Fabrication of Motorized Eccentric Punching Machine with Accident Avoiding System

R.V. Rangarajan[1], Ron Alex Binu [2], Sarath Chandran P [3], Sreeram S [4]
[1] – Assistant Professor, Department of Mechanical Engineering
[2,3,4-] UG Scholar, Department of Mechanical Engineering
HINDUSTHAN INSTITUTE OF TECHNOLOGY
COIMBATORE, INDIA

Abstract:- **The accident avoiding motorized eccentric punching machine system has gained a large amount of importance in last few decades. This importance is due to its accuracy and cost. This convenience in operating the motor system has made us to design and fabricate this unit as our project. The aim of our project is to take a system-wide approach to preventing the machine accident. The system includes not just the machine and the operator; but rather, it includes everything from the initial design of the machine to the training of everyone that is responsible for any aspect of it, to the documentation of all changes, to regular safety audits and a finally a corporate culture of safety-first. Punching or pressing process is one of the most important and necessary processing step in sheet metal industry. By automating this process one can have a greater control over the process. it is possible to achieve good results in the form of reduced manufacturing lead time, reduced cost and increased safety of the worker.**

Keywords— AC Motor, Belt drive, Pulley, Cam with cam shaft, Punch or punching, Spur gear, IR sensor

I. INTRODUCTION

The press is the punching machine tool designed to punch letter by applying motor energy. The metal is punched to the desired requirement. The presses are exclusively intended for mass production and they represent the fastest and more efficient way to form a metal into a finished punched product. Press tools are used to form and cut thin metals. Press tools operation can be simplified to a few simple operations involving a punch a die. There are Nemours types of presses in engineering field, which are used to fulfill the requirements. We are interested to introduce pneumatic system in presses. The main function of machine is to form or cut thin sheet metals or non metals using pneumatic power. In this project we have used to punching process for simple application. In today's practical and cost-conscious world, sheet-metal parts have already replaced many expensive cast, forged, and machined products. The reason is obviously the relative economy of operation, easier implementation for mass-production, as well as greater control on the technical parameters. In most of the sheet metal operations punching or pressing operation is the main or initial operation in the process sequence. Automating this operation results in reduced lead time and also can reduce human effort.

II. COMPONENTS AND DESCRIPTION

The major components that are employed in the fabrication of the accident avoiding motorized eccentric punching machine are as follows.

- AC Motor,
- Belt drive,
- Pulley,
- Cam with cam shaft,
- Punch or punching
- Spur gear
- IR sensor

A) AC MOTOR: An AC motor is an electric motor driven by an alternating current (AC). The AC motor commonly consists of two basic parts, an outside stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft producing a second rotating magnetic field. The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings. Less common, AC linear motors operate on similar principles as rotating motors but have their stationary and moving parts arranged in a straight line configuration, producing linear motion instead of rotation.

B) BELT DRIVE: A belt is a loop of flexible material used to mechanically link two or more rotating shafts, most often parallel. Belts may be used as a source of motion, to transmit power efficiently or to track relative movement. Belts are looped over pulleys and may have a twist between the pulleys and the shafts need not be parallel. In a two pulley system, the belt can either drive the pulleys normally in one direction (the same if on parallel shafts) or the belt may be crossed, so that the direction of the driven shaft is reversed (the opposite direction to the driver if on parallel shafts).

C) PULLEY: The Diameter of the shaft Pulley is 10 INCH and motor pulley 1 inch. The pulleys are made of Cast Iron and are screwed to the shaft. The machine can be driven at various speeds by changing the belt to each step. The belt drive mechanism is used for this project. This is used to transmit the power from the motor shaft to the brush shaft. The greater the shaft center distance, the more practical the use of chain and belt, rather than gears. Conveyor systems use chains, belts, or rollers, depending on the application.

D) **CAM WITH CAM SHAFT**: A cam is a rotating or sliding piece in a mechanical linkage used especially in transforming rotary motion into linear motion or vice versa. It is often a part of a rotating wheel (e.g. an eccentric wheel) or shaft (e.g. a cylinder with an irregular shape) that strikes a lever at one or more points on its circular path.

