Design and Analysisof Electromagnetic Punching Machine

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ABSTRACT

Punching Machine is one of the important machines in paper cutting industry and sheet metal industry. Electromagnetic punching machine is working on the principle of electromagnetics. It is used to cut card board, sheets, papers, foam, and thin plastic sheets. The machine are simple to maintain, easy to operate. The workpiece is often in the form of a sheet or roll. The materials for work piece may vary, commonly being metals and plastics. The punch and die both have different shapes for creating an array of variety shaped holes in the workpiece. The multiple punches can be used together to create a part in one step. The greatest challenge faced is to overcome the energy wasted because of friction in any mechanical process. This paper introduces the basic construction of an electromagnetic punching machine to carry out the punching operation. After successful fabrication, the set up was tested and the punching force produced was validated.

Keywords: - *Electrical solenoid, Lever, Crank Linkage, Friction, Electromagnet, Punching*.

1.INTRODUCTION

Punching is process of metal forming that utilizes a punch press to force the tool, called a punch, through the workpiece to create a hole through shearing. The punching is the most cost effective process to make holes in sheet or strip metal for average to high amount of material fabrication. It is able to create multiple geometric holes. The punches and dies are usually fabricated from the conventional tool steel or the carbides develop a burnished region roll-over, and the die break on sidewall of the resulting hole. Sheet metal is simply metal formed into thin and flat pieces. It is one of the fundamental forms utilized in metalworking, and can be able to cut and bent into the variety of different geometric shapes. Number of objects is constructed of the material every day. Thicknesses may be vary significantly, although extremely thin thicknesses can be considered as foil or leaf, and the pieces are thicker than 6 mm (0.25 in) are considered as plate.

2.PROBLEM STATEMENT

The major operation performed in industry is punching, and this operation perform in mass number the manpower is require to results high cost of production, more time require to complete the operation, which affect the accuracy of product so for automation in system we are trying to do a work on new system in punching.

3.CONSTRUCTION AND WORKING

The punching machine consist of punching tool, lever, crank Linkage, ram, ram guide, electronic solenoid, force amplification link, etc. The setup is connected to the single phase 230v supply which when get ‘ON’ the power supply to the electric solenoid is operated and the crank press is operated to do punching/bending/shearing operation. The punch work piece is removed from the punching machine and another is loaded on the die block in its plate. This process is repeat in order to obtain subsequent punches.

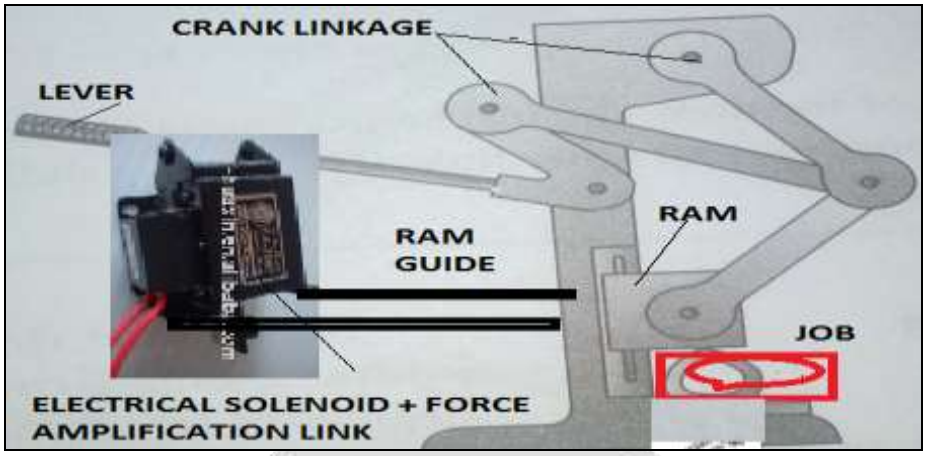

Fig-1: Schematic Diagram

3.1Sheet metal processing.

The sheet metal is used in manufacturing process. These are output of the rolling process. Metal sold are as flat, rectangular sheets of standard size. If the sheets are thin and very long, they may be in the form of rolls. The first step in each sheet metal process is to cut the correct shape and size 'blank' from larger sheet.

3.2Sheet metal forming processes.

Sheet metal processes can be categorised into two major classifications and one minor classification:

1) Shearing processes-process which apply shearing forceto cut fracture and separate the material.

2) Forming processes-process which cause the metal changesdesired shape without failure, excessive Thinning. This includes bending and stretching.

3) Finishing processes-processes which are used to improve The final surface characteristics.

