

# Design and Operation of Pneumatically Operated Multi Operational Machine

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**Abstract**— Industries are basically meant for production of useful goods and services at low production cost, machinery cost and low inventory cost. Today, in this world, every task have been made quicker and fast due to technology advancement but this advancement also demands huge investments and expenditure, every industries desires to maintain high productivity rate maintaining the quality and standard of the product at low average cost. In an industry, a considerable portion of investment is being made for machinery installation. So, in this project we have proposed a machine which can perform operations like grinding, drilling and cutting. This project presents the concept of pneumatically powered multi-purpose machine mainly carried out for domestic purpose. Basically, the objective of this machine is to reduce the human effort, time and carry out number of operations simultaneously. It is economically efficient. It is designed as a portable one. The machine is operated with the help of air which is been used as a fuel. Since the machine uses air as its fuel which is freely available, the machine gets relatively cheap. Humans have applied energy through the use of arms, back and legs. With the invention of pneumatically operated machine, maximum of the human efforts are put to rest. The power generated with the help of air is multiple times greater than the power generated with the help of human limbs. In an industry, a considerable portion of investment is being made for machinery installation. According to some economists, manufacturing is considered to be a wealth-producing sector of an economy, whereas a service sector is considered as a wealth-consuming sector. Emerging technologies have provided some new growth in advanced manufacturing employment opportunities in the Manufacturing Belt in the United States. Manufacturing provides an important material support for national infrastructure and for national defense.

The pneumatically powered machine is having a very simple mechanism which is operated with the help of a pneumatic compressor. The aim of this project is to cut various materials like wood, poly vinyl chloride (PVC) pipes with very much less effort and quickly. This is very much possible by connecting the input slot of the cutting machine to an air motor. This motor is a planetary torque multiplier or a gearbox that is mated to a pneumatic air motor. At the end of the gearbox is a reaction device that is used to absorb the torque and allows the tool operator to use it with very little effort. The torque output is adjusted by controlling the air pressure.

**Keywords:** PVC, Pneumatically Operated Multioperational Machine

## I. INTRODUCTION

Humans have applied energy through the use of arms, back and legs. With the invention of pneumatically operated machine, maximum of the human efforts are put to rest. The power generated with the help of air is multiple times greater than the power generated with the help of human limbs. In an

industry, a considerable portion of investment is being made for machinery installation. According to some economists, manufacturing is considered to be a wealth-producing sector of an economy, whereas a service sector is considered as a wealth-consuming sector. Emerging technologies have provided some new growth in advanced manufacturing employment opportunities in the Manufacturing Belt in the United States. Manufacturing provides an important material support for national infrastructure and for national defense.

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## II. LITERATURE REVIEW

Before starting our work we did undergo through many research papers which indicates that for a production based industry, machine installation is a tricky task as many factors being associated with it such as power consumption (electricity bill per machine), maintenance cost, number of units produced per machine i.e. capacity of machine, time consumption and many more. Some research papers which led us to the idea of a machine giving us a solution to all these factors are as follows:

A. *Design of a Universal Micro Radial Drilling Machine, Ajay Kumar Singh.*

In the present growing world of emerging technology, the micro machining process has demanding operations in various sectors like aerospace, oil, defense, automobile, biomedical science and many industries at micro and nano levels of manufacturing and designing. In various different types of micro machining, micro drilling is one of the tool based micro machining operation. Generally, micro drilling is used to fabricate micro holes in micro products. Main emphasis is drilling speed (R.P.M) and the feed rate of the spindle. In this study, the cutting speed and feed rate will be taken as process parameters. We tried to increase the accuracy by giving feed to drill spindle through lead screw instead of direct feed. Here are some aspects which are considered in the design of universal micro radial drilling machine.

