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Design and Modification of Semi Automatic Stacker

KEYWORDS: Manufacturing processes, Semi automatic, Material handling system, robust

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ABSTRACT *in this project, we studied the manufacturing process and functional activities of Besto handling system. co. Ltd and came across with the various problems and handling in the current system. After thorough studies, careful analysis and reviews of the various manufacturing systems and technologies, we propose to apply some new techniques to help Besto handling system become better and have a more efficient and effective manufacturing system.In this work an attempt is made to design of semi automatic stacker. Semi automatic Stackers are robust in construction and are smooth in operations. Semi automatic stackers are able to work efficiently for pallets on high rack, smooth control of precise lifting and lowering. By this project man power effort and time can reduce. We design and analyse of carriage fork and power pack box with different load. Our aim is design and develops a model of semi automatic stacker. This system has a significant importance in the equipment and material handling system.*

1. INTRODUCTION

Semi Automatic Stackers are in great demand in the various industries for their superb bulk handling capacity[1]. The product meets the vital parameters on which a product of this specification is tested. The operation is easy, it is reliable. They are noise and pollution free. The operating rate is low. It is applicable for the working place with high requirement on load. It is of one mast structure. It is a half electric forklift for load and unload and short-distance transportation

2.PROBLEM IDENTIFICATION

2.1 SPECIFICATION:

The semi automatic stacker has the following specifications

Sl No	Parameters	Value
1	Capacity	1000 KG
2	Min Fork Height	85mm
3	Max.Fork Height	1600 mm
4	Min.Mast Height	2000mm
5	Width of Fork	160mm
6	Length of Fork	900mm
7	Overall Width of Fork	330 mm
8	Width of Leg	100mm
9	Overall Width of Legs	590mm
10	Wheel Type Polyurethane(Standard) / Nylon	180mm
11	Battery	12 /150 V/Ah
12	Lifting Motor Power	1.8 kW

3. COMPONENTS

3.1DC MOTOR-A DC motor is a mechanically commutated electric motor powered from direct current (DC)[2]. 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.

3.2HYDRAULICPUMP

Hydraulic pumps are used in hydraulic drive systems and can be hydrostatic or hydrodynamic. Hydrostatic pumps are positive displacement pumps while hydrodynamic pumps can be fixed displacement pumps, in which the displacement (flow through the pump per rotation of the pump) cannot be adjusted, or variable displacement pumps, which have a more complicated construction that allows the displacement to be adjusted Hydraulic machines are machinery and tools that use liquid fluid power to do simple work. Heavy equipment is a commonexample.

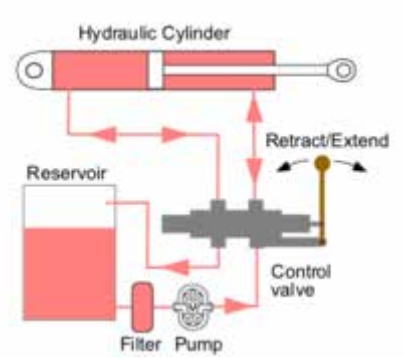

Fig. 1.circuit diagram of hydraulic cylinder.

3.3BATTERY

Direct current may be obtained from an alternating current supply by use of a current-switching arrangement called a rectifier, which contains electronic elements (usually) or electromechanical elements (historically) that allow current to flow only in one direction. Direct current may be made into alternating current with an inverter or a motor-generator set.

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A battery charger is a device used to put energy into a secondary cell or rechargeable battery by forcing an electric current through it. The charging protocol depends on the size and type of the battery being charged[3]. Some battery types have high tolerance for overcharging and can be recharged by connection to a constant voltage source or a constant current source; simple chargers of this type require manual disconnection at the end of the charge cycle, or may have a timer to cut off charging current at a fixed time.

3.4DC MOTOR POWER PACK:
A power pack can be designed for many purposes, making it possible to do several operations with different forces and speeds. It is possible with the same power pack to drive several cylinders and hydraulic motors simultaneously.

