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DESIGN, DEVELOP AND IMPLEMENTATION OF D PUNCH MACHINE

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Abstract :- *Drill machines have been the core of every industry. Drilling holes in parts, sheets and structures is a regular industrial work. The demand for efficient and precise manufacturing processes in various industries has led to the development of specialized machinery tailored to specific tasks. For precise and secure drilling, fixed drills are essential. However, in instances where there is limited space between the drill bit and drill bed, fixed drills may not be suitable. In such cases, hand drills are necessary, but they often encounter alignment issues during drilling. This research focuses on the design, development, and implementation of a Drill Hole Checking and Punching Machine (D Punch Machine), a special purpose machine aimed at automating the process of verifying drill hole dimensions and accurately punching in workpieces. The primary objective of this machine is to design, manufacture, and assemble parts while verifying the proper execution of the drill hole inspection. If the drill hole inspection is successful, the machine proceeds with the subsequent punching process. However, if the drill hole inspection fails, the part is rejected.*

Key Words*: *Special Purpose Machine (SPM), Drill machines, Precision, Drill Hole Checking and Punching Machine, drill hole inspection.

1. INTRODUCTION

1.1 Motivation:

The use of drill hole checking and punching machine's is essential in maintaining high quality and precision in manufacturing operations. These machines offer numerous benefits, including cost savings, improved efficiency, and faster results. By automating the inspection process, the need for manual inspection is reduced, which saves time and minimizes the risk of human error. Additionally, these machines provide a higher level of precision and consistency in measurements, enabling early detection of errors or deviations. This helps to prevent defective products from reaching the market, which ultimately protects a company's reputation and financial well-being. With the ability to rapidly inspect and measure multiple drill holes and punched features, these machines are a valuable addition to any manufacturing facility. Invest in drill hole checking and punching machines to take advantage of these benefits and improve your manufacturing process.

1.2 Necessity:

The need of the project is to check whether the workpieces or job has a proper drill hole or not. As drill hole operation on a workpiece is regular industrial work so, it is required to be perfectly done. Thus, this SPM is developed to analyze whether the drill hole operation is properly performed or not. If the operation is failed then the workpiece is rejected which can cause various other issues such as inadequate sample identification, deviation of drill hole, more feed, Instrumentation errors.

1.3 Objectives:

1) To study and develop a functional and efficient drill hole checking and punching machine that meets the industry's standards and requirements.

2) To ensure that the machine can accurately locate and verify drill hole positions on workpieces and check and punch with high precision.

3) To implement automation features to reduce manual labor and increase productivity.

4) To reduce production cost by minimizing material waste, labor requirements, etc.

2. LITERATURE REVIEW

2.1 Literature Survey:

Suchada Sitjongsataporn(IEEE), This paper features an automatic prototype drilling and sorting line using programmable logic control (PLC).

Nekrasov, S.; Zhyhylii, D.; Dovhopolov, A.; Karatas, M.A. researches on manufacturing of the new innovative joint of FRP machine parts.

Majid Rad, method adopted is of Automation which improve productivity and efficiency of operation to be performed and multispindle drilling for high output with challenges like Unplanned pauses in the process of drilling causes interruption in machinery .

N.A. Ghaffar, Ahmad Baharuddin Abdullah, Zahurin Samad - Hole precision is highly critical for precise assembly. This

factor is considerably vital for structural materials, such as composite materials.

Prof.Catalin Teodoriu (University of Oklahoma) , Automation in drilling equipment is the method being adopted and the benefits are used in drilling performance through advancing systems and methods, Company enabled drilling solutions , improved feasibility and difficulty faced

O.OJoesph (NBRRI institute) , method adopted is Automation and punching for SPM and the features are to Reduced material waste ,high speed production and the main challenges occurred after execution are of Maintenance, Tool costs

Giasin, K.; Hawxwell, J.; Sinke, J.; Dhakal, H.; Köklü, U.; Brousseau, E. The changes of cutting tool coated on form and measuremental errors of machined holes.

Muhammad Aamir, Majid Tolouei-Rad, Khaled Giasin - In the industry the drilling process is the most challenging among all the other machinery process as millions of holes are used to make bolted joints.

3. METHODOLOGY

3.1 Workflow :-

The flowchart shows the steps involved in a process that uses a pneumatic cylinder to pass air through a part. The process starts and the part is set on the machine. This is followed by passing air inside, solenoid valves are electromechanical devices that control the flow of air or process gas and are used for controlling the pneumatic cylinders into the part (job).The air passing will be detected by air pressure switch. Air pressure switch are used in pneumatic system to monitor changes in air pressure.

Then it enters in the continuous loop ,if the air passes from one point to another point, as indicated by the "Yes" path, then it will proceed to "Press letter "D" on part".

If the air does not pass from one point to another point, as indicated by the "No" path, the part is then thrown into a rejection box. The next cycle starts continuously unless the machine is turned off by the operator. This means that the machine will continue to cycle through the process until it is turned off.

Overall, the flowchart shows a process that uses a pneumatic cylinder to test whether air can pass through a part or not. If air can pass through the part, the part is marked with a "D" and then rejected. If air cannot pass through the part, the machine cycles through the process again.

