PRODUCT DESIGN ASSIGNMENT

ON

DEVELOPMENT OF A MOTORIZED HYDRAULIC PRESS

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Introduction

A pressing machine is a machine used in pressing forming processes, forging process, clinching, flattening of metal pieces to be recycled, punching and stamping on thick material plates such as metal, plastic and ceramics, it can also be applied in deep drawing. A hydraulic pressing machine or a hydraulic press does this using pascal's principle which states that when pressure is exerted in an isolated fluid system at rest, the pressure change at one point of the fluid occurs throughout the entire fluid mass. It uses exertion of pressure through the fluid to constitute an upward and downward motion driving a piston that applies pressure on the object of the pressing the machine is working on. I am proposing to use an electric motor with an on/off switch to drive the up and down motion on an inverted hydraulic jack which will act as the piston for the machine.

Hydraulic presses are very versatile in terms of what they can be used for, they have the ability to force down many materials to their lowest possible limits depending on their design they do not take up too much space. My proposed motorized hydraulic press eliminates the need for human power when applying the pressure from the jack. An on/off switch will be integrated into the motor so turning on and off can be done without needing access to the power source, the machine as most of its kind will take the H shape.

Objectives of Study

1. To develop a machine that serves as a tool for shapening, stamping, punching and forming/bending operations.
2. To make the process of material reforming via the hydraulic press easier by motorizing it.

Material Selection

S/N	Material	Specification/Function
1	I channel metal	The existing frame has a height of approximately 900mm and a width of 500mm, each part having a thickness of 10mm and channel is

		3/2. It is the body in which the entire machine exists within.
2	Rods	These lay at 160mm length and diameter of 23mm. They are the support on which the piston of the press are balanced on
3	Flat metal plates	There will be 3 separate metal plates cut around the press. One with a length of 275mm, width of 110mm and thickness of 10mm dependent on the jack and work plate dimensions, the other 2 with a full length of 500mm and width of 350mm spread across the bottom of the press. It acts as grip between both pillars and a stand for the jack and the motor.
4	Electric motor	The motor will generate the driving force for the jack's pump. This action will be done using a slider crank mechanism to convert the motor's rotary motion to the linear motion required for the jack's pumping action. The electric motor will function at a speed of 500rpm to prevent excess vibration and a horse power 0.4 at least.
5	Fixed and Moveable links	The assembly of the electric motor to the hydraulic jack will require a number of apparatus to accurately convert its rotary motion to linear on the jack, a number of improvised linkages will need to be set up for

		this aspect of the total assembly of the press.

Factors Considered in the Material Selection

A number of factors were considered when these materials were considered before the above materials and there specification were selected for the subject of this thesis.

1. Size
2. Tensile Strength
3. Length of materials
4. Affordability

B.E.M.E Estimated for Hydraulic Press Motorization

S/N	COMPONENTS	QUANTITY	UNIT PRICE (N)	PRICE (N)
1	5 ton hydraulic bottle jack	1	10,000	10,000
2	Mild steel (channel, flat, plate, round)	2	15,000	30,000
3	12V electric motor	1	8,000	8,000
4	Screws and bolts	12	400	7,200
6	Compression springs	2	500	1,000
7	Miscellaneous	----	----	20,000
TOTAL				76,200

