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HYDRAULIC PRESS MACHINE FOR HANDLE AND TRIGGER ASSEMBLY OF CP BREAKERS WITH FIXTURE

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ABSTRACT

This paper is basically focuses on the Design & manufacturing process. In this we design the Fixtures and Hydraulic Press Machine for Handle & Trigger Assembly of CP Breakers of Atlas Copco. Actually in company assembly of the CP breakers is doing by hammer. In the assembly dowel pin is inserted into handle, this pin and hole of handle having interference fit. Due to use of hammer sometime this pin goes wrongly and it get bended, this cause the rejection of handle assembly to eliminate this we make press machine with suitable fixture. In which the assembly is totally done by automatic manner simply pressing one button the whole assembly is completed without any damage. This project improves the mass production rate, reduce time required for assembly and reduced man power, and also totally eliminate the rejection rate. So this project is easy and healthy for handle and trigger assembly.

Keywords: Automatic, Fixture, Hammer, Hydraulic Press Machine, Rejection Rate.

I. INTRODUCTION

The project is totally based on the Design & Manufacturing. We are Design & Manufacture the Fixture as well as Press Machine for the implementation of our project.

1.1 Fixture

The fixture is a special tool for holding a work piece in proper position during manufacturing operation. For supporting and clamping the work piece, device is provided. Frequent checking, positioning, individual marking and non-uniform quality in manufacturing process is eliminated by fixture. This increase productivity and reduce operation time. Fixture is widely used in the industry practical production because of feature and advantages. To locate and immobilize work pieces for machining, inspection, assembly and other operations fixtures are used. A fixture consists of a set of locators and clamps. Locators are used to determine the position and orientation of a work piece, whereas clamps exert clamping forces so that the work piece is pressed firmly against locators [1].

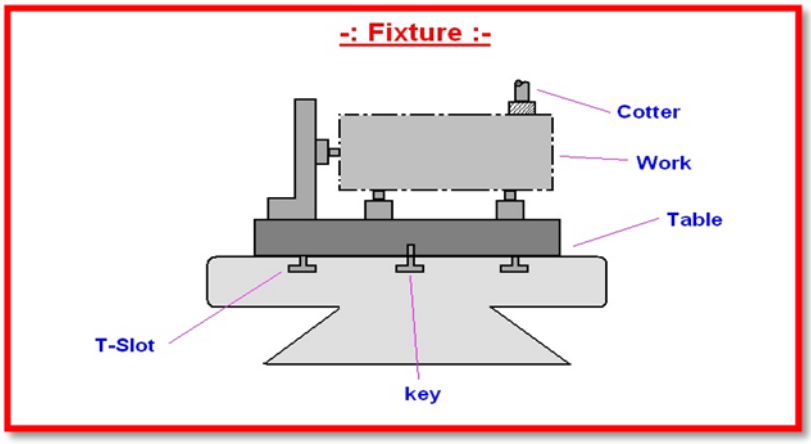

Fig I.I.I. Fixture

Clamping has to be appropriately planned at the stage of machining fixture design. The design of a fixture is a highly complex and intuitive process, which require knowledge. Fixture design plays an important role at the setup planning phase. Proper fixture design is crucial for developing product quality in different terms of accuracy, surface finish and precision of the machined parts in existing design the fixture set up is done manually, so the aim of this project is to replace with hydraulic fixture to save time for loading and unloading of component. Hydraulic fixture provides the manufacturer for flexibility in holding forces and to optimize design for machine operation as well as process function ability [2].

