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RESEARCH ARTICLE

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INNOVATIVE CONSTRUCTIBLE FEATURE IN PIPE RACK DESIGN HELPING IN REDUCTION OF ERECTION ISSUES IN FIELD OPERATION PHASE

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ABSTRACT

Increasing competition and best economic investments in a construction unit requires innovations and improvements of the capabilities of a construction company. Many case studies and record reviews in the field of improvement of quality focus solely on project quality improvement methods such as, improved and innovative constructability, implementation of total quality management principles, operability, value based engineering, improved design ability and many more.

This research endeavor focuses basically on an innovative idea of implementing an expandable pipe rack system that would focus on tackling the situation of increasing number of pipes of a plant in future run resulting in the reduction of future construction complexities of a plant pipe rack. Thus it basically involves the focus on pre-site fabrication stage, by the use of optimum knowledge of construction to ease the field operations to achieve the overall objectives of a project.

KEYWORDS: Innovative, constructible, piping, erection, field operation, pipe rack, constructability.

INTRODUCTION

A construction unit requires innovations and improvements of the capabilities of erection of a plant layout. Field of improvement of quality focuses solely on project quality improvement methods viz, improved and innovative constructability, quality management operability, value based engineering and improved design ability. Prior introduction and participation of the knowledge of construction and experience reduces the probability of creating such designs that cannot be built efficiently, thus reducing design rework, improving the overall schedule of the project and establishing construction cost saving. (Russell, 1964)

Pipe racks are the structures designed and built specifically to support multiple pipes where adequate structure is not available. Pipe layout on pipe racks follows the pipe planning study concepts. Avoid designing one pipe at a time in order to avoid overcrowding and fittings for pipes to enter and depart from rack.

According to the Construction Industry Institute (CII 1998) the main constructability concepts are grouped under three main phases of a project viz, conceptual planning, design and procurement and field operation. This paper deals in the design and field operation of project. The main purpose is to stimulate thinking about the constructability and how to make it practically feasible and workable.

This study presents the implementation of an innovative constructible programme which a refinery or power plant project will find useful, keeping in concern the design process and changing innovation from the existing conventional type of design based on the constructability concept. This concept would help in developing interdisciplinary interaction between the field and design personnel.

RESEARCH METHOD

First step in this study was the identification of constructability issues for a semi automated or fully automated pipe rack. Then the aim was set to study the implementation of constructability innovation at the project level. The purpose of this work is to develop and describe a process of technological innovation within the construction firm and prove it to be beneficial for its implementation and installation in the plants being set up now that involve piping and consequently pipe rack.

