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Design and Fabrications of Vibrating Table for Concrete Mould

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Abstract: ***The proposed concept in this project is to use vibrations to replace human labor of eliminating air bubbles from concrete blocks with the help of a vibrating motor arrangement. Concrete is made up of aggregate, water, and cement in a composite form. They generate a mass fluid that can be easily molded into different shapes for varied functions when combined in certain ratios. Concrete must be free of entrapped air and voids to achieve the appropriate strengths. Concrete consolidation is used to accomplish this. The process of eliminating entrapped air from a concrete mold is known as consolidation. Unbalanced eccentric assembly, stand frame, top plate as platform, springs, spring suspension system, and electric motor are the primary components. A lot of mistakes should be made when a person works by hand. It also required lots of workers and production does not come in required amount during that day so the vibrating table will save time as well as money. The removal of these spaces enhances the exterior surface of the molded concrete, allowing for the use of less water with cement, resulting in a considerably stronger finished product, and this was accomplished using a vibrating table. The goal of this project is to build a concrete vibrating table that efficiently ensures concrete consolidation for a better product. These concrete molds can be used to make concrete roof tiles and concrete paving bricks. Although there are various existing vibrating tables, our job was to develop and maybe manufacture an improved vibrating table using locally available materials.***
Keywords: Vibrating Motor, Stand Frame, Top Plate, Spring Suspension System, Nut, Bolt, Etc.

I. INTRODUCTION

Concrete vibrating tables have been used to minimize concrete porosity and improve the bond between the reinforcement and the concrete. The quality of the concrete was directly proportional to its consolidation. A freshly made batch of concrete had entrapped air, which was honeycombed. If the concrete is allowed to harden in this state, it will be non-uniform, porous, and poorly bonded to the reinforcing. It would also have an unattractive appearance. If the mixture is to have the properties that are generally wanted and expected of concrete, it must be consolidated. Consolidation is the process of reducing voids in freshly mixed concrete or mortar during placement to induce a closer arrangement of the solid particles, usually through vibration, centrifugation, rodding, tamping, or a combination of these actions. Composite materials are final products made up of at least two or more components that have better properties than the individual components. The inability to obtain a homogeneous structure is one of the most significant issues in the creation of composites. The air spaces that remain in the structure are one of the most crucial factors. When compared to the ideal homogeneous structure, an increase in the amount of air space may cause one of the composite's desirable features to be negatively affected. Vibration tables are commercially produced and sold. The vibration table is an important machinery in the preparation of concrete molds for use in products manufactured with aggregate and in constructions. The market's products were evaluated, and common traits were discovered. The width, depth, and height of the vibration tables with the smallest and greatest dimensions, respectively, are 450x400x420 mm and 1260x1270x1200 mm. Another factor to consider is the power of the electric motor that drives the table. 170 W and 746 W are the smallest and biggest values, respectively. single phase 220 V is used to charge the electric motor. The number of revolutions is usually less than 2500 -3000 rpm. A mechanical vibration table with a constant amplitude and varied frequencies was designed and manufactured in one study. A vibratory spring was used to drive the table, which resulted in a sinusoidal motion. The fresh concrete should be compacted to the highest possible density. It doesn't have any air pockets in it. A table vibrator was used to provide vibrations to samples prepared for fresh concrete for various durations in this study. When compared to non-vibrated samples, vibrated samples demonstrated higher compressive strength and unit weight. In the carbonation of concrete, all parameters that determine durability are also effective. Accelerated Carbonation tests can be performed in both natural and laboratory settings. In this study, concrete was compressed using the vibration technique, and accelerated carbonation tests were performed at various humidity rates on samples that were thought to contain the least and most voids.

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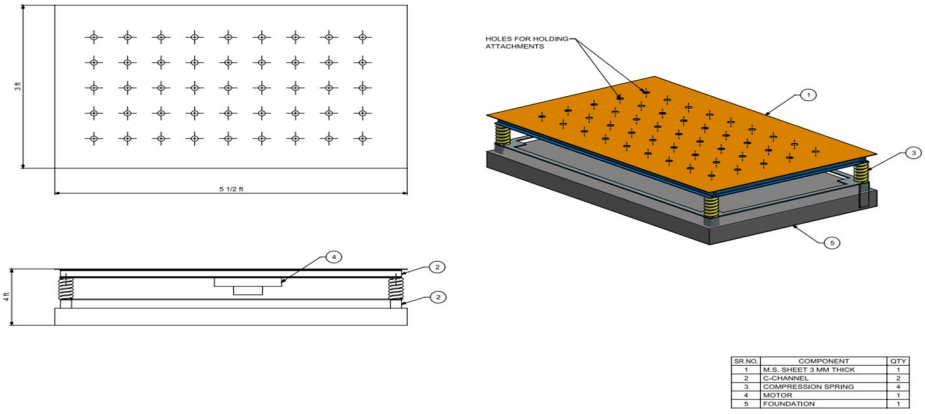
Fig .1.1 Open Vibrating table

