

Semi-Automatic Paraphernalia for Technical Hitches In Brick Moulding Process

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Abstract:- Bricks manufacturing is the process which involves how an initial form of sand is made into a solid brick which could withstand a heavy load for a long period of time in any atmospheric condition. Countries like India and Bangladesh are the leading producers of bricks in Asia. As the population of these countries is dense, there always comes a need of bricks for constructional purposes in these countries which in turn resulted in the large scale manufacturing of bricks. Large scale industries which are involved in the brick manufacturing process uses advanced machinery for the brick production process. Even though the finishing of brick done by these machines is accurate and precise, these machines cannot be afforded by the people who are doing this brick manufacturing process in rural places. We had done some research about the brick manufacturing process in rural places and sorted out some difficulties faced by those labours working in brick kilns. Now we had designed a semiautomatic brick moulding machine which will help the labours to reduce their work load. Even though there are many semiautomatic machines, we had developed a modified form of the machine which doesn't need an electrical source for its working. Our machine carry out only the initial process of brick making, that is moulding of the brick before making it to dry in sun. Hence this machine speeds up the process of moulding by increasing the number of mould and hence will help the manufacturer to increase their production and quality.

I. INTRODUCTION

Brick Moulding process is one of the important process carried out in Brick industries. This is the main process from which the shape of the bricks are obtained. The finishing obtained in this process will determine the strength and stiffness of the brick. As we all know that the countries like India, Bangladesh are very densely populated, the need for construction of huge buildings are also increased highly. To satisfy the demand of the increasing population, there comes the need to increase the production of bricks which are required in huge amount for construction. The brick manufacturing is carried out hugely in countries like India, Bangladesh, which are densely populated. [1]Brick industries contributes to about 10% of the country's economy. These industries employ more labour and hence solve the problem of unemployment. In rural areas the conventional methods of brick manufacturing is carried in large scale. These rural manufacturing sectors mostly employ conventional methods. This is because these industries don't have good financial support to afford machinery for advanced processing of bricks. The conventional methods are tedious process which involves much labour and skilled employee. This process also involves usage of more man power. Many labours have many difficulties while working in the industry. We had done some research about this process in the industry and found out that the labours are feeling difficulties in the process of moulding the brick. Hence we concentrated on the moulding process and tried to design a semiautomatic machine for these people. Our machine reduces the labours work load and also increases the no of bricks production. Hence this machine is going to reduce the work load of these rural people and will help them to do the work peacefully and quickly. The fig 1.1 shows which are the different processes that are used in many countries.

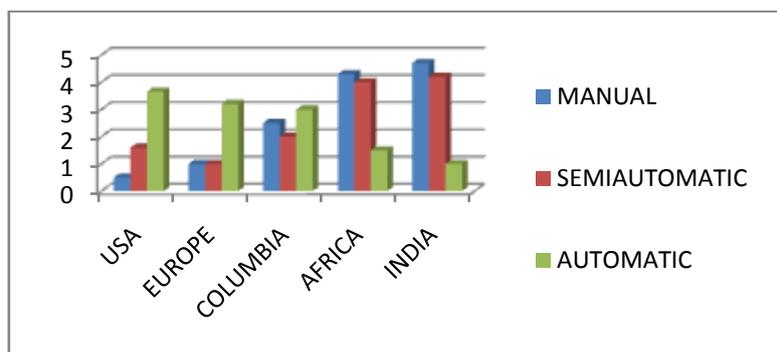


Fig 1.1 Brick making process followed in many countries

PROCESS OF BRICK MAKING

The conventional method of brick making process involves five main process. Those process are as follows:

- Mixing of clay and water
- Moulding
- Drying
- Firing
- Packing

These are the five main processes carried out in brick making sectors. Among these process, moulding plays a key role in obtaining the shape of the brick. In small scale industries this process is carried out with the help of the mould which is in the shape of the brick. The dimension of the mould is similar to that of the brick that has to be obtained as the product. Moulding process consume more time and energy. In conventional method maximum of three bricks are produced from one mould. Let us discuss in detail about all the process involved in brick making.

➤ 2.1 mixing of clay and water:

[2]In this process , 20%-30% of water is added to the clayey soil. The mixture forms the sloppy mud which is used for moulding. The quantity of water added for the preparation of sloppy mud must be precise. A little excess addition of water may result in reduction in quality.



