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Design And Fabrication of Two Pillar Mechanical (CAM) Operated Press Machine

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ABSTRACT

This paper is mainly focused on CAM OPERATED DRIVE MACHINE Compact and portable, handy equipment, which is skilful and is having something different from the ancient conventional process. Its manufacturing price also less. This project gives us knowledge, experience, skill and new idea of manufacturing. It is a working project and having guarantee of success. This machine is one of the most important in metal workshop & manufacturing industry. It is designed will be used for various process of punching , stamping, bending process has been made by excess a large cutting force on the work clamped on die. So this paper is designed for “PIERCING OPERATION" with low cost. Hence our project aim is to reduce operating cost of the punching press in small scale industries and less manpower skill compact optimizing design. The automation strategy when being implement is believed to result in machine size, cost &improved production quality.

Keywords : PIERCING OPERATION, CAM, Mild Steel

I. INTRODUCTION

The press is the punching machine tool designed to punch Hole by applying spring load ram force by motor energy. The required metal is punched for desired requirements. The presses are especially intended for mass productions and represent the fastest and more efficient way to form metal into a finished punched product. Press tools are used for form and cut the 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 fulfil the requirements. We are interested to introduce Eccentric cam drive system in presses [1]. The main function of machine is to punching or stamping thin sheet metals or non-metals using mechanical power. In this project we have used to punching process for simple application.

Most punch presses are large machines with either a 'C' type frame, or a 'portal' (bridge) type frame [2]. The *C* type has the hydraulic ram at the top foremost part, whereas the portal frame is much akin to a complete circle with the ram being centered within the frame to stop frame deflection or distortion. U type presses have a bed plate which is used to lock the die bottom bolster. For locking the die, T bolts are used and so this plate contains 'T - slots into which t-bolts are slid in. These slots are placed diagonally and with a slot horizontal to the longer side of the plate, is the general practice [3]. These slots run up to a central hole made in the plate, the hole being large enough to accommodate another bush with a hole, the hole being used for dropping the punched part to the bottom of the press. The top of the tool butted against a vertical sliding ram with a clamping system which accommodates only a particular diameter of a threaded cylindrical member called the "shank" of the tool. The bottom portion of the tool is locked to the bottom bed plate and the top portion of the tool is locked to the sliding ram. Top and bottom portions of the tool are generally guided by suitable pillar and bush assemblies, (one or two pairs), which gives safety to the punching elements of the tool.

II. RELATED WORKS

The punching is the major operation performed in industry, and to perform this operation in mass number the manpower is require which results in to high cost of production, more time require to complete the operation, affect the accuracy of product so for automation in system we are trying to do a work on new system in punching [4]. Those machines are typically equipped with a linear die carrier (tool carrier) and quick-change tools.

Punching is a metal forming process that uses a punch press to force a tool, called a punch, through the work piece to create a hole via shearing. The punch often passes through the work into a die [5]. Today the method is used where the application of lasers are inefficient or technically impractical.

This Punching Machines are one of the most important machines in Industry. Punching is metal forming process that uses a punch press to force a tool, called punch. Punch presses are developed for high flexibility and efficient processing of metal stampings. There is an increase in technological methods in all daily activities in the industries [6]. This is done to improve the quality, efficiency and cost deduction of a particular product. The main areas of application are for small and medium runs industries. This type of punching machine is used to create a hole in thin Aluminium sheet.

It is designed for punching the punch by exerting a large Cutting Force on the work clamped on a Die which can be operated Hydraulically, Pneumatically or Mechanically. All pieces are sent down a slat conveyor and are pushed sideways on a table. Any scrap is carried to the end of the conveyor and dropped into a bin. Different work pieces can be produced within one work cycle to optimize production [7]. The automation strategy when being implemented is believed to result in Machine Size, Cost & Improved Product Quality.

III. PROPOSED METHODOLOGY

Methodology used for whole processing of Mini Cam Operated Punching Machine is given below; this methodology gives way about how work is to be carried out in systematic way. It is standard process of describing process, how it is done in simplest manner as shown in fig 1.

