Review on Non-conventional Electromagnetic Machine

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Abstract— Conventionally in many manufacturing industries, punching operation is carried out manually using jigs and fixtures or by means of a machine. These machines are mechanical, pneumatic or hydraulic. These machines are costlier for manufacturing, installation and maintenance also. The running cost of these types of machines is also high. An electromagnetic punching machine proves itself better against these machines in respect with above said points. In this machine punching operation is carried out in project work on very thin aluminium sheet or other soft material. As simple layout and tricky operational enables this type of machine to work practically at low cost, low maintenance, low capital investment in less space. It is forecasted that in future this machine may have its significant place in the industry mentioned previously.

Key words: Non-conventional Electromagnetic Machine

I. INTRODUCTION

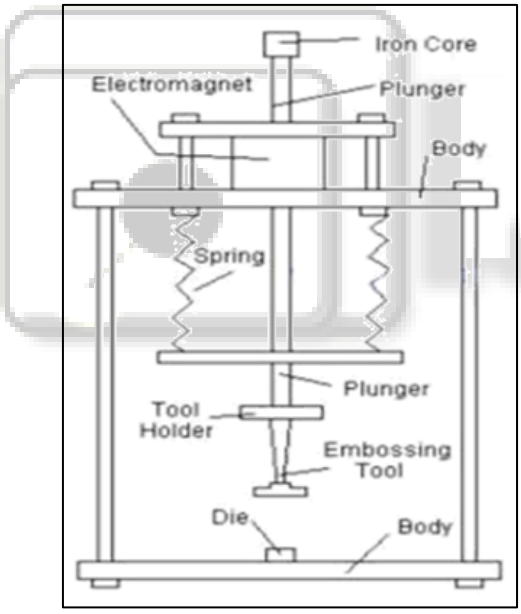

Fig. 1: Schematic Diagram of Machine

The whole idea is to develop a punching machine which can perform punching operation with fewer expenses and with low utilization of resources. So we thought of alternating the conventional power sources that are used in punching machine like mechanical, hydraulics and pneumatics. Here, a plunger is incorporated in electromagnet and it is allowed to carry out vertical movement. Here, plunger is made of mild steel and lower part of it carries the tool holder. The plunger is held with the springs and the material which is to be punched is kept just below the punching tool. When the electromagnet is made on it attracts the plunger into the upward direction. Due to compressed spring the punching is carried out

II. CONSTRUCTION & WORKING

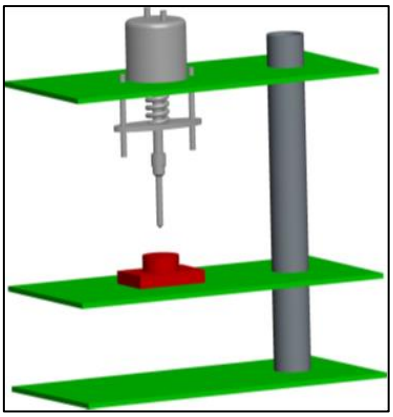

Fig. 2: Computer Aided Design

In the machine, there's an electromagnet which incorporates a plunger passing through it. The plunger is allowed for vertical motion through electromagnet. 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. A working material is placed just below the punching tool. Entire assembly is into fabricated housing or body. Whenever, electromagnet is made on, it pulls the plunger towards it and plunger is forced upward direction, which pushes the spring. When electromagnet is dead, the compressed spring pushes the plunger into downward direction and thus punching is carried out. After punching, the elongated spring pulls back the plunger into its original position.

III. COMPONENTS

Fig. 3: Frame Structure

Fig. 4: Electromagnet

Fig. 5: Spring

IV. DESIGN CALCULATION

A. Calculation of Electromagnetic Force

Current (I) = 28 amp
Voltage (V) = 12 V
No. of turns (N) = 625
Diameter of rod (D) = 0.03 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
Electrical power (P):

$$P = V \times I$$
$$= 12 \times 28$$
$$= 336\ W$$

Magnetic field intensity (H):

$$H = N \times I / length$$
$$= 625 \times 28 / 0.07$$
$$= 250000 A/m$$

Magnetic Flux Density (B):

$$B = H \times \mu_0$$
$$= 250000 \times 4\pi \times 10^{-7}$$
$$= 0.3142 \quad Nm/A \text{ or tesla}$$

Force (F):

$$F = B^2 \times A / (2 \times \mu_0)$$
$$= 0.3142^2 \times 3.45 \times 10^{-3} / (2 \times 4\pi \times 10^{-7})$$
$$= 135\ N \text{ or } 13.8\ Kg$$

B. Calculation of Punching Force

Punching force = perimeter * plate thickness * shear strength

V. CONCLUSION

The project work and testing shows that this machine, simultaneously solve some problems from various types of punching machines there exhibiting a good integrated result. This machine can be fixed in less place, requires low maintenance, does not require skilled labour has high rate of action, has longer span of time, require less capital investment, has low running cost hence can be implemented in the industry to help to lower down the production cost. Automating this unit gives a unique advantage of interfacing this unit in industrial automation unit.

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