Fig: 2.1 A Mass of Sloppy Mud



Fig: 2.2 Aluminium Mould

➤ 2.2 MOULDING:

It is the most important process in brick making. This process decides the quality of the brick and its finishing. In this process brick moulds are used for moulding process. These moulds are made of aluminium to avoid rusting. In this process the moulds are filled with the sloppy mud. Before adding the sloppy mud a little amount of water is sprayed on the walls of the mould . This will help in giving a good finishing and easy removal of mould. The sloppy mud is filled in the mould and the mud is evenly spread. Then the mould is turned upside down to lay the brick in the floor and left for drying.

➤ 2.3 DRYING:

It is the process in which the moisture content of the bricks are removed. In this method the bricks are dried under the heat of sun. As India lies over the equator of the earth, many places in India experience hot climate. Hence no external setup is required for this process of drying.[2] In this process about 80% of the moisture content is removed and the brick becomes stiff and strong. Fig 2.3 shows how the drying of bricks are carried out in rural industries.



Fig: 2.3 Bricks are dried under hot sun



Fig: 2.4 Firing process in brick industries

➤ **2.4 FIRING:**

Firing is the process in which the bricks are heated to very high temperature using a fire source. This process totally removes the moisture content of the bricks and make them tough. In rural areas, by burning the firewood, the firing process is carried out. Firing must not be done for a long time. Long time exposure to heat will create cracks in the brick, hence the firing process must be carefully done.

➤ **2.5 PACKING:**

After the process of firing the slid bricks are allowed to cool and then packed for export and sales. Cooling of these bricks after firing is required to reduce the temperature of the bricks. These are the five process involved in solid brick making.

TECHNICAL HITCHES IN MOULDING

Moulding is one of the toughest process which involves more labour and time. There are many difficulties faced by labours during this process. This is the reason why we had designed a semi-automatic equipment to assist them. In moulding process the mixture of clay and water is made into the shape of rectangular solid brick. In this process a aluminium mould is used to obtain the shape of the brick. In earlier days the mould used where made of iron. Due the rusting in iron, these moulds worn out easily. Hence in earlier days the mould are often replaced. Now these moulds are of made of aluminium. As aluminium could withstand stress and it is rust free, it is used for making the mould. In moulding process each brick is moulded manually by labour. Maximum of three mould box is used in manual process. We had visited some brick kilns in rural places and estimated the time for doing one mould. For producing three mould it takes about 55 seconds. Labours have to spend more energy for doing this process. After loading the sloppy mud , the mould becomes heavy. It is very difficult to carry the mould from one place to another. Hence we shorted out the difficulties in this process and designed a equipment which may help the labours to reduce their work load. This device will also need man power to get operated. We had purposely made this equipment as a manual machine. On making it manual, the employment of the labour will not be affected and simultaneously their work load will also be reduced. Using our machine in same 55 seconds we can produce nine blocks of brick. Hence this will reduce the time of moulding process.



Fig: 3.1 Moulding by hand



Fig: 3.2 Conventional moulding process

II. EXISTING MACHINES FOR MOULDING PROCESS

There are many advanced machinery available for moulding purposes. Many large scale industries uses fully automated machines in which moulding is done automatically.[4] This machine available in market gives good finishing to the bricks and reduces the cost of production. These machine involves the usage of electrical energy for running the motor. The cost of these machines are very high. These machines have a system called extruder, which place a important role in moulding process. The extruder's job is to remove the moisture content of the sloppy sand coming through it. The sand coming out of extruder will be like a tightly packed solid. This will also will have perfect finishing and will help in easy drying of the bricks.



Fig: 4.1 Extruded sand



Fig: 4.2 Automatic machine

Fig 4.1 shows the block of extruded sand obtained from automatic machine. The above diagram shows how the sand comes out of the extruder. The extruding process is a very expensive process and in turn makes the machine cost to go up. These machine reduces labour cost and improves the quality of bricks. In rural areas, the brick manufacturing is carried out in small scale. These machines cannot be afforded by them. [3]The machine shown in Fig 4.2 is a small movable brick moulding machine. This machine itself will cost up to Rs. 100000. The motors and engine used in this machine will increase the cost of the machine.

QUOTATION

SUB: - Quotation for "ALLTECH" Brand Bricks Machine.