The cam can be a simple tooth, as is used to deliver pulses of power to a steam punching, for example, or an eccentric disc or other shape that produces a smooth reciprocating (back and forth) motion in the follower, which is a lever making contact with the cam. The cam can be seen as a device that rotates from circular to reciprocating (or sometimes oscillating) motion. A common example is the camshaft of an automobile, which takes the rotary motion of the engine and translates it into the reciprocating motion necessary to operate the intake and exhaust valves of the cylinders.

The camshaft is a rotating object usually made of metal that contains pointed cams, which converts rotational motion to reciprocal motion. Camshafts are used in internal combustion engines (to operate the intake and exhaust valves), mechanically controlled ignition systems and early electric motor speed controllers. Camshafts in automobiles are made from steel or cast iron, and are a key factor in determining the RPM range of an engine's power band.

E) PUNCHING : This is the punching which hits the work piece with a great force. This punch is activated with the help of the compressed air. The power from the motor is transmitted to the punch through the cam shaft mechanism such that the rotary motion is converted into the reciprocating motion.it is a forming process that uses a punch press to force a tool, called a puch press, through the workpiece to create a hole via shearing. Punching is applicable to a wide variety of materials that come in sheet form, including sheet metal, paper, vulcanized fibre and some forms of plastic sheet.

The punch often passes through the work into a die. A scrap slug from the hole is deposited into the die in the process. Depending on the material being punched this slug may be recycled and reused or discarded. Punching is often the cheapest method for creating holes in sheet materials in medium to high production volumes. When a specially shaped punch is used to create multiple usable parts from a sheet of material the process is known as blanking. In metal forging applications the work is often punched while hot, and this is called hot punching. Slugging is the operation of punching in which the punch is stopped as soon as the metal fracture is complete and metal is not removed but held in hole.

F) SPUR GEAR: Spur gears or straight-cut gears are the simplest type of gear. They consist of a cylinder or disk with teeth projecting radially. Viewing the gear at 90 degrees from the shaft length (side on) the tooth faces are straight and aligned parallel to the axis of rotation. Looking down the length of the shaft, a tooth's cross section is usually not triangular. Instead of being straight (as in a triangle) the sides of the cross section have a curved form (usually involute and less commonly cyclonical) to achieve a constant drive ratio. Spur gears mesh together correctly only if fitted to parallel shafts. No axial thrust is created by the tooth loads. Spur gears are excellent at moderate speeds but tend to be noisy at high speeds.

G) IR SENSOR: An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herschel in 1800. While measuring the temperature of each color of light (separated by a prism), he noticed that the temperature just beyond the red light was highest. IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum). Anything that emits heat (everything that has a temperature above around five degree kelvin) gives off infrared radiation. The IR transmitter and IR receiver circuit is used to sense obstacles crossing the sensor. It is fixed in front of the machine with a suitable arrangement. There are two types of infrared sensors: active and passive. Active infrared sensors both emit and detect infrared radiation. Active IR sensors have two parts: a light emitting diode (LED) and a receiver. When an object comes close to the sensor, the infrared light from the LED reflects off of the object and is detected by the receiver. Active IR sensors act as proximity sensors, and they are commonly used in obstacle detection systems (such as in robots).

(i) AT NORMAL CONDITION:

- The IR transmitter sensor is transmitting the infrared rays with the help of 555 IC timer circuit. These infrared rays are received by the IR receiver sensor. The Transistor T1, T2 and T3 are used as an amplifier section. At normal condition Transistor T5 is ON condition. At that time relay is ON. The motor is ON.

(ii) AT ABNORMAL CONDITION

- At abnormal conditions the IR transmitter and IR receiver, the resistance across the Transmitter and receiver is high due to the non-conductivity of the IR waves. So the output of transistor T5 goes from ON condition to OFF stage. In that time the relay is OFF position, so that the motor is OFF

