CONSTRUCTION OF A MULTIOPERATION HYDRAULIC PRESS MACHINE

A thesis

by

Md. Abubakar Siddik;	ID: BME1903019287
Mohammad Forhad Hossain;	ID: ME2102024579
Md. Al Amin;	ID: ME2003022146
Sakil Mollah;	ID: BME2001020611
Majharul Islam;	ID: ME2102024523

Department of Mechanical Engineering

SONARGAON UNIVERSITY (SU)

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Md. Abubakar Siddik
ID: BME1903019287

Md.Al Amin
ID: ME2003022146

Mohammad Forhad Hossain
ID: ME2102024579

Sakil Mollah
ID: BME2001020611

Majharul Islam
ID: ME2102024523

Supervisor: Md. Mahafujul Islam
Lecturer

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APPROVAL

This is to certify that the project on " **Construction of A Multioperation Hydraulic Press Machine**." By Md. Abubakar Siddik, (ID: BME1903019287), Mohammad Forhad Hossain, (ID: ME2102024579), Md. Al Amin, (ID: ME2003022146), Sakil Mollah, (ID: BME2001020611), Majharul Islam, (ID: ME2102024523) has been carried out under our supervision. The project has been carried out in partial fulfillment of the requirements of the degree of Bachelor of Science (B.Sc.) in Mechanical Engineering of years of 2024 and has been approved as to its style and contents.

……..

Md. Mahafujul Islam

Lecturer of Mechanical Engineering

Sonargaon University (SU)

DECLERATION

We, hereby, declare that the work presented in this project is the outcome of the investigation and research work performed by us under the supervision of Md. Mahafujul Islam, Lecturer, Department of Mechanical Engineering, Sonargaon University (SU). We also declare that no part of this project and thesis has been or is being submitted elsewhere for the award of any degree.

Md. Abubakar Siddik
ID: BME1903019287

Mohammad Forhad Hossain
ID: ME2102024579

Md. Al Amin
ID: ME2003022146

Sakil Mollah
ID: BME2001020611

Majharul Islam
ID: ME2102024523

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ABSTRACT

The paper presents the development of a manually operated hydraulic press which encompasses the design of the press. The components and parts of the machine were designed using various design equations. The design results were used to select materials for various components. The detailed drawing of the developed machine was done using Solid Work software. In fabricating the machine, mild steel was used as the locally sourced material. The use of mild steel is because its strength, rigidity, and machinability fall within the design specifications. Some components of the machine developed include; the frame, cylinder mounting table, press pin, working table/bed, hydraulic jack, and hand lever. This piece of material was bent after pressing the hand lever. Hydraulics press works on Pascal's principle. According to Pascal's law, "The pressure throughout a closed system is constant". At one end of the system is a piston with a small cross-sectional area driven by a lever to increase the force. Small-diameter tubing leads to the other end of the system. It is mainly used for punching, molding, forging, and deep drawing operations. A hydraulic press is a topic of applied science and manufacturing. Fluid mechanics provides the theoretical foundation for hydraulics, which focuses on the engineering uses of fluid properties. In fluid mechanics, hydraulics is used to develop, regulate, and transmission of power by the use of pressurized liquids. Here our objective is to manufacture a mini hydraulic press machine, for press operations.

Keywords: hydraulic jack, mini hydraulic press machine

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NOMENCLATURE

T	Thickness of the cylinder in mm,
Ro	The external radius of the cylinder
Ri	The radius of the inner cylinder
P	Working pressure
M	Bending moment
L	Distance/length of the beam
I	Moment of inertia
H	Height of the frame
F	Factor of safety
F	The load exerted in N
Dp	Diameter of the piston rod
σb	Bending stress
R_b	Reaction at point B
R_a	Reaction at Point A
M_b	Bending moment
Di	The cross-sectional internal diameter of the cylinder
Rx	Horizontal reaction
a_c	Area of the internal cross-section of the cylinder
V	The volume of the crucible
W	Load
Y	Distance from the neutral surface to the end
σt	Maximum permissible tensile stress

Chapter 1

Introduction

1.1 Background of Study

Presses are tools for applying pressure. They are used in industry to cold work metallic objects into a variety of shapes using processes like blanking, piercing, chawing, shaping, bending, and shearing. It is a significant segment of the manufacturing sector that is utilized for the low-cost mass manufacture of parts for domestic electrical appliances, electric motors, and automobile bodies. Every press has a machine frame that supports a bed, a ram, a power source, and a prime mechanism. Presses with a mechanical crank may be hydraulic, pneumatic, or both. The topic of hydraulics focuses on the laws regulating fluid balance and motion and how they might be applied to solve particular issues in a variety of engineering fields [1].

The hydraulic press is a crucial tool for press fitting operations as well as material deformation in processes like metal forming and strength testing in workshops and laboratories. A hydraulic press is a machine that produces compressive force using a hydraulic cylinder. It employs a hydraulic lever, which is akin to a mechanical lever [1]. When very large nominal forces are required, hydraulic presses are preferred. Presses can be divided into three main categories: hydraulic presses, which work on the hydrostatic pressure principle, mechanical presses, which transmit power through the kinematic coupling of parts, and screw presses, which transmit power using power screws [2].

