DESIGN AND ANALYSIS OF STRIP AND MAGNET CLAMPING MACHINE

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ABSTRACT

Automation Systems are essential for most modern industries. It has been achieved by various means including mechanical, hydraulic, pneumatic, electrical, electronic devices and computers, usually in combination. The main objective of magnetic clamping machine is to automate the strip and magnet clamping process, to generate the CAD model of metal strip and magnet clamping machine, to perform design and analysis of metal strip and magnet clamping machine, to enhance the production rate of company by using metal strip and magnet clamping machine, to improve quality, flexibility, accuracy and safety of the process, to minimize errors as well as time required for the process and to implement semi-skilled labors to the work and save manpower cost.

The CAD model of strip and magnetic clamping machine was generated as per the data collected, objectives of the project, references. After the CAD model generation, Finite Element Modelling and Finite Element Analysis was carried out. The linear static analysis results show that the stresses are well within the safe limit, hence the design is safe.

This will improve product quality. Automation not only results in higher production rates than manual operations it also performs the manufacturing process with greater uniformity and conformity to quality specifications. Reduction of fraction defect rate is one of the chief benefits of automation.

Keyword: - *Automation, Strip and Magnet Clamping.*

1. INTRODUCTION

Automation is a set of technologies that results in operation of machines and systems without significant human intervention and achieves performance superior to manual operation. Automation Systems are essential for most modern industries. It has been achieved by various means including mechanical, hydraulic, pneumatic, electrical, electronic devices and computers, usually in combination.

Earlier the purpose of automation was to increase productivity (since automated systems can work 24 hours a day), and to reduce the cost associated with human operators (i.e. wages & benefits). However, today, the focus of automation has shifted to increasing quality and flexibility in a manufacturing process. In the automobile industry, the installation of pistons into the engine used to be performed manually with an error rate of 1-1.5%. Presently, this task is performed using automated machinery with an error rate of 0.00001%. PROJECT

Industrial automation eliminates healthcare costs and paid leave and holidays associated with a human operator. Further, industrial automation does not require other employee benefits such as bonuses, pension coverage etc.

Above all, although it is associated with a high initial cost it saves the monthly wages of the workers which leads to substantial cost savings for the company. The maintenance cost associated with machinery used for industrial automation is less because it does not often fail. If it fails, only computer and maintenance engineers are required to repair it.

Although many companies hire hundreds of production workers for a up to three shifts to run the plant for the maximum number of hours, the plant still needs to be closed for maintenance and holidays. Industrial automation fulfils the aim of the company by allowing the company to run a manufacturing plant for 24 hours in a day 7 days in a week and 365 days a year. This leads to a significant improvement in the productivity of the company.

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Adding a new task in the assembly line requires training with a human operator, however, robots can be programmed to do any task. This makes the manufacturing process more flexible.

Adding automated data collection, can allow you to collect key production information, improve data accuracy, and reduce your data collection costs. This provides you with the facts to make the right decisions when it comes to reducing waste and improving your processes.

Industrial automation can make the production line safe for the employees by deploying robots to handle hazardous conditions.

2. CAD MODELLING

CAD DRAWINGS:

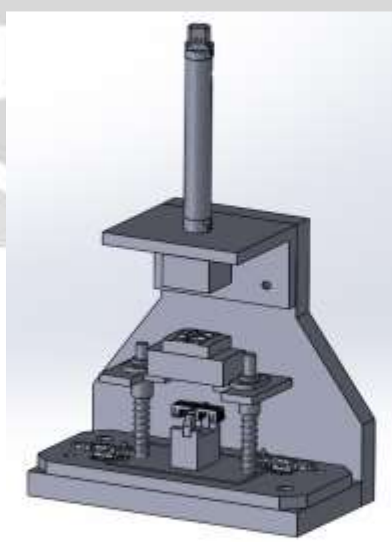

Fig 2.1: Isometric view of clamping machine

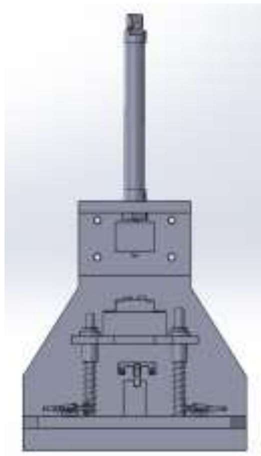


Fig 2.2: Front view and Side view of clamping machine

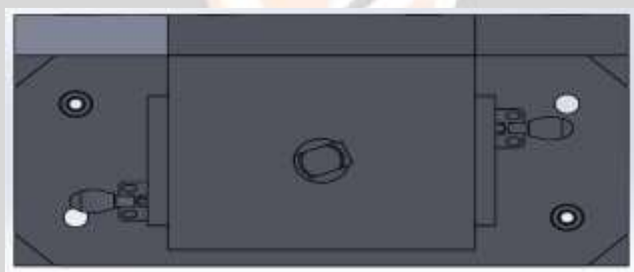

Fig 2.3: Top view of clamping machine

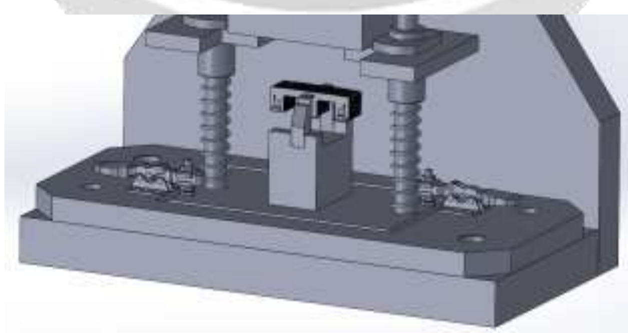

Fig 2.4: Isometric view of parts of clamping machine

3. FINITE ELEMENT ANALYSIS

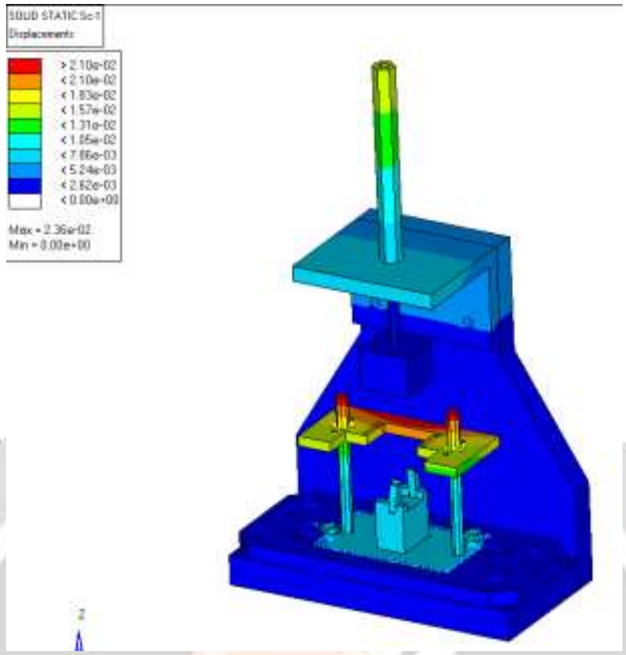

Fig 3.1: Maximum Displacement in assembly= 0.0236 mm

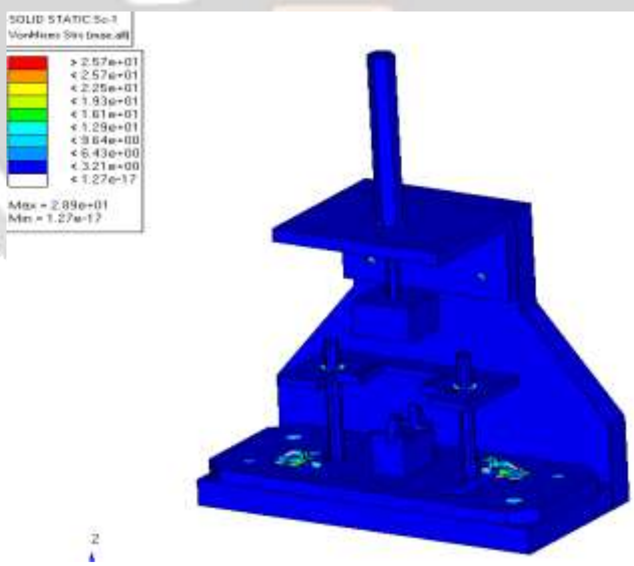

Fig 3.2: Maximum Von mises Stress in assembly = 28.9 MPa

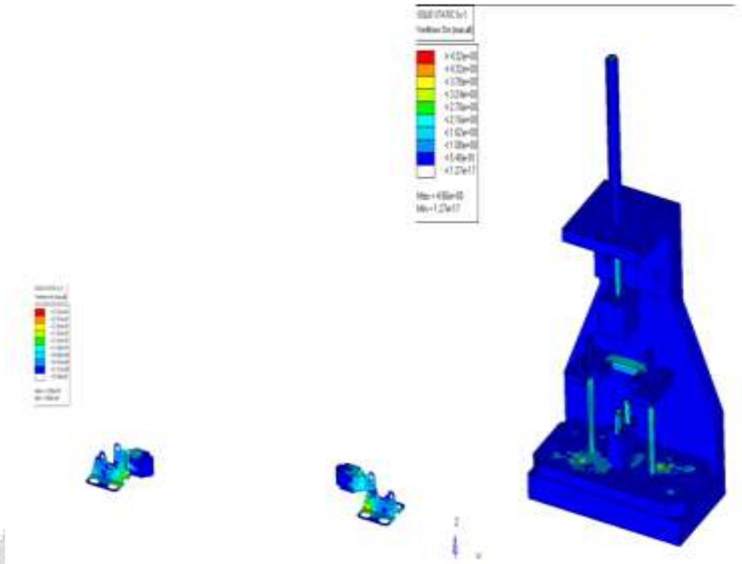

Fig 3.3: Maximum Von mises Stress in assembly = 28.9 MPa

4. RESULT DISCUSSION

Maximum Pneumatic force 75N is applied on each clip. 75 N force is very less for clamping structure. To check the effects of maximum forces on the designed structure a Linear static Analysis is carried out by using Finite Element Analysis Technique.

From the Results of FE analysis, it is observed that structure is deformed by 0.0236mm and maximum stresses developed in structure is 28.9 Mpa.

Yield stress of structure material is 205 MPa.

Grade	Tensile Strength (MPa) min	Yield Strength 0.2% Proof (MPa) min	Elongation (% in 50mm) min	Hardness	
				Rockwell B (HR B) max	Brinell (HB) max
304	515	205	40	92	201
304L	485	170	40	92	201
304H	515	205	40	92	201
304H also has a requirement for a grain size of ASTM No 7 or coarser.					

Table 4.1: Material property

5. CONCLUSIONS

As per the requirement Semi-Automated clamping machine is designed with collected detail data. The existing use of the mallet need is replaced with an automated machine which can overcome the uneven forces being applied to magnetic parts. On the basis of objective, data accumulated and design calculations a cad model of Semi-Automated clamping machine is modelled using Solid works.

After CAD modelling the Finite Element Modelling and Finite Element Analysis was carried out by using HYPERMESH and Nastran to validate the Designed CAD model. The linear static analysis results show that the stresses are well within the safe limit, hence the design is safe. The product quality has been improved. Automation not only results in higher production rates than manual operations but also performs the production process with greater uniformity and conformity to quality specifications. This machine will also help to reduce the wastage of material, which plays an important role in product cost.

6. REFERENCES

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