

DESIGN AND FABRICATION OF AUTOMATIC WALL PLASTERING MACHINE

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ABSTRACT

The aim of project is to fabricate plastering machine. Plastering is the plasterwork which is known as ornamentation done by plasterers on walls. The advantages of using this machine are for saving in man power, raw material and cycle time. The building construction is time consuming sector because lot of work is labor based there is too much shortage of skilled labor, increase in labor cost and technological advances are forcing rapid change in the construction of building. Building construction mainly consists of commercial infrastructure and residential building, plastering work is must in every sector. We are introducing new machine to automate the rendering work which is very much demand for construction field.

This innovative idea is to render the plasters on walls automatically. The aim of this idea is to reducing the work of plasterer. It is feasible, light weight, inexpensive and simple structure comparing to the existing machine. It was done by hard work, smart work and contentiously effort, by helping the supervisor of project and trying in the workshop. This innovative process keeps up with the ever changing world of building automation.

Key word :- Automation, Plastering, rendering, cement mix.

1. Introduction

Plastering is that the rendering work that is understood as ornamentation done by plasterers on walls by manually in most elements of the globe. The plaster desires a lot of effort of labours and conjointly consumes longer in manual method. This innovative machine is exclusive and may be one quite automatic coating machinery ideally appropriate for the construction/building trade. It will plaster the wall mechanically by moving upward and downward motion in vertical direction. It will be plastered by one-time in vertical direction. Its two rails for rising and moving mechanically, so it will be used for various height and dimension of the wall. Its massive capability hopper and you'll be able to place the mortar in it one-time. It's simple to work. Simple to maneuver, while not removing any elements of the machine and there are roller wheels below the machine for simple movement. With the constant increase within the demand of the development, the contractors forced to extend their construction work and conjointly the standard of the development to stay within the competitive market. It's still labour demand and conjointly most of the work concerned is repetitive.

1.1 Objective

Automation is one of the numerous and evolving disciplines among all technologies. The aim of this innovative plan is to render the plasters on walls mechanically. This concept aims in reducing the work of labours. It's possible, light-weight weight, cheap and easy structure scrutiny to the present machine. This innovative method keeps up with the ever ever-changing world of building automation.

- It is the new machine used to reduce human work especially work of plasterers.
- It is the machine, instead of handmade in construction plastering area.
- It is very easy and simple to operate.
- It is not much expensive when compare to its previous versions.
- Simple structure, light weight, small cubage, easy to operate.
- Saving more than 20% raw material (cement & sand).

1.2 Literature Review

We have been taken the idea of automatic wall plastering machine with the help of following literatures.

1. Design and Fabrication of Automatic wall plastering Machine:

Author Name: Mahesh P.K, Shree Rajendra

Journal Name: IOSR Journal of Mechanical and technology.

This work includes applying the mortar into the wall and additionally pressuring mortar with a creating surface level. The model has been developed and tested with success. With this development the 2 major downside construction industries presently facing are often reduced. They're consummate labor shortage and Quality within the construction method with less wastage. Through the trials it's noted that the machine is a lot of productive compare to the labor with relevancy the rendering work and additionally the standard achieved is sort of admire the labour.

2 Automatic Plastering Machine:

Author Name: Arivazhagan B.

Journal Name: International Journal of Advanced analysis in physics, Communication & Instrumentation engineering and development.

Machine-driven rendering machine is exclusive and maybe one reasonably machine-driven rendering machinery ideally appropriate for the construction/building business. Machine-driven rendering machine works with typical cement mortar that brings it to a swish, flat end with variable and adjustable thickness to suit every application. Machine-driven rendering machine makes rendering easier, faster, and easy as compare to manual application. This concept also can additional increased by interfacing liquid crystal display & computer keyboard for creating the method while not external supply.