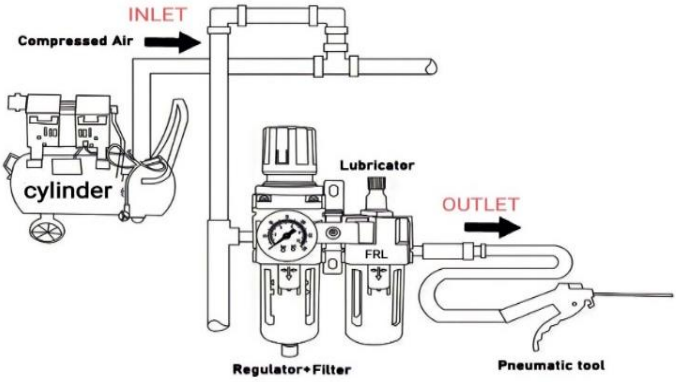


Figure 1. Inlet & Outlet of air

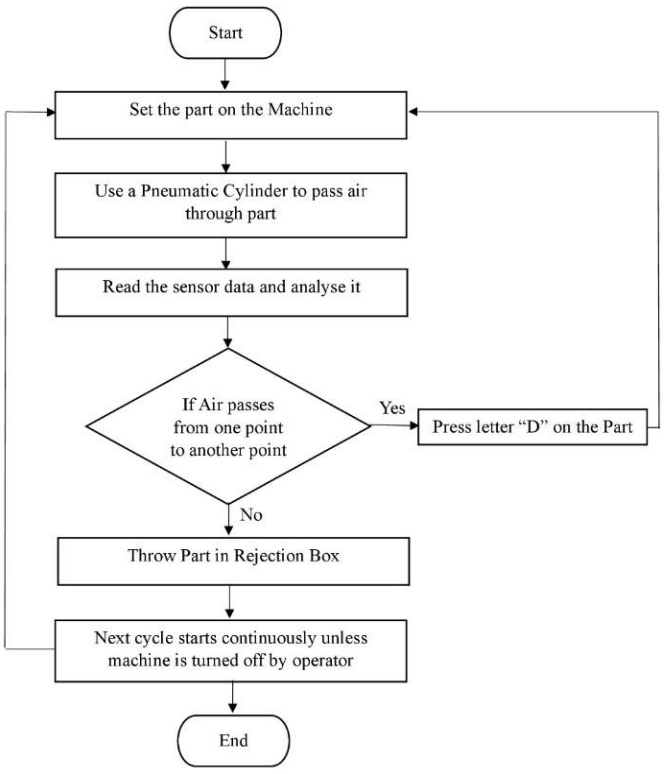


Figure 2. Flowchart

3.2 Block Diagram:

This block diagram shows integration of components to crea te an efficient and automated system. When the machine gets started the part will be set on the machine and then the sensors will determine the actual part and then the air pressure passed through the pneumatic cylinder from the part with the help of PLC will be determined and through PLC it will analyse the pass or fail condition. Hence, the hole will be checked in the part and the output will be obtained.