Dear Sir,
Thank you for contacting us about Alltech Brand Bricks Machine. Kindly go through to our quotation as under:

Sr. No.	Job Description	Qty.	Price in Rupees
01	"ALLTECH" Brand Mobile Bricks Molding Machine, Model: ABM-1000Q With Standard, make 6.5 HP Diesel Engine, 15 nos. Stainless steel mold with logo, 2 nos. Trolley, Automatic Mold cleaning system	01	3,50,000/-
02	Extra Mould	01	2,200/-
03	Extra Trolley	01	5,000/-

Fig: 4.3 Quotation for automatic machine

The above image shows the quotation for a fully automated machine. The cost of the machine as given by the company is Rs. 350000. So small scale industries are not buying these machines. Instead they are using labour power. In rural India, there is a availability of huge human source. Hence only large scale industry employs machine in manufacturing. Our equipment mainly aims at the rural people and to reduce their workload. Our equipment doesn't need electricity. Hence the process will not depend on the electricity. In rural areas electricity is provided only for a particular period of time in a day. Hence the problem of electricity is going to play a main role in the production of bricks in rural area. So our machine reduces the labour work without the help of electricity. In rural areas, they used to do moulding process in a open space. Hence electrical wires cannot be connected to these machines. Hence automatic machines cannot be employed for these people. This is the reason why we had designed a semiautomatic machine. In this machine there is no need for any electrical devices. This will facilitate them to comfortably carryout their process. These are some of the advantages of our machine.

SEMI-AUTOMATIC PARAPHERNALIA FOR TECHNICAL HITCHES IN BRICK MOULDING PROCESS

Brick moulding equipment is simple tool designed to reduce the work load of the labours working in the brick making industries. This equipment is used to mould bricks in a easy and efficient way. Our equipment consists of many parts. Let us discuss about each part in detail.

CONSTRUCTION

The different parts of our equipments are as follows:

- The outer casing
- The mould box
- Rammer
- A crank and Links
- Scriber

These are the five main parts present in our brick moulding equipment.

• Outer casing:

The below diagram shows the outer casing of our equipment. The outer casing consists of a rectangular casing supported by six legs. Four legs are at the two extremes of the body and other two are present at the middle of the casing. A slider runs throughout the length of the casing. this slider is provided for the movement of scriber from left to right or from right to left. At the left end of the equipment a small water tank is provided. This tank consists of water and it will hold the scriber after scribing. The casing is made of steel. The casing must be made strong to withstand the pressure and force acting on it. In the slider through which the scriber is moving is provided with two inclined cuts to facilitate the movement of the mould box. The inclined hole is provided in such a way that the holes dimension is smaller than the scriber. This avoids the slipping of the scriber while sliding.



Fig: 5.1 Outer casing



Fig: 5.2 Mould box

- **The mould box:**

The mould box is a box in which the sloppy sand is loaded into. [6]The mould box is made up of aluminium. Aluminium makes the box light in weight and rust free. The mould box is attached to the crank shaft. When the crank shaft rotates the mould box is lifted up. The name to be written on the bricks is mounted on the bottom of the box.

- **Rammer:**

The rammer is another important part of the moulding equipment. Rammer is made up of mild steel to withstand forces acting on it. Rammer consists of two arms. These are attached to the outer casing of the machine. The rammer is operated using a simple lever mechanism. The end of the arm is attached to the top layer of the rammer. The centre of the arm is screwed to the casing. Hence this acts as a lever.

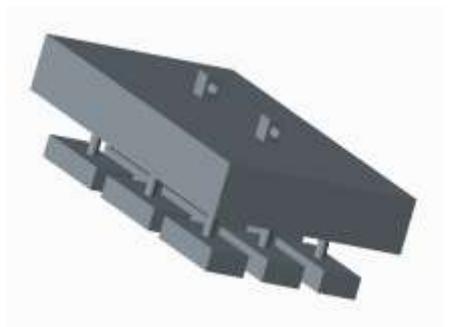


Fig: 5.3 Rammer

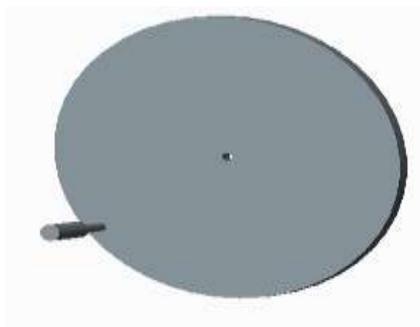


Fig: 5.4 Crank

At the bottom layer of the ram, nine solid blocks of steel is attached perpendicular to the mould box. These steel block are used to ram the sloppy mud present in the mould. This makes the sloppy mud to pack tightly without any air gap.