3. Automatic Wall Plastering Machine:

Author Name: Arunkumar Birder

Journal Name: International Journal of Engineering and Technical Research (IJETR) ISSN: 2321-0869 (O) 2454-4698 (P), Volume-4, Issue-1, January 2016

The building construction is time consuming sector because lot of work is labor based there is too much shortage of skilled labor, increase in labor cost and technological advances are forcing rapid change in the building construction. Building construction mainly consists of commercial infrastructure and residential building, but in every sector plastering work is must. We are introducing new machine to automate the plastering work which is very much demand for construction field. The machine consists of AC/D C motor, Gear box, wire rope, pulley, tray mechanism, guide ways, etc. The present work developed model of wall plastering machine.

2. Construction and Working

The structures are fabricated by using required necessary components like steel frame, metal bars, power screw, AC/DC motors, different wheels nut and bolts. All these are well assembled as for the requirement.

The mechanical design of our project covers the 70% of the design of automatic plastering Machine.

• The enhanced mechanical design for the automatic wall plastering machine consists of:

- Mix plastering material will put on slope of the middle section of machine
- Vertical rail guide to move the middle section vertically.
- Vertical head to hold the middle part and move along vertically.
- Middle section to hold the cement mix temporarily.
- Aluminum sheet to evenly smudge the cement on the wall

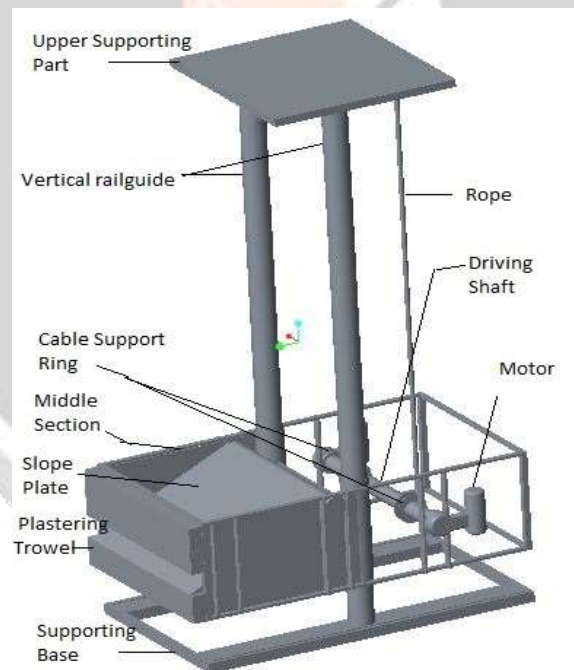


Fig -1: 3D View of Plastering Machine

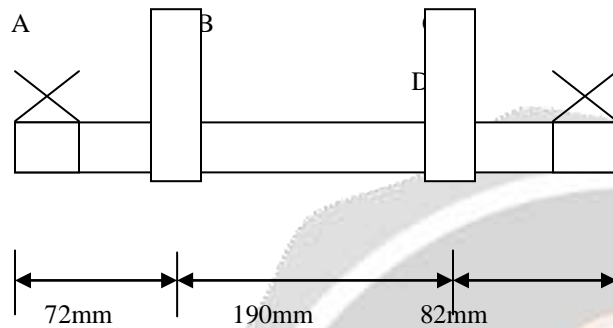
2.1 Working

The machine consists of a metal frame, sheet metal tray supported by middle section Frame, guide ways and motor. Initially, the plastering machine has to be placed near the wall which has going to plaster. The machine should be in leveled. Then the cement mixture which consists of cement and sand in the ratio approximately around 1:4 is poured into inclined plate of the tray. The lifting force is transferred to tray through power shaft, which driven by DC motor.

The linear movement to the tray assembly is given through a guide way. The main part is fixed to vertical column of metal rod and another part of guide way is fixed to tray setup. Applying pressure or vary the thickness of plaster is done.

