywheel Motor (HPFM) (ii) Suitable torsionally flexible clutch and torque amplification gear pair and (iii) a process unit. Essentially the flywheel motor consists of flywheel, which is being driven by

a human through a simple bicycle mechanism and pair of speed increasing gears P1G1. The schematic of flywheel motor is as shown in figure 1.1. A rider pedals the mechanism “M” converting the oscillatory motion of thighs into rotational motion of counter shaft “C”. This countershaft “C” connected to flywheel shaft with speed increasing transmission consisting of pair of speed gears P1G1. Driver pumps the energy in flywheel at energy rate convenient to him. In this way, the muscular energy of human is converted into kinetic energy of flywheel by this man machine and for its efficient use it is necessary to optimize its parameters.

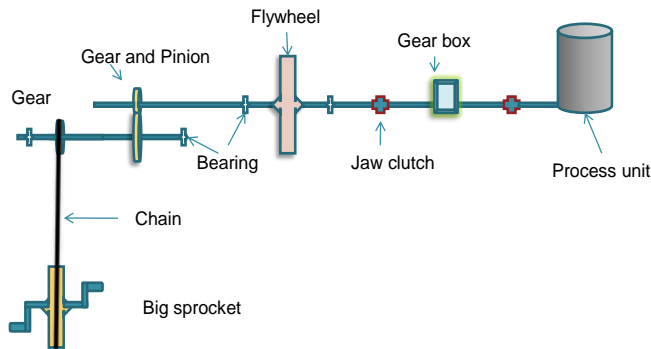
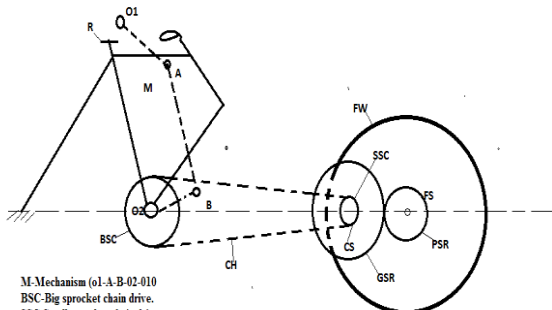


Figure 1.2 Conceptual Design

From above line diagram of conceptual design shows three system of machine

Energy Unit: Energy unit consist of conventional bicycle mechanism, chain and sprocket can give speed increasing ratio of 2.4 using bicycle rear sprocket. A speed increasing gear pair with speed rise ratio 1.95 and a flywheel to store this energy.

Transmission and amplification unit: After storing the maximum possible energy in the flywheel, this available energy in the flywheel transmits towards process unit.



M-Mechanism (01-A-B-02-010)
 BSC-Big sprocket chain drive.
 SSC-Small sprocket chain drive.
 GSR-Gear of speed Rise.
 PSR-pinion of speed Rise.
 FW-Flywheel.
 CH-Chain.
 CS-Counter shaft.
 FS-Flywheel shaft.

Figure 1.1 Side view for Human Powered Flywheel Motor.

These transmission parts consist of square jaw clutch and the torque amplification gear, which is state amplification ratios 4.10.

Process unit: The improved method is by using pedaling mechanism, bevel gear arrangement mounted on a central axis

that turns dasher in a large stainless steel container surrounded by another container filled with the mixture of ice and salt, where ice cream ingredients are stirred and blended. An external wooden drum opens so that a metal inner drum for the ice cream mix can be placed inside.



Figure1.3 Ice-cream making drum where ice-cream stirred and blended.

A central dasher is pushed into the drum, so that the mixture will be stirred. Typically, the metal inner drum holding the ice cream remains still, while the dasher rotates around the inside, scraping down the sides and redistributing the chilled portions of the mixture. They require ice, rock salt (which lowers the temperature of the ice) and plenty of physical stamina to pedaling the bicycle that rotates the dasher.