III. SAFETY OPERATION

3.1 HAND TRACKING AS A SAFETY SYSTEM

Personnel protection is becoming increasingly important in automated processes. Wherever machines perform high-risk movements, Fingertip injuries, avulsions, or even cut-off fingers and hands are all typical workplace accidents caused by mechanical hazards. The injuries have significant physical, social and financial implications for the victim, but also for

employers and manufacturers of the equipment. the relevant health and safety regulations must be observed. Even if the operator is momentarily distracted, shearing, crushing, and impact injuries must be prevented. Together with the appropriate safety control units, active photoelectric protective devices such as safety thru-beam sensors and safety light grids ensure that a stop is applied on detection of unauthorized access or if someone reaches into a danger zone. In the field of safety applications, within a range of up to 65 m, single-beam safety light barriers offer an economical and highly reliable solution. A focus on essential safety functions and avoidance of time-consuming configuration by software contribute to the effectiveness of the light barriers. Popular mounting and connection technologies help guarantee quick installation. The extended temperature range of - 30 °C up to 55 °C and the robust housing with IP67 degree of protection allows use even in adverse ambient conditions. Multiple-beam safety light barriers create a two-dimensional protection field which allows a varying detection capability and different protection field heights depending on the application requirement. Operating personnel benefit from greater flexibility for a variety of use cases, while the highest safety requirements—up to PL e, Cat. 4, and SIL 3 are reliably met. Additionally, redundant multiple tests in ongoing operation ensure increased plant availability.

The sophisticated, narrow housing design along with a range of accessories also permits convenient installation. Single thru-beam photoelectric sensors are a simple and cost-effective way of securing hazardous areas. Together with a safety control unit, secure single thru-beam photoelectric sensors create a photoelectric protective device, such as Type 2 or Type 4 in accordance with EN ISO IEC 61496. The SL and SLA series are available in different designs and sensing ranges. Multi-ray photoelectric sensors define a protection field of a certain height and width.

They are based on the principle of the thru-beam sensor. The protection field, which is created from red or infrared modulated light beams, is evaluated by a receiver unit or external control interface unit. These photoelectric safety sensors are often characterized by a high number of beams with a low beam gap, which can lie between 500 mm for dual-beam protection and 14 mm for finger protection.

3.2 IMPORTANCE OF HAND SAFETY

It has been estimated that almost 20% of all disabling accidents on the job involve the hands. Without your fingers or hands, your ability to work would be greatly reduced. Your hands are one of your greatest assets and must be protected. Despite the precautions we take, your hands will receive minor injuries from time to time. Hands are exposed to many hazards, such as cuts from sharp objects, smashing and pinching from moving machinery, joint and nerve pain, environmental contact (heat, cold, plants, insects), and chemicals.

The Common causes of hand injuries include:

- Improper use of tools or using the incorrect tool
- Lifting or applying force incorrectly
- Using the wrong PPE or failing to utilize PPE
- Distraction and lack of awareness/focus due to to complacency
- Inadequate assessment of risk
- Bypassing safety procedures
- Cutting corners or rushing.

3.3 SAFETY CONTROL UNIT

Safety control units permit the connection and control of machine safety components. Due to its modular design, the Safe Box system can be flexibly configured. Depending on requirements, several components can be connected to one control interface. The Safe Box is suitable for connecting and controlling photoelectric safety sensors, mechanical protective devices, and safety switches.

IV. WORKING PRINCIPLE

The Accident avoiding motorized eccentric punching machine is provided with a “V” pulley of C.I. This pulley is connected to the motor by a ‘V’ belt. When the motor is started, the main shaft of the punching also starts revolving at the same speed. The running speed is 1440 R.P.M. The rotation will be of vertical direction because of Cam and cam shaft. The main shaft drives the horizontal shaft.The speed is also reduced in the ratio of 1: 10. When the main shaft rotates 10 times the horizontal shaft will rotate only once. The machine enables us to get 144 strokes / minute. The cam is keyed to the horizontal shaft. The cam is made up of cast iron piece. The link is connected to the cam stud. The Punching is fixed at the top of the eccentric cam shaft end. The sheet metal or any other work piece to be straightened is placed below the punching and the motor is switched on such that the punching action causes the work piece to clear off the bends. In front of the machine IR sensor is used to detect the hand to avoid accident in the machine.