II. METHODOLOGY

Older machines have also been considered for this project. The old machine used for cushioning rubber for vibration did not have a fix with the concrete mold. But now we use springs, first draw a layout diagram as per standard size of table (5x3) feet and list out roughly material for making bottom structure. We use MS angle (35x5mm) for making rigid bottom structure. After that bottom structure corner MS pipe (3") welded and they guide Helical compression spring vertically, if machine get ON springs do not move any other directions it stable at own position then top plate or top structure making by MS C Channel sections (3'') it provides heavy weight. This channel was welded as per standard size table (5x3 ft) and same MS pipe welded to corner for supporting and guiding springs. We fixed the motor at center of top table by nut bolt arraignment. In above top structure wooden plate are mounted and fixed it. After that 4 helical compression springs (length 18") install bottom structure each then top plate is mount over it. Spring is detachable and if it is damaged it is easy to replace.

III. DESIGN OF TABLETOP

The design of rigid tabletop that had a motor directly attached, that for any load size, such design has proven to be advantageous in maintaining a constant amplitude of vibration. They discovered that the amplitudes of the tabletop should be between 0.3 and 0.4 mm after improving our background investigation. Because of the modest amplitudes. We decided to preserve the existing tabletop thickness of 6 mm to provide the requisite stiffness while minimizing cost. A wooden sheet is also used for table top it light weight and no corrosion occur



SR.NO.	COMPONENT	QTY
1	M.S. SHEET 3 MM THICK	1
2	C-CHANNEL	2
3	COMPRESSION SPRING	4
4	MOTOR	1
5	FOUNDATION	1

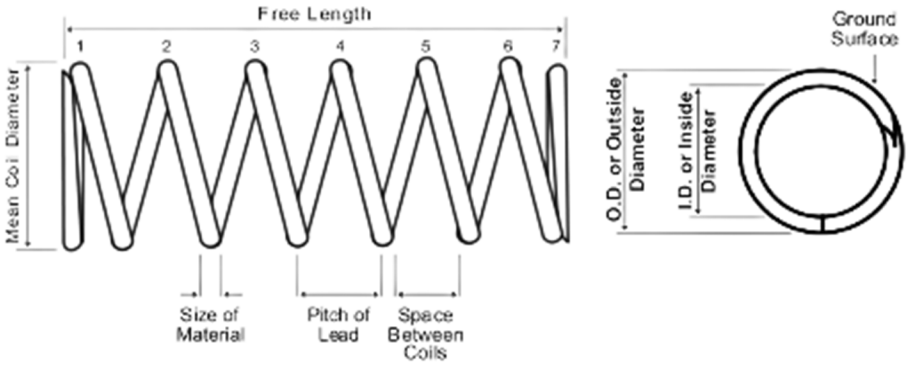
Fig .1.2 Design of Vibrating table

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IV. CALCULATIONS

A. For Springs

D= Mean diameter of springs
d = Wire diameter of springs
Lo = Free length of springs



Torque acting on spring

$$T = F \times \frac{D}{2}$$

d is diameter of wire, and I is the polar moment of inertia,

$$I = \frac{\pi d^4}{32}$$

Shear stress in springs is,

$$\tau_T = \frac{8FD}{\pi d^3}$$

Maximum shears stress

$$\tau_T + \tau_F = \frac{8FD}{\pi d^3}\left(1 + \frac{1}{2 \times \frac{D}{d}}\right)$$

$$\tau_{max} = \frac{8FD}{\pi d^3}\left(1 + \frac{1}{2c}\right)$$

Deflection of spring

$$\delta = \frac{8FD^3N}{Gd^4}$$

Assuming approximate weight of concrete to 35 kg to 45 kg load = 350N to 450N over an area of 1524x915mm
Total load on spring = 450+weight of unloaded tabletop
= 450 + 150=600 N
Considered Spring wire diameter as 16mm and spring index c is 5

Load taken by each spring = $\frac{600}{4}$ = 150N

So, $\tau_{max} = \frac{8 \times 150 \times 76}{\pi \times 16^3}\left(1 + \frac{1}{2 \times 5}\right)$ = 7.79 MPa

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The maximum deflection of tabletop is restricted to 2mm

$$\delta = \frac{8FD^3N}{Gd^4} = \frac{8\times150\times76^3\times N}{84000\times16^4}$$

Here, G of shear modulus of spring is 84000 MPa or approximately 80000 MPa (AISI 1095 steel spring)

$$\delta = 0.095\times2 = 0.19 \approx 0.5$$

V. ADVANTAGES

1) All types of cement frames or paver cement blocks are made with quality
2) The maintenance cost of machine is very low
3) Easy to handle and operate
4) Unskilled people can operate the machine
5) Less space required

VI. FUTURE SCOPE

First this machine is operated electrically, in future electric motors will be replaced and we will use hydraulic or pneumatic motors. Maintenance cost is minimum and mass production rate increases. In rural areas most of the plants are located and electricity is a major problem.