- **Crank and links:**

The crank of this equipment is large circular disc made up of steel. [5]The cranks are the device which are used to rotate something. Here we had used the crank to rotate the mould box. The cranks are connected with the mould box through a link. The centre of the crank is fitted to the casing about which it rotates. The diagram 5.4 shows the crank of our equipment. It should be made with large diameter to make the mould box upside down. A projection is also given to attach the link with the crank. Fig 5.5 shows the link of our equipments.



Fig:5.5 Links



Fig: 5.6 Scriber

- **Scriber:**

The scriber is a device which is used to remove the excess sloppy mud from the mould box. It consist of a flat base which is used to remove the excess sand. In our equipment the scriber moves along a slider. A horizontal rod is inserted inside the slider which in turn is connected with the base. The scriber is kept immersed inside the water tank. This will help in providing good finishing to the mould. Fig 5.6 shows the scriber of our equipment.

III. WORKING OF THE EQUIPMENT

Let us now discuss in detail about the brick moulding equipment.

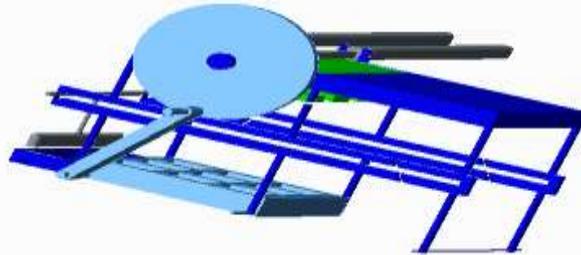


Fig: 6.1 Moulding equipment

Fig 6.1 the isometric view of the brick moulding equipment. This equipment follows the same process that is followed in the conventional method. This machine follows very simple mechanical concepts, hence it does not need any skilled labours. Now let us see in detail about the step by step process involved in the working of the equipment. The first and foremost process involved is loading the sloppy mud in the machine. This has to be done manually by the labours. There is no need to load the sand with a specific amount. They can load it randomly with any measure. The sand must be spread over all the holes. Now the sand would be unevenly spread over the moulds. After loading the sand, the next step to be followed is ramming. Ramming is one of the important process that is used to make the sloppy sand to fit into the mould. The rammer works with the principle of lever mechanism. The arm of the lever is screwed at the centre. Hence a rocking motion can be obtained in the rammer.

The rammer can be made to move up and down using this mechanism. By giving upward force at the end of the arm, we could obtain the downward movement of the rammer. Similarly by applying downward force on the arm we could obtain the upward movement of the ram. The ram is moved up and down so that the sloppy mud gets tightly filled in the mould box. About 6-7 times the ram must be moved up and down to make the sand to fit tightly without any air gap. This will help in giving a perfect shape to the brick to be formed. [7]After finishing the process of ramming, we have to carry out scribing. Scribing is the process which will help in removing excess of sand that is lying over the mould. It also plays a important role in giving a good finish to the lower surface of the brick. The scriber is attached to a slider running along the whole length of the casing. The scriber is moved through a small spacing provided in between the slider. For easy movement of the scriber the spacing provided must be little greater than the dimension of the scriber handle. This facilitates the easy movement of scriber with less friction. Scriber is dipped in water before sliding over the mould in order to provide surface finishing for the bricks.



Fig: 6.2 Surface finishing process done by hand.

In Fig 6.2 we can see the procedure for giving a surface finish to the mould in conventional method. In this the labour uses the water to get a good finishing on the bottom surface of the brick. Similar action is done

by the scriber in our equipment. The scriber is moved from left to right which will remove the excess sand over the mould.

The scriber must be dipped in water so that it will contain water in it. This is the process involved with the scriber part. Now the sand is ready to mould into a required shape of brick. To obtain the correct form of brick, the mould must turn upside down. Hence the next process we are going to carry out is making the mould upside down. This can be done by using a simple mechanism. The mechanism involves a crank and a link as a connecting rod. There are some essential conditions to be followed to achieve the mechanism. To achieve the mechanism the diameter of the crank should be made large. The link should be shorter than the crank diameter and must be attached to it and the mould box. So when we rotate the large crank the link attached to it will lift up. At a certain angle of the crank, the link attains an angle of 90 degree. Due to the weight and the gravity action, further movement of the crank will make the link to go in opposite direction. This results in upside down movement of the mould box. And by reversing the crank the mould box is brought to its original position. After making the mould box to come to its initial position, the whole equipment is moved to the next position. Then the similar process is carried out for producing the next set of bricks. The most important thing that has to be done in the production of brick process is giving a good finishing to the bricks. In our equipment the finishing obtained is little better than the finishing obtained by conventional methods. This equipment reduces the labours effort and gives good finishing to the bricks.