1.1.1 Types of Fixture

1. Vise Fixture
2. Facing Fixture
3. Boring Fixture
4. Face Plate Fixture
5. Turning Fixture

1.1.2 Steps of Fixture Design

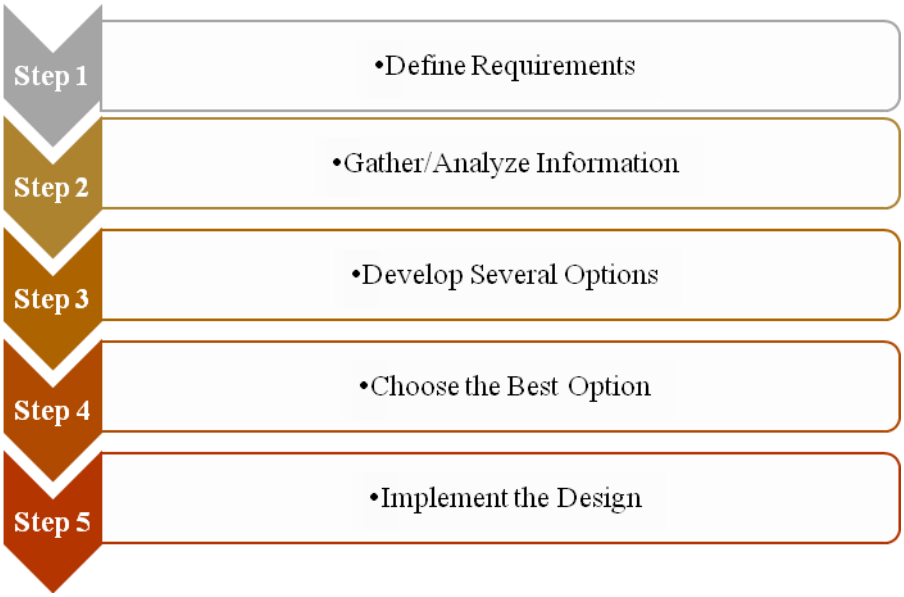

Table I.I.II.I. STEPS OF FIXTURE DESIGN

1.2 Press Machine

Fluid Mechanics provides the theoretical foundation of hydraulics and focuses mainly on its engineering applications. The basic law of fluid dynamics that govern the working of any hydraulic system, is the Pascal's law. The development of engineering over the years has been the study of finding ever more efficient and convenient means of pushing and pulling, rotating, thrusting and controlling load, ranging from a few kilograms to thousands of tons. Presses are widely used to achieve this. Presses are pressure exerting machine tools. They can be classified into three principal categories as: hydraulic presses which operate on the principles of hydrostatic pressure, screw presses which use power screws to transmit power and mechanical presses which utilize kinematic linkage of elements to transmit power [3].

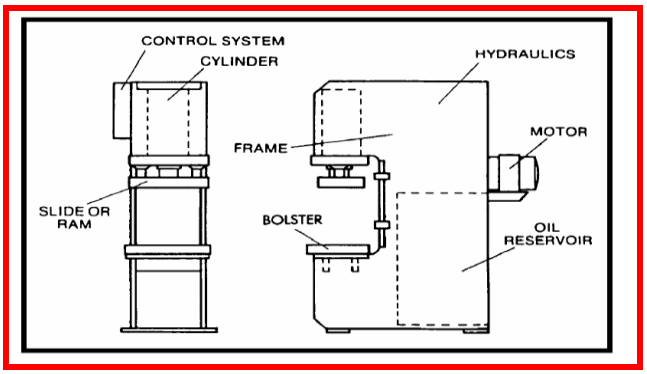

Fig I.II.I. HYDRAULIC PRESS MACHINE

Typical hydraulic press consists of a pump which provides the motive power for the fluid, the fluid itself which is the medium of power transmission through hydraulic pipes and connectors, control devices and the hydraulic motor which converts the hydraulic energy into useful work at the point of load resistance. The performance of a hydraulic press depends, largely, upon the behavior of its structure during operation. However, these welded structures are becoming complicated and their accurate analysis under given loading conditions is quite important to the structural designer. Hence it is found that optimal design of a hydraulic press in terms of its weight is the need of the hour. The research on machine tool structures was stepped up by the application of the finite element method . This is a more generalized method in which a continuum is hypothetically divided into a number of elements interconnected at nodal points to calculate the strain, displacement and stress . FEM is preferred because it permits a much closer topological resemblance between the model and the actual machine. It has been only recently employed for press structures. The ANSYS Finite Element software system is used as a tool to establish the theoretically predicted numerical model. This theoretically predicted numerical model is based on different factors, like the boundary condition, the mesh density and the type of the element being used [3].