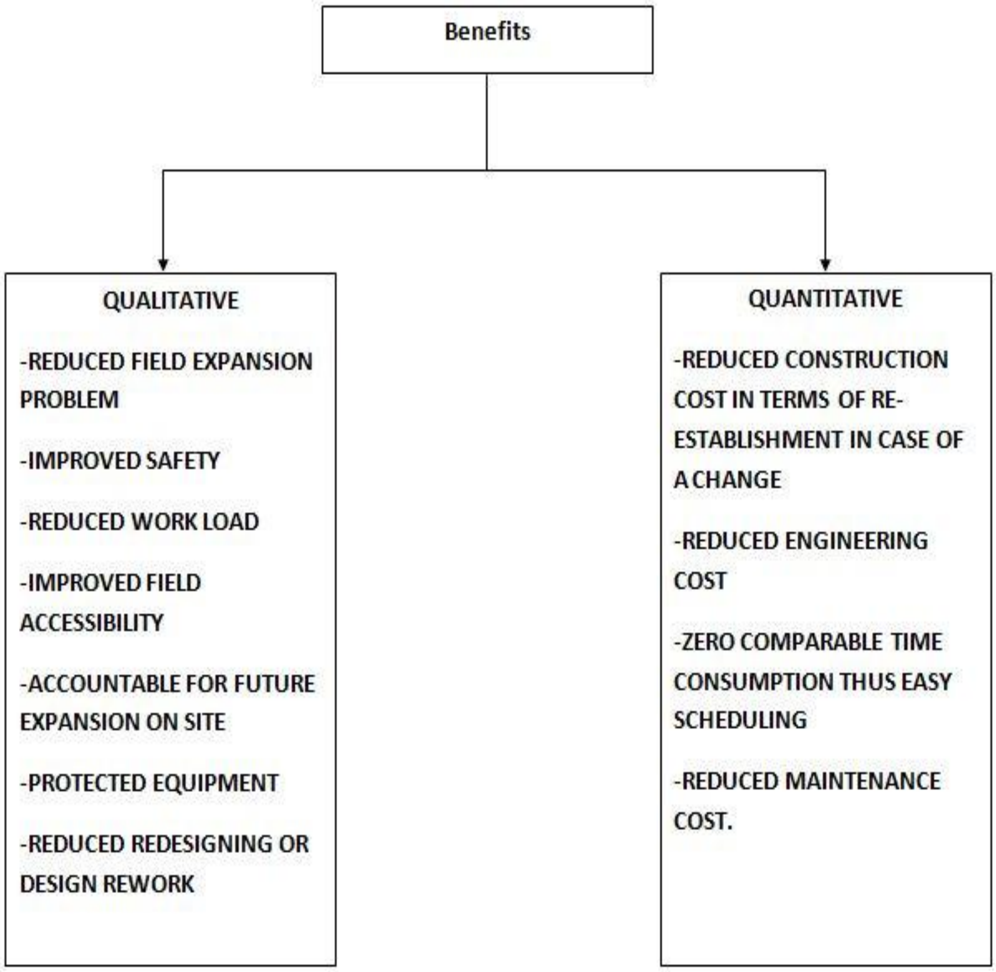
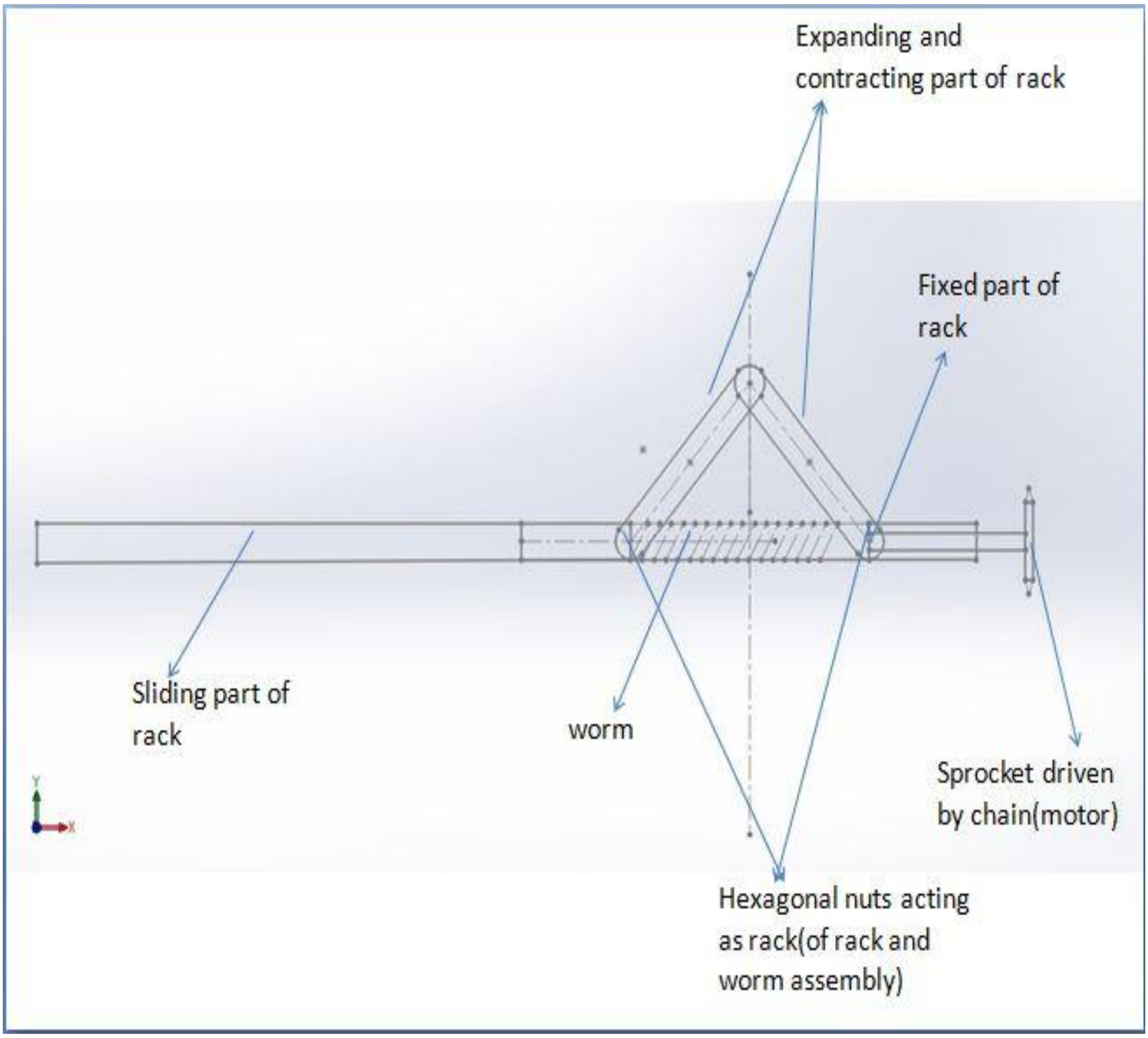


CHART DEPICTING CONSTRUCTABILITY BENEFITS

PROJECT CONSTRUCTABILITY IMPLEMENTATION

The whole setup is as shown below:



The setup consists of two hexagonal nuts welded below the rack strips, inside which passes a bolt or worm (same principle as that of screw jack) One extreme end of the worm if fitted with a sprocket over which runs a chain driven by a motor. When the sprocket rotates then the floating nut slides over the worm and thus facilitating in the expansion of the rack. Thus implementing this system throughout the pipe rack will help in having same outcome over all the racks and thus full assembly will expand or contract.

Mathematically

Let there be a pipe rack with maximum width or span of 6m

According to the equation

W= (f x n x s) +A+B

W=width of pipe rack

f=safety factor

=1.5 if pipes are counted from Piping Flow Diagram

=1.2 if pipes are counted from Piping and Instrumentation Diagram

n=number of pipes in the densest region upto 450NB

s=average spacing= 300mm (as considered in running units)

A=Additional width for lines of instrument cable, ducts etc

B=Future provision=20% of (f x n x s) + A

Taking a example, let

n=10

s=300

f=1.5

A=450

W=4500+B

Now B can be 20% of 4500=900mm

Thus pipe Rack span =5400mm

Still we have 600mm (6000-5400)

For further expansion and contraction which will facilitate some temporary cable or for accessibility of human to instruments or pipes. This can be achieved by implementation of the above explained mechanism.

CONCLUSION

This research when implemented would reduce the design rework, will provide easy accessibility on the field, improved safety, reduced field expansion problem, reduced maintenance cost, reduced construction cost in terms of re-establishment and easy scheduling.

The important factor of this research is that early consideration of constructability implementation can help in many terms of setting up of a plant involving piping. It also shows that constructability implementation with compilation of innovative ideas can improve project performance and reduce project cost.

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