

Design & Fabrication of Multifunctional Operating Machine

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Abstract— This paper basically presents before us the idea of multifunctional operating machine used for fabrication and production works. Industries produce different types of goods and services which are useful to the customers. In today's world, due to rapid advancement in technology and due to increase in demand from the customers, it is necessary for the industries to cope up with the demands at average cost and better quality of products. So to fulfil these conditions, we have designed and fabricated a machine which can perform four different operations simultaneously so as to save time and cost. In this model there will be a motor which will drive the mechanism with the help of bevel gears and by bevel gears the shafts will rotate, giving drive mechanism to different operations. The operations will be drilling, cutting, buffing, grinding. The main aim of the project is to save time related to perform operations on different machines, to save electricity, increase productivity, and to save floor space.

Key words: Multifunctional Operating Machine

I. INTRODUCTION

In today's world industries are the backbone of the world. Industries are used for the production of various goods and services which satisfies the customers by taking into consideration their needs and hence producing goods at low cost and better quality. In today's world there has been a significant improvement in technologies that are used, taking this into consideration the industries are producing the needed goods at a mass quantity, which increases the rate of production, better products, increases the profit of the industry. The main purpose of designing and fabricating the multifunctional operating machine is to save time, labour cost, and to satisfy the customer. In this paper we are highlighting the design and fabrication of multifunctional operating machine which performs drilling, cutting, buffing, grinding operations.

II. LITERATURE REVIEW

While working on this project we went through various papers for increasing our knowledge about the project. The following research papers helped us to further increase our knowledge.

A. *Heinrich Arnold* 1 November 2001

Rather long re-investment cycles of about 15 years have created the notion that innovation in the machine tool industry happens incrementally. But looking at its recent history, the integration of digital controls technology and computers into machine tools have hit the industry in three waves of technology shocks. Most companies underestimated the impact of this new technology. This article gives an overview of the history of the machine tool industry since numerical controls were invented and introduced and analyzes the disruptive character of this new technology on the market. About 100 interviews were conducted with decision-makers and industry experts who witnessed the development of the

industry over the last forty years. The study establishes a connection between radical technological change, industry structure, and competitive environment. It reveals a number of important occurrences and interrelations that have so far gone unnoticed^[1].

B. *Sharadshrivastava, Shivamshrivastava, C.B.Khatrijune* (2014)

Presented multi- function operating machine: conceptual model this paper presents the concept mainly carried out for production based industries. The model facilitate us to get the operation performed at different working centre simultaneously as it is getting drive from single power source. Objective of this model are conservation of electricity (power supply), reduction in cost associated with power usage, increase in productivity, reduced floor space^[2].

C. *Kevin Patel, Niraj Kumar shrivastav, Prof. Surendraagrwal*

Presented Design and Development of a Multifunctional Portable Machine. This paper presents a development of a portable workshop which will be available for the small work. Their most important aim is to make aware the student about the basic operations at very minimum cost in the institute, they can learn the basic mechanism behind the operations, beside that it can be useful for industries and also at home for repairing purposes, and in the industries small job preparation can be done without using the heavy machines^[3].

III. METHODOLOGY

As we know that bevel drive is used for transmission purpose, so we are going to use a pair of bevel drive which are in closed contact and power supply provided by motor and that power is utilized to done the operations. As scotch yoke mechanism is provided for only cutting operation.

The steps which are going to follow to work out the project as follows

- 1) Design of the respective model.
- 2) Purchasing of required components
- 3) Fabrication.
- 4) Testing and Optimization

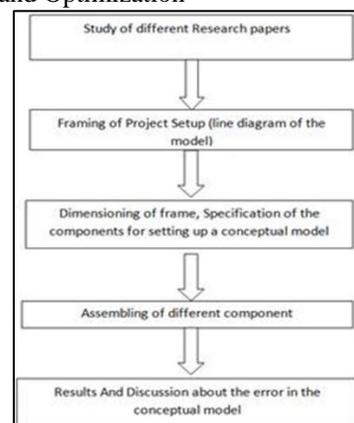


Fig. 1:

IV. WORKING PRINCIPLE

In this machine we have used two major principles on which this machine works:

A. Power Transmission by Bevel Gears

The machine would consist of bevel gears which may be mounted on different shafts according to the need, as the gears are mostly used as a speed reducer. A motor will give power to operate various gears, as the motor rotates the bevel gears will also rotate with the motor providing a motion to the shafts and performing different operations.



