Gang Drilling Machine

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Abstract— The growth of Indian manufacturing sector depends largely on its productivity & quality. Productivity depends upon many factors, one of the major factors being manufacturing efficiency with which the operation /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 is 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 drilling machine will be increased by designing and development of Gang Drilling Machine with an arrangement of Muiltispindle drill head. This paper deals with such development undertaken for similar job under consideration along with industrial case study.

Key words: Special Purpose Machine; Gang Drilling; Mutispindle Drill Head

I. INTRODUCTION

It is one which can be used to drill a number of holes at various large and even unsymmetrical layouts according to our requirements, where the conventional drilling machines cannot be used. This is an improvement over geared drill heads and drill heads adopted with universal joints. The drill head is mounted on the drilling machine table. The drill head spindle is inserted in to the machine spindle. It is used to drill a number of holes in different layouts according deals with a proper idea of usage of eccentrics in the field of drilling. The report furnishes a cost estimation of all the components of the equipment by careful considerations of all factors such as cost of material, labor, machining and purchased components.

The very essence of our economic life and growth is dependent in a great part upon the continued improvement of Electronic and Mechanical fields. To aid these fields, we have designed which can be widely used to drill products like printed Circuit Boards, Engine heads and other Automobile components Extreme care should be there to drill multi holes at different layouts. The Gang Drilling Machine helps to achieve accurate and identical drilled layouts in mass production

II. LITERATURE REVIEW

- Tuna Eren (FEBRUARY 2010) [1] studied to achieve optimum controllable drilling parameters through the multiple egression technique to give minimum drilling cost.
- M. Takale, V. R. Naik (January-April 2012) [2] studied about design and manufacturing of multi spindle drilling head and cycle time optimization, the machine used for multi spindle drilling head is same (Radial drilling machine) which present uses to produce the part, so machine hour rateremains unchanged.
- Olga Guschinskaya, Alexandre Dolgui, Nikolai Guschinsky, and Genrikh Levin(January 2007) [3] studied about Scheduling for multi-spindle head machines with a mobile table.
- Ali Riza Motorcu, Abdulkadir Gullu (2006) [4] studied about statistical process control in machining, a case study for machine tool capability and process capability.
- C. Brecher, M. Esser, S. Witt (2009) [5] studied about the Interaction of manufacturing process and machine tool. Central Machine Tool Institute, Machine Tool Design Handbook, through which we had found out the optimum design steps for designing the special purpose machine.
- V.B.Bhandari, [6] Design of machine elements through which we had carried out design calculation regarding different machine elements
- J.S. Strenkowski, C.C. Hsieh, A.J. Shih, [7] studied an analytical finite element technique for predicting thrust force and torque in drilling. This helped in the selection of various parts

III. BACKGROUND

A Gang drilling machine will drill a number of parallel holes simultaneously in a work piece. Gang drilling machines are employed for work of a light character, especially repetition work, such as drilling small components for the Automobile and Aircraft industries. A Gang drilling machine has a number of drill spindles driven by a single motor. All the spindles holding the drills are fed in to the work piece at the same time. For this purpose, either the drill heads can be lowered onto the work piece or the work table is raised.

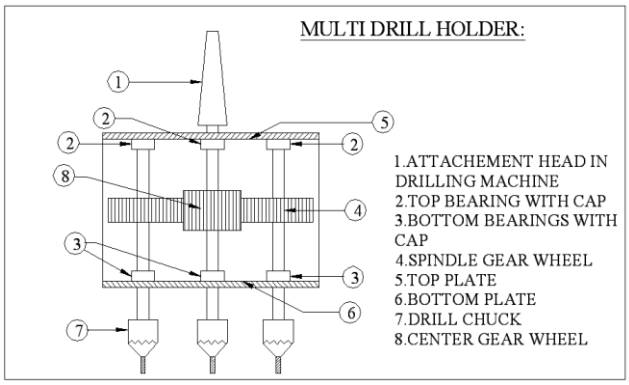
The Main eccentric is driven by the drilling machine spindle which is driven by a single motor. The several drill holding eccentrics are driven by the main Eccentric through a Revolving plate. Eccentric is a mechanism which is usually used to convert rotary motion into sliding motion. It shall be noted that an Eccentric cannot convert reciprocating motion into rotary motion. Here we are converting the rotary motion into revolutionary motion and in to rotary motion. (i.e.) when the main spindle rotates, the rotary motion of the spindle is converted into revolutionary motion of the Revolving plate.

