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Fabrication of Brick Carrying Device

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ABSTRACT:

Brick Carrying Device is widely used in transportation and delivery operations due to the high level of flexibility and agility offer to supply chains. However, there is a negative side to the application of brick carrying devices in construction site which can be removed or minimized by proper ergonomic and technical considerations. In this thesis work, the safety problems, economic issues and environmental effects associated with brick carrying being used in organization are reviewed in order to come up with alternative solutions to the current way of using old brick carrying in their supply chain. The analysis of the problem resulted in ergonomic, safety and technical recommendation on using brick carrying within their associated supply chain. The appropriate technical design of brick carrying that fits the organization facilities are introduced with the aim of streamlining the supply chain flow within the organization. However, cost is considered as a limiting factor for this organization. Hence, proper ergonomic awareness and use of appropriate accessories to the brick carrying devices are considered as a contemporary alternative solution to replacing brick carrying devices being used in thissupply chain.

Keywords- *Brick Carrying, Ergonomics, Load Analysis.*

I. INTRODUCTION

For the last couple of years, carrying bricks on head is the most common practice adopted by the labourer at construction sites in India and the other developing countries. Most of these labourer are women especially in India. Carrying bricks/load on head might cause injuries in brain and neck, pain in muscles and other spinal problems. Bricks on back using a rope, on shoulders using wooden plank, etc. are few others ways of doing the task of transporting bricks on construction sites[1].

The problem taken up by us is important as it involves a lot of pain and drudgery for people especially women who have to carry the load on their head. Hence it is important to understand the bio-mechanical aspect of this. The construction industry in India is the second largest economic activity after agriculture. Safety consciousness is yet to percolate to these construction sites where majority of the workers work under hazardous conditions[2.]

Figure-1 Brick carrying on head

II. OBJECTIVE

The objective of this project is to Design and fabrication of brick carrying device based on ergonomics. Fabrication of Brick Carrying Device using cast iron.

III. LITERATURE SURVEY

[1].**JaunsBanwell et.al. [1996]**had invented a new and useful Improvement in Brick-Carrying Devices jointly inclamp for such uses in which are combined the features of a strong and efiective means for grasping a number of brick together, so that the same can be handled conveniently, a simple and effective construction by which the clamp is adapted for insertion into a close pile of brick to engage the desired number of the same, and a convenient and ready means for adjusting the appliance to engage and hold a greater or less number of brick.

[2]. **Brennan John F et.al. [2001]**invented regard to analogous operations where bricks, or like material, require to be transported short distances.. They made a sketch and described the idea of making this prototype. The object of the present invention is to provide mechanical means for thus carrying the brick, which means shall be, in view of the exigencies of the use to which the device is to be put, of light and simple construction. The need to estimate safe levels of loading for manual handling activities has arisen with the confirmation.

[3]. **James Banwell et.al. [2004]** examined the relationship between work stressors and the following health indicators: psychosomatic complaints, health behavior, and musculoskeletal problems. Results of the study revealed that High work pace, low intellectual discretion, and physical stressors were associated with increased health complaints (both psychosomatic and musculoskeletal) and musculoskeletal disorders after adjustment for gender, age, education, and sports participation. Psychosocial stressors are not only associated with psychosomatic complaints and health indicators, but also with musculoskeletal problems, both acute and chronic.