3. Design of Machine

Design of shaft:



Consider a support reaction at a point A & B & considering vertical load at B & C

$$R_{AV} + R_{DV} = 3.188 + 3.188$$

$$R_{AV} + R_{DV} = 6.376 \text{ N} \quad \dots\dots\dots \textcircled{1}$$

Taking moment at pt. A

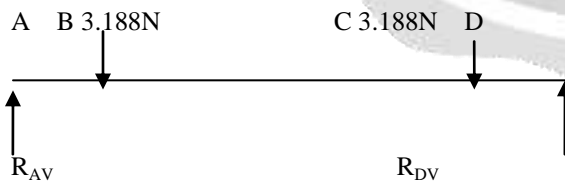
$$3.188 * 0.072 + 3.188 * 0.262 - R_{DV} * 0.344 = 0$$

$$R_{DV} = 3.095 \text{ N}$$

$$\textcircled{1} \rightarrow R_{AV} + 3.095 = 6.376$$

$$R_{AV} = 3.281 \text{ N}$$

The bending moment at pt A & D is zero



And the bending moment at pt. B

$$M_{BV} = 3.281 * 0.072$$

$$= 0.236 \text{ Nm}$$

The bending moment at pt C

$$M_{CV} = 3.095 * 0.082$$

$$= 0.253 \text{ Nm}$$

Resultant bending moment at pt. B & C

$$R_{BH} = R_{CH} = 0$$

$$M_B = \sqrt{MBV^2 + MBH^2}$$

$$= \sqrt{(0.236)^2 + 0} = 0.236 \text{ Nm}$$

$$M_C = \sqrt{MCV^2 + MCH^2}$$

$$= \sqrt{(0.236)^2 + 0} = 0.253 \text{ Nm}$$

Select maximum = 0.253 Nm at pt.C

Now,

Material for shaft Fe360

$$S_{yt} = 220 \text{ N/mm}^2$$

$$S_{ut} = 360 \text{ N/mm}^2$$

Now according to A.S.M.C Code

$$\tau = 0.18 * S_{ut} = 0.18 * 360 = 64.8 \text{ N/mm}^2$$

$$\tau = 0.30 * S_{yt} = 0.30 * 220 = 66 \text{ N/mm}^2$$

Select $\tau = 64.8 \text{ N/mm}^2$ where for gradually,

Now we know that $K_b = 1.5$ applied load

$K_t = 1$ for rotating shaft

$$\tau_e = \sqrt{(K_b * M_b)^2 + (K_t * T)^2}$$

$$= \sqrt{(1.5 * 253)^2 + (1 * 10910)^2}$$

$$= \tau_e = 10916.598 \text{ N/mm}^2$$

We know that,

$$T_{\max} = \frac{\pi}{16} * \tau_{\max} * d_s^3$$

$$10916.298 = \frac{\pi}{16} * 64.8 * d_s^3$$

$$D_s = 16$$

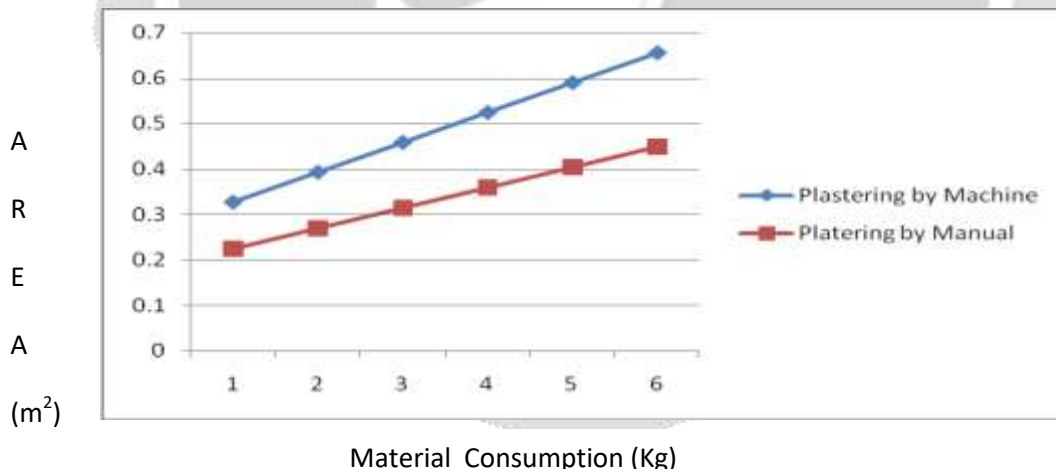
4. RESULT :

Table no. 4.1 shows the cement mix required to plaster the particular area is given as under by machine and by manual method.