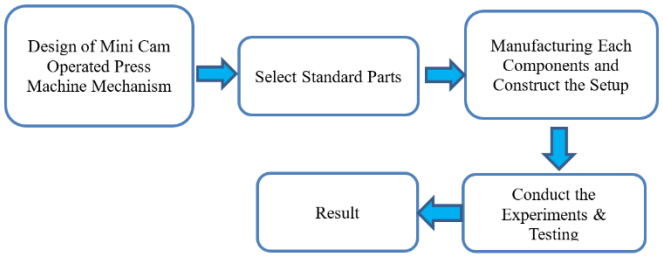


Figure 1. Flow Diagram for the proposed model

In achieving the aim of this work, parts of the machines were designed for using various design equations. The design results used to select materials for the various components. The detailed drawings of the developed locally sourced material. The use of mild steels due to the fact that strength, rigidity in the design specification. It is available & cost effective.

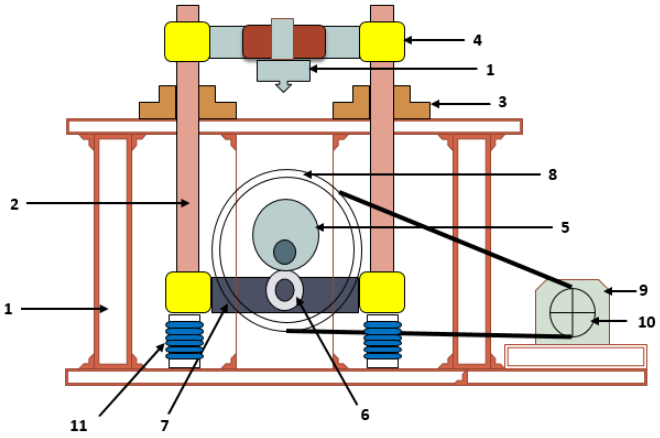


Figure 2. Constructional Featured

Parts Details

1. Main Frame Assembly- Mild Steel
2. Pillar Guide Shaft-
3. Guide Housing- Cast Iron
4. Ram Block- Mild Steel
5. Eccentric Cam- EN24
6. Roller Follower- Bearing
7. Bottom Arm-Mild steel
8. Driven Gear & Pulley Assembly
9. Motor with Gear Box
10. Drive Pulley-Cast Iron
11. Suspension Spring

The Assembly phase of all compounds is assembled in design and Testing Phase as we testing the prototype functions. The Main objective of the paper will be to improve to contain technical Development in optimizing the Cam Drive Mechanism for power press model as shown in fig 3.

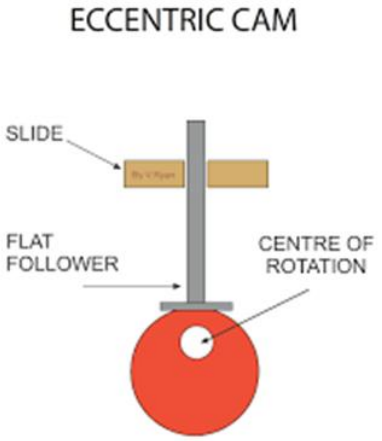


Figure 3. CAM and Follower Mechanism

Table 1. Selection of Material

Machine Frame Structure	Mild Steel
Drive Shaft	EN8
Guide Pillar Shafts	Hard Chrome Plating Rod
Bearing Housings	Cast Iron
Ram Block	Cast Iron
Bottom Arm	Mild steel
Pulley	Cast Iron
Main Eccentric Cam	EN24

Consideration of Material Properties

Mild Steel :

- Very high yield strength
- Extremely high tensile strength
- Good draw ability & welding
- Best weight reduction
- Tensile strength ultimate 440MPa

EN24 :

- Very high strength steel alloy
- Good ductility and wear resistance
- Excellent machinability
- Easy to Heat treat & Temp

Applications :

- High strength shafts
- Gears

Cast iron:

- Hardness - Material resistance to abrasion
- Toughness - Material Ability to absorb energy
- Ductility - Ability to deform with out fracture
- Low stress concentration

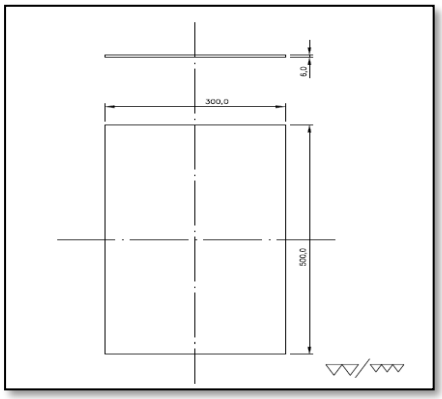
Applications:

- Bearing gap
- Machine bed
- Brackets

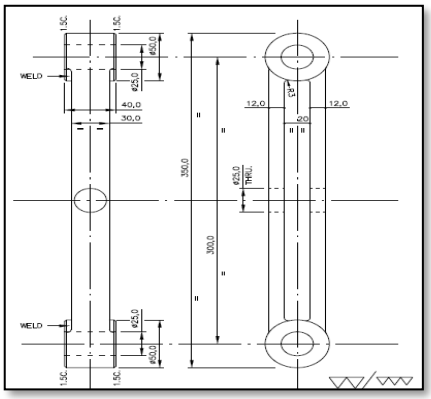
3.1 Design Phase

At first the all machine elements draw the manual sketch then convert in cad drawings with the help of AutoCAD software next step prototype 3D model is done in the system using Creo software as shown in fig 4 and 5. The component that is used in this project is separately designed at first with the dimension altered as per the requirement to fit with one another. Then finally all are assembled together and then the design is finalized with the required dimensions which is to be machined (Fabricated) and assembled for building the project prototype.