Finding ever more effective and practical ways to push, pull, rotate, thrust, and regulate loads ranging from a few kilograms to thousands of tons has been the focus of technical progress throughout the years. This is frequently accomplished via presses [1].

research on topology-based structural optimization for cost reduction of a 10-ton hydraulic press and a scrap baling press. ANSYS WORKBENCH software was used to apply topology optimization to various parts of a scrap baling press and a 10 Ton hydraulic press. The initial design space of the components was subjected to the appropriate loads and limitations. To use ANSYS software to verify the structural performance, an integrated approach was also developed. In the end, the item that was being manufactured for the press and the shape-optimized design model

were compared. Topology optimization is supposed to lead to more creative and superior product designs [3].

When examining mechanical workshops critically, it becomes clear that the majority of press machines are expensively imported into the nation. It is therefore wise to develop more of these crucial machines here at home. To compete favorably with imported press machines of the same intended capacity, this work shows the construction of a manually operated hydraulic press that is inexpensive, hydraulically operated, and has a high design capacity. The development of more of these machines will reduce their high purchase and import costs, strengthening our local manufacturing sectors [1].

A hydraulic press is a device that produces compressive force using a hydraulic cylinder. It employs a hydraulic lever, which is akin to a mechanical lever. The metallic material is placed in a plate on a hydraulic press, which allows for the crushing, straightening, or molding of the metal. Hydraulic press machines can fully compress any material, unlike their mechanical counterparts. Additionally, hydraulic presses require just half the space of mechanical ones due to their capacity to compress a high pressure into a cylinder with a smaller diameter [4].

By decreasing the time and stress involved in installing and removing bearings and other types of force fits in machine assemblies, the development of the manually operated hydraulic press and pull machine will benefit workshops (especially small and medium-sized ones). This will result in easier and less expensive maintenance and repair of machines and plants. As a result of using only locally produced resources to construct every component of the machine, this effort lessens reliance on imported items and supports domestic technology. Industrial hydraulic presses are often designed or retrofitted to crush or press any "process" or "product". For instance, this could apply to metallic ores, steel plates, aluminum rolls [5].

The production, manufacturing, and metalworking industries all use hydraulic presses as common tools. These devices are utilized for tasks like material stamping, shaping, and bending. For use in small enterprises and at home, mini hydraulic press machines are scaled-down counterparts of industrial hydraulic presses. These machines offer a wide range of advantages, including shorter cycle times, less energy consumption, and lower costs. The goal of this project is to build a compact hydraulic press machine that is easy for regular people to use [5].

1.2 Problem Statement

The Problem with pressing small parts like bearings is that a high-capacity machine is needed, which necessitates a huge power source and more powerful pumps. It expands the machine's size and raises both its initial and ongoing expenses. Compact, effective equipment that can be used for pressing, punching, bending, and forming is what a micro hydraulic press machine is designed to be. The goal of this design project is to create a compact hydraulic press machine that is simple to use, economical, and has a high level of precision and accuracy in its operations. The machine must be able to produce enough force to carry out a variety of activities while upholding safety regulations. Additionally, while reducing the possibility of damage or injury during operation, the design should be flexible enough to accommodate workpieces of various sizes and shapes. To ensure lifespan and dependability, the mini hydraulic press machine should be constructed with the simplicity of maintenance and repair in mind.to addressing the above problem we design mini hydraulic press machine for adjusting and removing of bearing housing and modeling by using solid work soft ware

1.3 Objective of the study

The objective of the current study is classified into two classes. Which are the general objective and specific objective.

1.3.1 General objective

The general objective of this study is to design a mini hydraulic press machine for adjusting and removing bearing housing that is cost-effective, mobile, and energy-efficient for small-scale businesses.

1.3.2 Specific Objective

- To select the appropriate materials of mini hydraulic press machine
- To design the hydraulic bottle jack
- To design the frame of mini hydraulic press machine
- To draw detail drawing and assemble by using SOLID WORK SOFTWERE

1.4 Research question

- How to select appropriate materials?
- How to design hydraulic bottle jack?
- How to design frame?

- How to draw detail drawing and assembly drawing?

1.5 Methodology

In achieving the aim of this work parts of the machine were designed using various design equations. The design result was used to select materials for various components the detailed drawing of the developed hydraulic press machine was done using SOLID WORKS software for the selection of material for the machine, mild steel was used as theoretically sourced material the use of mild steel is because its Strength, rigidity and machinability falls within the design specification. It is also available and cost-effective.

1.6 Scope and Limitation of the study

1.6.1 The Scope of the Study

The scope of this study is to design and construct a mini hydraulic press machine with a maximum force capacity of 10 tons. The machine will be designed to perform basic functions like pressing, bending, and drawing of materials design, analysis and also detail study of parts like hydraulic jack, frame, punch, spring, base. also refer to various methods of fabrication and testing criteria.