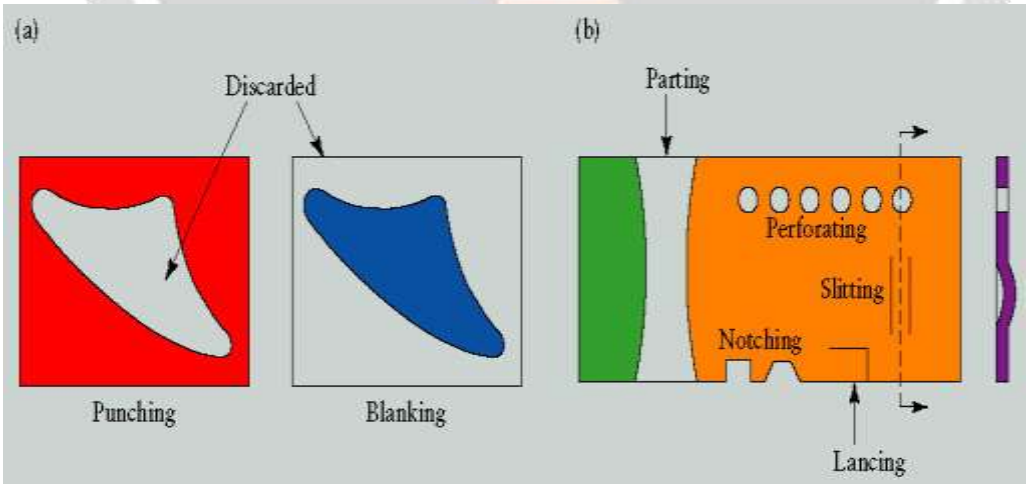

fig.2 different punch shapes

4. DESIGN.

4.1 The Punch.

During the punching process, the punch encounters the compressive and tensile forces. As the punch contact surface of the material is punched, the punch tip applies pressure to the workpiece until it overcomes the material's tensile strength. The workpiece materials are sracks, producing the hole and releasing the compressive forces on the punch. As the punch continues to penetrate the die to ensure slug discharge, the workpiece material starts to scrape the punch flanks.

4.2The Stripper.

The stripper performs two vital functions during the punching process. The most obvious is to hold the workpiece material against the die as the punch approaches, and retracts. The second function is to hold the punch tip rigid as it punches the hole in the workpiece.

4.3 The Die.

Punching a hole efficiently requires a precise fit between the punch and the die. Concentric and angular, good die and punch alignment, ensures that the punch can be entering the die without making any contact with it. Another consideration is the die clearance, the difference between the die and dimensions of the punch. Uniform die clearance around the punch's periphery is critical, especially in tools with sharp corners such as squares and rectangles. The small radius in the corners of a die maintains a uniform clearance. As the die clearance increases with material thickness, so does the size of the radius. The proper radius improves part quality and improves die strength.

4.4Design And Calculations.

Design consists of technical information and development of new machine or mechanism to perform the specific function with maximum efficiency and economy. It is also consists of initial force need to be perform an operation.

Forces

The punch force:

$F = 0.7tL\ (UTS)$

Where; t=Sheet metal thickness.

L=Total length.

UTS= Ultimate strength of the material.

Design of punch:

Material	Tensile strength N/mm^2	Yield strength N/mm^2
High speed tool steel	1150	1160

Assume; 4mm punch,
Theorotical force=1885N
Force Fact=Fthe/A (N/mm^2)
Fact=1885/π*(4^2)
Fact=37.50 N/mm^2
Fact< Fthe Design of punch is safe.

5. ADVANTAGES AND APPLICATION

5.1Advantages
1) It is compact device and cheaper than conventional machine.
2) It is portable machine.
3) It is flexible setup.
4) Friction loss is minimum due to very little metal-metal contact.

5.2 Application

1) Punching foam for packaging accessories.
2) Punching sheet metal is 1mm to 12mm.
3) It is used to punching the asbestos sheet for gasket sheet.
4) It is using to punching a plastic sheets and paper.

CONCLUSION

We are therefore, happy to state that in calculation of mechanical aptitude proved to be a very useful purpose. The paper included very general type of machine parts requires minimum component than conventional machinery. The selection of materials helped us in machining of the various components to get very close tolerance and minimizing the level of wear and tear. Focus & taking care of all above points leads to a better part quality & better tool stability kknowing the different methods to inspect the tool parts and components develops the knowledge about different fits and tolerance.

REFERENCES

1] Satalkar A. B., Shah M. R., Thoke A. M., Sul A. J., Prof. Gadge R. R., Prof. Bhane A. B.," Design & Fabrication of Electromagnetic Punching Machine"
2] Deshmukh S. R., Gharate H. B., Rane A. S., Yeshi A. W. Prof. Sonar R. M. "Electromagnetic Punching Machine " International journal of Modern Treads in Engineering and Research, July, 2015.
3] A.Sivasubramanian (2014), Assistant Professor, Department of Mechanical Engineering, Saveetha School of Engineering, Saveetha
4] Pawan Kumar Rai, Dr. Aas Mohammad, Hasan Zakir Jafri
5] Design of machine Elements: - Prof. V. B. Bhandari, Tata Mc .Grew Hill Publishing Co. New Delhi.
6] Workshop Technology, Hajara Chaudhari.
7] Khurmi and Gupta "Machine Design" Edition 2005. Page no. 261- 280 and 558-570