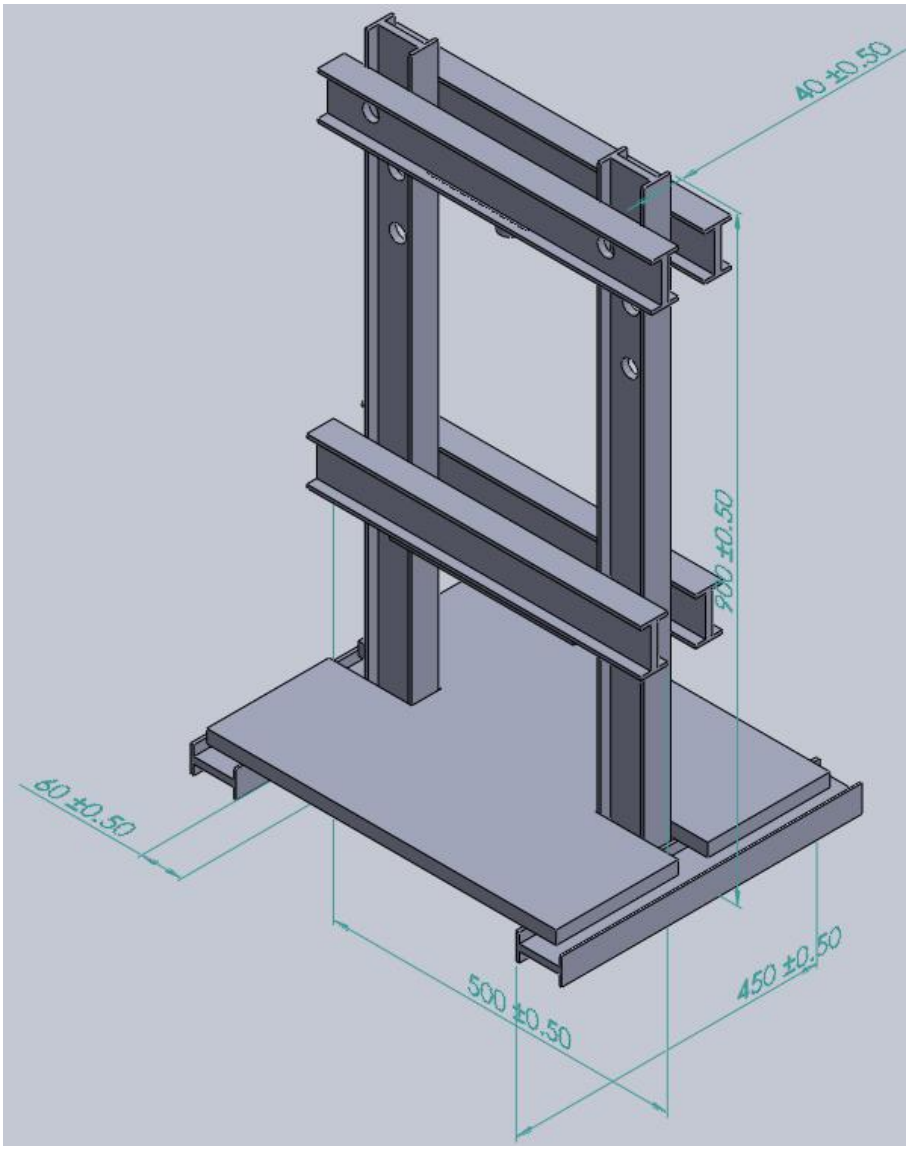

Fig.1 Hydraulic Press Frame

The H-frame as stated in previously stated in the table above is the sole housing for the entire machine, on which the operation to be carried out takes place and the work piece is held. Underneath the frame sits the hydraulic bottle jack, the jack will create the upward pushing force for the work piece and the pumping action will be carried out of the above stated electric motor.

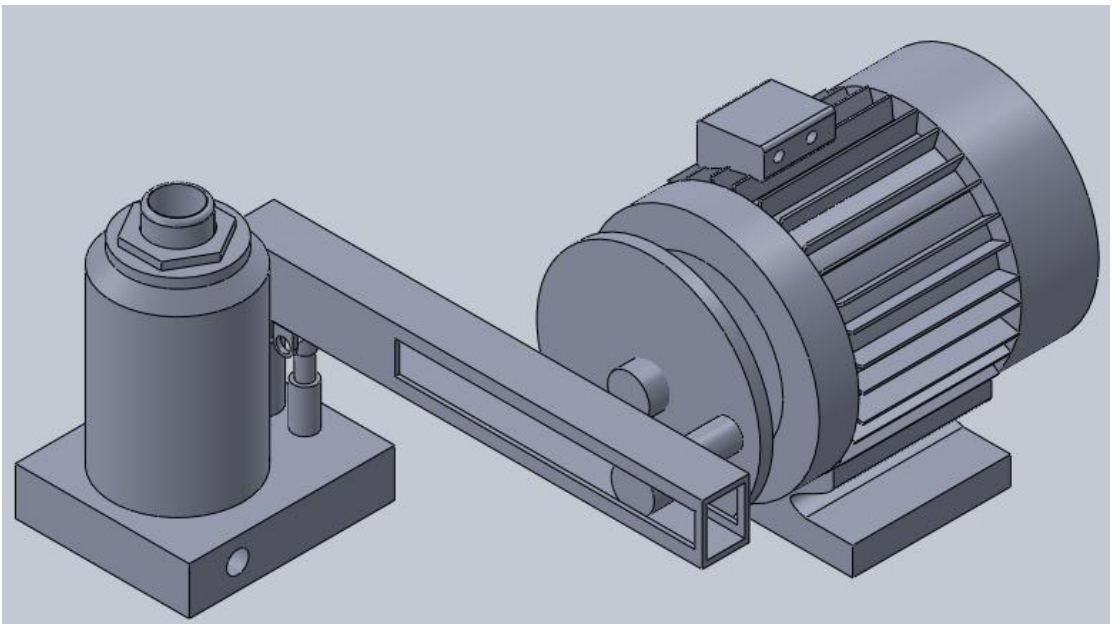

Fig.2 Hydraulic Jack and Motor Assembly

The mechanism of the jack and motor will consist of a slider and crank to allow change of motion between the motor and the jack ram.