The present work is based on the finite element analysis of different parts of the hydraulic press machine and weight optimization of critical components of the hydraulic press machine.

II. LITRATURE REVIEW

Sr. No.	Author Name	Worked on	ISSN No.
1	Shailesh S.Pachbhai1, Laukik P.Raut	A Review on Design Of Fixtures	2091-2730
2	Shrikant. V. Peshatwar, L.P Raut	'' Design And Development Of Fixture For Eccentric Shaft: A Review"	2248-9622
3	Sawita D. Dongre, Prof. U. D. Gulhane, Harshal C. Kuttarmare	Design And Finite Element Analysis Of JIGS And Fixtures For Manufacturing Of Chassis Bracket	2321-9637
4	Heidar Hashemi' Awaluddin Mohamed Shaharoun, Izman S.	Fixture Designers Guidance: A Review of Recent Advanced Approaches	1995-6665
5	*D.* Ravi	Computer Aided Design and Analysis of Power Press'	1990-9233
6	Gaurav Pradip Sonawane, Gaurav Shashikant Udgirkar	Design, Analysis And Manufacturing Of Hydro-Pneumatic Press Machine	2250 -3005
7	Arun V. Javir, Niranjan N. Manchekar	Up gradation In Hydraulic Press Machine	2319-8354
8	Asim M.Kamate , Prof.(Dr.) J.S. Bagi	A Review On Design Analysis And Optimization Of A 20 Ton Hydraulic Press	2349-4476

Table II.ILITRATURE REVIEW

III. PROBLEM STATEMENT

The problem is that the assembly of CP Breakers done manually with the help of hammer. The assembly of CP breakers includes different shapes of handles which are Horizontal or C & D type, Trigger, Dowel pins & Holes for which the dowel pin is to be inserts. The assembly is done in the company where the operator takes handle and place on the table & this handle is hold by the 2nd operator, then the trigger is attaché to the handle and then the Dowel pin is put on the hole which is hold on the hole by one hand of the 1st operator and with using other hand of he will take hammer and apply force on that dowel pin.

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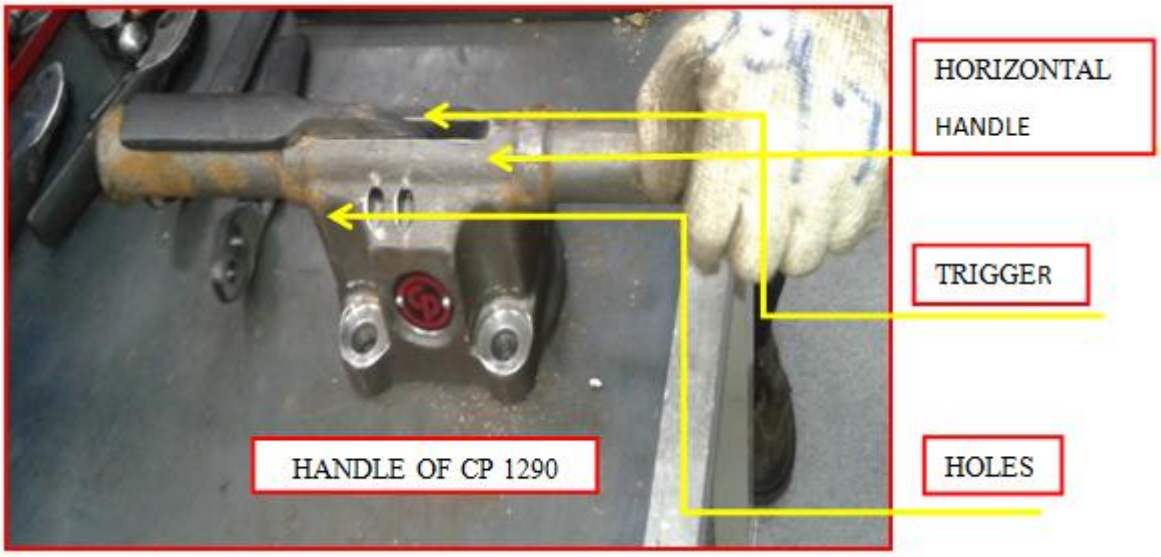


