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Design & Manufacturing of Fixture with Automatic Indexing Mechanism for Press Machine

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ABSTRACT: As per survey, the indexing mechanisms used for press work in small scale industries were manual. This was carried out by using equipment like indexing plate & levers. This method is less accurate, time consuming & prone to errors. As per our survey in the industry 'Sahyadri Mech Ind Pvt Ltd' which is a leading company in press work, it was observed that the indexing mechanisms used were manual. This was slowing down their rate of production & increasing the number of defective products. A Fixture with Automatic Indexing mechanism will be helpful to overcome this issue. This will increase the productivity by eliminating the errors caused due to human interventions while indexing. This mechanism will orient the blank correctly & the clamping system will prevent the motion of the blank. All this will be achieved by using stepper motor, sensors and microcontrollers.

KEYWORDS: Automatic indexing, microcontrollers, IR sensors, stepper motor.

I. INTRODUCTION

In press work, indexing refers to the process of accurately positioning a sheet metal blank to a specific angular or linear location, allowing for precise operations such as punching, blanking, shearing etc. The indexing mechanism is a system or device that facilitates this precise positioning. Sahyadri Mech Ind Pvt Ltd is a leading blower manufacturer which is located in Sawantwadi, Maharashtra. They produce a wide variety of blowers and for this they use sheet metal as the raw material. As per our survey, we found that the indexing mechanisms used by them for machining were manual. This manual approach is prone to errors, time consuming, and less accurate. Also, this may affect the quality and rate of production. To avoid this, an automatic indexing mechanism consisting of Stepper motor, micro-controller, and sensors is used. Stepper motors are widely used because of their simple implementation, attractive price performance ratio, and high torque at low speeds. There are various ATMEGA microcontroller used for many applications. In our project we are going to use ATMEGA 328 Arduino microcontroller. This microcontroller has different numbers of analog and digital inputs. A specially provided USB cable which acts as an interface between the micro controller and the computer. From the USB cable, we upload the program to the microcontroller. A4988 is a stepper motor driver is used in this system. stepper motor driver is used to controlling the stepper motor. Stepper motor driver is protecting the stepper motor against the over voltage, over current, over temperature. this is a micro stepping bipolar stepper motor driver. there are five different step revolution. but this is select the full mode step mode. After introducing an automatic indexing mechanism, the machining process will become more accurate, less time consuming, and the wastage of products will be reduced.

II. ANALYSIS OF INDUSTRIAL SURVEY

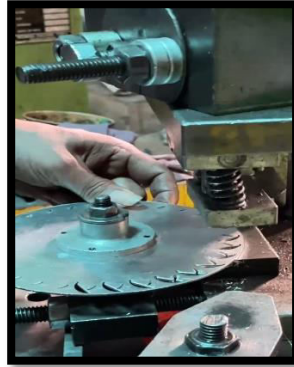


Fig II.1) Press Work (On GI Sheet)

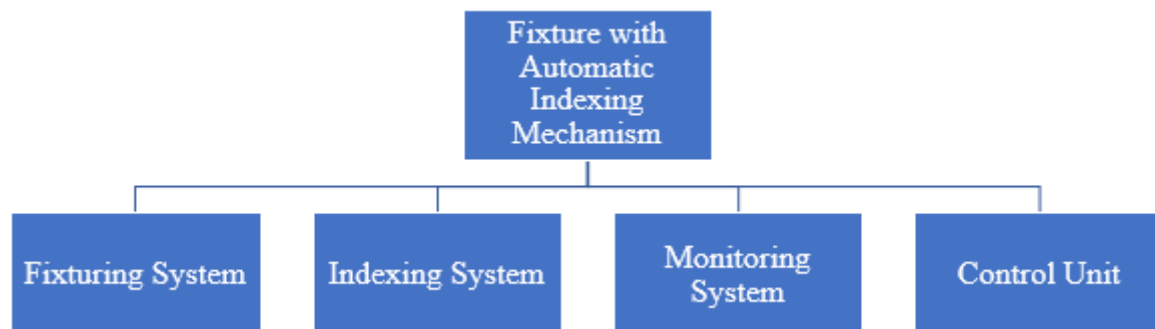
Through a survey in the company ‘Sahyadri Mech Ind Pvt Ltd’ a blower manufacturer. The company mostly uses sheet metal employing various operations such as punching and blanking on press machines. In the production of blowers, they manually create slots on circular discs at regular intervals. This manual indexing method is time-consuming, less precise, and prone to errors. Our project ‘Design & Manufacturing of Fixture with automatic indexing mechanism for press machine’ completely addresses the above-mentioned problem. This will help them by making the production process less time consuming, more productive by eliminating the errors.