Through the Main Eccentric and the revolutionary motion of the Revolving plate is converted into rotary motion of the Drill holding Eccentrics. The conversion of the motion is achieved by the eccentricity provided in the eccentrics. Eccentricity is 15mm at all the eccentric spindles].

Drill bits can be fed by lowering the Drill head. The pillars provided with springs guide the Driller head in motion. Springs secure the Drill head with drill bits, from a rapid fall, while releasing the Drill head from the machine spindle. It is designed to drill five holes of various diameters in

unsymmetrical layouts. The art of eccentricity plays a major role in this principle.

IV. GEAR SETUP



V. GEAR SELECTION

Gear Type: Spur Gear
Material: MS – L8
Manufacturing Method: Casting Lathe
Number of teeth: 21
Total Number of gears: 05

Circular Pitch = $P = \frac{\pi d}{z}$

$\frac{\pi(81)}{21}$

P =12.11 mm

Module = $m = \frac{d}{z}$

$\frac{81}{21}$

m = 3.86
Addendum = module
Addendum= 3.86
Dedendum= 1.25m
= 1.25*3.86
Dedendum= 4.38
Fillet Radius= 0.4 mm
Pressure Angle = 14.5°

Center to center Distance = $\frac{m(Zp+Zg)}{2}$

$\frac{3.57\ (21+21)}{2}$

Center to Center distance = 81.06 mm

VI. ADVANTAGE, DISADVANTAGE & APPLICATIONS

A. *Advantages*

- Drill number of holes at a time.
- Reduce working time.
- Complete operation in less time
- Easy to handling.
- One electric motor used to run a many spindle.
- Increase productivity.

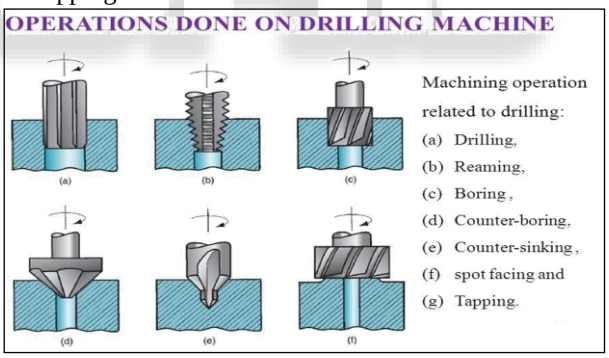
B. *Disadvantages*

- Cannot drill thick metal sheets
- Suitable up to 20 mm thickness
- Need an electrical power supply.
- More noise compared to regular drilling machine

C. *Drilling Operations*

Operations that can be performed in a drilling machine are –

- Drilling
- Reaming
- Boring
- Counter boring
- Countersinking
- Tapping



VII. MACHINE

VIII. CONCLUSION & FUTURE ENHANCEMENT

By using multi spindle drilling head productivity is going to be increased. Because with the present process one hole produces at a time requires 12 seconds for each component i.e. 2400 parts are produced during 8 hours, but by using multi spindle drilling head cycle time approximately takes place 5 seconds i.e. 2400 parts may produce during 3.5 hours.

This project work is still under process. The analysis of the Multi Spindle Drilling head under various stresses is to be done on analysis software. The further design of the body of drilling machine is to be designed and checked for the cutting force and different stresses. The structural analysis on the frame is to be done for the safety of machine and the operator. After the machine is ready for use, the breakeven analysis and cost comparison is to be carried out for the current conventional method of drilling machine

Multi-spindle Drilling machines are used in mechanical industry in order to increase the productivity of machining systems. Such machines are equipped by spindle heads that carry multiple tools for performing machining operations. The most noteworthy aspect when using multi-spindle machines is the cycle time, due to parallel machining the total operating time is dramatically decreased. Added benefits include less chance for error, less accumulated tolerance error, and eliminate tools changes. In such a multi-spindle machine, a part to be machined is fixed on the table. It is not possible neither to fix two or more parts on the table nor use two or more tables at the same machine. Thus, in every moment only one part can be present on such a machine. No part can be loaded before the previous part is not finished.

In today's market the customer demands the product of right quality, right quantity, right cost, & at right time. Therefore it is necessary to improve productivity as well as quality. One way to achieve this is by using multi spindle drilling machine. On the other hand, in order to meet quality requirements of final product. Another way of achieving good quality during production is to use the statistical quality control techniques at every stage of production. If the production is statistically under control the process can continue and there is no need for a change in the process. However, if it is not statistically under control, the assignable causes should be discovered and removed from the process.

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