

A REVIEW ON DESIGN AND MANUFACTURING OF AUTOMATIC DRILLING SPM.

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ABSTRACT

The project is a study about the automation of the drilling machine for mass production of the drilling operation. Drilling is the process in which a circular hole is made using a drill bit. Special purpose machine is a part of a multitasking machine. due to this, we can improve productivity and efficiency. By using SPM the holes, we get are of accurate dimensions and the same accuracy. Our aim is to automate the drilling process on Air break push rod which is generally used in heavy vehicles. There is two drilling head which is mounted on fix distance and fixed length which is 12.7mm and 6.5 mm respectively. The design was analyzed using FEA tools. The material used for jig assembly is AISI OI for table Steel (Carbon steel) AMS5060AMS5060C. The pneumatic circuit is also designed for clamping operation; various components are used for it are DCV FRL Unit, Compressed air, Conducting lines, silencer, etc.

Keywords- SPM, Drilling Machine

INTRODUCTION

Drilling is a cutting process in which a drill bit used to cut a hole of circular cross-section in solid materials. The drill bit is a rotary cutting tool. The drill bit is pressed against the workpiece and then rotated. This forces the cutting surface of the workpiece cutting off chips from the hole. Drilling may affect the mechanical properties of the workpiece by creating stresses around the hole opening like residual stresses and a very thin layer of highly stressed and disturbed

material on the newly formed surface. Due to this workpiece may get affected by corrosion and crack on the surface. A finishing operation should be done to avoid this.

Special purpose machine is a part of a multitasking machine. And the new approach to increase the productivity of the organization. The comparison between ordinary machine and spm in sense of time, costs, number of steps involved, etc. the multitasking machine is one of the preferred choice [1]. This technology of SPM is decided upon the principles of minimizing the cost, better productivity and enhanced safety, etc. which bands with the high primary investment, advanced maintenance cost, etc. SPM is one of the higher degree mechanism in which human participation is bartered by mechanical, electrical, fluid power technologies capable of liability the physical effort and even intellectual work in case of CNC machines. Automation can be said as a new method to be performed without human assistance. In other words, Automation is the automation is use of various control systems for operating equipment such as machines, boilers and heat-treating ovens, switching on telephone networks and stabilization of ships, planes, jet, and other applications and vehicles with negligible interference, and with some processes, been completely automated. Automation is achieved in various sectors including hydraulic, mechanical, pneumatic, electronic devices, electrical and computers, usually in grouping.

Nowadays many industries face problems of inefficient work or everyone wants works to get automated and also in lesser cost, therefore, there is a special purpose machine SPM. And for automation of that machine, we consider some design aspects. Therefore SPM can be designed at a lesser cost than any other automated machine [1].

LITERATURE REVIEW:

[1] Yousef M. Abujela et al explains to design and fabricate an automated drilling machine based on PLC to produce holes (8mm depth) in the center of a cubic workpiece (3 m × 2 cm × 3cm). The drilling machining development planned for a drilling cycle. As we press the start switch the cycle process starts. The linear motor is placed in place the drilling head in the home situation and rotates the rotary disk to bring the first workpieces to the desired position. Momentarily, the drilling procedure is running after the inductive sensor within the (desired position) sense the item. Then the method can stop mechanically once created the opening and went back to its original position, after that the rotary disk starts to rotate quarter cycle to carry the drilled object out the table throughout the lower rotary disk. The PLC castoff to perform these operations, by reading data from sensors and actuate the DC motors. He resulted that the designed system was able to run the drilling procedure separately for three objects per minute based on the desired sequence. The automated drilling machine was successfully designed and implemented based on a PLC control system. The prototype is done to drill a small hole in wood workpiece around (8mm) complexity, and perform drilling for three objects per minute, so as to extend the productivity of small drilling machines instead of human work. From the results of drilling performance testes, the arrangement was apple to drill small holes and all the objectives stood complete effectively as propose.

[2] Manish N. Kale et al gives the detail material for design, fabrication, and analysis of special purpose machine and also compares the cycle time with previous method. This machine is containing automation by using a pneumatic system. The analysis is done by use of FEA and modeling is perform by use of CAD. On various load conditions the design was analyzed for induced stress in workpiece. Most of the manufacturing industries are using automation to increase production and therefore overcome the lack of skilled labor. The aim of this paper is reduce cycle time by exchanging the drilling machine by SPM. For drilling and riveting operation, the concept is that plates having dissimilar size and thickness are drill on drilling spindle and after that reverted on the orbital spindle. Both operations are on the same SPM. In these papers, the design, analysis, fabrication, and cad analysis is given. The working principle is given. He concluded that the SPM is beneficial for the mechanical workshop, small scale industries where

drilling and riveting operations perform on the same job. By use of this machine we get less transportation cost, operation time and also increases efficiency as well as the accuracy of the product. By use of conventional machining procedures for making the hole of 6 mm span in an 8 mm to 10mm thick plate, the time essential for drilling and riveting operation is around two minutes. But we found that by using SPM the time required is 1 min. Therefore, there is 65 sec less time required for producing one complete job with this machine for the same period of time.