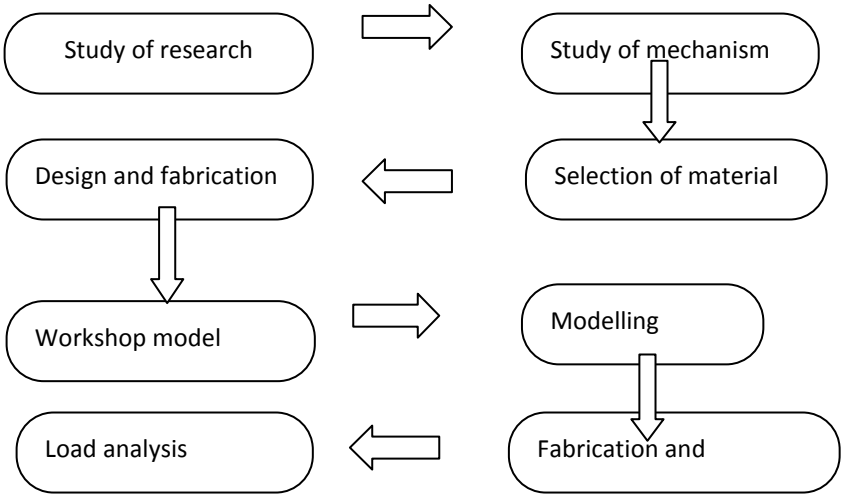
[4]. **Herman R Smith et.al. [2005]**had invented certain new and useful improvements in Handling, Transporting, and Storing Brick.He found that most of the ambulance workers had been confronted with acute stressors in their work. Of the participants, more than a tenth suffered from a clinical level of post-traumatic distress, one tenth reported a fatigue level that put them at high risk for sick leave and work disability and nearly a tenth of the personnel suffered from burnout.

[5].**EmilianoLausell et.al. [2007]** invented an adjustable carrying device for a single handed grasping, lifting and transporting of an object which has at least two parallel opposed surfaces and a width between said parallel opposed surfaces, said carrying device comprising a pair of handle brackets spaced by a handgrip carried by said first gripping member for sliding and pivoting said first gripping member in relation to said second gripping member and for holding said, adjustable carrying device.

[6].**Nichols Michael J et. al.[2008]** provided an adjustable carrying device that will not allow its removal from the object being transported, until the object has been safely placed on a surface area similar to that contact area provided by human hands.

[7]. **Mortensen James W et.al.[2010]** have invented new and useful Improvements in Brick-Handling Devices to be clamped upon a number of bricks at one time-say eight or ten-and carry the same personally from one place to another.

IV. METHODOLOGY



4.1 MATERIAL PROPERTIES

In this project we are using cast iron and stainless steel.

Compressive (Crushing) StrengthMPa	570 to 1290
Elastic (Young's, Tensile) Modulus GPa	82 to 140
Fatigue Strength (Endurance Limit) MPa	69 to 170
Brinell Hardness	160-300

Table 1: Grey cast iron properties

4.2 FABRICATION MODEL

Before starting the process of ideation, the team was asked to understand the whole process so that they can get important insights of the design process. They even tried to use the device to get a feel of how the new solution can accommodate the limitations in this design. An important missing was the involvement of workers at this stage. They could have given the already existing device for use and taken specific feedback for improvements. Reviewing the existing solutions is important to understand the need to design

This model is created in workshop in which use cast iron and stainless steel.

Fig.4.1 Fabricated model of brick carrying device

This device is use to carrying brick at the plane surface and carries more bricks. In this fig one worker can carry 12 no of bricks easily on plane surface as well as rough surface.

Fig. 4.2- Carrying Bricks on fabricated model

This device can also use to carrying cement bag on the fabricated model. In this fig one worker can carry 1cement bag on plane surface as well as rough surface.

Fig.4.3 -Carrying Cement Sack on fabricated model

4.3 PROTOTYPING AND FEEDBACK FROM USERS/MENTORS

The team designed a device as described in their proof of concept stage. They got it made with the help of a local fabricator and went to test it in the field to get user feedback.

Functions and Reviews	**User 1**	**User 2**	**User 3**
Gender	Male	Male	Female
Load capacity (No. of brick)	10-12 No. of brick)	14-17 No. of brick)	10-12 No. of brick)
Age	21	35	26
User Review	Little un-satisfied Uncomfortable to load-unload the bricks.	Satisfied and suggest reducing the weight of the model.	Need some size reduction in frame diameter.

They got feedback from labourers and also demonstrated the use of the device. The important thing missed in the feedback is the use of device by women since 51% of the workers carrying bricks on their heads are women. Thus uniform design of solutions will not work and it is important to have perspective of all the stakeholders.

V. THEORETICAL CALCULATION & RESULT

5.1 CALCULATIONS

The standard size of a brick (IS Standard) is 190 mm ×90 mm ×60 mm and with the mortar joint, it becomes 210mm × 100 mm× 62 mm.

l = 210 mm= 0.688976 ft.

b = 100 mm =0.328084 ft.

h = 62 mm = 0.203142 ft.

