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# Design and Fabrication of Semi Automatic Wall Plastering Machine

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**ABSTRACT:** The main aim of this research work is to reduce the plastering work and cost by designing & fabricating the semi-automatic wall plastering machine. Automatic machines has been developed to automate the plastering work, so that there will be a saving of period, labour cost and getting good plaster finishing to the walls but problem addressed here is, it consumes a lot of power to lift the main chamber with cement mix to plaster the walls due to this electricity cost will be more [1]. In order to overcome this problem, we are introducing a semi-automatic wall plastering machine, in this machine lifting of main chamber with cement mix can be done by manually by rotating the handle which is connected to worm wheel with steel rope drive mechanism. The pushing of cement mix in the main chamber is done by belt conveyer and rotor which is driven with the help of gear box sprocket, which is driven by electric motor. [2]

**KEYWORDS:** Semi-automatic wall plastering machine, Fabrication, Plastering, AC Motor, Cement mix, Worm wheel.

## I. INTRODUCTION

Wall plastering is the main procedure among the followed in the building construction, which is used for plaster the walls of the construction to get smooth and finished wall surfaces. Plastering is also essential to give specified strength to the walls; it protects the walls from moisture from both the sides. This innovative machine is unique and perhaps one kind of automated plastering machinery ideally suitable for the construction industry. It works with conventional cement mortar which brings it to a smooth, flat finish with variable and adjustable thickness to suit each application. It can plaster the wall manually by moving up and down in vertical direction by manually. It can be plastered by one-time in vertical direction. [3]

## II. NEED

1. The semiautomatic wall plastering machine will help to save labour cost.
2. To avoid the wastage of the mortar, thus to save the cost.
3. To save the shortage of skilled labour.

## III. DESIGN OF MACHINE COMPONENTS

### 3.1 Loads on Hopper

Plastering Width = 2ft = 0.6096m

Plastering height = 6ft = 1.8288m



Plastering thickness = 1cm = 0.01m

Mortar mixing proportions: 1:4 (normally)

Density of wet mortar,  $\rho = 2400\text{Kg/m}^3$

Plastering Volume,  $V = 0.6096 \times 1.8288 \times 0.01$

$V = .01114\text{m}^3$

$m = \rho V$  ..... (1)

$m = 2400 \times 0.01114 = 26.75\text{Kg}$

(1) Total weight on hopper including cement mixture = 80Kg

(2) Maximum force acting on rope is  $F = W \times g$  ..... (2)

$F = 80 \times 9.81 = 784.8\text{N}$

**3.2 Rope Design**

Approximate weight on hopper = 20kg

Axial load acting on rope = 80Kg

Select rope material as steel wire.

Taking F.O.S. for steel wire as (lifting) = 3.5

Nominal breaking strength of rope

$\sigma_{break} = 1770\text{N/mm}^2$

Allowable Stress

$\sigma_{allowable} = \sigma_{break} / F.O.S = 1770 / 3.5 = 505.7\text{N/mm}^2$  ..... (3)

We know that,  $F = 80 \times 9.81 = 784.8\text{N}$

$\sigma_{allowable} = F / A$  ..... (4)

Where,  $A = \pi d^2 / 4$

$d = \text{diameter of rope in mm}$

$\sigma_{allowable} = F / (\pi d^2 / 4)$

$505.7 = 784.8 / (\pi d^2 / 4)$

$(\pi d^2 / 4) \leq (784.8) / (505.7)$

Therefore  $d \leq 6.2$

Selecting diameter  $d \leq 8\text{ mm}$  safe for design.