[3] H. Ferdnando et al explains the development of automatic drilling machine for PCB. This is drilled automatically without labor interference. This system is based on PLC, all commands given through it. It consists of microcontroller 89c51. The paper includes hardware design, software design and working of the machine. This system has better performance than the other system. This result is attained by prevailing both shaft for X- and Y-axis. The presentation of the system can be modified by utilizing more minute delay for the stepper motor. The cull of cull raw material avails in the machining of the sundry module to very close tolerance their by reducing the caliber of wear and tear need fewer impasses here that we have hoist no stone unturned in our potential effort during welding, cutting, soldering, & filling work of the project model to arrive fulfilment. He concluded that the automatic drilling machine utilizing PCB increases efficiency and productivity.

[4] P. R. Sawant et al engraved about Design and expansion of SPM for multi drilling and tapping machine. He study how to compare productivity of component by using conventional radial drilling machine and special purpose machine (SPM) for drilling and tapping operation. In this case study, the SPM used for eight multi drilling operation (7 of Ø6.75 and Ø12), linear tapping operation of Ø12 and angular tapping operation of Ø5.1 of TATA cylinder block. The following study is done in this paper,

1. By use of hydraulic clamp time is reduced (loading and unloading)
2. Increase in productivity both qualitative and quantitative,
3. Less human interference, indirectly reduction in worker fatigue,
4. Less rejection due to automatic controls,
5. Increase the profit of the company.

He concludes that SPM is designed for process of TATA cylinder block, in which operations are for UNIT A-8 multi drilling (Ø6.75 and Ø12), UNIT Bi-linear tapping of Ø12 and UNIT C-angular tapping of Ø5.1.

[5] R. A. Barawade et al discusses valuation for the production of the component with conventional pillar drilling machine and SPM is designed for the drilling. The SPM performs multi drilling process of impeller job. The production of the impeller is amplified dueless time required for machining and by swapping

the conventional drilling machine with SPM. Also, SPM some advantages like lesser rejection, less time consumption in operation, profit increases and less operator fatigue. This machine has 5 spindles driven by a single motor and all the spindles are fed into the work piece at once. The SPM unit is feed towards the job by using a cylinder-piston arrangement. To achieve the accuracy in operation the drill jigs are provided to guide the drills in mass production. Nowadays, the customer demands the product of higher quality, right quantity, and minor cost & at the right time. Therefore, it is necessary to improvise the quantity as well as quality. Possibility of hole missing is removed because 5 holes drilled at a time. The cost per piece is reduced.

[6] Nikhil Shinde et al has written about the twin spindle drilling machines. It is used to drill two holes in a workpiece at once, in single setting. The holes are drilled on a number of workpieces with the similar accuracy, so as to make them compatible. This machine has 2 spindles driven by one motor and each the spindles are fed into the workpiece at once. Feeding motions are found either by raising the work table or by lowering the drills head. In production work, drill jigs are used for guiding the drills in the workpiece so as to get required results. He concluded that drilling depth cannot be projected properly, the job may spoil due to human errors, and different size holes cannot be drilled without changing the drill bit. Consumes too much time for doing repeated multiple jobs, these all are the disadvantages or we can say drawbacks. To reduce all these problems, this automated drilling machine is designed which is aimed to drill the holes mechanically over a job according to the boring depth. The size of the machine is smaller than the previously using machine so it is very simple to move from one place to other. So machine can easily move from one place to another. The overall space required is very less than previous. The efficiency of this machine is quite good than the older machine. In this concept, the vertical movement of the drilling machine will be regulated automatically.

[7] Tushar A. Patil et al analyze & design the drilling cum orbital riveting machine. this machine will help us to increase production by reduction of time constraint. ORM is the orbital riveting machine which will complete the riveting operation automatically along with drilling operation. We use 2 spindles on single machine to minimize operation time and performing the drilling & riveting operation at once to achieve accuracy with productivity in riveting 2 to 3-degree offset spindle is used; the upper part of the rivet is expanding over the plates without hammering. He concluded from his work that this machine works safely and fulfill the required condition required for machining operations like drilling and riveting, It is found that this machine will play very crucial role in industry as it reduces time constraint also it increases the productivity.