Fig. III.I. HORIZONTAL HANDLE

During this operation the main problem is occur that 'when 1st operator applying the force on the dowel pin with the help of hammer at that time the handle is get disturbs, suppose operator applies the large force which exceed the limit force applicable, because of this high force & disturbance the chances of bending of dowel pin is increases, because the Diameter & Thickness of that Dowel pin is very small around 4mm to 8mm diameter.

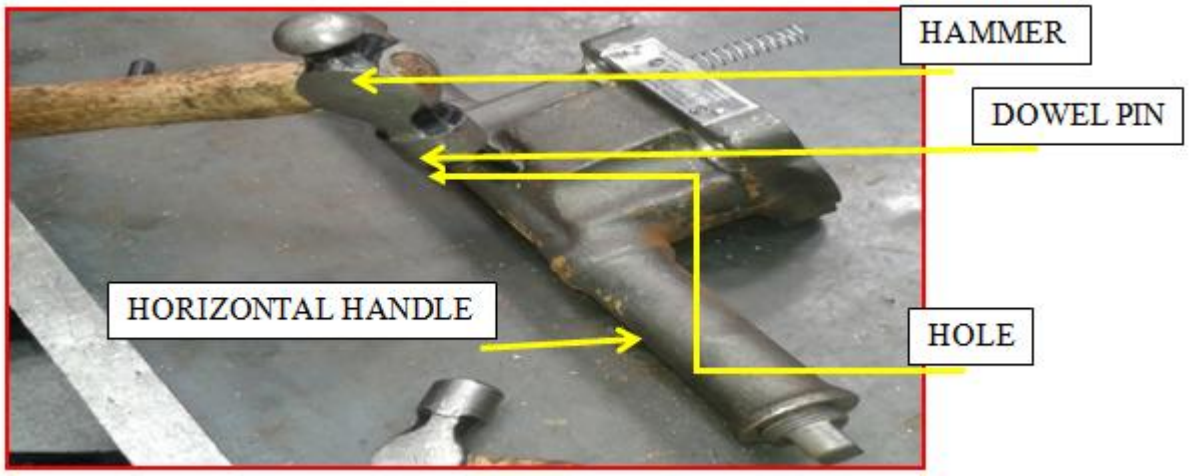


Fig. III.II. ACTUAL WORKING

In the dowel pin and hole of handle which having Interference fit is provided which is inserted in that hole, because of this interference fit once the dowel pin is inserted in the hole & if it get bended while inserting in the hole then it will cannot come back again and if this occur while assembly the total assembly of handle is going to the scrap.

Due to this problem of operation there is increase in the rejection rate as well as scrap of product. Another problem we found is that when the 1st operator is holds the dowel pin by his own hand and with help of another hand he would apply the force on that dowel pin while applying the force to that dowel pin the 1st operator's hand may be injured, because of that reason there is skill operator is required & this will again increase the pay scale of that operator.

D Type Handle

Fig. III.III. D TYPE HANDLE

C Type Handle

Fig. III.IV. C TYPE HANDLE

IV. OBJECTIVE

To overcome the problem of this assembly of the company we decide to improve the process of operation for doing this assembly of CP Breaker. So our main task is to eliminate the 'scrap' as well as reduce or remove the rejection rate, increase the production rate, improve mass production, reduce cost, reduce man hour, reduce labor cost. This will be done by introducing the 'Press Machine' on the assembly line. By introducing the Press machine on the shop floor the requirement of operator is less then less skilled operator can handled this press machine.

By utilization of Press machine for doing the assembly of the CP breakers an equal amount of force will apply on that dowel pin to insert in the hole, this will totally eliminated the bending of dowel pin and hence the rejection rate is totally eliminate. Another reason for which the assembly is goes scrape, that while application of force the handle is disturbed & because of this reason the dowel pin is get bands to overcome this problem, we design the Fixture for holding the handles firmly during operation so the problem of bending of dowel pin is totally eliminates.