1.6.2 The Limitation of the study

In this study we will do only design and analysis of mini hydraulic press machine and modeling by using SOLID WORK but not the real object since the shortage of money, material requirement for the machine, time needed to design

1.6.3 Significance of The Study

To do this project is important to analyze the course we have taken in mechanical engineering for example the course of machine element to design, the course of strength of material, the course of fluid dynamics, and so on. And also, to develop computer skills in auto CAD and solid work. We scientifically did this project since it is the applicant of the University of Arab Minch in practical work and sample projects for university students. The development of a mini hydraulic press machine will be significant as it will meet the needs of small-scale businesses and home enthusiasts who do not have the means to afford larger industrial hydraulic press machines. Furthermore, this study will explore and overcome the current limitations of mini hydraulic press machines, such as mobility and energy consumption. Moreover, the machine's design will be replicable and can be shared with various industries.

1.6.4 Organization of The Study

This study was organized into five chapters. Chapter One introduces the background of the study, the statement of the problem, the objective of the study, scope, limitation, and significance, chapter two is a literature review, chapter three contains the method and material, chapter four, a design analysis and chapter five conclusion and recommendation.

Chapter 2

Literature Review

2.1 Literature Review

According to Santosh Kumar in 2014, Using the optimum resources possible in designing the hydraulic press frame can reduce the cost of the hydraulic press. By optimizing the weight of the material utilized for building the structure. An attempt has been made in this direction to reduce the volume of material. So here we consider an industrial application project consisting of the mass minimization of an H-frame-type hydraulic press. This press has to compensate for the forces acting on the working plates and fulfill certain critical constraints. ANSYS has been used for this analysis. The main aim is to reduce the cost of the hydraulic presses without compromising on the quality of the outbound to design specification, stress distribution, deflection and cost-focused on optimized design. The methodology followed in this work is a comparison of stresses induced in the machine for different thicknesses used for the construction of the frame and column of the H-frame-type hydraulic press [6].

According to Ganesh M Mudennavar in 2018, The hydraulic pressing machine is used for converting the shape of the material to the required form by the compressive force of the section. In this work, a hydraulic pressing machine of twelve tons capacity is designed and analyzed. The design has to resist the generated force during operation and calculate design parameters like stress-induced and total deformation developed during operation. This pressing machine is made for the manufacturing of automotive body buildings and sheet metal applications. The machine is designed for special purposes only and has a load capacity of 12 tons. The structural analysis becomes part of identifying the product design. The frame and cylinder are modeled using CATIA V5 and analyzed by ANSYS software [7].

According to Ms. Kalyani Sengar in 2020, A hydraulic press is a machine that uses a hydraulic cylinder to generate a compressive force. The frame and cylinder are the main components of the hydraulic press. In this project, the press frame and cylinder are designed according to the design procedure. The frame and cylinder are modeled using the modeling software CATIA. Using the optimum resources possible in designing the hydraulic press components can reduce the cost by

optimizing the weight of the material utilized for building the structure. An attempt has been made in this direction to reduce the volume of material. So, in this paper, consideration is given to an industrial application consisting of the mass minimization of an H-frame-type hydraulic press [8].

According to L. Adnan Sheri in 2019, Hydraulics is a topic in applied science and engineering dealing with the mechanical properties of liquids. Fluid mechanics provides the mechanical theoretical foundation for hydraulics, which focuses on the engineering uses of fluid properties. In fluid power, hydraulics is used for the generation, control, and transmission of power by pressurized liquids; here is my system of pressing operation. The hydraulic press depends on Pascal's principle: the pressure throughout a closed system is constant. At one end of the system is a piston with a small cross-sectional area driven by a lever to increase the force. Small-diameter tubing leads to the other end of the system [9].

According to Prof. Kare. K.M in 2021, A hydraulic press is a device (see machine press) using a hydraulic cylinder to generate a compressive force. It uses the hydraulic equivalent of a mechanical lever and was also known as a Bramah press after the inventor, Joseph Bramah, of England. He invented and was issued a patent on this press in 1795. A hydraulic press is a machine using a hydraulic cylinder to generate a compressive force. The frame, hydraulic cylinder, and press table are the main components of the hydraulic press. Hence a hydraulic press is a machine that makes use of the pressure exerted on the fluids to crush, straighten, or mold. The concept of the hydraulic press is based on Pascal's theory, which states that when pressure is applied to fluids in an enclosed system, the pressure throughout the system always remains constant. In a hydraulic press, force generation, transmission, and amplification are achieved using fluid under pressure. The liquid system exhibits the characteristics of a solid and provides a very positive and rigid medium of power transmission and amplification. In a simple application, a smaller piston transfers fluid under high pressure to a cylinder having a larger piston area, thus amplifying the force. There is easy transmissibility of large amounts of energy with practically unlimited force amplification [10]