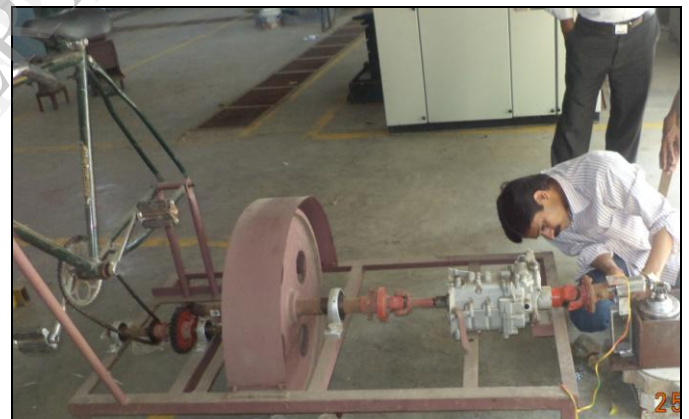


Figure 1.4 Fabricated model of pedal operated ice-cream making machine.

IV. OBJECTIVE OF THE STUDY

The study was undertaken with following objectives:

- I. To provide a new era in the ice-cream making technique.
- II. To provide design and development such that machine will be simple to build and operate.
- III. To design and develop the machine as efficient as possible so that volume or weight capacity of ice-cream should be equal or more than exiting machine.
- IV. Relatively little maintenance.
- V. Also to develop a low cost human power machine and this machine will be more compact.

VI. Fulfill the earning source of small sector businessman where electricity are unavailable.

V. COST ESTIMATION

Sr. No.	Name of components	Material	QT.	WT Kg	Rs/Rate	Amount
1	Rectangular pipe	MS	12m	12	120	1440
2	Angle	MS	6m	18	50	900
3	Angle	MS	6m	9	50	450
4	Spur Gear	CI	3		600	1800
5	Pinions	CI	2		400	800
6	Bearings	MS	8		250	2000
7	Shaft	MS	2	16	80	1280
8	Cycle Set	MS	1		1000	1000
9	Flywheel	CI	1	50	60	3000
10	Clutch	CI	1		300	300
11	Clutch Wire		1		75	75
12	Clutch Spring	MS	1		100	100
13	Nut Bolt	MS	24		4	96
14	Paint				250	250
15	Inner Drum	Steel	1		200	200
16	Wooden Drum	Wood	1		300	300
17	Leath Work				1500	1500

Miscellaneous Cost:-

Labour cost = 1000Rs

Fabrication charges = 1000 Rs

Oil paint charges = 200 Rs.

Total Cost:- Material cost +Miscellaneous cost Total cost= 15491+2200 = 17691 Rs.

VI. DESIGN OF ICE-CREAM MACHINE

Main Assembly				
Item NO.	Name of Components	Dimensions (mm)	Materials	QTY.
1	Base Frame	LHW=735*50*430	MS	1
2	Drum Frame	LHW=100*500*25	MS	1
3	Drum	Dia.=200mm, length = 220mm	Steel	1
4	Spur Gear	PCD=117, Total width=25.50, No. of teeth=39	CI	1
5	Pinion	PCD=60, Total width=25.50, No. of teeth=20	CI	1
6	Bearings	Bore Dia. 25 mm	MS	8
		Bore Dia. 35 mm	MS	2
7	Shaft	D = 25mm , L =	MS	1

		420mm		
8	Shaft	D=35,L=500mm	MS	1
9	Flywheel	Dia = 1200 mm, Weight = 103Kg	CI	1

VII. FIELD PERFORMANCE DATA FOR ICE-CREAM MAKING MACHINE

Parameters	Ice-cream Making Machine
Material processed	2 Kg
Operating time	15 min
Capacity	8 kg / Hr.
Labour requirement	1
Overall performance	Satisfactory
Remark	Useful for small sector businessmen

Table 1.5 Field Performance Data from Machine

Machine take 15 minute to making ice-cream of 2 kg. of steel drum size 30 cm dia. and 40 cm length rotating at 20-400 rpm. The field test data for ice-cream machine energized with Human Powered Flywheel Motor are given in Table.

VIII. CONCLUSION

By providing the proposed solution of the ice-cream making Machine Energized by Human Power Flywheel Motor to the small sector businessmen those who want earning source in rural areas, it will definitely empowered with the capacity of ice-cream approach in different rural area of India. The model suggested will be fabricated in low cost which can be easily affordable for small scale business sector. A continuous involvement of the labour is not required and also unskilled labour can handle this machine easily. Once the flywheel attempt maximum speed it reduce pedaling effort throughout process.