So our main objective is that "Design & Manufacturing" of Press machine as well as Fixture.

V. COMPONENTS

- **Fixture: -** base plate, v block, nuts, Teflon block, dowel pin, toggle clamp.
- **Press machine: -** base plate, upper plate, column, boltsand legs for support.
- **Hydraulic equipment: -** piston & cylinder, valve, reservoir, pipes & hoses, motor, pump, seals,

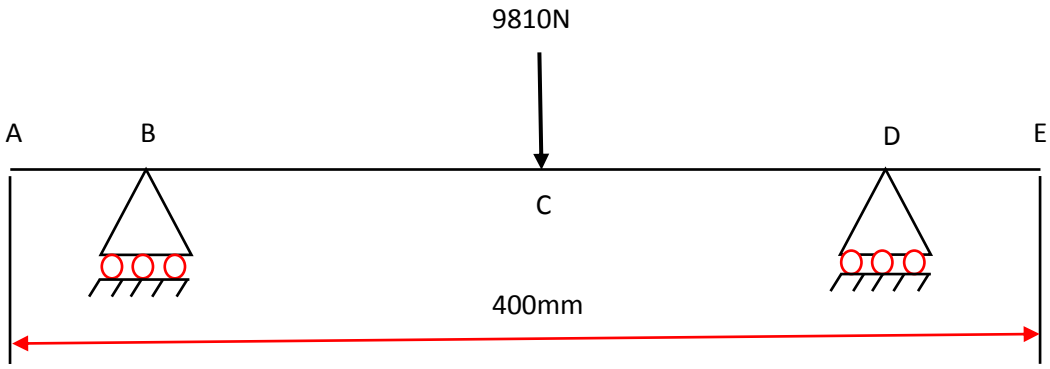
VI. MANUFACTURING PROCESSES

- Cutting of Raw material
- Sizing

- Milling
- Drilling
- Threading (internal & external)

VII. DESIGN & CALCULATION

1. Shear force &bending moment for PRESS MACHINE.



REACTIONat B (RB) = 4905 N

REACTIONat D (RD) = 4905 N

❖ **SHEAR FORCE CALCULATION**

Shear force at A= 0 N

Shear force at B (LEFT) = 0 N

Shear force at B (RIGHT) = 4905 N

Shear force at C (LEFT) = 4905 N

Shear force at C (RIGHT) = -4905 N

Shear force at D (LEFT) = -4905 N

Shear force at D (RIGHT) =0 N

Shear force at E = 0 N

❖ **BENDING MOMENT CALCULATION**

Bending moment at A = 0

Bending moment at B = 0

Bending moment at C = 863.28*10^3

Bending moment at D = 0

Bending moment at E = 0

- **Maximum Bending Stress**

$$\frac{M}{I} = \frac{\sigma}{Y}$$

$$\sigma = \frac{M}{I} \times Y$$

$$\sigma = \frac{863.28 \times 10^3}{685.90 \times 10^3} \times 19$$

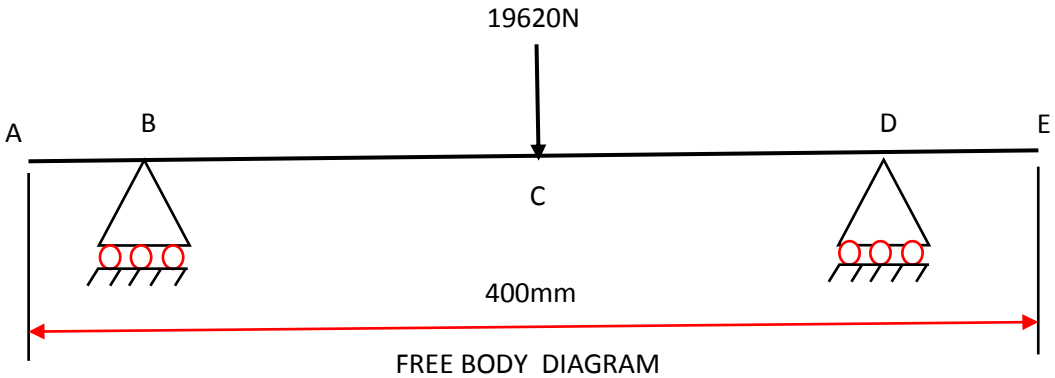
$$\boldsymbol{\sigma} = \mathbf{23.91\ N\text{-}mm^2}$$