2.2 Detail components of the mini hydraulic press machine

- Hydraulic Jack
- Spring

- Base
- Movable Plate
- Upper Plate
- Punch
- Frame

2.2.1 Hydraulic jack

A mini-press machine uses a hydraulic jack to apply force to the materials being pressed. The hydraulic jack consists of a cylinder, a piston, and hydraulic fluid. When the hydraulic fluid is forced into the cylinder, it pushes against the piston, causing it to move in a direction toward the material being pressed and generating force. The amount of force generated by the hydraulic jack depends on the size of the cylinder and the amount of pressure applied by the hydraulic fluid. In the mini press machine, the hydraulic jack is used to apply pressure to the die, which compresses the material being pressed. The operator manually pumps the hydraulic fluid into the cylinder using a lever, which causes the piston to move and generate force. As the pressure builds up, the material being pressed is compressed until it reaches the desired shape and density. Hydraulic jacks are widely used in machines that require high force, such as cranes, bulldozers, and presses. They are preferred over other types of jacks because they can generate a large amount of force with a relatively small amount of input energy, making them more efficient and cost-effective.

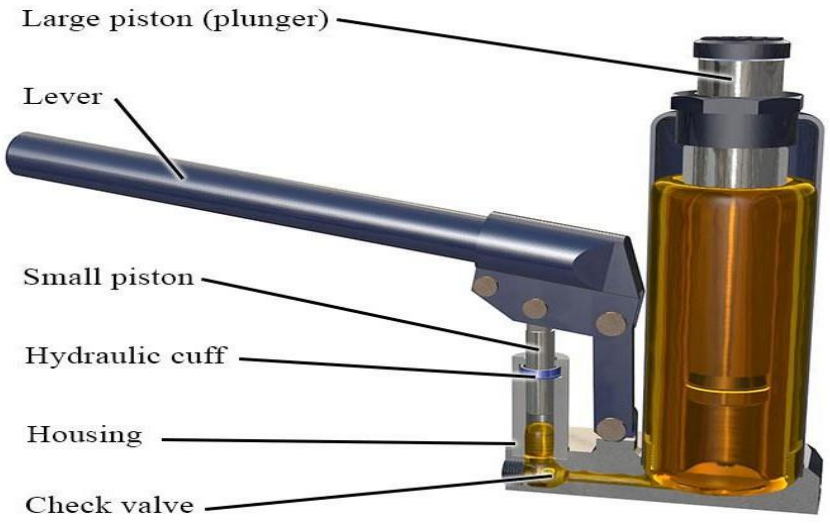


Figure 2.1 Bottle jack design [11]

A. The most common elements

- piston
- plunger
- lever arm
- check valve
- body

How hydraulic jack's work

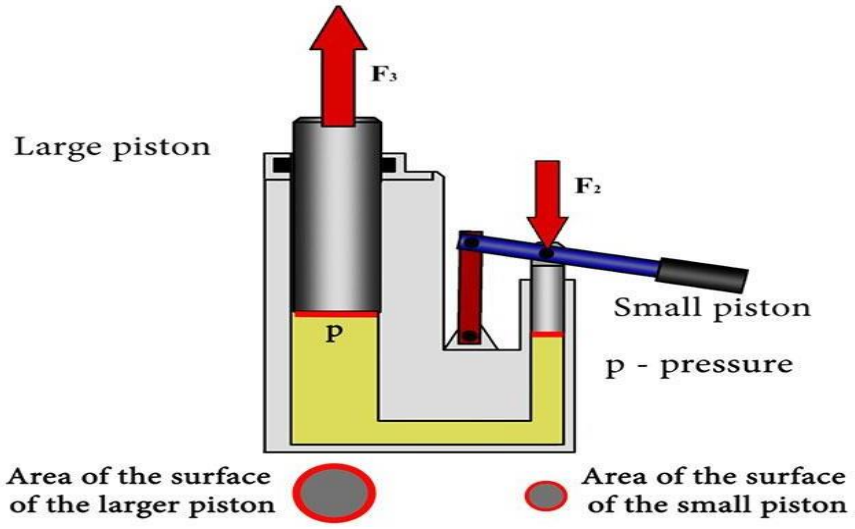


Figure 2.2 works of hydraulic press machine [11]

The small piston is subjected to a force through the use of a mechanical lever, which causes it to travel downward. The ratio of this force to the piston's surface area will be used to compute the pressure beneath the piston. The laws of hydrostatics state that pressure applied to a liquid's surface causes equal transmission of that pressure to all of the liquid's points in all directions. This means that the huge piston will experience the same pressure.

The pressure under both pistons is the same, but the area of the surface of the larger piston is larger, so it can assume a larger force. The larger the area of the piston (plunger) and the smaller the area of piston 1, the greater the amplification factor that can be obtained by using the hydraulic lever. The total displacement of the large piston will depend on the volume of fluid displaced by the small piston. The area of the surface of the second piston is larger; therefore, the distance it is displaced by will be less than the distance that the first piston was displaced by. The check valves

allow fluid to flow in one direction but do not allow it to flow in the opposite direction.

