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Fabrication and Design of Efficient Concrete Mixer Machine

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Abstract- *The construction and building industries are becoming most vital day by day due to exorbitant increase in human population resulting more and more demand shelter. Concrete which mainly consists cement, sand and gravel is an important component required for construction of houses and roads. Most operation of concrete mixing is done manually because of insufficient machinery and high fabrication cost. In this work fabrication of a low cost concrete mixing machine is done. The materials used in this work are mainly gravel, sand, water, mild steel, hopper, electric motor, shaft, bearing, V-belt, angle bar, mild steel plate, bolts and nuts, etc. The design and drafting of all components of concrete mixer is done by Auto CAD software. The result obtained in this particular work shows that the compressive strength of brick is sufficiently high if it is produced by concrete mixer.*

Keywords-Design, concrete mixer, Compressive strength, fabrication, mixing volume

1. INTRODUCTION

Concrete is a material widely used in the construction industry. It comprises of cement, coarse aggregate (natural gravels or chippings) and fine aggregate (sand). These constituent materials are properly mixed in a fixed proportion with water to form the concrete. The cement has its major role as the binder to the aggregates whereas the aggregates acts as the filler materials that give strength to concrete. Concrete has the unique distinction of being the only construction material manufactured on the site, whereas other materials are merely shaped to use at the work site [1]. A concrete mixer machine is a device that homogeneously combines cement, aggregate such as sand or gravel, and water to form concrete [2]. A typical concrete machine mixer uses a revolving drum to mix the components.

The compressive strength of concrete mainly depends on the, aggregate/cement ratio, aggregate grading as well as the water/cement ratio. The freshly mixed concrete should be workable to be properly placed and the hardened concrete needs to be durable and attain a specific compressive strength [3]. The purpose of designing concrete mixer machine is to achieve concrete that meets a specified strength. Concrete can be produced by employing either manual or mechanical mixing methods. In most of the places, hand mixing which involves turning over the mixture of the concrete materials from one end of the mixing tray or platform to the other is a popular method of producing concrete. However, the end product obtained from manual mixing method possesses weak compressive strength. The compressive strength of concrete depends so much on the consistency achieved through mixing [4].

To determine the mixing method best suited for a specific application, factors to be considered include location of the construction site (distance from the batching plant), the amount of concrete needed, the construction schedule (volume of concrete needed per hour), and the cost. However, the main consideration is the quality of the concrete produced. This quality is determined by the performance of the concrete and by the homogeneity of the material after mixing and placement. There should be a methodology to determine the quality of the concrete produced, but only few methods and only one attempt of standardization were found in the literature. The methodology to determine the quality of the concrete mixed is often referred to as the measurement of the efficiency of the mixer. The efficiency parameters of a mixer are affected by the order in which the various constituents of the concrete are introduced into the mixer, the type of mixer, and the mixing energy (power and duration) used.

Concrete is a generic term for a mix of aggregate -- usually stone or gravel, water and cement. Modern **cement** is a complex blend of finely ground minerals, and goes by the generic name of "portland." Concrete is made by combining the three ingredients in a mixer, whether that mixer is stationary or driving down the road, and the water is absorbed by the cement, which then binds the aggregate together, creating concrete.

2. MATERIAL AND METHOD

The materials used in this research work are sand, gravel, and water. Moreover, A single piece of concrete mixer is a composition of many essential parts or components. Each component serves an important purpose in the functioning of

the mixer. The various components used in the construction of the concrete mixer are as follows:

(a) Thrust Bearing

A thrust bearing is a particular type of rotary bearing. Like other bearings they permit rotation between parts but these are designed to support a high axial load while doing this. Thrust bearings absorb axial loads from rotating shafts into the stationary housings or mounts in which they are turning. Axial loads are those transmitted linearly along the shaft. Pure thrust bearings are those bearings which only resolve axial forces from the rotating component into their mounting and not radial forces[5].

(b) Ball Bearings

A ball bearing is a type of rolling-element bearing that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. Ball bearings tend to have lower load capacity for their size than other kinds of rolling-element bearings due to the smaller contact area between the balls and races. However, they can tolerate some misalignment of the inner and outer races [6].