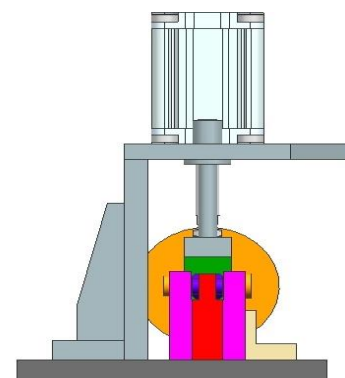
[8] Pravin Chougule et al explains about PLC based automation in drilling with conveyor assembly. He

states that the time consumption for drilling and clamping is very less compared to the time required for manual operation. The manually operating Drilling Machine is automated with the help of Conveyor Assembly. The Direction control valve will supply air to the Pneumatic cylinder from the air compressor, which will clamp the drilled object. Now the down-contactor will get on an AC motor moves the Driller Vertically down. After this driller will drill the object up to the marked level, which will be noticed with the help of a Lower limit switch. Now the up-contactor will get on and Driller will be moved vertically upward up to its original position. The upward position of the driller will be noticed with the help of Upper limit Switch. Now direction control valve will release the air from the pneumatic cylinder which de-clamps the drilled object. After this, the Conveyer will move for the Drilling of Next job when the upper limit switch is on. This way the process works continuously. The driller motor is not controlled through the PLC, so it has to be switch on manually before the start of the process. He concluded that this system reduces human efforts, manpower requirement and time. The PLC panel used to control the machine operations makes the work much easier than manually operated. It is also a safe system as the person neither has to neither handle the driller nor clamp the object.

DESIGN AND MANUFACTURING OF DRILLING PART ELEMENTS IN JIGS

Jig generally consists of locating element, clamping element and tool guiding or setting element.

- Locating elements
Locating elements position the workpiece accurately with respect to tool guiding elements in the jig.
- Clamping element
The role of Clamping element is to hold the workpiece securely in the located position during the operation.
- Tool guiding element
The tool guiding elements help in guiding the tools in the correct position with respect to the workpiece. Drill bushes guide the drill accurately to the workpiece.



Design of Jig for SPM

EFFECTS OF MANUAL METHOD

- Time-consuming as measuring and marking operation involved.
- Two labors required one to hold the object and second to perform the operation.
- Manual errors occurring in operation.
- Holes inaccuracy leads to rejection of part.
- Skilled labor required.
- Rejection indirectly leads to material and economic loss.

AUTOMATION IN WELDING PROCESS

- That's why we introduce automation in this automation technique, first of all, we designed for lager part or air break push rod.
- First, both the drilling heads are mounted
- Then the part which is going to be drilled is mounted on fixtures
- Then holding the part by use of an actuator
- Then four holes of two different size are drilled
- in this way the overall drilling process takes place

CONCLUSION

Paper and dissertation aim at the automation of "automation of drilling machine", with all desirable features of SPM carries. which is successfully achieved. Designed and dimensions match their expected criteria. All the objectives achieved as per considerations labor cost reduced, the time required which is reduced, and mainly the production increased three times than previous. So productivity increased to a great extent through this project.

REFERENCES

- [1] Yousef M. Abujela, A. Albagul, Ibrahim Masur, and Obida M. Abdallah, "Automated drilling machine based on PLC", IJISET, Vol. 2 Issue 3, ISSN: 2348-7899, March 2015, University of Lybia.
- [2] Manish kale, "Design, fabrication, and analysis of special purpose machine for drilling and riveting operations", V-5 No.1, IJRSE, ISSN: 2319-3182, February 2016, Pune University.
- [3] H. Ferdnando, I. N. Sandjaja, G. Sanjaaya, "Automatic drilling machine for PCB", IJRSE, Petra Christian University.
- [4] Prof. P.R. Sawant, Mr. R. A.Barawade, "Design and development of SPM-a case study in multi drilling and tapping machine", IJAERSE-ISSN2249-8974 Vol. I Issue II January-March, 2012.
- [5] R. A. Barawade, P.M. Gavali, P.V. Shinde, "Design and Development of Special Purpose Machine (SPM) – A Case Study in Multi Drilling of Impeller" IJTRD Volume 3(3), ISSN: 2394-9333, May-Jun 2016.

[6] Shinde Nikhil, Vishwakarma Prem, Sanjay Kumar, "Design & Development of Twin Drill Head Machine and Drilling Depth Control", IJRSET ISSN (Online): 2319 – 8753 Vol. 4, Issue 5, May 2015

[7] Tushar A patil, prof P.N. Ulhe, and Pratik D. Bhoyar, "Analysis & design of drilling cum orbital riveting machine", IJIRT Volume 2 Issue 8 ISSN: 2349-6002 January 2016

[8] Pravin Chougule, Kaushik Sardeshpandey, and Vardhman Patil, "PLC-based automation in drilling with conveyor assembly" IJLTET, Vol. 6, Issue 4, ISSN: 2278-621X, March 2016.

[9] Fazlina Binti Mansor. "Design and evaluation of jig for holding the cylindrical part for mass production for drilling operation"