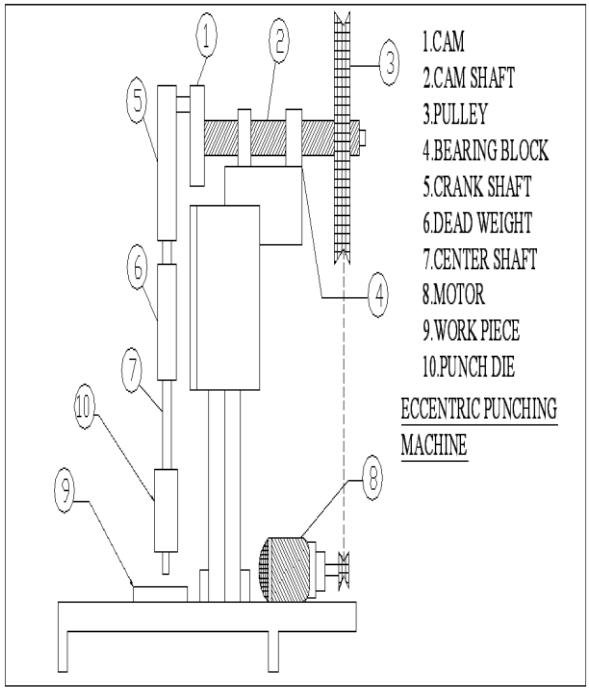

Figure-1 2D DRAWING OF THE MACHINE

Figure-2 PROTO TYPE MODEL

IV ADVANTAGES, DISADVANTAGES ADVANTAGES AND APPLICATIONS

4.1 ADVANTAGES

- This system is more safety to the operator
- Quick in response
- Simple in construction
- It is very useful in all industries
- Accident avoiding

4.2 DISADVANTAGES

- Speed of the machine is very high so it can produce vibration.

4.3 APPLICATIONS

- All Brick Breaking Industries
- In all Foundries
- In all Machine Shop
- All small scale industries

V. LIST OF MATERIALS

Sl. No.	PART NAME	MATERIAL
01.	AC Motor	Cu
02.	Pulley	C.I
03.	Belt	Nylon
04.	Punch (Model)	M.S.
05.	Bottom base Plate	M.S.
06.	Spur gear	C,I
07.	Sensor unit	Electronic
08.	Frame Stand	M.S.
09.	Shaft	M.S
10.	Bearing with bearing cap	M.S

VI. COST ESTIMATION

Sl. No.	PART NAME	MATERIAL	Quantity	Amount (Rs)	Sl. No.	PART NAME
01.	AC Motor	Cu	1	2500/-	01.	AC Motor
02.	Pulley	C.I	2	300/-	02.	Pulley
03.	Belt	Nylon	1	700/-	03.	Belt
04.	Punch (Model)	M.S.	1	500/-	04.	Punch (Model)
05.	Bottom base Plate	M.S.	1	500/-	05.	Bottom base Plate
06.	Spur gear	C,I	2	1000/-	06.	Spur gear
07.	Sensor unit	Electronic	1	1000/-	07.	Sensor unit
08.	Frame Stand	M.S.	1	500/-	08.	Frame Stand
09.	Shaft	M.S	2	300/-	09.	Shaft
10.	Bearing with bearing cap	M.S	4	1500	10.	Bearing with bearing cap
	TOTAL		8,800.00			

V. FABRICATION PROCESS

SL.NO	PARTS	DIMENSION
1	Eccentric wheel	15cm dia, 0.6cm thickness
2	shaft	20cm
3	Motor	0.25 hp ,1440 rpm,220V
4	Gear ratio	1:4
5	Base rod	14cm
6	Vertical rod	24cm
7	Hole diameter	0.8cm
8	Sheet metal	0.05cm

VI. CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between the institution and the industries.

We are proud that we have completed the work with the limited time successfully. The “FABRICATION OF ACCIDENT AVOIDING MOTORIZED ECCENTRIC PUNCHING MACHINE” system is working with satisfactory conditions. We can able to understand the difficulties in maintaining the tolerances and also the quality. We have done to our ability and skill making maximum use of available facilities.

Thus we have developed a “ACCIDENT AVOIDING MOTORIZED ECCENTRIC PUNCHING MACHINE” which helps to build a low cost punching machine which is operated in a very simple manner. This machine will be helpful for not only clearing off the bends but also can be used for breaking hard materials. By using more techniques, they can be modified and developed according to the applications.

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