Micro-drilling process have been widely used to produce micro holes such as micro dyes and molds, fuel injection nozzles, watches, bearings and printed circuit boards, etc. it is also having more attention in a wide spectrum of precision production industries. Experiments are

conducted to investigate the effectiveness of drilling processes by measuring the hole quality after micro machining. Two aspects, location error and oversize of the hole, of drilling quality are measured. Depending on the type of drills and drilling processes, it may occur that the drill walks on the surface of the work piece before entering the part. Whirling of the drill edge at the time of penetration into the work piece degrades hole quality as well. In order to avoid whirling of drill bit on the surface of work piece, we require high R.P.M machine. This high R.P.M will lead to drill hole easily in a sheet of nearly 4 mm. in order to attain high R.P.M, generally two systems are used and they are pulley system and gear ratio system. But here also required R.P.M are not obtained so we can use embedded systems for getting desired R.P.M. In this machine the arm acts similar to a robotic arm but in a manual way. There is a cross slide which gives the linear movement to the drilling machine which takes care of the depth of the hole required and a stroke length of 125 mm can be achieved using the slide. Since the machine is manually set, the accuracy of the hole or point at which the hole can be drilled depends on the accuracy with which the machinist sets the end drill bit to the point. Once the drill bit is made to touch the pointer marked on the work piece, then the machine is to be started, set to the required speed and the depth is given using the slide, which gives a linear motion to the drilling machine. The flexibility achieved using this machine is an added advantage to the machine. With multiple axes available, we aim to achieve drilling at any position known to us or required in the given design. The measuring and accuracy in order to maintain perpendicularity of the drill is obtained by using angular measuring instruments like spirit level, protractors, etc. The linear measurements are done by using linear scales.

#### *B. A Paper on Two Spindle Drilling Head, Dnyaneshwar B Bharad.*

Generally, the growth of Indian manufacturing sector largely depends upon the productivity and quality. Productivity depends upon various factors, one of the major factor is efficiency with which the operation activities are carried out in the industry. Productivity can be highly improved by reducing the machining time and combining the operations etc. As the name indicates twin spindle drilling machine have two spindle driven by a single power head, and these two spindles holding the drill bits are fed into the work piece simultaneously. The center distance between the two spindles can be easily adjusted. For this purpose, the drill spindles are connected to the main drive by the means of universal joints. We can drill two holes at a time with a provision of varying center distance between two drilling spindles. It has the advantage of portability. The size of the machine is smaller than the older machine making it very simple to move it from one place to another. So, this machine can easily be transported. The overall space required is also minimizing. The efficiency of this machine is better than the older machine. Large saving in power has been achieved. The machine is very simple to operate. It drills the holes at faster rate, of right quality, right quantity, right cost and at right time. Therefore, it is necessary to improve productivity as well as quality. It can be achieved by using multi spindle drilling head. On the other hand, it is possible to meet quality

requirements of final product. For mass production, multi spindle drilling machines are used. It's a time saving technique. Multi spindle head machines are used in mechanical industry. Therefore, it is possible to increase the productivity of machining systems. It is used to drill two holes in a work piece simultaneously, in one setting. The holes are drilled on number of work pieces simultaneously. It is easy to make them interchangeable. Two spindles of machine is driven by a single motor simultaneously. In this system, motions are obtained either by raising the work table or it can be done by lowering the drill head. The center distance between the drill spindles are adjusted in such a way that the spindles are connected to the main spindle by universal joints. In mass production work, drill jigs are generally used for guiding the drills in the work piece. It is necessary to achieve the accurate results. Drilling depth cannot be estimated properly different size of hole cannot be drilled without changing the drill bit. It consumes lot of time for doing repeated multiple jobs. These all are the drawbacks. It is necessary to find out solution of the problem. To overcome all these problems, this automated drilling machine is designed. The main aim of this machine is to drill the hole.

#### *C. Design and Fabrication of Multipurpose Grinding Machine, Rohit U L.*

This paper presents the concept of Multi-Purpose grinding Machine mainly carried out for production based industries. Industries are basically meant for production of useful goods and services at low production cost, machinery cost and low inventory cost. Today, in this world, every task is been made quicker and fast due to technology advancement but this technology also demands huge investments and expenditure, every industry desires to make high productivity rate maintaining the quality and standard of the product at low average cost. We have developed a conceptual model of a machine which would be capable of performing different operations simultaneously and it should be economically efficient. In this machine, we are actually giving drive to the main shaft which is connected to another shaft with the help of a V-belt with the help of which the multi grinding operation is done by using an electric motor. The mode facilitate us to get the operation performed at different working center. Simultaneously it is getting drive from a single power source. Objectives of this model are conservation of energy (power supply), reduction in cost associated with power usage and increase in productivity.