3.4.1Power Pack for Automatic Stacker:
Technical Data[4]: 1. Weight: A typical D.C. power packs with 2.4 ltr. Tank weighs approx. 18.2 kgs when filled with oil. For larger tanks add 1 kg for each additional ltr. Of capacity. 2. Hydraulic Oil Mineral oil with a viscosity range from 6 to 450 centistokes at stabilized working temperature. 3. Working Pressure Typical working pressures are normally around 180 bars although pressures of up to 250 bars are: attainable. (Special pressure settings are available on request) 4. Motor Options: Voltage Rating 12 & 24 VDC Power Rating 0.5 kw, 0.8 kw, 1.5 kw, 2.0 kw, 2.5 kw & 3 kw. 5. Pump Option 0.7 cc/rev, 1.0cc/rev, 1.5cc/rev, 1.9cc/rev, 2.3cc/rev, 3.0cc/rev, 4.0cc/rev,5.1cc/rev, 6.3cc/rev, and 7.0cc/rev

Fig.2.power pack of Automatic Stacker.

4. DESIGN CALCULATION
DESIGN CALCULATION OF SEMI AUTOMATIC STACKER:
4.1CALCULATION FOR MOTOR:
V Calculation of power required for lifting the maximum load up to maximum height:

Specification of Automatic stacker:
1. Load=1000kg
2. Lifting height = 1.6 m
3. Lifting time = 12 sec

Solution;
Force = mass x acceleration.

= 1000 x 9.81

= 9810 N

Work done = Force x Height

= 9810 x 1.6

=15696 Nm

Power = Work done / Time Taken

= 15696 / 12

= 1308 W

Safety Factor = 1.3

Total Power Required = 1308 x 1.3

= 1700.4 W

= 1.7 KW

So,

The battery requirement for running the motor is 12v/ 150AH.

4.2CALCULATION FOR BATTERY
Power Rating of Motor = 1800 W.

Battery Voltage = 12 Volts.

P = V x I

I = P / V

I= 1800 / 12

I = 150 Amp.

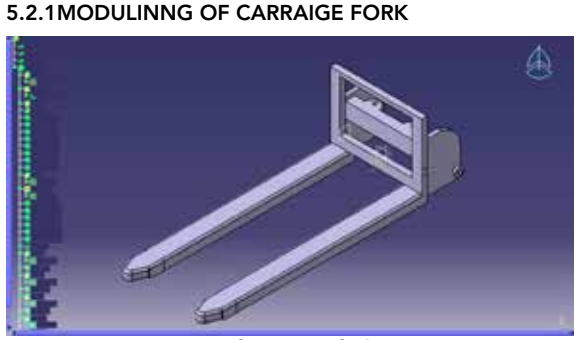
Battery Requirement: 150 AH.

So,

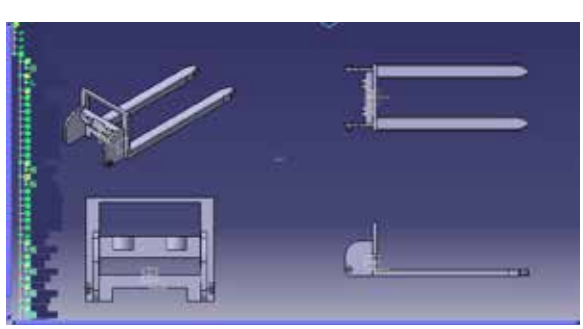
The battery requirement for running the motor is 12v/ 150AH

5. DESIGN AND MODELING:
5.1 INTRODUCTION OF SOFTWERE USED
5.1(a) CATIA
INTRODUCTION: The full form of CATIA is Computer Aided Three-dimensional Interactive. CATIA V5 is a powerful software package yet has a relatively short learning curve. One of the reasons for the short learning curve is that it is fully Windows compatible and the processes are consistent across the workbenches, toolbars and tools. If you learn the basics of a particular workbench the same process can be used for more complex problems. Several tools are used in more than one workbench.

