

Development and Fabrication of Semi-Automated Wall Plastering Machine

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ABSTRACT

Plastering is the plasterwork which is done manually with the effort of human in most of the parts of the world by plasterboard because of this there is a huge demand of labor which increases labor cost and finally, increases the cost of Construction. The quality of plastering mainly depends upon skill of labor. Hence plaster surface may or may not be smooth and even. The solution for the same is automating the plastering technique so that the cost of construction can be saved and plaster surface will be smooth. The plastering machine can plaster the wall automatically faster with greater surface finish. Due to this overall plastering time and cost are saved.

Index Terms: *Plastering, Plasterboard, labor cost, Automation, plastering time, Surface finish etc.*

I. INTRODUCTION

Construction sector is responsible for the progress of any country, because Nation growth depends upon civilization, industrialization and Transportation which has initial stage of construction. Construction revolution has made the contractor to equip their equipment to perform with maximum output at minimum cost. In order to achieve maximum output following parameters should be taken in account. They are labor cost, and plastering time. These parameters should be minimized. For this either skilled labor or automatic plastering system are required. With constant increase in the demand of Construction, and quality of the construction to remain same in the competitive market, Contractor are forced to improve their construction. Construction Sector is the biggest economic sector which amounts 10-20% of gross national product. Because of labor demand and step by step plastering technique, it is still slow process. So, for improving the economic growth of the country and glory of country, the technique of plastering must be improved.

The construction of building, apartment, complex, home and Shops are basic requirement of human beings. Wall plastering is one of the main processes in building construction which improves the beauty of the building. Plastering also improves the wall strength, protect the wall from moisture. Wall plastering also improves outer and inner look of particular room. The tool and materials for this includes trowels, hammer, plaster board, sand, cement, and other various ingredients. Since wall plastering is done manually, this intimates us towards automating the plastering technique.

II. Objectives

- To Study and understand the problem of existing wall plastering methods.
- To Develop and Fabricate semi-automated wall plastering machine and to study its performance.

III. LITERATURE REVIEW

The construction of a building consumes lot of time, Due to the requirement of skilled labor and helping worker to construct or plaster the wall. So it leads the increase in the labor cost in building areas. Then come to the history of plastering has been explained below:

Nowadays, For unskilled labour, plastering is difficult task in construction site. If plastering is to be done we need a skilled labour and they charges more labour cost. In other way after plastering of a wall by

manually there is chances of not getting the flat and smooth finishing. Drying time has also been reduced because of other advancements in the plastering industry, processing methods being another such reason. This is great news for plasterers, it means that instead of plastering taking weeks to complete, a job can now be completed in a matter of hours.



Figure 3.1 a & b are Manual methods of plastering

The manual plastering can lead to excess shrinkage and cracking after the walls have been plastered. The various types of surface finish are as follows:

- a) Smooth finish, which can be obtained by using a wooden float, steel trowel.
- b) The maximum size of sand and crushed stone or gravel vary from 12.5 mm to 6.5 mm.



Figure.3.2Automated method of plastering machine.

The construction sector the process of work is to be done by manually, here manual work required lot of time to complete the given job within the time period. So we are introducing the machine for wall plaster technique in the field of construction / building sector, the initial cost of the machine is maximum as per our estimation, because it improves the efficiency of the wall plastering quality. The wall plastering which gives good look to walls and protect the walls. It initiative towards the automation in plastering techniques. [1]

In the construction of building which requires more time, Due to the shortage of skilled labors and the availability of the workers. More ever the plastering of the wall is takes more time because outlook of the wall should be looks good. In the construction site a building consists of residential building and infrastructure of the building, here in both the sector plastering is compulsory. So we are showing a interest on automate the plastering method with a machine it does not required any skilled labor and need only helper to operate the machine in field.[2]

In this concept machine-driven is to rendering machine works with cement mortar that gives smooth finishing of the wall plaster in flat surface. In the machine we can adjust the thickness the wall plaster as per our requirement size. This type of machine are mainly used to construction of big buildings like malls, villas, plots, etc., here this concept can improve the further technology. This machine is not a fully automated machine to plaster the wall it requires one skilled labor, more helpers in further we can reduce that as make the machine fully automated with self mixing of cement mortar. The present work is to develop and testing of the wall plastering machine.[3]