Fig. 2:

B. Scotch-Yoke Mechanism

This mechanism is used for cutting operation in this machine. This mechanism is used for converting rotary motion into reciprocating motion. The reciprocating part is directly coupled to a sliding yoke with a slot that engages a pin on the rotating part.

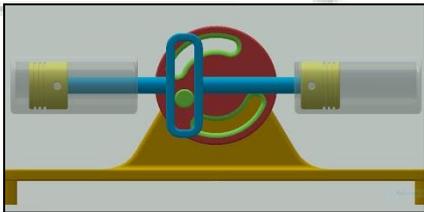


Fig. 3:

C. Working of the Model

In this conceptual model of "multifunctional operating machine" we are giving supply to the shaft by motor through belt-pulley arrangement. On that shaft grinding and buffing wheel are mounted which operates on same speed, and also a bevel gear is mounted on this shaft which is meshed with other two. As one of the two meshed decide speed of drilling operation while remaining one is for scotch yoke mechanism which converts rotary to linear motion for cutting purpose.



Fig. 4: Bevel Gear Arrangement



Fig. 5: Overview of the Project

D. Specifications of the Component used in Conceptual Model

- Frame of the model: 18 inch*18 inch*36 inch
- Shaft 1: 20 mm diameter, length 508 mm shaft 2: 20 mm diameter, length 228 mm
- Motor: 1/2 hp, 1440 rpm, 220v AC supply
- Bearing: pedestal bearing 20mm inner diameter quantity -6
- Drill: chuck size 10 mm
- Buffing wheel: 4 inch
- Grinding wheel: 4 inch
- Pulley size: 3 inch (no.2)
- Gears: type -bevel gear (straight)
- No of teeth on bigger gear -22
- No of teeth on smaller gear -16

V. RESULT

The main aim is to represent our concept, we have taken some data from our conceptual model and tried to calculate the deviation from the standard calculated values which is as follows:

As pitch radius of pinion is $r_p = 1.5$ cm, pitch radius of gear $r_g = 2$ cm.

By the relation between pitch cone angle and velocity ratio, velocity ratio can be found as we have pitch cone angle for both gear and pinion as 55 deg. and 35 deg.

Velocity ratio 1.502 Now from the model we should have the revolution of grinding and drilling as 3.058

S no.	No. of revolution given to main shaft	Theoretical revolution at driven end	Actual revolution at driven end
1	1	1.428	1.335
2	2	2.856	2.67
3	3	4.284	4.22
4	4	5.712	5.65
5	5	7.14	7.075
6	6	8.568	8.503

Table 1: Difference In Between Theoretical Power Transmission & Actual Power Transmission

S no.	No. of revolution given to main shaft	Theoretical effective stroke length at driven end	Actual effective stroke length at driven end
1	1	8	8.01

2	2	8	8.01
3	3	8	8.01
4	4	8	8.01
5	5	8	8.01
6	6	8	8.01

Table 2: Difference in between Theoretical Effective Stroke Length of Yoke & Actual Effective Stroke Length of Yoke for Different No. of Revolution of Main Shaft

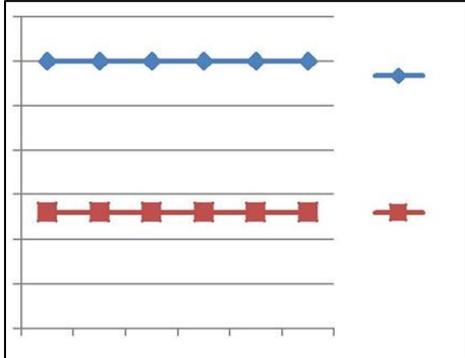


Fig. 6: Plot to show error in between Actual & the Oretical Effective Stroke of Length

VI. CONCLUSION

We can see that all the production based industries wants to be economical in cost aspect with high work rate which can be made possible through the utilization of this multifunctional operating machine which will consume less power as well as less time. This machine will found to be much useful where these four basic operations are regularly, repeatedly needed in uncountable amount, especially in carpentry workshops and in small scale industries too.

So, in this paper we have proposed a machine which can perform operations like drilling, buffing, cutting, grinding at different centers simultaneously which implies that industrialist have not to pay for machine performing above tasks individually for operating operation simultaneously

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