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Review on Electromagnetic Multipurpose Machine

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Abstract- *In past, there was need for to develop machines which helps to reduce the human efforts. These machines fulfil the basic needs of the industries with minimum human efforts and performs operations such as punching, blanking, embossing etc. For to survive in today's widely growing and competitive world, the company has to always implement new technologies which will help them to withstand in up growing. This paper introduces the basic construction of an electromagnetic blanking machine. In this machine, the force is generated by an electromagnetic coil wound around a metal core. Since the proposed design replaces mechanical or hydraulic drive with an electromagnetic. The setup is capable to control the force generated by an electromagnet with controlling the power supplied. The blanking machine setup is designed to press thin aluminium sheet, card board, asbestos, papers, foam and thin plastic sheets.*

Blanking is metal forming process that uses a blank press to force a tool, called blank. This type of blanking machine is used to create a hole in thin cork sheet, asbestos, plastic sheet and more material as per the capacity of electromagnet. Generally, in conventional blanking process like mechanical, hydraulic and pneumatic force is used to operate the blank in which creates large amount of friction; as well as inaccuracy to perform the micro level operation. This type of blanking machine is based on the magnetic force developed by electromagnetic coils. This machine is manually operated i.e. ON/OFF system which helps to reduce friction and also control the power consumption. This project is designed for small operations. It has low initial cost, low maintenance cost, less capital investment.

Key Words: Electromagnet, Blanking Tool, Die, Al sheet, Power Supply, Tool Holder

1. INTRODUCTION

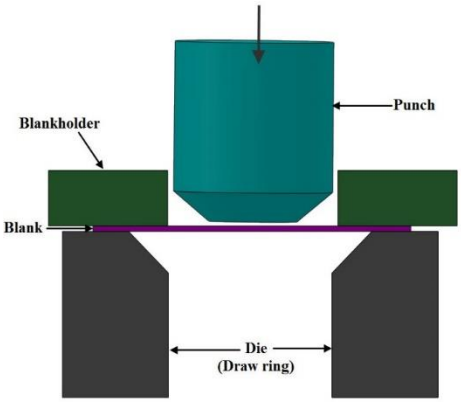

Fig-1: Diagram of Blanking Machine

2. PROBLEM STATEMENT

The embossing and punching are the major operations performed in industry, and to perform these operations in mass number the manpower is required which results into the high cost of production, more time required to complete the operation, affect the accuracy of product.

Pneumatic blanking machines:

1) More floor area is required due to compressor, air filter, lube tube, dryer, regulators etc.
2) Seal leakages can cause energy loss.
3) Operation becomes noisy.

Hydraulic blanking machines:

1) Hydraulic fluid is often corrosive.
2) Loss of energy due to friction.
3) Aeration will cause foaming, degradation of hydraulic fluid, damage to the internal parts.

Mechanical blanking machines:

1) Power losses due to friction.
2) Operation becomes noisy operation.

3. CONSTRUCTION AND WORKING

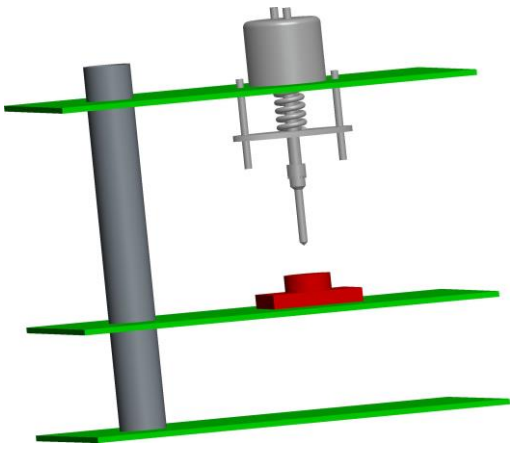

Fig-2: Design made with Solid Works

Upper figure shows that, there's an electromagnet which has a plunger passing through it. The plunger can move up-down side freely. The plunger is made of mild steel and to the lower end of the same a tool holder is attached; this tool holder holds a punching tool that is used for punching. The plunger is hanged with the help of springs. Electromagnetic

Winding contains copper coil because Copper is good conductor of electricity. The working principle of electromagnet is based on the Ampere's rule. The magnetic field produced by the winding, magnetizes the electromagnet**.** When the electromagnet is turned ON, it attracts the plunger in the upward direction. The compressed spring now exerts force on the vertical bar and pushes it down and embossing is done. Now, stressed spring pulls the plunger in its original position; enabling the Operator to remove the work piece and load another work Piece. Here, the electromagnet is made ON/OFF in fraction of second which creates a jerk.

4. MACHINE ELEMENTS

Fig-3: Frame Structure

Fig-4: Electromagnet

Fig-5: spring

5. CALCULATIONS

Calculation of Electromagnetic Force:

Current = 32 amp
Voltage = 12 V
No. of turns (N) = 625
Diameter of rod (D) = 0.029 m
μ_0 = Permeability of Free Space
$= 4\pi*10^{-7}\ Hm^{-1}$
F = Force in Newton
B = Magnetic Flux in tesla
A = Area of Magnet

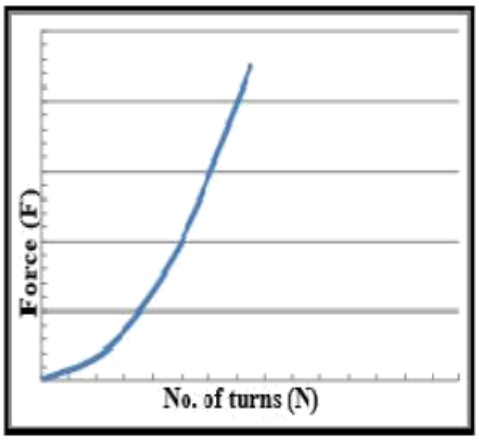

Fig-6: Graph of Force Vs. No. of Turns

Electrical power(P):

$$P = V \times I$$
$$= 12 \times 32$$
$$= 384 \text{ Watts}$$

Magnetic field intensity (H):

$$H = N \times I / \text{length}$$
$$=625 \times 32 / 0.07$$
$$= 285714 \text{ A/m}$$

Magnetic Flux Density (B):

$$B = H \times \mu_0$$
$$= 285714 \times 4\pi \times 10^{-7}$$
$$= 0.3588 \quad \text{Nm/A or} \quad \text{tesla}$$

Force (F):

$$F = B^2 \times A / 2 \times \mu_0$$
$$= 0.3588^2 \times 3.45 \times 10^{-3} / 2 \times 4\pi \times 10^{-7}$$
$$= 176.8 \text{ N or } 18 \text{ Kg}$$

Calculation of blanking force:

Punching force = perimeter * plate thickness * shear strength

6. CONCLUSION

The electromagnet-assisted blanking setup is a device which uses the principles of electromagnetic attractions combined

with a mechanical, few mechanical elements to blank a hole on the surface of a given sheet of material form or shape a given material to desired shape. It is a very flexible process with the frictional effects reduced to the maximum possible extent. This is a significant improvement from the currently existing mechanism for blanking. As well as being a portable and a compact device, the power consumption of the setup is also controlled accurately as electrical energy is used. This enables the blanking machine to develop the required force to blank a hole of the surface of the work piece.

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