Design and Development of Hydraulic Power Hammer

P.F.Shinde[1], S.S.Dhanji[2],A.S.Phalake[3],A.S.Sawant[4]
[1, 2, 3, 4] Dept of Mechanical Engineering
[1, 2, 3, 4] Rajendra Mane College Of Engineering &Technology,Ambav

Abstract- *Blacksmithing processes is one of the most ancient craft and forerunner of all metal forming processes used in almost fading out in Nigeria because of the quality and the quantity of the products[3].This paper presents the result of work carried out in improving the design, construction and testing of hammer mill by addressing some lapses associated with the design and construction of the existing ones. These improvement involves redesigning and construction of the hammer mill beater, hammer mill chamber, redesigning and construction of the hammer mill shaft, incorporating a piston cylinder directly to the hammer therebyproviding the means of varying the speed of the hammer [5].The developed cam operated flywheel driven blacksmith forge hammer is used in rural areas. The energy is stored in the form of flywheel. This paper present the design of flywheel and modification of semicircular cam, used for machine which make convenient for rural areas[2].*

I. INTRODUCTION

Blacksmithing techniques gives step by step instruction on how to make range of tools and products. The designs of all the items are based upon the experiences of the authors while working with rural blacksmiths in Zimbabwe and Malawi.[1]. In India large amount of agricultural tools or implements are still manufactured in villages or rural areas. The automation may be in the form of forging machine. The machine was modified by the incorporating a flywheel. The design of flywheel is made in asuch way thatthe stored energy will be utilized for thedeflecting leaf spring. Continuous hammering is the major advantage of the modified machine. [2].Blacksmithing is an ancient indigenous technology which is the progenitor of various metal forging operations in use today and can be found in virtually all major culture of world[3].

At the 20th century,the demand of compound curves in sheet metal was growing rapidly. The power hammer was developed in the early 20th century from blacksmith hammers in Amesbury, Massachusetts in the USA. The principle of the power hammer is similar to the wheeling machine in that they both shape the metal[4]. Incorporation of gasoline engine instead of motor will increase the efficiency of the hammer mill machine. Up to 92.47% and also increase the economic condition of the rural populace.[5]

II. LITERATURE REVIEW

Sr. No.	Name of Author	Title of paper	Key Finding
1	David Harries & Bernard Heer	"Basic Blacksmithing- An introduction to tool making with locally available materials."	This is basically a case study in which the basic blacksmithing process was explained.
2	A. R. Sahu & U. D. Gulhane	"Design of flywheel & modified cam for manually energized black smith forge hammer for rural artisans."	Reduced the stresses on the follower stem during continuous operation by modifying the cam design & obtained the maximum hammering output by introducing the flywheel which made the machine more efficient.
3	P. K. Oke	"An evaluation of local improved blacksmith process."	In this research the main aim was to increase the overall

			efficiency of the hammer mill machine.
4	DoertingWill. B.	"Reviving blacksmith with open die forging hammer"	Fabrication of a more convenient & semi- automat forging machine to reduce the human efforts and the energy wasted in the process.
5	Hadi & Mohd. Ibrahim, et al	"Improvement on the Design, Construction and Testing of Hammer Mill."	Increased the overall efficiency of the hammer mill machine by introducing the gasoline engine for the hammering action.

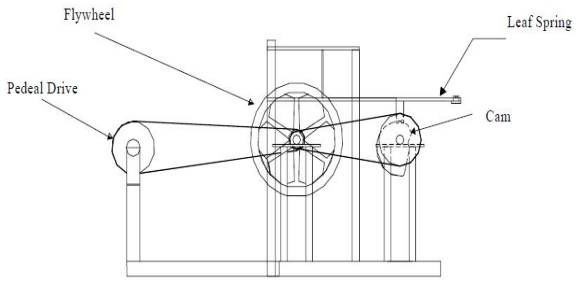
III. METHODOLOGY

1. David Harries & Bernard Heer

The journal proposed by the authors gives the detailed study of all the parameters concerned & used in the traditional blacksmithing processes. This journal also gives the information about production of tools according to our design & gives detailed data of how to setup a blacksmith workshop according to the applications of our products.

2. A. R. Sahu & U. D. Gulhane

In this paper the authors mainly focused on designing of a flywheel mechanism instead of the handles used in the machines to get more & continuous hammering output in minimum amount of time. Also there were modifications done in the semi- circular cam to reduce the stresses on the follower stem.