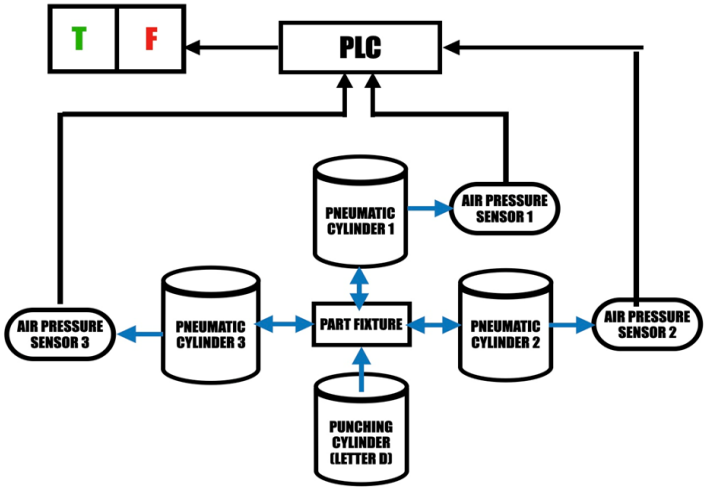


Figure 3. Block Diagram

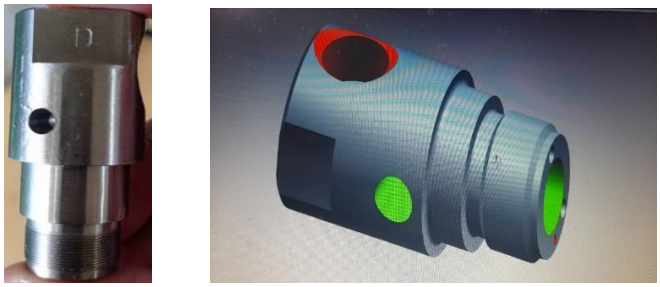


Figure 4. Job/Part to be checked

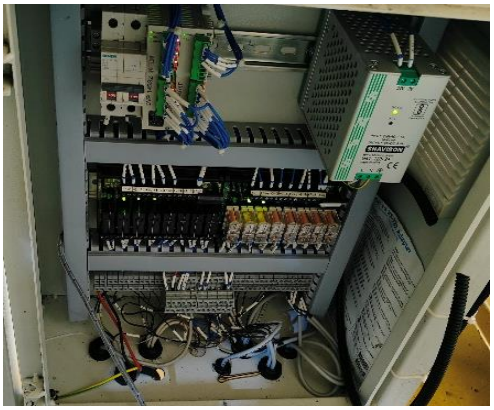


Figure 5. Hardware Implementation

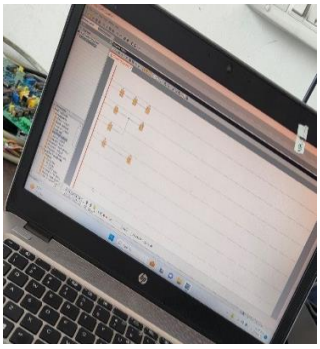


Figure 6. Software Implementation and Testing

4. ANALYSIS AND APPROACH

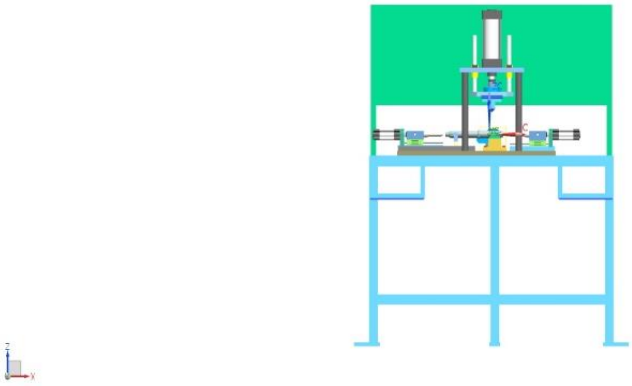
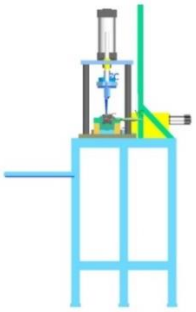


Figure 3. AutoCAD Design 1



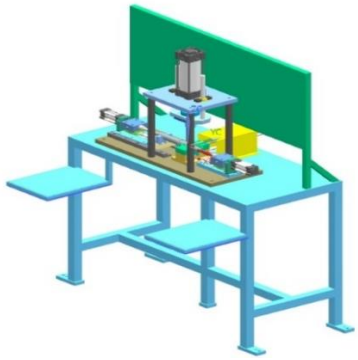


Figure 4. AutoCAD Design 2

Designing a drill hole checking and punching machine using AutoCAD is a complex process that requires following several steps. However, following these steps will ensure a successful outcome that meets all requirements. By defining the requirements, creating a conceptual design, and using AutoCAD to create a 2D and 3D layout, the machine can be designed with precision and accuracy. Additionally, designing individual components, assembling them correctly, and creating detailed drawings are crucial steps in the process. By performing virtual tests and simulations, the machine can be tested to ensure it functions as intended. Once the design is finalized, the machine can be prototyped and tested in the real world. By following industry standards and best practices, AutoCAD provides a powerful set of tools for designing, simulating, and documenting complex machines like a drill hole checking and punching machine.

5. RESULT

Improved Quality Control :This leads to a reduction in defective parts and an overall improvement in product quality as error caused due to manual intervention were minimized.

Increased Efficiency :With automated drilling and punching operations, number of units manufactured earlier - 200 (per shift) ,number of units manufactured now - 800(per shift)

Enhanced Accuracy and Precision : 99% part are inspected before proceeding for next operations.

Flexibility and Versatility : Depending on the capabilities of the machine, it can offer flexibility in handling various materials, hole sizes, and patterns. This versatility allows for adapting to changing production needs and requirements.

Cost Savings : Reduced labor costs, decreased material waste due to fewer errors, and increased productivity contribute to overall cost efficiency.

6. CONCLUSION

In summary, the Drill Hole Checking and Punching Machine marks a significant leap forward in manufacturing technology, providing a remedy for the inherent challenges encountered in drilling and punching processes within industrial environments. The implementation of this machine has yielded remarkable results, with process efficiency soaring to an impressive 95%. This improvement not only bolsters productivity but also leads to substantial cost reductions and waste minimization for manufacturing enterprises.

Moreover, our study underscores the pivotal role of automation and precision in contemporary manufacturing practices. By integrating sophisticated technologies such as automated checking and punching mechanisms, we can mitigate human errors, ensure uniformity in product quality, and streamline production workflows.

Furthermore, the successful deployment of the Drill Hole Checking and Punching Machine underscores the pivotal role of research and development in tackling industry-specific hurdles. This endeavor serves as a testament to the transformative potential of innovation in enhancing efficiency and competitiveness within the manufacturing domain.

Lastly, the Drill Hole Checking and Punching Machine heralds a promising era of enhanced manufacturing efficiency, providing a glimpse into the future of automated production systems. Through continued innovation and refinement of such technologies, we can chart a path toward a more efficient, sustainable, and competitive manufacturing sector.

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