Now, when we pull the handle upwards, the small piston will move upwards as well. The volume of the space underneath it will begin to increase, and the pressure will drop. Valve One will let fluid out of the tank and into the space under the small piston. Valve 2 is installed in such a way that it does not allow fluid to flow out of its place under the plunger. When the small piston reaches the top, we will begin to put pressure on the lever again. Valve 1 will not let fluid into the tank, and valve 2 will allow fluid from under the small piston to flow into the space under the large piston, which will move up a little more. This cycle can be repeated many times: the lever is moved up and the cavity under the pump plunger is filled; the lever is moved down and the liquid is forced out into the space under the large plunger. If the load needs to be lowered, the release valve is opened, and the large plunger moves downward under the effect of the load mass, while the liquid from under it goes into the tank.

2.2.2 Spring

A manual-operated hydraulic press machine typically consists of several components that work together to generate hydraulic force for pressing and shaping materials. One important component of a hydraulic press machine is the spring. The spring in a manual-operated hydraulic press machine is typically located in the hydraulic cylinder, which is responsible for generating the hydraulic force needed for pressing or shaping materials. The spring is designed to provide resistance against the force generated by the hydraulic fluid, which in turn helps to regulate the pressure and force of the hydraulic press. During operation, when the hydraulic cylinder is activated, the hydraulic fluid enters the cylinder and pushes against the spring, compressing it. The compressed spring then works to regulate the force and pressure of the hydraulic fluid, helping to maintain a consistent and controlled level of pressure for the hydraulic press. In addition to regulating pressure and force, the spring in a hydraulic press machine also plays an important role in maintaining the safety and stability of the machine. If the pressure or force generated by the hydraulic fluid becomes too high, the spring will compress further, helping to prevent potential damage to the machine or injury to the operator. Overall, the spring is an important component of a manual-operated hydraulic press machine, helping to regulate pressure and force and maintain the safety and stability of the machine during operation.



Figure 2.3 Spring [12]

2.2.3 Punching

Punching in a manually operated hydraulic press machine involves the process of cutting and forming holes or shapes in a material using a punch-and-die mechanism. The punch and die sets are mounted on the press machine, and the material is placed in between them. The operator then activates the hydraulic system by pumping the handle or pulling the lever, which applies a force to the punch, pushing it through the material and into the die. To perform a successful punch, the operator needs to follow a few steps:



Figure 2.4: punch [13]

Step for successful punch operation

1. Choose the appropriate punch and die size for the desired shape and size of the hole.

2. Secure the material to be punched in place to prevent it from moving during the punching process.

3. Set the depth of the punch to ensure that it goes through the material without damaging the die.

4. Position the punch and die sets correctly on the press machine, aligning them with the material in place.

5. Activate the hydraulic system by pumping the handle or pulling the lever, making sure that the pressure is steady and consistent.

6. Complete the punching process by moving the punch up and down through the material until the desired shape or hole is formed. Once the punch has been completed, the material can be removed from the press machine, and the punch and die sets can be cleaned and adjusted for the next punching process. It is essential to follow proper safety procedures when using a manual-operated hydraulic press machine, such as wearing protective gear, maintaining proper posture, and avoiding any contact with the punch and die sets during the punching process.

2.2.4 Frame

A frame in a manual-operated mini hydraulic press machine is a crucial component that provides structural support and stability to the machine. The frame is responsible for holding the press components together and ensuring accurate alignment during operation. The frame is typically made of high-strength steel or cast iron and is designed to resist the intense force and pressure generated during the machine's operation. It also provides a platform on which the press's movable and stationary components are mounted.



Figure 2.5 frame of the machine

Most mini hydraulic press machines feature a C-frame design, where the frame is shaped like the letter "C" with the opening facing forward. The C-frame design provides excellent stability and makes it easier to access the work area. Apart from providing stability, the frame also houses the hydraulic cylinder, which generates the pressure required to perform pressing operations. The hydraulic cylinder is mounted to the frame using high-strength bolts and is operated using the manual pumping system.

2.3 Application of Manual Operated Mini Hydraulic Press Machine

A manual-operated mini hydraulic press machine is a type of machine that uses hydraulic pressure to generate force to compress or mold different types of materials. These machines come in different sizes and shapes but are generally compact and user-friendly.

Some common applications of manual-operated mini hydraulic press machines include:

- **Jewelry making:** A mini hydraulic press machine can be used for pressing metal sheets and wires to make beautiful jewelry items.
- **Fabric printing:** Textile artists and garment makers use mini hydraulic press machines for printing designs and patterns on fabrics.
- **Woodworking**: The press machine can be used for pressing wood veneers and laminates.
- **Leatherworking:** The press machine can be used to punch holes, emboss designs, or compress leather.