- **Maximum Deformation**

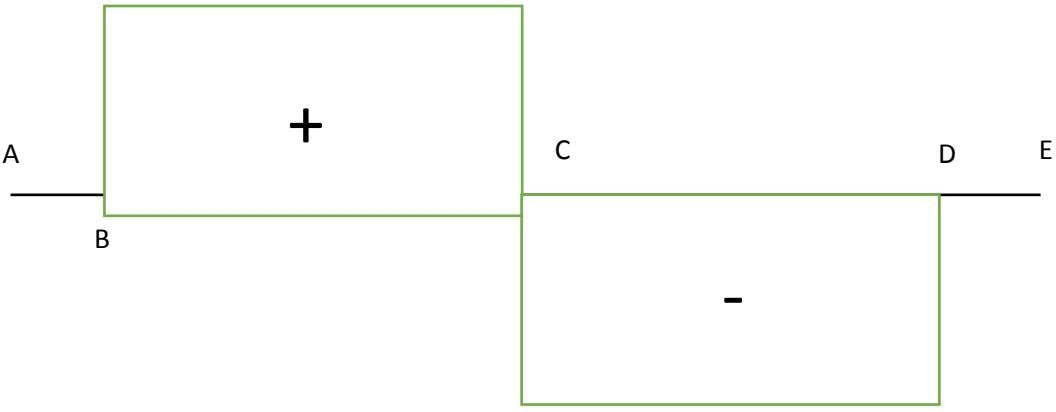
$$\delta = \frac{PL^3}{48EI}$$

$$\delta = \frac{9810 \times 400^3}{48 \times 200 \times 10^9 \times 685.90 \times 10^3} \quad \text{..... (P = 9810 N, E = 200 GPA)}$$

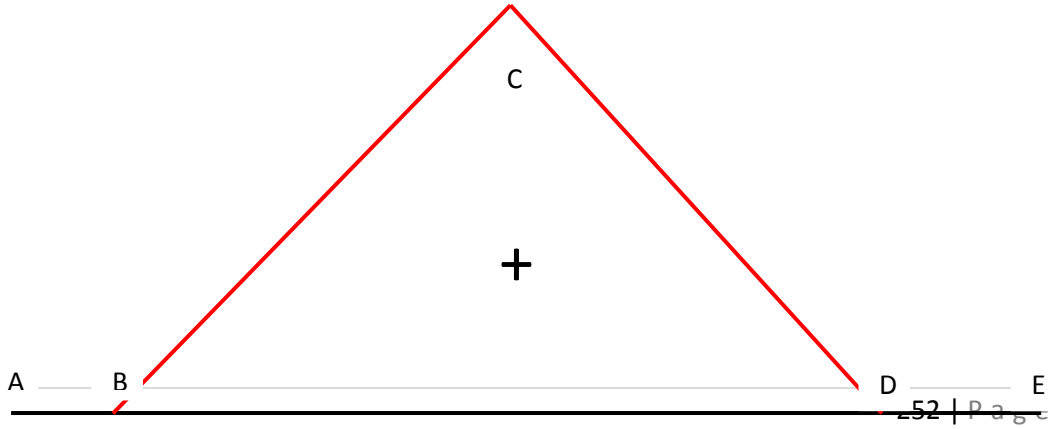
$$\boldsymbol{\delta = 9.534 \times 10^{-8}\ mm}$$