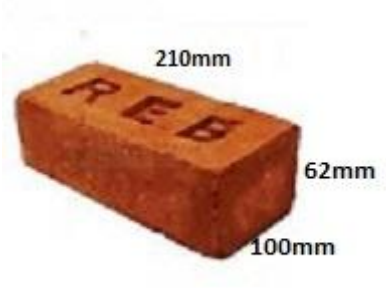


Fig. Brick Dimension

Actual brick weight (W_a) = 3kg

Weight of device (W_d) = 10kg

No of brick carrying on the plane by device (n) = 18

Total weight of brick and device when carrying on plane (T) = 60

The maximum load taken by device with sack or sand on the shoulder (W_{max}) = 27kg

The Total weight of sack with cement or sand on device (W_s) = 37kg

The maximum load on head with device (W_h) = 10kg

The total weight (W_t) = 20kg

5.2REQUIRED LOAD CAPACITY

Many of those engaged with this work area believe that this is the most important criterion for choosing the type and model of our casters. To stay on the safe side there has been a rather universal agreement on the load capacity of each caster in brick carrying devices which is expressed in terms of bottom line load capacity for each caster. In the industrial and managerial fields they say that each caster should have the capacity to support one-third of the total weight. This can be considered as an easily comprehensible criterion for people involved in this field. This design-manufacturing requirement may arise from different uncertainties like rough surfaces covered with barriers like card boards or plastics. It may also happen due to overloading or unbalanced type of load distribution on the casters. Another reason that makes it necessary to respect this safety factor is that sometimes personnel do not handle the brick carrying devices in a proper way. Thus using this safety margin will compensate for human error as well[6].

5.3 MOVING NESTED BRICK CARRYING DEVICES

When brick carrying devices are nested the center of gravity moves toward the fixed casters side of the base frame. Hence, there would be a high risk of overturning if a single nested brick carrying device is to be pulled from the side with fixed casters. Therefore when handling a nested brick carrying device, we need to push it from the side with fixed casters and not pull it.

When brick carrying devices are packed together to make a unit, there is little risk of overturning due to the inherent safety character in moving them. Operators need to push them, otherwise they will not stay together or in other words this is the only way to keep containers nested.

It is usually a good practice to strap the nested containers together to avoid risky situations. This is especially important when they are being pushed down a slope. In this case there is a risk of the leading ones to breaking

5.4FILLING AND EMPTYING ACTIVITIES IN BRICK CARRYING DEVICES

Many harms and injuries can take place at this phase. Proper implementation of ergonomic guidelines can secure personnels life and health in short and long run.

5.5 LIFTING AND LOWERING TASKS

It is quite common for operators to face back injuries due to lack of attention to safety guidelines while filling or emptying brick carrying. Operators task should go through a risk assessment process if they are supposed to handle packages weighing over the permitted guideline loads.

VI.CONCLUSION

Brick carrying devices are very easy to handle and effective facilities when it comes to distribution and delivery of goods. On the other hand, companies and organization face budget limits and authorities decision supports on purchasing new models of brick carrying devices and replacing old types. Meanwhile the solution for companies at this era of change would be to assure that proper ergonomic training and enforcements are at place. Health and safety facilities and accessories would partially mitigate the hazardous situations in this chain of delivery and transportation activities.

Money and time are being spent on this issue to get to higher levels in meeting up with requirements specified in related standards and guidelines. As role containers are very often being used in association with manual handling in supply/demand chain, they can have very important effect on reduction of accidents and Inefficiencies for industries and people.

Hence the market demand already exists regarding optimized and ergonomic design and manufacture of brick carrying devices with meeting the customization requirements from the customer sides. By market demand I mean the demand from any party which is affected directly or indirectly by use of brick carrying devices. As it is quite comprehensive in this regard, more or less the whole supply/demand chain can be potentially or actually affected. Therefore it seems to be a multi-partition right to make the right decision in this regard.

In our case where hospital supply chain has been under study, there are some design considerations regarding the brick carrying device as well as some ergonomic, safety and security revisions that need to be conveyed throughout the organization through proper methods applicable to each department and warehouse.

VII. ACKNOWLEDGEMENT

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