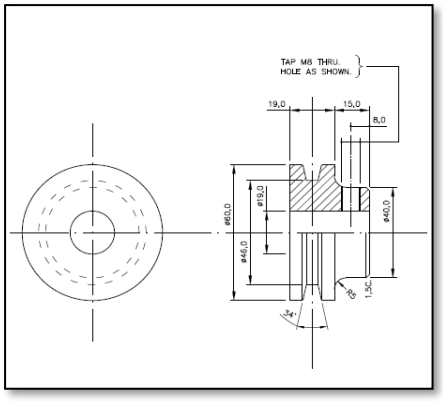
Bottom Base Plate



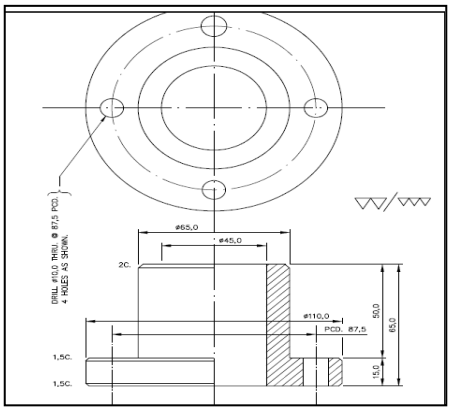
Bottom Acting Arm



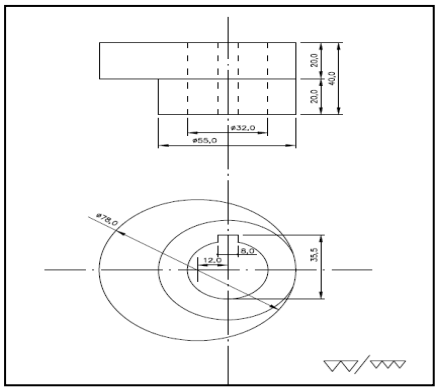
Drive Pulley



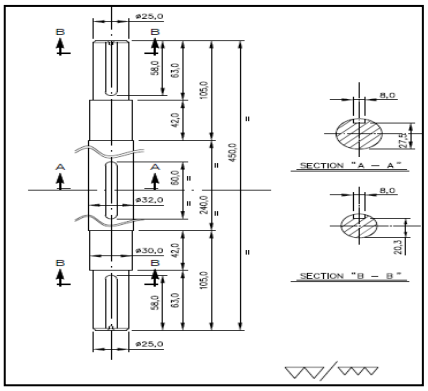
Bearing Housing



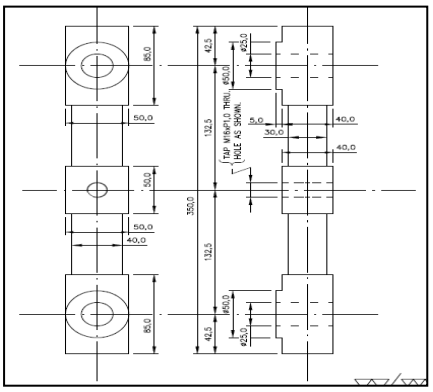
Main Eccentric Cam



Main Cam Drive Shaft



Ram Block



Top Mounting Plate

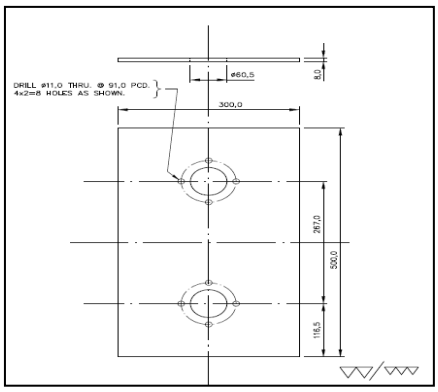


Figure 4. CAD Design

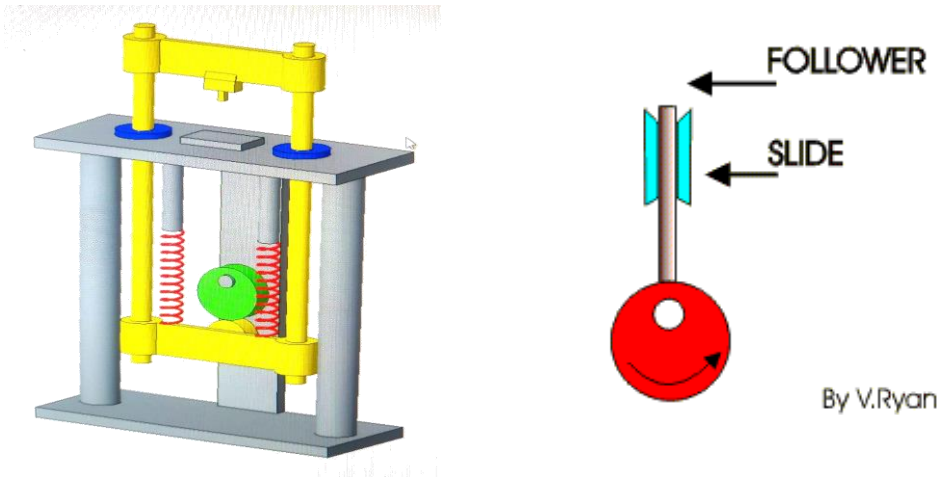
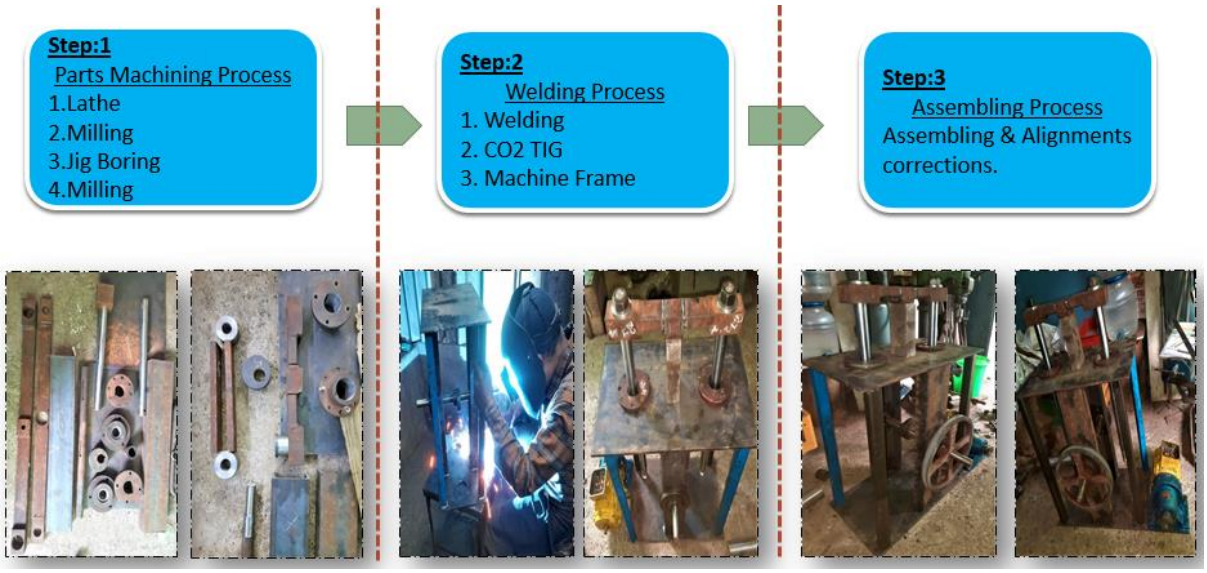
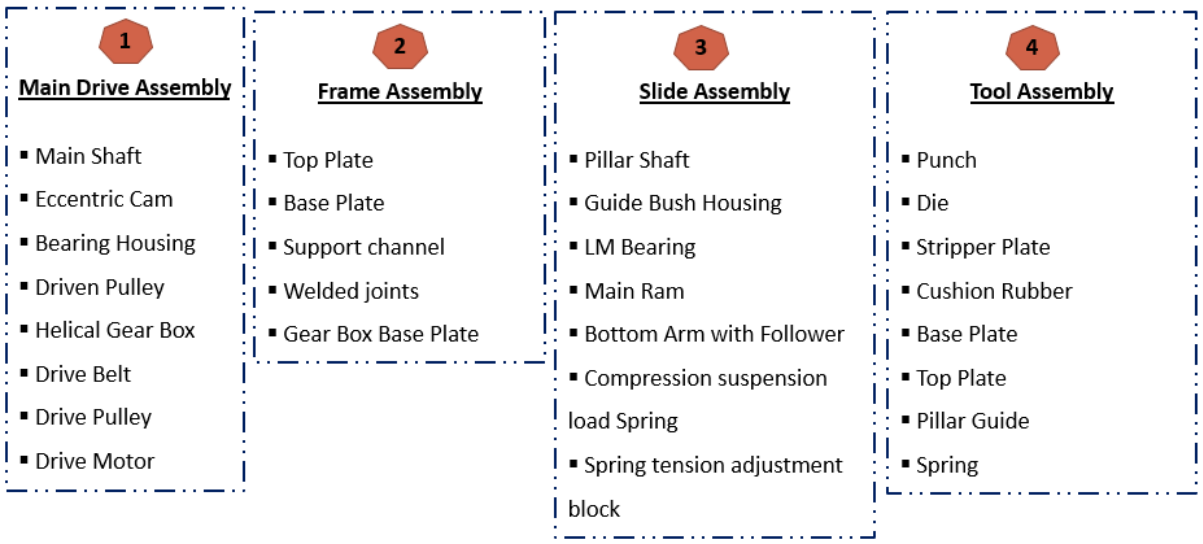


Figure 5. 3D Model View

3.2 Fabrication Phase



3.3 Assembling Phase



3.4 Testing Phase

The punching press works on the principal conversion mechanism that converts the rotary motion to linear motion. The main motor provides the power to drive the flywheel. With a clutch and connecting rods, the flywheel drives the crankshaft or the eccentric gear. To convert the circular motion to the linear motion. There is the need for a transfer point between the slider and the connecting rods. There are two types of designs to convert circular motion into linear motion one is the spherical type. And another is a pin or cylindrical type. During the operation, the drive mechanism powers the rams up and down movement. This action opens and closes the upper die & lower die shoes. During the operation, a sheet metal strip passes between the die shoes. And finally, when the punch (ram attached with the die) moves down, applies pressure on the metal sheet and cuts a hole.