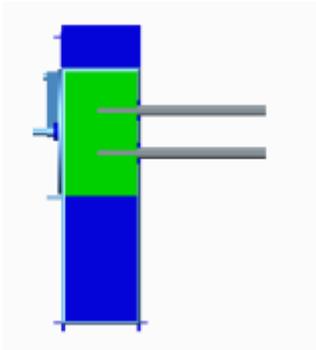


Fig: 6.3 TOP VIEW

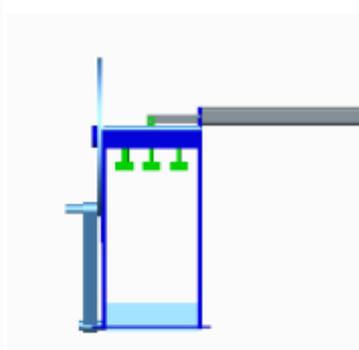


Fig: 6.4 SIDE VIEW

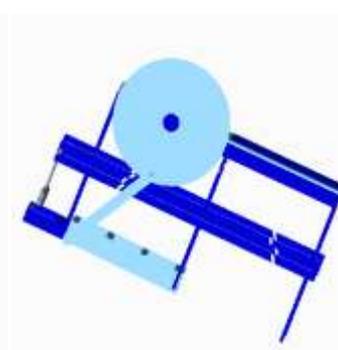


Fig: 6.5 FRONT VIEW

IV. FORMULA AND CALCULATION

To calculate the weight of the machine we used simple relations between mass, volume, density. We had planned to make the mould box with aluminium and the other parts of the machine from mild steel. Hence we calculated the mass of those parts using the following relation:

$$\text{Mass (kg)} = \text{Density (kg/m}^3\text{)} * \text{Volume (m}^3\text{)}$$

To calculate the torque required to drive crank, we use the torque formula. The torque formula is given by

$$\text{Torque} = \text{Force (given by us)} * \text{Diameter}$$

To calculate the ram movement we use the simple lever equation. The basic lever equation helps in finding the distance at which the ram's fulcrum has to be fixed, so that the arm can exactly ram the sand in mould.

$$\text{Load arm} * \text{load} = \text{effort arm} * \text{effort}$$

To calculate the angular displacement of the mould box with respect to crank rotation we have to carry out the same process carried out in cam analysis. Cam analysis method of simple harmonic motion is used to project the mould box movement.

V. COST CONSTRUE

From the design created by us we had estimated the whole cost of our design. [8]The below table shows the material we used and their cost.

S.NO	MATERIAL	QUANTITY	COST
1	Mild steel	65kg	Rs.3250
2	Aluminium	0.750kg	Rs.172.5
3	Scriber sponge	1	Rs.50

Approximately the material cost will be up to Rs. 3500. Then for constructing the machine using welding, lathe works of the machine will cost around Rs. 5000. The total cost of our machine will be equal to Rs. 10000 approximately.

VI. ADVANTAGES OF THE EQUIPMENT

The first and foremost advantage of our machine is that it is cost effective. Comparing to other moulding devices available in the market, our equipment will be cheaper. The main reason for its less cost is that the design of our equipment is simple. There is no electrical or electronic materials used in our equipment. This automatically reduces the cost of the machine. This equipment will help in reducing process time. It speeds up the moulding process by producing more bricks at a time. Normally it takes 1.25 minutes for the workers to mould 3 bricks. By using our machine in the same time we can mould 9 bricks. This also will act as a main advantage of our machine. Implementing our machine is not going to affect the employment of the rural people as it is a semi automated equipment. The machine involve labour source. Finishing can be obtained better than the conventional process. The materials in our equipment are very cheap and easily can be replaced. This equipment is cost effective, comfortable, and easy to handle. These are some of the advantages of our equipment.

VII. CONCLUSION

This is a simple idea implemented by us to improve the brick production in rural India. Our next level in this project will be to make it as a automatic machine with much reduced cost. This equipment will help the labours in the rural area to reduce their work burden. This will also help the company to improve their production rate and their quality by giving a good finishing to the bricks.

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