IV. METHODOLOGY

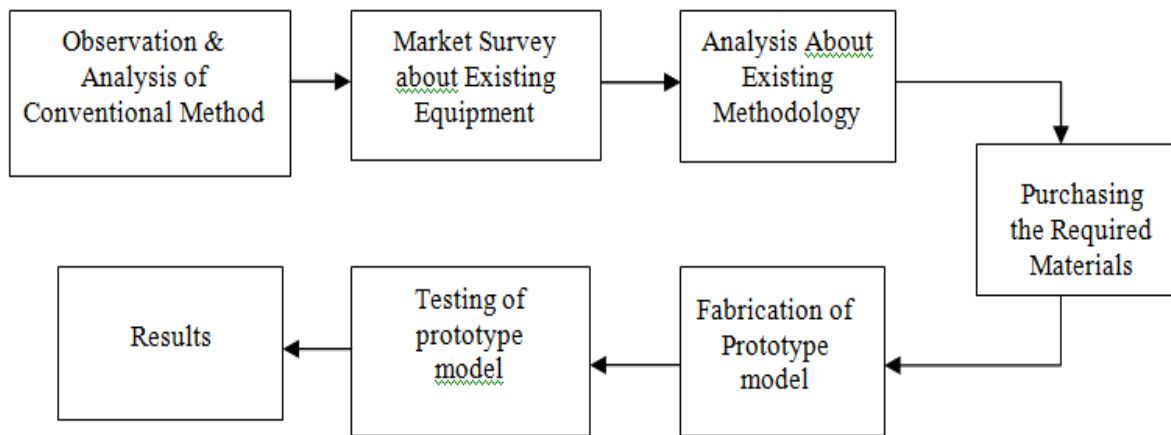


Figure4.1. Methodology

- Observation and analysis of the conventional methods used to plaster walls.
- Market survey about any existing tools, equipment and machineries.
- Analysis about the existing methodology.
- Methods to tackle the disadvantages in the current methods.
- Design of machine components.
- Development of machine components.
- Fabrication of the designed model.
- Testing of the model in construction field.

V. SYSTEM REQUIREMENTS

5.1 Frame

A fixed structural engineering is the load resisting constructed with straight or curved members inter connected by rigid connection is resist movement included with the joint of members.

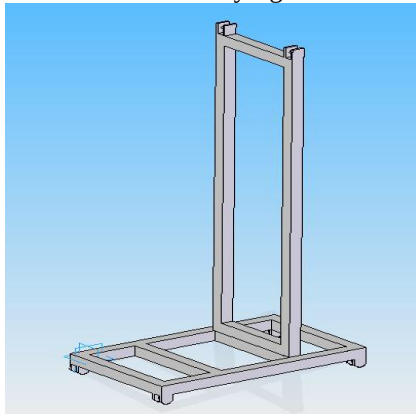


Figure 5.1 Frame

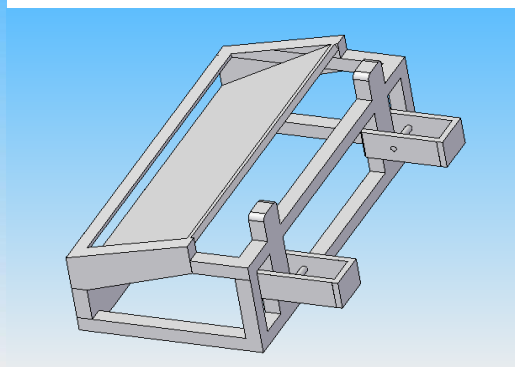


Figure 5.2 Carriage

5.2 Carriage

A carriage is a movable part design for carrying loads. It houses different components like rollers, motor, belts, pinion, etc.,

5.3 Motor

A motor is an electrical device that converts electrical energy into mechanical energy. Electric motor can be powered by direct current source, alternative current source.

Motor specifications:

Power of motor: 0.5 HP

Speed of motor: 1440 rpm
Frequency: 60 Hz

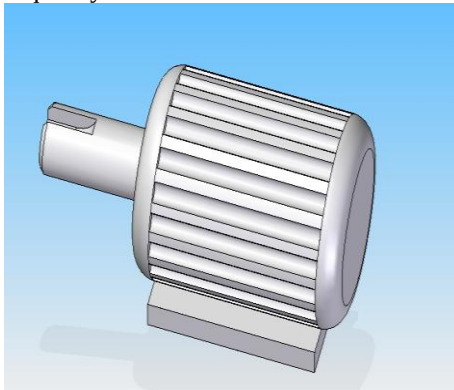


Figure 5.3 Motor

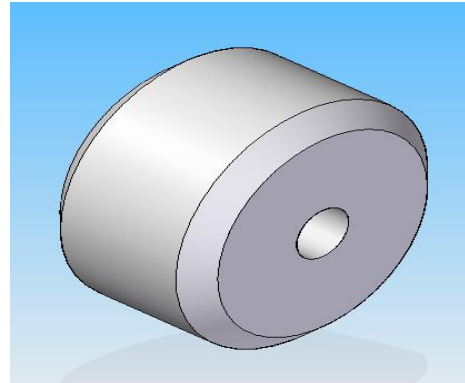


Figure 5.4 Roller

5.4 Roller Bearing

A **Roller** bearing is a typically have higher radial load elements for supporting loads and reducing friction.