III. METHODOLOGY

A) OBJECTIVES

1. To develop an automatic indexing mechanism which will orient the blank at desired angle.
2. To develop a clamping system which will prevent the movement of the blank while punching.
3. To integrate indexing and clamping system with a microcontroller.
4. To develop an Input system which will provide the instructions for indexing of the blank & an output system which will display its current position.

B) CONSTRUCTION:



C) WORKING PRINCIPLE:

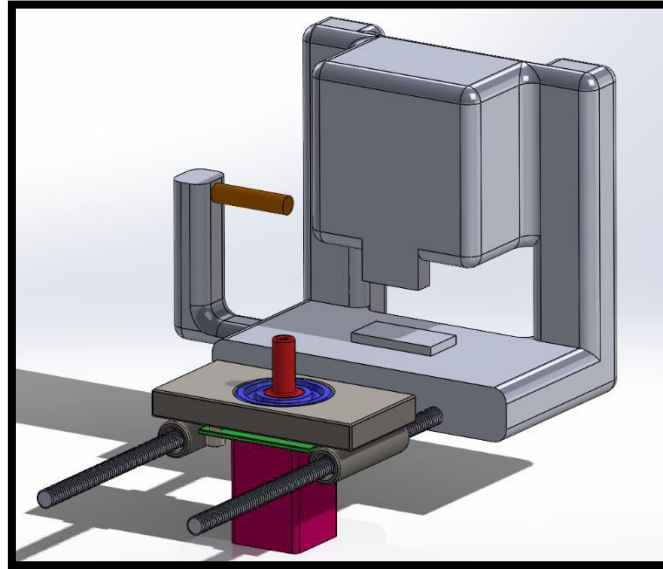


Fig. no. III c) 1) Automatic indexing mechanism

- Initially the fixturing system will be mounted on the press machine.
- Then the blank will be mounted on the base plate and the aligner will be placed on it. The aligner will align the central axis of the blank and the press machine and then with the help of clamping screw the aligner will secure the blank by applying downward force on it due to screwing action.
- Then by adjusting the potentiometer the required number of holes will be chosen which will be displayed on the OLED display.
- Once the start push button is pressed the monitoring system and the press machine will be activated. Then the IR sensor will transmit the signals to the control unit about the ram's position.
- When the ram will be at the top dead Centre (TDC) the Arduino will transmit the signals to the stepper motor via the stepper motor driver which will cause the stepper motor to rotate and orient the blank at the desired indexing angle.
- Meanwhile at each step the current status about number of holes produced will be shown on the display. This process will be repeated the desired number of holes are produced
- At last, when the desired number of holes will be produced the buzzer will notify about the completion of the process.

D) MEASUREMENTS AND CALCULATIONS:

For number of holes required –

- Total number of holes = 40
- Total steps required for 1 rotation of stepper motor = 200
- Steps to be incremented after each punch = $200 / 40 = 5$ steps
- Therefore, the stepper motor should rotate by 5 steps after each punch.

IV. CONCLUSION

In this project we have manufactured a working prototype for automatic indexing mechanism with a fixture for press tool, which will provide more accuracy reduced the process and setup time and will also enhance the operator's safety to a huge extent.



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