2.4 Advantages and Disadvantages of Manual Operated Mini Hydraulic Press Machine

A. Advantages

- Mini hydraulic press machines are highly effective in generating very high compressive forces that would be difficult or impossible to achieve manually.
- With the manual operation, these machines allow for greater precision and control over the press process.
- Mini hydraulic press machines are relatively compact and easy to store when not in use.
- They are easy to operate with minimal training required.
- No conventional grid electricity is required
- Long operating life

- ❖ Highly reliable and durable
- ❖ Easy to operate and maintain
- ❖ Eco-friendly

B. Disadvantages

- ❖ Manual operation means that they may not produce the consistent force required for large-scale manufacturing.
- ❖ there is a risk of injury to the operator if the machine is not operated properly.
- ❖ Mini hydraulic press machines can be expensive to purchase and maintain
- ❖ Operating speed is low
- ❖ Maintenance cost high
- ❖ Skilled operator required

In conclusion, the design of mini hydraulic press machines involves several factors such as component selection, safety mechanisms, renewable energy sources, and **SOLID WORK** modeling. Further research is needed to explore new designs that can improve efficiency and reduce costs while maintaining safety standards

2.5 Literature review summery and Gap

A literature review summary of mini hydraulic press machines indicates that these machines are compact and versatile tools used for various applications such as small-scale manufacturing, metalworking, and laboratory experiments. They are portable, easy to operate, and offer high force capabilities.

Existing studies highlight the advantages of mini hydraulic press machines, including their ability to exert precise and consistent pressure, their compact size, and their suitability for limited workspace environments. These machines are commonly used in industries such as jewelry making, small-scale production, and scientific research. However, there are some gaps in the literature regarding mini hydraulic press machines. Firstly, there is a lack of comprehensive studies comparing different models and brands, making it difficult for users to make informed decisions when purchasing these machines. Additionally, studies exploring the optimization of machine parameters, such as pressure levels, stroke length, and cycle time, in order to improve efficiency and performance are limited. Moreover, there is limited research on the design and development

of safety features for mini hydraulic press machines, such as emergency stop mechanisms and overload protection systems. Understanding and addressing safety concerns are crucial for ensuring operator well-being and preventing accidents or damage to the equipment.

Lastly, the literature lacks studies that explore the environmental impact of mini hydraulic press machines, such as energy consumption and waste generation. Considering the growing importance of sustainability, a comprehensive analysis of these factors would be valuable for manufacturers and users alike.

In conclusion, while mini hydraulic press machines offer numerous advantages for various applications, there is still a need for more research and exploration in areas such as machine comparison, optimization of parameters, safety features, and environmental impact assessment. Future studies addressing these gaps would significantly contribute to the advancement of this technology.

Chapter 3

Materials and Methodology

3.1 Materials Selection

The selection of the materials depends upon the various types of stresses that are set up during operation. The material selected should withstand it. Another criterion for the selection of metal depends upon the type of load because a machine part resist load more easily than a live load and live load more easily than a shock load [14].

The selection of the material depends upon the factor of safety, which in turn depends upon the following factors.

- Reliabilities of properties
- Reliability of applied load
- The certainty as to the exact mode of failure
- The extent of simplifying assumptions
- The extent of localized
- The extent of initial stresses set up during manufacturing
- The extent of loss of life if a failure occurs
- The extent of loss of property if a failure occurs

Material selection plays a very important role in machine design. For example, the cost of materials in any machine is a good determinant of the machine's cost. More than the cost is the fact that materials are always a very decisive factor in a good design. The choice of the particular material for the machine depends on the particular purpose, and the material for the machine depends on the particular purpose and the mode of operation of the machine components. Also, it depends on the expected mode of failure of the components [14].

Engineering materials are mainly classified as metals and their alloys, such as iron, steel, copper, and aluminum. Non-metals such as glass, rubber, plastic, etc. Metals are further classified as ferrous metals and non-ferrous metals. Ferrous metals are those metals that have iron as their main

constituent, such as cast iron, wrought iron, and steel. Non-ferrous metals are those that have a metal other than iron as their main constituent, such as copper, aluminum, brass, tin, zinc, etc.

Also, certain mechanical properties of metals have greatly influenced our decisions. These properties include:

Strength: A material that can resist the externally applied force without break down or yielding the internal resistance offered without break down or yielding the internally applied force is called stress.

Stiffness: A material can resist deformation under stress.

Elasticity: It is the property of a material to regain its original shape after deformation when the external force is removed.

Plasticity: It is the property of a metathetic retaining the deformation produced under load, permanently.

Ductility: A very important property of the material enabling it to be drawn into wire with the application of a tensile force. A ductile material is both strong and plastic.

Brittleness: It is the properties of a material opposite to ductility, it is the property of breaking of a material with little permanent deformation when subjected to tensile load, brittle materials snap off without giving any sensible elongation. Cast iron is a brittle material.

Hardness: It embraces different properties such as resistance to water, scratching, deformation.

3.2 Methodology

Designing a mini hydraulic press machine requires a structured approach that involves several stages. The following is a general methodology that can be used to design a hydraulic press machine.