#### *D. Design and Fabrication of Multi-Spindle Machine, Tushar B Malode.*

The growth of Indian manufacturing sector depends largely on its productivity and quality. Productivity depends upon many factors, one of the major factors being manufacturing efficiency with which the operations / activities are carried out in the organization. Productivity can be improved by reducing the total machining time, combining the operations, etc. In case of mass production where variety of jobs are less and quantity to be produced is huge, it is very essential to produce the job at a faster rate. This is not possible if we carry out the production by using general purpose machines. The best way to improve the production rate (productivity) along with quality is by use of special purpose machine. Usefulness

and performance of the existing radial multi-spindle machine will be increased by designing and manufacturing of multi-spindle head attachment. This paper deals with the design and development of multi-spindle head for cycle time optimization of the component.

Multi-spindle machines are used for mass production, a great time saver where many pieces of jobs having many operations can be carried out. Multi-spindle head machines are used in mechanical industry in order to increase the productivity of machining systems. The multiple spindle machine is a production type of machine. It is used to perform different operations on a work piece simultaneously, in one setting. This machine has four spindles driven by a single motor and all the spindles are fed into the work piece alternately. Feeding motions are obtained either by raising the worktable or by lowering the drill head. The center distance between the spindles can be adjusted in any position as required by the different jobs. For adjusting the center distance between the spindles, they are connected to the main spindle by bevel gear joint. In mass production, work drill jigs are used for guiding the drills in the work piece so as to achieve accurate results. In today's market, the customer demands the product of right quality, right quantity, right cost and at right time. Therefore, it is necessary to improve productivity as well as quality. One way to achieve this is by using multi-spindle machine.

#### E. Study and Fabrication of Multipurpose Tooling Machine, Yashraj V Patil.

This paper deals with fabrication of multipurpose tooling machine. This machine is based on the mechanism of belt drive with pulleys, bevel gears and scotch yoke. The various machining process in manufacturing industries are carried out by separate machining machines. It requires more space as well as time with high expenses. But the fabrication of multipurpose tooling machine contains five operations in a single machine. The operations are namely drilling, shaping, cutting, buffing and grinding. It is a new concept specially meant to reduce the work time and save the cost. This machine can perform multi-purpose operation at the same time with required speed and this machine is automatic which is operated by motor which is run with the help of an electric power supply. In an industry, a considerable portion of investment is being made for machinery installment. We have proposed a machine which can perform operations like drilling, shaping, grinding, buffing and cutting at different working stations simultaneously which implies that industrialists have not to pay for machines performing above mentioned tasks individually for operating operations simultaneously. In this competitive world, speed is required in each and every field. Hence, rapidness and quick working are most important factors. The engineers are constantly confronted with the challenges of bringing ideas and design into reality. So, new machines and techniques are being developed continuously to manufacture various products at cheaper rates and high quality. It is a compact, portable unit capable of doing many operations that normally require expensive single purpose machines. With different attachments that are available with the unit, cutting, drilling, shaping, buffing and grinding can be performed quickly and inexpensively. Industries are basically meant for production

of useful goods and services at low production cost, machinery cost and low inventory cost. Today, in this world, every task has been made quicker and fast due to technology advancement but this advancement also demands huge investments and expenditure. Every industry desires to make high productivity rate maintaining the quality and standard of the product at low average cost.

### III. PROBLEM STATEMENT

#### A. Relevance (Need for Project)

- To design and develop a multi-purpose machine for the purpose of performing multiple operations such as cutting, drilling and grinding (inside and outside). Also fabricate the model of the same which will show the working desired by the multi-purpose machine.

#### B. Design Data

##### 1) Material used:

- Square tube – 40\*40\*18G.
- Length – 18 feet.

##### 2) Cutter:

- Maximum R.P.M – 15,200.
- Dimension – 107\*1.0\*16mm.
- Company name – YURI Greenline.

##### 3) Gear:

- Gear ratio – 1:4.
  - Pitch – 3mm.
- ##### 4) Welding Machine:
- 3 phase welding machine.
  - Arc welding machine.