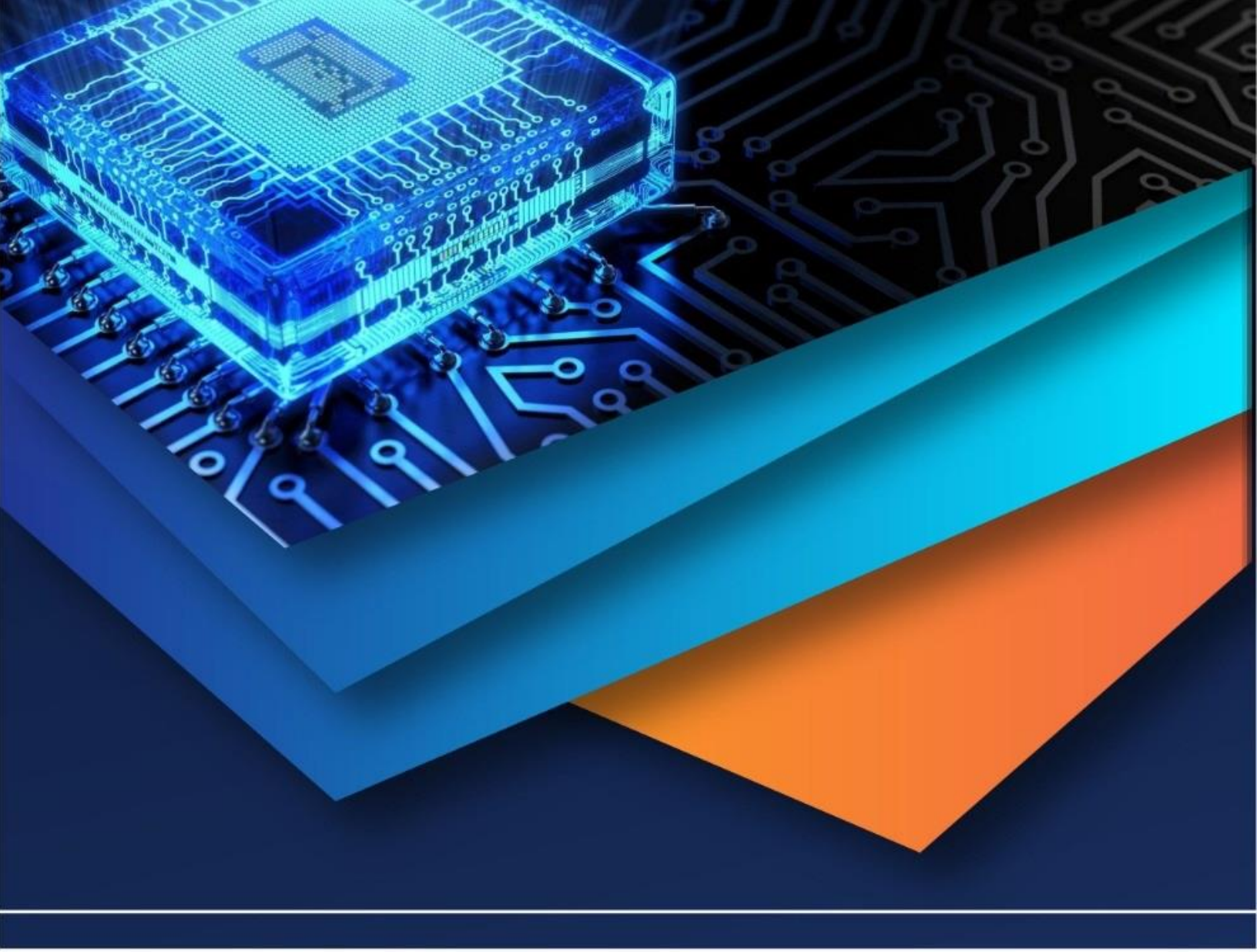
After completion of vibrating mold, this mold worker moving for soaking in sunlight areas it is difficult to handle some time it breaks it may affect on production. So, all are processes are performed i.e., drying, removing moisture, strength checking, in one platform so that mass production is increases. We install various types of sensors for making different types of concrete blocks. It helps only one worker monitor the whole process.

VII. CONCLUSION

In today's mechanical world, the vibration table is quite significant. We concluded that by giving vibration to the concrete mold, the compactness of the mold improved, and as a result, the strength of the mold increased. Different types of concrete blocks and cement frames are made easily.

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