5.5 3-Phase Electric wire

3- Phase power refers to three wire Alternating Current power circuits.

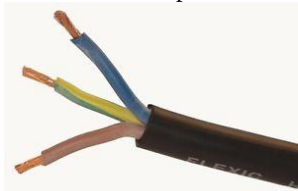


Figure 5.53-phase Electric Wire



Figure 5.6L.T control switch.

5.6 Low Tension Control switch

L.T Switch arealso known as Reverse and forward switch. It is an electrical component that can make or break an electrical circuit, interrupting the current or diverting it from one conductor to another.

5.7 Shaft

Shafts are made in to circular cross-section and it may be solid or hollow. The elements that support rotating parts like gears and pulleys and it turn are themselves supported by bearings resting in the rigid machine housing.

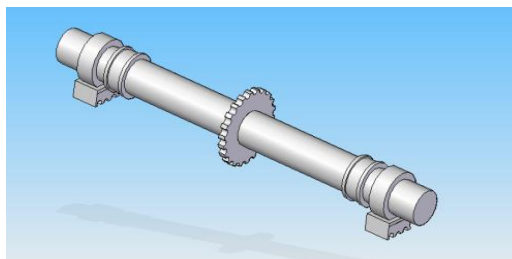


Figure 5.7 Shaft

VI CONSTRUCTION

After purchasing the raw material (like square pipe, L-channels, pulleys, roller bearings, Gear box, AC motor); square pipes and L-channel are cut down into the required dimension. These cut parts are assembled using arc welding which gives rise to a frame and carriage. The carriage is attached to the frame with help

of roller bearings and the wire rope so that the carriage will slide over the vertical guide. The wire ropes are clamped to the shaft and further shaft is connected to motor with the help of gear and gear box. Motor is driven electrically.



Figure.6.1.a & bSemi-automated wall plastering machine.

VII. Comparison

	Manual	Semi-automated wall plastering machine
Plastering Thickness	12mm	8-12mm
Plastering speed	2.5m ² /hr	2.5m ² /30 min
Material	More material required compared to plastering machine as there is more wastage of mortar.	Less material required, compared to conventional method as less material wastage is there.
Rendering speed	Low	High
Workers required	- By manually 1 Manson and 2 helpers are required for the plastering of a 20m² wall per day(8hours) 3 labor / 20m² wall.	Here 2 labors are required for 20 m ² wall, one for operate machine and another for pouring of mortar to complete the plastering of a wall
Rendering quality	Relay on the skilled Workers Manually sum percentage of mortar is wasting during plastering.	Better surface finish Based on model design
Coating	Several times	One time
Cost	- For a wall of 2.5m² a labor charges Rs.87.5/- per 1 Hour. - For a wall of 20m² a labor charges Rs.700/- per 8 Hour.	- Here we required non-skilled labor. - For a Non-skilled worker charges per day(8 Hours) Rs.450/-
Time Requires	8 Hour per 20m ² wall	Approximately 2 Hour per 20 m ² wall

VIII. Advantages, Limitations and Applications

8.1 Advantages

1. It is time and money saving.
2. It saves labor and other related cost.
3. It increases the productivity.
4. It was observed that wastage was reduced by 0%.

5. The working conditions, preparation are similar to the manual rendering method.
6. Machine cost will be less than existing machines.

8.2 Limitations

1. It is difficult to repair damaged plaster using semi-automated wall plastering machine.
2. It does not have automated loading of mortar.
3. It cannot plaster curved and inclined wall.

8.3 Applications

1. Semi-Automatic plastering machine is one type of unique machine will be used in construction field.
2. It helps to save time, labor cost, raw material. hence this machine is economically efficient.

IX. Conclusion

The present works carried out by applying mortar into tray and also apply the pressuring to mortar to make the surface level. The Semi-Automatic plastering machine model been developed and tested successfully. During the trials of the machine we noted that the machine is more productive compared to the manual plastering technique by a labor, It also achieved more quality than the manual work. It helps to reduce the time and money. By saving in time, raw material, labor cost the overall price of the construction is low and hence the machine is economically good than the manual plastering technique.

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