IV. RESULT

The load necessary for punching the material as established by carrying out extensive calculations was 1 ton capacity. The mechanical press is designed for 1.5Ton. The costs encountered in this project are material cost, labour cost, Power cost, and designing cost, manufacturing cost, administrative expenses and cost of indirect expenses. Considering all these parameter. The price of machine calculated compare hydraulic and pneumatic method its very low investment and less power energy consumption. It is observed that utilizing the proposed mechanical press machine will substantially reduce the cost and space required. The new drive for the sheet metal presses with camshaft allows us to optimize the kinematics of simple mechanical presses as shown in fig 6.

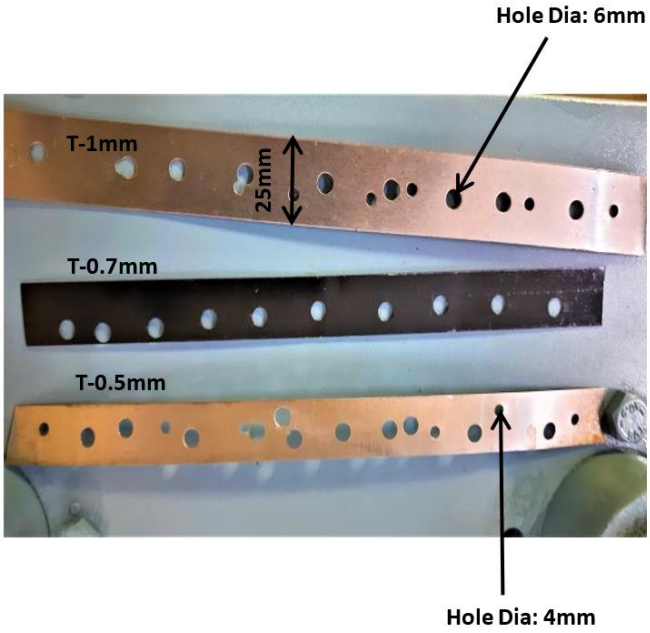


Figure 6. Final Result

SPM Calculations:

$$Motor\ speed - 1440rpm$$

$$Gear\ box\ Output\ Speed\ - 130rpm\ N2$$

Drive pulley Diameter:

$$50.8mm\ Perimeter\ - \pi d\ = 50.8x\ \pi = 159.12mm$$

Driven Pulley Diameter:

$254mm\ perimeter - \pi D = 254X\ \pi = 797.56\ mm$

Speed of the Driven shaft:

$N1 = D\ XN2\ /\ d = 159.12x130\ /\ 797.56 = 26rpm$

Strokes per Min SPM= 26

Punching Force Calculation:

Coil Material –Mild steel

Plate Thickness-0.5mm to 1mm

Perimeter- πd or 2 π r

If punching one circle hole in the 0.5mm thickness low carbon steel hole Dia 6mm

Perimeter=$3.14x6 = 18.84mm$

Thickness =0.5mm

Shear strength=0.3447kn/mm

Punching Force (KN)=$18.84X0.5X0.3447 = 3.24KN$

Result : Covert to Ton: 3.24/9.81=0.33Ton

V. CONCLUSION

Punching process is an important element of manufacturing that helps the manufacturing process industries in metal producing processes. There are different types of punching presses like hydraulic, pneumatic, power press. Hence this project has helped to get innovate view of punching press in low cost and working and applications in small scale industry's continues cycle mass production while concluding this report we feel quite fulfill in completed the project assignment well on time we had good practical experience on fulfillment of the schedule of working project model. The selection of choices, raw materials helped us in machining of the various components to very close tolerance. Fabrication and assembly work of this project model is our entire satisfaction.

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