Table No.4.1 Area of Plastering Vs. Material Consumption

Sr. No.	Cement Mix (Kg)	Plastering Area(m ²)	
		By Machine	By Manually
1.	5	0.328	0.225
2.	6	0.3936	0.27
3.	7	0.4592	0.315
4.	8	0.5248	0.36
5.	9	0.5904	0.405
6.	10	0.6560	0.45

- Plastering by Machine : $1.435m * 0.4572m = 0.6560m^2$ in 10 kg material consumption
- Plastering by Manual : $0.4572m * 0.9842m = 0.45m^2$ in 13kg material consumption



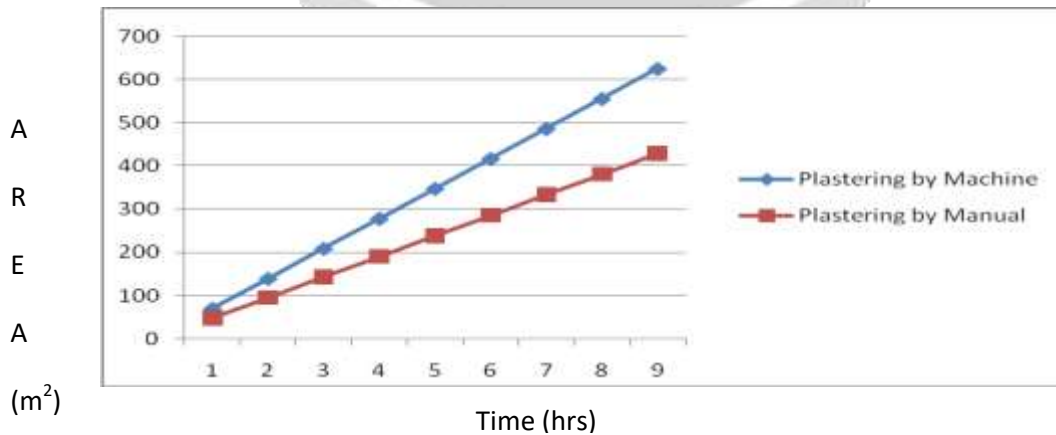
Graph No. 4.1 Area of Plastering Vs. Material Consumption

- From this graph No. 4.1, it is found that, the plastering machine plastered more area by less consumption of material.
- Table no. 4.2 shows that the time required to plaster particular area is given as under by machine and manual method.

Table No. 4.2 Area of plastering Vs. Time

Sr. No.	Time (hrs)	Area Covered (m ²)	
		By Machine	By Manual
1	1	69.46	47.64
2	2	138.9	95.28
3	3	208.35	142.92
4	4	277.8	190.56
5	5	347.25	238.2
6	6	416.7	285.84
7	7	486.15	333.48
8	8	555.6	381.12
9	9	625.05	428.76

- Plastering by Machine : $1.435\text{m} \times 0.457\text{m} = 0.6560\text{m}^2$ in 34 seconds
- Plastering by Manual ; $0.4572\text{m} \times 0.9842\text{m} = 0.45\text{m}^2$ in 34 seconds



Graph No. 4.2 Area of plastering Vs. Time

- From this graph No. 4.2, it is found that the plastering machine plastered more area in less time.

5. CONCLUSION

- 1) From graph no. 4.1 we can conclude that, the plastering machine plaster more area as compared to manual method for same material consumption.
- 2) From graph no. 4.2 we can conclude that, the plastering machine plaster more area as compared to manual method for same time.

6. REFERENCES

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