**3.3. Design of Column**

Material used = Mild Steel

Factor of safety for steady loads  $F.O.S = 4$

Young's modulus = 210 GPa

Moment of inertia of cross-section:

$I = (BH^3 - bh^3) / 12$  ..... (5)

$I = \{[0.05 \times (0.15)^3] - [0.045 \times (0.125)^3]\} / 12 = 1.4 \times 10^{-5}\text{m}^4$

Effective Length ( $L_e$ ) =  $L / 2 = 1.8 / 2 = 0.9\text{ m}$

Crippling Load  $P = \pi^2 EI / (L_e^2)$

$P = (\pi^2 \times 210000 \times 1.4 \times 10^{-5}) / 0.9^2 = 35.8\text{KN}$

Safe load = Crippling Load /  $F.O.S = (35.8 \times 10^3) / 4$   
 $= 8950\text{N}$

### 3.4 Chain and Sprocket Calculations

We assume,

Front sprocket teeth  $T_2 = 43$

Rear sprocket teeth  $T_1 = 14$

Single Phase 1 HP Motor

Rated Power = 0.75 KW

Velocity Ratio =  $T_2 / T_1 = 43/14 = 3.07$

### 3.5 Motor Gear Design

Motor used = Single phase, 1 HP AC Motor

Speed of Motor  $N_1 = 1420$ rpm

Pulley diameter  $D_1 = 40$ mm

### 3.6 Design of worm and worm wheel

Materials used are

- 1) Worm Wheel : Cast Iron
- 2) Worm : Cast Iron

Ultimate Strength of Cast Iron : 200 MPa

Number of teeth on worm : 4

Number of teeth on worm wheel : 26

Gear ratio :  $26/4 = 6.5$

## IV. FABRICATION OF MACHINE

The semiautomatic wall plastering machine was fabricated using components like steel rope, frame, sheet metal, metal bars, worm wheel and worm, wheels, and nuts and bolts.



Fig.1 Semiautomatic Wall Plastering Machine



#### V. WORKING OF THE MACHINE

Initially, bring the machine close to the wall to be plastered. Cement and sand mixing takes place roughly in the proportion of 1:4 in mortar is poured into the hopper-tray, which is lifted by means of a rope by manually. After plastering completes, than mortar flows downwards due to gravitational force. The wedge plate applies pressure on to the cement mixture so that the cement adheres to the wall. The clearance between the wall and machine can be adjusted as per the thickness of the plaster. When the carriage moves upward, the mortar gets applied, and the downward movement sees that the finishing of the plaster is done [4].

#### VI. CONCLUSION

Semi Automated plastering machine is unique and perhaps one kind of semi automated plastering machinery which is ideally suitable for the construction industry. Semi Automatic wall plastering machine has been developed to apply the mortar on the vertical walls with pressure and having the capability of adjusting the mortar thickness manually. The developed model has been tested and the performance is found satisfactory. The developed semi automatic plastering machine will solve the issues like shortage of labour, raise in labour cost, etc. It is observed that the wastage of mortar is reduced more than 60 % and thereby reduces the raw material requirement.

#### REFERENCES

- [1] Shreeranga Bhat, et al (2017) "Design and Fabrication of Wall Plastering Machine", *Journal of Mechanical Engineering and Automation*, DOI: 10.5923/j.jmea.20170705.07, Volume 7, Issue 5, pp-159-163.
- [2] Arunkumar Biradar, et al (2016) "Automatic Wall Plastering Machine", *International Journal of Engineering and Technical Research (IJETR)* ISSN: 2321-0869 (O) 2454-4698 (P), Volume-4, Issue-1.
- [3] Arivazhagan.B, (2014) "Automatic Plastering Machine", *International Journal of Advanced Research in Electronics, Communication & Instrumentation Engineering and Development* Volume: 2 , Issue: 2.
- [4] Mahesha P. K, Sree Rajendra (2014) "Design and fabrication of automatic wall plastering machine prototype", *IOSR Journal of mechanical and civil engineering*, volume 11,issue 4, pp 01-06.
- [5] G. Pritschow, J et al, "On site Mobile Plastering Robot: A Practical Design Concept", Dept. of Machine & Robot Systems, University of Stuttgart, Germany.
- [6] Johan Forsberg, Roger Aarenstrup, "A Construction Robot for Autonomous Plastering of Walls and Ceilings". Robotics and Automation, Lulea University of Technology, Sweden.



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