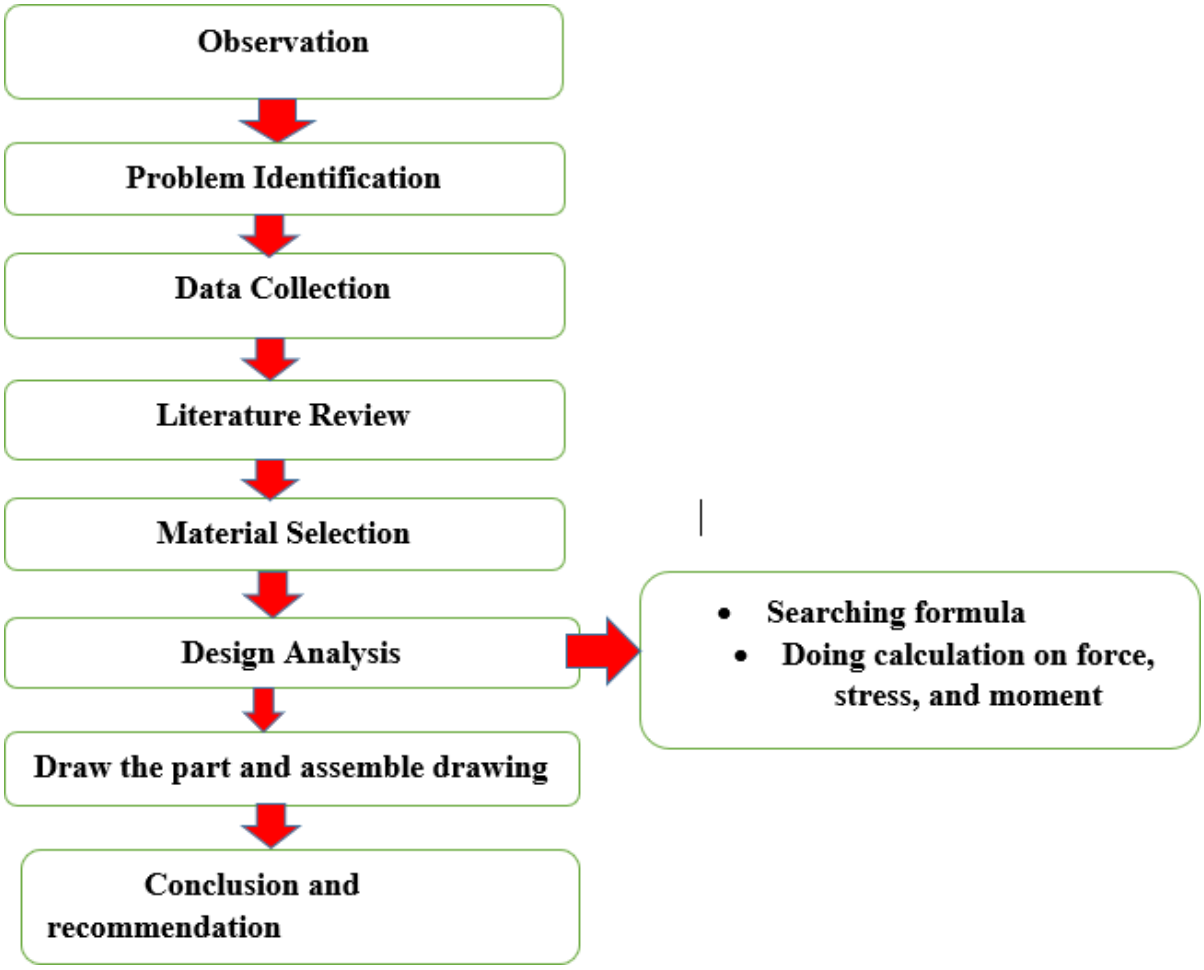


Figure 3.1 Methodology Chart

In designing a machine component, there is no rigid rule. The problem may be attempted in several ways. However, the general procedure to solve a design problem is as follows:

1. **Recognition of need**. First of all, make a complete statement of the problem, indicating the need, aim or purpose for which the machine is to be designed.

2. Synthesis (Mechanisms). Select the possible mechanism or group of mechanisms which will give the desired motion.

3. Analysis of forces. Find the forces acting on each member of the machine and the energy transmitted by each member.

4. Material selection. Select the material best suited for each member of the machine.

5. Design of elements (Size and Stresses). Find the size of each member of the machine by considering the force acting on the member and the permissible stresses for the material used. It should be kept in mind that each member should not deflect or deform than the permissible limit.

6. Modification. Modify the size of the member to agree with the past experience and judgment to facilitate manufacture. The modification may also be necessary by consideration of manufacturing to reduce overall cost.

7. Detailed drawing. Draw the detailed drawing of each component and the assembly of the

Chapter 4

Conclusion and Recommendation

4.1 Conclusion

A hydraulic press machine has been developed. The machine was fabricated using locally made materials. The machine is capable of performing various press works. The design has a main focus on reducing operator fatigue and increase safety. It can able to perform multi-operations by just changing the Punch like punching, molding, forging, bending, and deep drawing operations. Mild steel is used to make the hydraulic press as it is cheap and the best material, and also it is easily available material in the market. It has high bending & tensile strength, and is compatible with operation like punching, molding, forging, and deep drawing operations.

4.2 Recommendation

We recommended that the design of mini hydraulic press machine for adjusting and removing of the bearing housing, the bearing ring, pressing small object, bending sheet metal by using mini hydraulic press machine. we use in this design ten Ton jack having limiting performance but increasing the performance of machine increasing the jack capacity. This is a compact hydraulic press that is ideal for small scale application such as bending pressing and straightening it has a 10- ton capacity and easy to operate when choosing a mini hydraulic press machine consider the capacity durability and ease of use also, make sure to choose a model that is suitable for our specific application.

