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Automatic Loader and Unloader for Press Machine

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ABSTRACT: In a press Machine, the components are tended to undergo some operations like punching, blanking, coining, bending, etc. But all these operations are processed manually. Manually in the sense the loading of raw product on the die which is fixed on the bed of press machine is done using human hands and after press operation the final product is removed from the die with human hands as well. So, to overcome this manual work of loading and unloading of raw and final component respectively, automation can be implemented. Automation for loading and unloading of the raw and final product simultaneously is carried out. Here in this project the same concept is implemented. Now the whole operation of loading and unloading of raw and final product return Mechanism and Lead screw Linear Actuator. So, all the process will be run through Arduino board by feeding a programme to it. The programme will be as per the requirement of press Machine.

KEYWORDS: Press Machine, Punching, Blanking, Coining, Bending, Automation, Arduino.

I. INTRODUCTION

Press Machine This is a multi-purpose machine used to shape the metal sheet to be used for getting the desired shape of the parts to be used in electric and electronic appliances, automobile industry etc. Earlier, the task of giving shape to the metal sheet was done manually with great effort and force. The power press machine has revolutionized this process by adding force and accuracy in the operation of pressing. Quick Worth-Return Mechanism It is the arrangement of crank slider to convert the rotatory motion into reciprocating motion. It display a non- uniform stroking of crank, where the front stoke is slightly longer having a faster return. It transmits two strokes over one cycle of revolution. Components used are Dc 12v Kk-P20/15 3kg Lifting Solenoid Electromagnet Double Acting Mini Pneumatic Air Cylinder Auto Heavy Duty Power Door Lock Actuator Motor 2 Wire 12v (Black) 12 Volts Dc Motor 800 Rpm Square Tubes Operations performed are Cutting, Welding (Mig Welding), Arduino (Programming), Double Acting Actuator Control With Pneumatic System. Analysis is more precise part after design of frame and assemble. Total load acting on the frame of mechanism. After Analysis by the help of ANSYS, get geometry structural model, Static Structural, Forces (Compressive Yield Strength, Tensile Yield Strength, Isotropic Secant Coefficient of Thermal Expansion, Alternating Stress Mean Stress, Isotropic Elasticity and Isotropic Relative Permeability) acting on the frame, Geometry, Coordinate systems, Connections, Mesh, Static structural (A5), Solution (A6), Material data (Structural Steel). Working of the design Custom designed and built for each application, automatic load/unload systems increase pressroom production while at the same time creating an efficient, operator safe work place. Automatic load/unload systems is the first step in a complete work cell that starts with raw materials at the input and finishes with a completed, ready-to-ship part at the output. The ability to custom design pre and post press machines and then integrate with automatic load/unload systems make it a great fit for pressroom automation applications.

II. LITERATURE REVIEW

i) DEVELOPMENT OF QUICK RETURN MECHANISM FOR EXPERIMENTATION USING SOLIDWORKS

Journal of Engineering Studies and Research – Volume 26 (2020) No. 3 Quick Return Mechanisms (QRMs) are one of the essential accessories used in machine tools which involve reciprocating cutting action with a quick return stroke and a constant angular velocity of driving crank. The aim of this work was to simulate, design and construct a prototype of a QRM that can be used for demonstration and instrumentation. The QRM was simulated using Solidworks and a



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prototype was developed from the simulated results. The experiment was conducted using the prototype. The kinematic simulation of the Solidworks model was compared with the kinematics of motion of the prototype. The result showed that the Percentage Stroke Length error was 0.36%. It was observed that, there was no significant difference in the simulated and experimental results, hence, the prototype can be used for demonstration and experimentation to assist students in understanding basic principles of the machine operation.

ii.)Paper Name- WORKING PRINCIPLE OF ARDUINO AND USING IT AS A TOOL FOR STUDY AND RESEARCH International Journal of Control, Automation, Communication and Systems (IJCACS), Vol.1, No.2, April 2016 This paper explores the working principle and applications of an Arduino board. This also explores on how it can be used as a tool for study and research works. Arduino board can provide a quick tool in development of VLSI test bench especially of sensors. Main advantages are fast processing and easy interface. Today, with increasing number of people using open-source software and hardware devices day after day, technology is forming a new dimension by making complicated things look easier and interesting. These open sources provide free or virtually low costs, highly reliable and affordable technology. This paper provides a glimpse of type of Arduino boards, working principles, software.