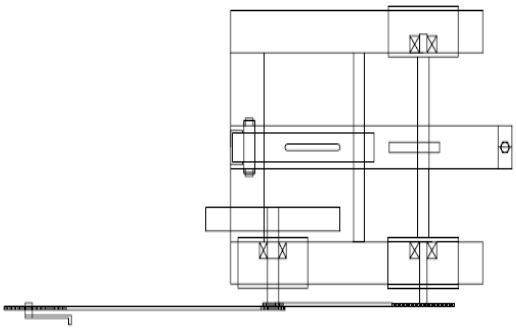


Fig. Machine diagram using the flywheel mechanism

- Cam Modifications-

The cam & follower mechanism was basically used to produce required force for deflection of the spring plate up to 46mm. But in original machine the semi- circular cam was used which increased the stresses into the follower stem during continuous operations. To reduce that a slight change in cam was made.

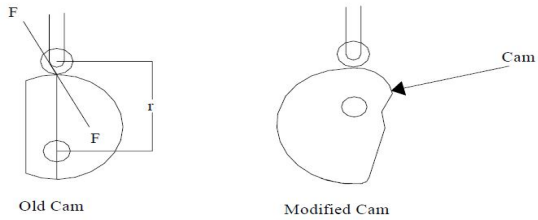


Fig. Cam modification

- Performance Evaluation-

After the two design & modifications, the actual performance of the machine was done. The actual observations was then tabulated and compared with the theoretical data. Main comparison was done for the energy generated by the flywheel when it was fully energized. The flywheel gave approximately 46 strokes per minute which was found out to be the exact data when calculated theoretically.

3. P. K. Oke:-

This paper is basically a case study which involves the improvement of the quality & quantity of the local blacksmith workshops & their products in the rural regions of Nigeria.

The research consisted of survey of the blacksmiths shops, where a questionnaire was prepared to use as an instrument & were administered by the local shops. The survey was done in the capital state regions of Nigeria like Ekiti, Lagos, Kwara, Ogun ondu, Osun & Oyo states.

4. Will. B. Doerting-

To overcome the problems arising due to the traditional blacksmith processes such as the wastage of time & energy, power hammers were developed. These hammers proved to be useful as the time required to produce the components was greatly reduced & also saved more human efforts. But these machines were built in a very rigid & bulky construction. To overcome this problem the author of this paper designed a more compact forging machine which occupied less floor space & can be easily moved from one place to another. The first design change was done for the hammer itself. The weight of the sand constituted the hammering force required and the weight of the hammer was greatly reduced hence reducing the machine weight.

The next design change was for the dies.Custom dies were used in the machine instead which can be used in a single machine for multiple operations.

5. Hadi & Mohd. Ibrahim, et al-

In this research work the belt drive mechanism was skipped & gasoline engine was incorporated into the hammer mill machine.This design consisted of hammer mill design & configuration of the same, determination of the power & torque transmission, determination of the centrifugal force, determination of maximum bending moment & lastly the study of damping characteristics of the machine.

Then according to the analysis the optimum operating parameters of the machine was obtained. The fig. below gives the tabulated results of the optimum parameters of the machine.

S/No	PARAMETERS	SYMBOL	VALUE	UNIT
1	Speed of shaft	N	1500	rpm
2	Torque Transmitted to the shaft	T	20.363	Nm
3	Power Transmitted to the shaft	P	3198	Nm
4	Beater mass	B_{mass}	0.9	kg
5	Centrifugal force	C_f	41.6	N
6	Maximum B. M.	$M_{b\ max}$	0.02	Nm
7	Natural Frequency	f_N	0.50	Hz
8	Damping Factor	D_f	14.25	ω
9	Damping Natural Frequency	f_N	0.65	ω

Fig. Results obtained from the calculations of this research.

REFERENCES

[1] David Harries & Bernard Heer, Intermediate Technology Publications,1993,ISBN1853391956
[2] A. R. Sahu & U. D. Gulhane,13th September 2003
[3] P. K. Oke, Journal of Engineering & Applied Sciences 2, Medwell Journals, 2007
[4] Doerting, Will. B. (2011), Kaleidoscope: Vol-10, Article 09
[5] Hadi & Mohd. Ibrahim, et al, Journal of Engineering & research, Vol-6, Issue-3, pp-139-146,2017