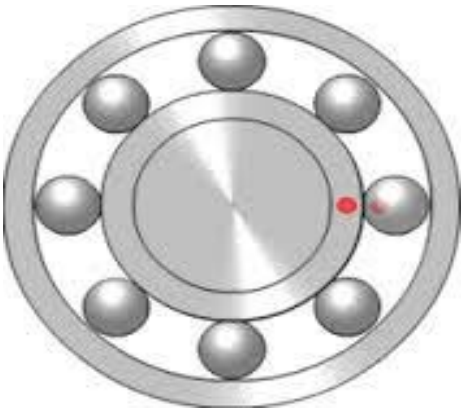

Fig 1- Ball Bearing

A ball bearing is a round, metal ball that works in unison with other bearings of the same shape and size to allow a spinning motion. They come in many different sizes, from extremely tiny to very large. Friction causes heat, and steel ball bearings rolling around (sometimes at a very high rate of speed) are no exception. The most common cause of ball bearing failure is heat. If the bearing set is exposed to the elements, the combination of hot and cold weather mixed with rain and dew can break down the lubrication fast.

(c) Revolving Drum

The basic component of any given concrete mixer is a revolving drum, which mixes all the components. The various components like cement, aggregates like gravel and sand, water and other chemicals are poured into the revolving drum. The revolving drum is essential as this is the part which helps to maintain liquidity in the mixture. Basically a revolving drum is made of iron. The revolving drum has blades inside it which mixes the components thoroughly and evenly.The size of the concrete mixer is basically defined by the size of the revolving drum. The mixer comes in various sizes as the use occurs.

(d) Helical Springs

Springs are elastic bodies (generally metal) that can be twisted, pulled, or stretched by some force. They can return to their original shape when the force is released. In other words it is also termed as a resilient member. A spring is an elastic object used to store mechanical energy. Springs are usually made out of spring steel. Small springs can be wound from pre-hardened stock, while larger ones are made from annealed steel and hardened after fabrication. When a spring is compressed or stretched, the force it exerts is proportional to its change in length.

(e) Handle

The handle in the concrete mixer is solely for the purpose of tilting the drum so that the mixture can be poured out easily. Since its utilization is for tilting the drum, therefore the drum while revolving is positioned with open mouth up with the help of the handle. Since the handle is being used for the purpose of tilting the drum it should be sturdy and rigid. The reason for this is that the drum becomes heavy once the mixture is poured in it. Therefore a strong handle is a necessity in a concrete mixer.

(f) Hollow rod

The hollow rod constitutes the basic structure of the concrete mixer. The whole stands on this hollow rod. The hollow also supports the drum. Therefore it is essential that the hollow rod be very strong and should have high load bearing capacity.

(g) DIRECT CURRENT MOTOR

A DC motor is a mechanically commutated electric motor powered from direct current (DC). The stator is stationary in space by definition and therefore its current. The current in the rotor is switched by the commutator to also be stationary in space. This is how the relative angle between the stator and rotor magnetic flux is maintained near 90 degrees, which generates the maximum torque. The introduction of DC motors to run machinery eliminated the need for local steam or internal combustion engines, and line shaft drive systems. DC motors can operate directly from rechargeable batteries, providing the motive power for the first electric vehicles. Today DC motors are still found in applications as small as toys and disk drives, or in large sizes to operate steel rolling mills and paper machines[7].

Design Specification: The parameters and the number of sample used in this work are as follows**:**

Table 1- Parameters and specification

COMPONENTS USED	PARAMETER	NO. OF PIECES USED
Thrust Bearing		2
Ball Bearing		1
Bucket	150*150 mm^2 Centre distance – 225mm	1
Helical Spring		1
Handle		1
Hollow Rod	View cross-section	1
D. C. Motor		1

Drafting of Shaft, Thrust Bearing and the concrete model:

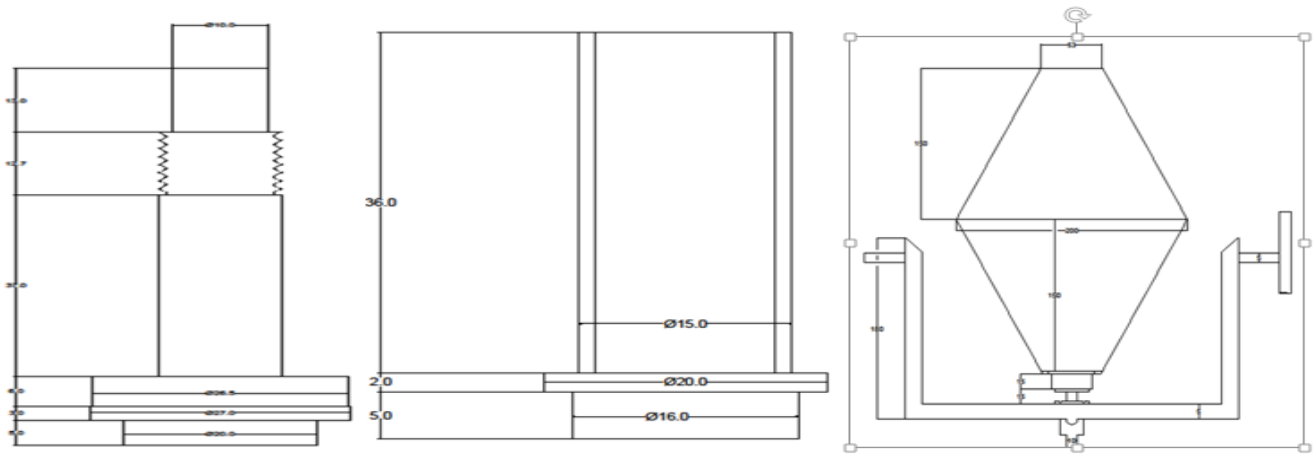

Fig. 2- Drafting and Designing of Components

Free hand sketch of drawing:

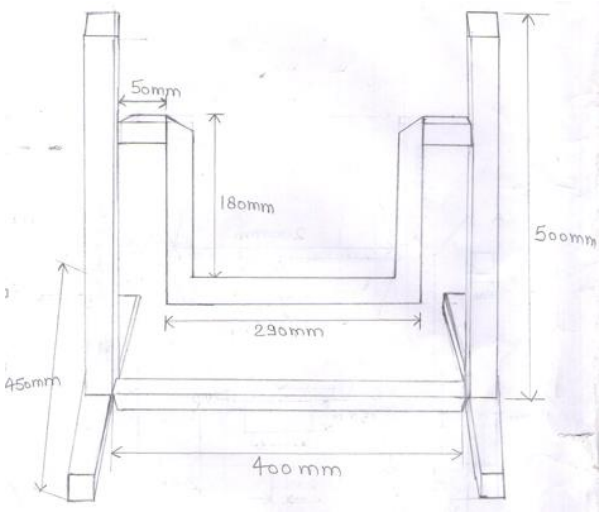

Fig. 3- Drafting and Designing of Frame

3. RESULTS AND DISCUSSION:

When all the components and assemblies are combined a good concrete mixer is obtained.

Fig. 4- Assembled Concrete Mixer

The important parameter for getting sufficient strength of the concrete is the ratio. The thickness achieved in different ratios are mentioned in table 2.

Abbreviation

C = cement in bag

F_a = fine aggregate

C_a = coarse aggregate

Ratios:

Table 2- Selective Ratios

NOMINAL MIX	MATERIAL			THICKNESS
	C	F_a	C_a	
1:1:3	3.8	6.9	13.8	2 inch
	8.4	8.6	17.2	2.5 inch
	5.7	10.3	20.6	3 inch
	6.7	12	24	3.5 inch
	7.6	37	27.4	4 inch
1:2:3	3.4	8.2	12.3	2 inch
	4.3	10.3	15.4	2.5 inch
	5.1	12.3	18.5	3 inch
	14.6	14.3	21.5	3.5 inch
	6.8	6.4	22.6	4 inch
1:2:4	3.4	6.9	13.8	2 inch
	4.3	8.6	17.2	2.5 inch
	5.1	10.3	20.6	3 inch
	6	12	24	3.5 inch
	6.8	13.7	27.4	4 inch

Calculation of Compressive strength of a brick: The strength of brick manufactured after use of concrete mixture can be calculated as under:

Compressive strength of a brick is determined by the ratio of Load to the Cross - section area.

Length of the brick = 15.5 cm

Width of the brick = 11 cm

Cross – sectional area of the brick = length x width

Cross – sectional area of the brick = 15.5 x 11

Cross – sectional area of the brick = 170.5 cm2

Load at which the brick is breaked = 80 KN

Calculation of compressive strength of brick:

Compressive strength of the brick = Load / cross-section area

Compressive strength of the brick = 80 / 170.5

Compressive strength of the brick = 0.4692 KN/cm2

Fig. 5- Brick

4. CONCLUSIONS

1) Mixers can evenly mix large volumes of concrete much quicker than hand mixing would allow.

2) Another benefit of a cement mixer is the constant movement provided by the revolving drum.

3) This movement prevents drying, allowing longer time frames to be achieved between mixing and pouring.

4) Finally, a concrete mixer allows for the concrete to be mixed off-site, if necessary. This portability is often achieved with the use of a cement truck, which incorporates a rotating drum to hinder drying during the transport process.

Due to all these advantages over Hand Mixing, Mixer is an essential good for construction.

5. REFERENCES

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