iii)Paper Name- PRESS MACHINE AUTOMATION

International Advanced Research Journal in Science, Engineering and Technology January 2017 An insertion of sheet metal in a press machine is a major problem in a Kalburgi industry. To overcome this problem Press machine automation with AVR control was done. There is rapid need of automation to reduce human effort PES's MODERN COLLEGE OF ENGINEERING, PUNE-05 15 and increase the work efficiency. Inductive proximity sensor used for the detection of metal object. When a metal object is placed within the magnetic field generated by the sensor, the resulting current induced from an additional load and the oscillation ceases. This Causes the output driver to operate and depending on the normally open and, normally close the output signal is produced.

III. METHODOLOGY

Automation in press-machine: loading and unloading material (pick and drop the raw and final product). The machine will catch load the raw product (sheet metal) on to the press machine and also simultaneously unload the final product (i.e., after pressing operation) using grippers and the process of loading and unloading will be carried out through quick return mechanism and slider mechanism (lead screw linear actuator). Hold weight- 0.2 to 1 kg, Factor of safety for gripping= Ultimate load/Applied load= (3kg * 9.81)N / (1kg * 9.81)N = 3 FOS.Shape of object- circular, rectangular



Figure 1: Air Cylinder

Specific operation- Bending and punching etc. Specific for Ferrite material (Magnetic in nature)To reduce the human effort Reducing time by making automation. Scope of the project is In Niya Automotive there is eight different type of press machine But all the loading and unloading operation perform by manually. So automation is future keep in mind we are making a new 'Automatic loader and Un-loader Mechanism for press machine'. To overcome the above problem, our goals are to reduce the human efforts, reducing time by making automation, increase production rate and to reduce delay time wastage. By our inventions we are definitely satisfy customers expectations by supplying them good Quality product. For improving gripping quality it is necessary to change some mechanism such as we decided to



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use pneumatic gripper but roughness value of sheet is needed so we use magnetic gripper. This system is only for ferrite material but if we do certain gripper changes (pneumatic or vacuum gripper) we can use this in plastic moulding industry. Knowledge of automation, Robotics, six sigma and Manufacturing will be acquired by carrying out this project.



Figure 2: Manual Working On Press Machine

A power press machine is a machine which is used for cutting, shaping, blending and pressing any metal sheet into required shape. This is a multi-purpose machine used to shape the metal sheet to be used for getting the desired shape of the parts to be used in electric and electronic appliances, automobile industry etc. Earlier, the task of giving shape to the metal sheet was done manually with great effort and force. The power press machine has revolutionized this process by adding force and accuracy in the operation of pressing. Power press machine works on the principle of reforming the metal sheet by applying the required force. The major parts are a bed, ram, clutch, flywheel, and crankshaft. Upper and lower dies are attached to ram and once work piece placed on the bed is fed to the machine, and operation initiated. As a result of the rotary motion of flywheel, pressing and shaping task is performed when upper and lower die put a force together.

IV. HARDWARE REQUIREMENT

Double Acting Mini–Pneumatic Air Cylinder



Figure 3: Double Acting Mini Pneumatic Air Cylinder

MAL series pneumatic air cylinder. Single rod, double acting, 150mm stroke, 25mm bore. The Air Cylinder is a mechanical device which utilizes the power of compressed gas to produce a force in a reciprocating linear motion. Hard material design. Single Rod convenience to install. Double acting action type, compress gas well.



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12V DC Motor 800 RPM

It comes with Good Quality Gears. The metal gears have better wear and tear properties. The gearbox is sealed and lubricated with lithium grease and requires no maintenance. Although the motor gives 500 RPM at 12V, the motor runs smoothly from 4V to 12V and gives a wide range of RPM, and torque. The shaft has a hole for better coupling.