REFERANCES

- [1] Goff, H. Douglas. "Ice Cream Ingredients". Dairy Science and Technology Education Series. University of Guelph.
- [2] The Human-Powered Home: Choosing Muscles Over Motors, Tamara Dean New Society Publishers, 18-Oct-2013 - House & Home - 261 pages
- [3] David Gordon Wilson. 1986. Technical Reviewers, "Understanding Pedal Power" Volunteers in Technical Assistance (VITA) 1815 North Lynn Street Suite 200, Arlington, Virginia, USA.
- [4] K. S. Zakiuddin, H. V. Sondawale, J. P. Modak, , March 2012 "Human Power: An Earliest Source of Energy and It's Efficient Use" Pratibha: International Journal Of Science, Spirituality, Business and Technolohg (IJSSBT), Vol. 1, No.1 ISSN (Print) 2277—7261..

- [5] Zakiuddin K.S., Modak J.P. 2010. "Design and Development of the Human Energized Chaff Cutter" New York Science Journal.
- [6] Modak J.P. 1982. "Manufacturing of lime flyash sand bricks using a manually driven brick making machine" Project sponsored by Maharashtra Housing and Area Development Authority (MHADA), Bombay, India.
- [7] Ms.K.S.Priyenka Devi., Ms. A.Sangamithra. March 2004. Department of Chemical Engineering, School of Chemical and Food Sciences, Kongu Engineering College, Perundurai -638052. Department of Food Technology, Article in the science tech Entrepreneur.Tamil Nadu.
- [8] Comparison of commercial stabilizers with modified tapioca starches on foam stability and overrun of ice cream Siwatt Thaiudom1*, Khoon Singchan2 and Thanomduang Saeli1 School of Food Technology, Institute of Agricultural Technology, Email: contact@nmce.com
- [9] K. S. Zakiuddin, J. P. Modak "Post-harvest crop processing machine" September, 2012 AgricEngInt: CIGR Journal Open access at <http://www.cigrjournal.org> Vol. 14, No.3 99
- [10] Mr. Prasad A Hatwalne, Mr. Mahesh Gorde, Mr. Swapnil B. Patond, Mr. Parvezalam I. Shaikh "An Ergonomics Design Of Pedal Operated Flour Mill" International Journal of Scientific and Research Publications, Volume 2, Issue 4, April 2012 1 ISSN 2250-3153
- [11] Prasad A.Hatwalne, SushilT.Ambadkar, R.V.Paropate,VivekR.Gandhewar, A.M.Wankhade "Design and development of Pedal operated flour mill". Journal ofAgricultural Engineering Vol. 44(2): April-June, 2007
- [12] S. K. Undirwade, Dr. M.P. Singh, Dr. C.N. Sakhale, V. N. Bhaiswar, V.M. Sonde "Experimental & Dimensional Analysis Approach For Design Of Human Powered Bamboo Sliver Cutting Machine" [IJESAT] International Journal Of Engineering Science & Advanced Technology Volume-2, Issue-5, 1522 – 1527 ISSN: 2250–3676
- [13] A.K.Pitale, P.A.Hatwalne "A Review on- Flywheel Motor" International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 1, Issue 2, November 2012
- [14] P.A.Hatwalne "Flywheel Motor-An Update" International Journal of Advanced Technology & Engineering Research (IJATER) ISSN No: 2250-3536 Volume 2, Issue 6, Nov. 2012 page no.100
- [15] S.M.Moghe, K.S.Zakiuddin, V.G.Arajpure "Design and Development of Turmeric Polishing Machine" International Journal of Modern Engineering Research (IJMER) Vol.2, Issue.6, Nov-Dec. 2012 pp-4710-4713 ISSN: 2249-6645
- [16] UmeshBokade, Zakiuddin Syed Kazi and Girish D. Mehta, Presented a paper "Design and Development of Manually Energized Water Distillation Device" International Journal of Mechanical Engineering and Robotics Research Vol. 2, No. 1, January 2013 ISSN 2278 – 0149.
- [17] Robert P. Patterson, Maria I. Maren "Bicycle pedaling forces as a function of pedaling rate and power output" Medicine and Science in Sport and Exercise copy right by the American College of Sport Medicine, Vol. 22 No.4, and Printed in USA.
- [18] Ambekar, A.G., "Theory of mechanisms and machines", PHI learning private limited, June-2009, ISBN-978-81-203-3134-1,
- [19] Sharma, C. S. and Purohit, K., "Theory of mechanisms and machines", Prentice-Hall of India private limited, 2006, ISBN-81-203-2901-5.

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