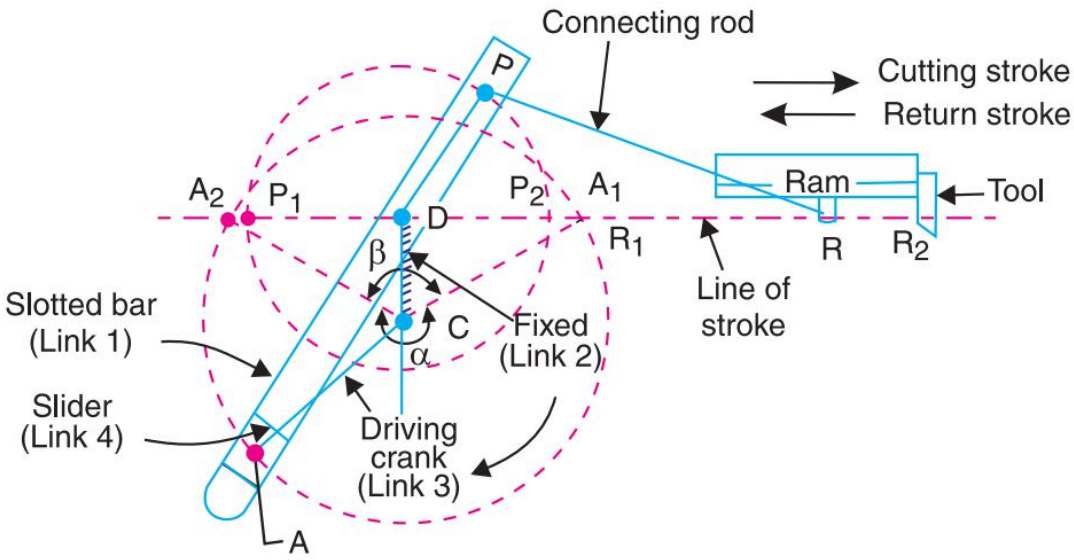

Fig.3 Diagramatic Representation of Slider Crank Mechanism Utilized (Source: Theory of Machines by R.S Khurmi)

Calculations

- Load (W) = 5ton = 50kN (approx.)
- Operating pressure (P) = 25 M Pa

- Lift range (L) = 20cm
- Human effort required on handle (e) = 20Kg
- Permissible tensile stress of mild steel (σt) = 120 N/mm2
- No. of strokes for lifting load (n) = 150
- Factor of safety = 5
- Permissible shear stress of mild steel (τ) = 20 N/mm2
- Permissible compressive stress of mild steel(σc)= 20 N/mm2
- Lever Arm length = 300mm
- Slider diameter = 70mm
- Force required on Jack lever = Load(W) x g

  = Wg = 20 x 9.81

  = 196.2N

Operations Performed in the Fabrication of the Motor Hydraulic Press

1. Cutting Operation: The entire H frame of the press was built out of mild steel metals that were cut to certain dimensions to fit the required designs. Following the design in figures 3.1 and 3.2 the whole 18ft mild steel acquired needed to be cut down to size. Also cutting operation took place in the flat plates on which the motor and jack were placed on as well as the rods that hold the channel metal parts above, the lever of the bottle jack was also cut to its designated shape.
2. Welding Operation: The balances for the pillars of the motor hydraulic press were welded to both pillars. Welding operation was chosen due to durability, point of connection of the pillars and the feet and the fact that these parts may not necessarily need to be disassembled at any time. The metal plates acting as a platform for the motor and jack having being previously cut in 3 separate plates were welded together when assembled underneath the frame bot above the feet of the press. The adjustable piston of the motor hydraulic press and plate underneath it serve not only as the piston but also a welded joint between the two channel pieces holding it as well as the work plate being elevated by the jack when pumped.
3. Drilling Operation: The rods that hold the piston above the press are placed inside holes that extend to both ends of the press frame, the holes are created on the channel metal by drilling operation with the use of a milling machine. The holes

were drilled to just be large enough to contain the rods with just enough allowance. This operation also took place to create the slot in the lever of the bottle jack lever for the crank to slide through in the slider mechanism.

4. Turning Operation: the piston of the press was initially cut then turned to its designated shape by turning operation of a lathe machine as well as the tool that connects the motor and the bottle jack lever if the need be.