Figure 4: DC Motor





Figure 5: Square Tubes

ARDUINO



Figure 6: Arduino

The ADK USB Host Shield compatible with Arduino is based on the MAX3421E, which is a USB peripheral/host controller containing the digital logic and analog circuitry necessary to implement a full-speed USB peripheral or a full-/low-speed host compliant to USB specification rev 2.0. It is compatible with more <u>Arduinos</u> – not only <u>UNO</u> and <u>Demilune</u> but also <u>Mega and Mega 2560</u> work with a Standard variant of this shield out of the box. No more SPI rewiring and code modifications – just solder included stackable connectors (2×3 ICSP connector's female side should be facing down), plug and play! Using Arduino Compatible USB HOST function, let your Arduino communicate with other USB devices, and supports USB HUB function. USB Host shield adds USB Host capabilities to the Arduino board. They are large no of USB Host shield which is available in the market but the only problem is that you have to

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choose the right host <u>shield</u>. Before using that, first of all, you should know, what is a USB Host shield? The USB protocol defines two types of devices. One is called the host (or server) and the other one is called peripheral (client). The Host device controls the peripheral device and also provides power to it. When you connect any USB device like a mouse or a keyboard to your computer, your computer acts as the host and controls (or polls) the client device (keyboard or mouse or even an Arduino).

V. WORKING

Custom designed and built for each application, automatic load/unload systems increase pressroom production while at the same time creating an efficient, operator safe work place. Automatic load/unload systems is the first step in a complete work cell that starts with raw materials at the input and finishes with a completed, ready-to- ship part at the output. The ability to custom design pre and post press machines and then integrate with automatic load/unload systems make it a great fit for pressroom automation applications. Arduino: Arduino is connected with wiper motor and compressor. To control the whole system automatically. Programmed the code by the help of C++ language. Wiper Motor: Motor run from initial signal getting from Programmable Ardinuo circuit. Crank is connected with Wiper Motor. Crank and connecting rod is converting rotary motion into sliding motion. Arms is connected with slider, Slider move in fix pre-defined dimension (200). Arms have connected with door lock actuator with Electro-magnetic Gripper. This assemble used to catch and drop the Ram Material and Final Product at same time. Connecting rod, Slider and Crank combine, delivered the raw material and Final product after ram performing operation. Arms going to neutral position and this time Ram come and perform the task (Blanking, Bending etc.) This Cycle continuously working up to achieve desired task.



Figure 7: Working Model

Neutral position: Press operation carried out (Bending, Punching etc.) 1st position: First arm, load the Raw material and final punch product at same time. Magnetic whole system and actuator goes up, Arms move by the help of Quick Worth Mechanism. 2st position: Both the Arms un-load row material in working section and final product dispatch section.



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VI. CONCLUSION

1. Loading And Unloading Of Raw Material And Final Product Automatically On Press Machine.

2. Neutral Position: Press Operation Carried Out (Bending, Punching Etc.)

3. 1st Position:

a. First Arm, Load The Raw Material And Final Punch Product At Same Time.

b. Magnetic Whole System And Actuator Goes Up, Arms Move By The Help Of Quick Worth Mechanism.

4. 2nd Position: Both The Arms Un-Load Row Material In Working Section And Final Product Despatch Section.

5. The Combination Of Human And Automation Control Is The Most Desirable Output For One Automation Design, Characterizing It With Flexibility And Completeness. The Motivation Behind The Automation Is To Make The System Simpler And Cheaper To Engineer. A Second Is To Relieve The Human Operator, The Reduction In The Workload. And The Most Important Thing Is To Make The System Safer.

6. Creativity And Innovation In New Technology, Which Reflects To Developing A New Alternative System Of Production With Different And New Parameters, Which Are Related To Flexibility And Dynamicity With Close Collaboration With Humans Within The Production System, Which Are Unachievable By Fully Automating The Process Is The Essential Step In This Paper.

7. The Purpose Of The Automation System Is To Perform And Evaluate All The Necessary Tasks More Efficiently, More Reliably And More Precise With Higher Accuracy Then The Human Worker Itself.

8. The Most Important Factor In Acknowledging The Implementation Of Automation Is The Improvement Of The Work-Environment By Improving The Conditions, Hazardous Work And Eliminating Monotony As Well As Saving Physical Demanding Work.

9. After The Study And The Research It Can Be Concluded That The Work In Hazardous Environment, Monotonous, And Physical Tasks Are Not Appropriate To Be Conducted Manually.

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