FREE BODY DIAGRAM



SHEAR FORCE DIAGRAM



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VIII. FINAL DESIGN

BENDING MOMENT DIAGRAM

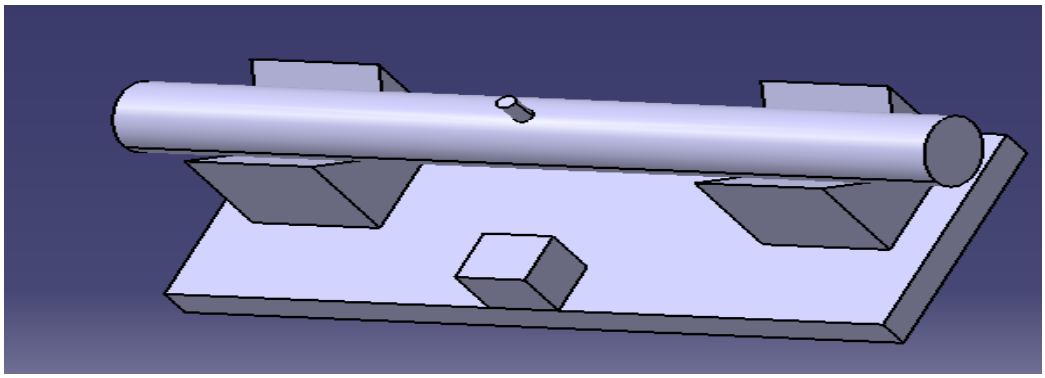

Fig. VIII.I. HORIZONTAL FIXTURE

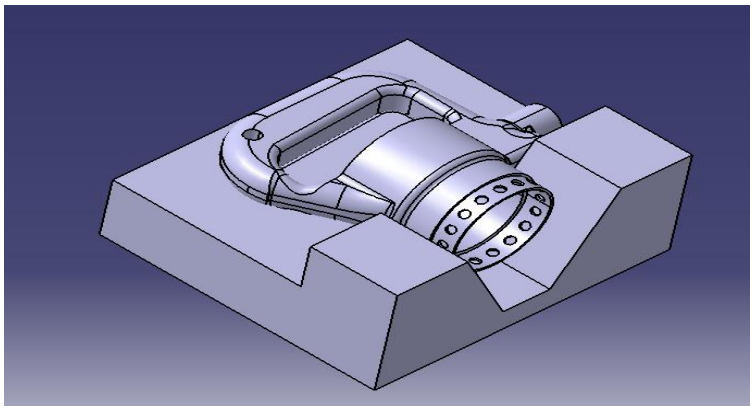

Fig. VIII.II.C & D TYPE FIXTURE

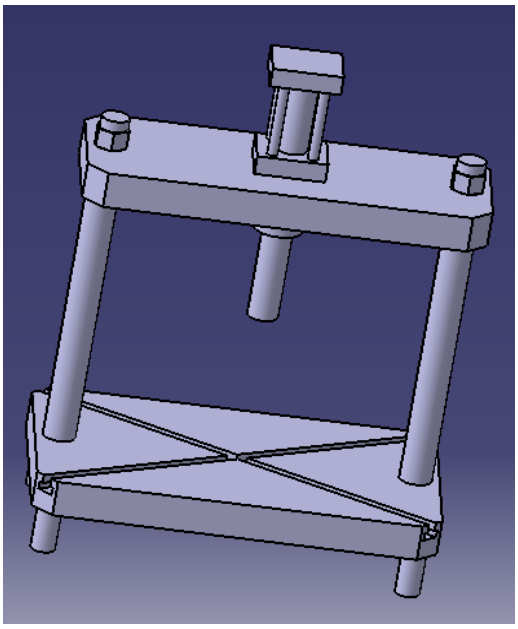

Fig. VIII.III. PRESS MACHINE

IX. FUTURE SCOPE

Our project is improve the efficiency of the assembly of the Handle of CP Breaker, So future scope of our project is that make the whole assembly line of CP Breakers is automatically with the help of ROBOTIC ARM.

X. CONCLUSION

This whole project Conclude that the Assembly of CP Breakers Handles is become easy, process time reducing, secure, safety for operation & more Beneficial to the Company. So production rate of the company is increases also it reduces the labor cost due to this the profit of company increases.

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