##### 5) Bevel Gear:

- 2 bevel gears.
- Ratio – 1:3.
- Pitch – 1 mm.
- Bush turning with press fitting and hand welding.
- Bolt type – Hex.
- Spanner size – 10 mm.

##### 6) Bearing:

- Outer Diameter – 27 mm.
- Inner Diameter – 10 mm.
- Thickness – 8 mm.
- Type – Ball Bearing.
- Bearing Number – 6000z.

##### 7) Bearing Housing:

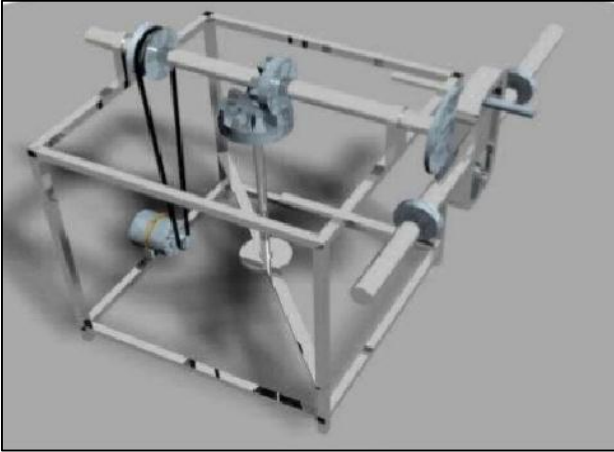
- Material size – 40\*10 mm\*18 feet.
- Cutting size – 40\*10\*55.
- Milling size – 40\*10\*50.
- Lathe machine – Four jaw dog chuck.
- Boring size – 27 mm.
- Grinding operation at last.

##### 8) Shaft:

- For inside and outside grinding (output shaft):
  - Bar dimension – 10 mm diameter of length 280 mm.
  - Lathe machine – 3 jaw true chuck for facing operation.
  - Boring – 6 mm.
  - Drilling – 6 mm for holding grinder wheel on both side.
  - M6 drill tap on both sides.
- For inside and outside grinding (input shaft):



- Bar dimension – 10 mm diameter of length 150 mm.
- Lathe machine – 3 jaw true chuck for facing operation.
- M8 drill tap on one side only.



#### IV. METHODOLOGY

Design concept generation refers to the actual conceptual design where the design concept is an approximate description of technology working principles and form of product. It has a detailed description on how the product will satisfy and meet customer requirements. Existing design constraints may even be solved by having a good development in the design concept.

For this project, Many alternative concepts have been generated. The various generated concepts were then individually evaluated to find the most appropriate concept for the product. The concept that gave the most advantages were considered as the best concept and waits further evaluation. The product sketch for the chosen concept was further drafted.

Design concept generation is usually expressed in the form of sketches or rough 3-D model sand often accompanied by brief textual description for the overall design concepts.

- Literature review
- Identification of the problem
- Finding solution of the problem
- Data collection
- Energy representation conversion
- Design of product
- Market survey for required components
- Purchase of required components system
- Manufacturing and assembly
- Testing and experimentation
- Evolution of result of the product



#### V. ADVANTAGES

- Multi operations are performed at one time
- Size is compact therefore it requires less space
- Time saving
- Less man power is required
- Low manufacturing and maintenance cost

#### VI. APPLICATIONS

It is used in

- Small scale industries
- Workshop

#### VII. CONCLUSION

Design and fabricate of multipurpose machine is successfully implemented. This multi operational machine can perform operations simultaneously or individually like machining operation cutting, grinding drilling. We can see that all production based industries wanted low production cost and high work rate which is possible through the utilization of multifunction operating machine. It requires less power as well as less time since this machine provides working at different center it really reduced the time consumption up to appreciable limit. In an industry portion of investment is being made for machinery installation

#### VIII. ORGANIZATION OF REPORT

Chapter one consists of introduction in which we included basic introduction of project along with problem statement, objective, scope and methodology.

Second chapter is literature review which consists of the study of literature i.e. the past study about the project topic i.e. multipurpose machine.

Third chapter consist of the working principle of the project

Fourth chapter is design calculations which includes calculations done for the design of the prototype

Fifth chapter consist of advantages applications of the project along with future scope and conclusion of the same.