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APPENDIX

APPENDIX A: DETAIL, ASSEMBLE AND EXPLODED DRAWING

APPENDIX B: TABLES

Table 1 material property

AISI	Type	Special properties	Heat Treatment	Yield MPa	UTS MPa	Elong %	BHN
1040	Plain carbon	Medium strength	Normalized	374	589	28	201
			Quench & Temper	593	779	19	262
1340	Mn Steel	High strength as normalized	Normalized	558	836	22	248
			Quench & Temper	1593	1806	11	505
2340	Ni Steel	Medium strength + LT toughness	Normalized	490	722	22	205
			Quench & Temper	776	883	19	248
3140	Cr-Ni Steel	Medium strength + corrosion resistance	Normalized	485	770	22	212
			Quench & Temper	766	883	20	248
4140	Cr-Mo steel	High temperature strength	Normalized	655	1020	18	302
			Quench & Temper	1641	1772	8	510
4340	Ni-Cr-Mo steel	Highest strength + toughness	Normalized	861	1279	36	363
			Quench & Temper	1675	1875	10	520
5140	Cr steel	High strength + corrosion resistance	Normalized	427	793	23	229
			Quench & Temper	1641	1793	9	490
6140	Cr-V Steel	High temperature strength	Normalized	615	939	22	269
			Quench & Temper	1689	1931	1	610

SAE / AISI Number	Condition	Tensile Yield Strength (0.2% offset)		Ultimate Tensile Strength		Elongation over 2 in	Brinell Hardness
		kpsi	MPa	kpsi	MPa	%	-HB
1010	hot rolled	26	179	47	324	28	95
	cold rolled	44	303	53	365	20	105
1020	hot rolled	30	207	55	379	25	111
	cold rolled	57	393	68	469	15	131
1030	hot rolled	38	259	68	469	20	137
	normalized @ 1 650°F	50	345	75	517	32	149
	cold rolled	64	441	76	524	12	149
	quench & temper @ 1 000°F	75	517	97	669	28	255
	quench & temper @ 800°F	84	579	106	731	23	302
	quench & temper @ 400°F	94	648	123	848	17	495
1035	hot rolled	40	276	72	496	18	143
	cold rolled	67	462	80	552	12	163
1040	hot rolled	42	290	76	524	18	149
	normalized @ 1 650°F	54	372	86	593	28	170
	cold rolled	71	490	85	586	12	170
	quench & temper @ 1 200°F	63	434	92	634	29	192
	quench & temper @ 800°F	80	552	110	758	21	241
	quench & temper @ 400°F	86	593	113	779	19	262
1045	hot rolled	45	310	82	565	16	163
	cold rolled	77	531	91	627	12	179
1050	hot rolled	50	345	90	621	15	179
	normalized @ 1 650°F	62	427	108	745	20	217
	cold rolled	84	579	100	689	10	197
	quench & temper @ 1 200°F	78	538	104	717	28	235
	quench & temper @ 800°F	115	793	158	1 089	13	444
	quench & temper @ 400°F	117	807	163	1 124	9	514
1060	hot rolled	54	372	98	676	12	200
	normalized @ 1 650°F	61	421	112	772	18	229
	quench & temper @ 1 200°F	76	524	116	800	23	229
	quench & temper @ 1 000°F	97	669	140	965	17	277
	quench & temper @ 800°F	111	765	156	1 076	14	311
1095	hot rolled	66	455	120	827	10	248
	normalized @ 1 650°F	72	496	147	1 014	9	13
	quench & temper @ 1 200°F	80	552	130	896	21	269
	quench & temper @ 800°F	112	772	176	1 213	12	363
	quench & temper @ 600°F	118	814	183	1 262	10	375

Table 2 Basic dimensions for square threads in mm (normal series) for design of mini hydraulic press machine according to IS: 4694-1968

(Reaffirmed 1996

Nominal diameter (d_1)	*Major diameter*		*Minor diameter*	*Pitch*	*Depth of thread*		*Area of core* (A_c) mm^2
	Bolt (d)	*Nut* (D)	(d_c)	(p)	*Bolt* (h)	*Nut* (H)	
22	22	22.5	17				227
24	24	24.5	19				284
26	26	26.5	21	5	2.5	2.75	346
28	28	28.5	23				415
30	30	30.5	24				452
32	32	32.5	26	6	3	3.25	531
(34)	34	34.5	28				616
36	36	36.5	30				707

Table 3 Basic dimensions for square threads in mm (Fine series) according to IS : 4694 – 1968 (Reaffirmed 1996)

Nominal diameter (d_1)	*Major diameter*		*Minor diameter*	*Pitch*	*Depth of thread*		*Area of core* (A_c) mm^2
	Bolt (d)	*Nut* (D)	(d_c)	(p)	*Bolt* (h)	*Nut* (H)	
10	10	10.5	8	2	1	1.25	50.3
12	12	12.5	10				78.5