5.2MODULING OF SEMI AUTOMATIC STACKER
5.2.1MODULINNG OF CARRAIGE FORK



(a) 3D Isometric view of carriage fork



(b) 3D multi view of Carriage fork

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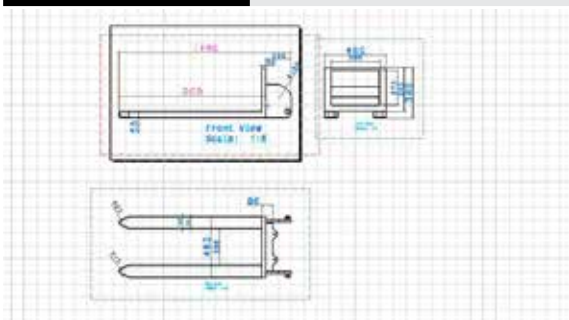
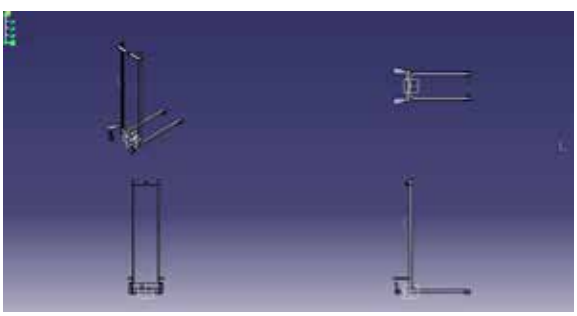


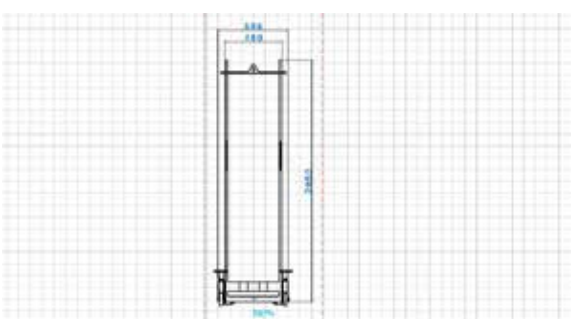
(c) 2D Projection view of carriage fork

5.3MODULINNG OF MAST:

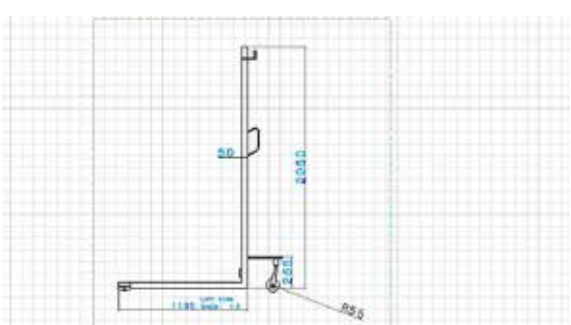
(a) 3D Isometric view of mast



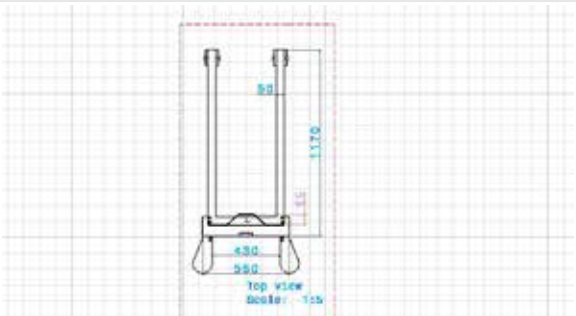
(b) 3D Multi view of mast



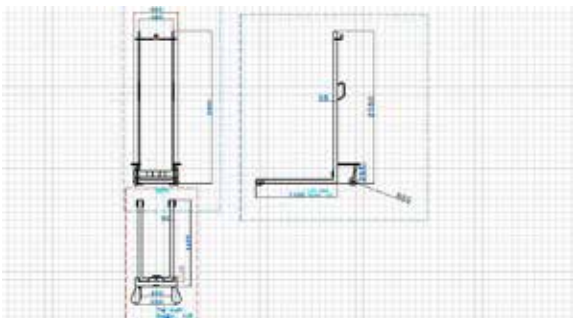
(c) 2D FRONT VIEW



(d)2D SIDE VIEW



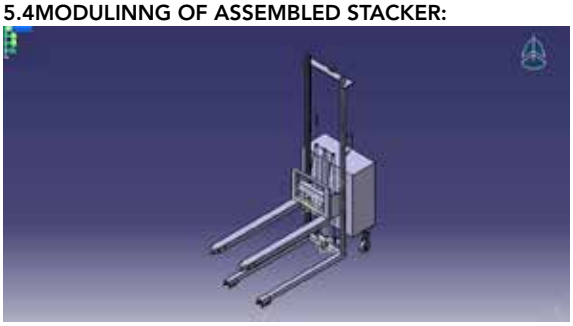
(e)2D TOP VIEW



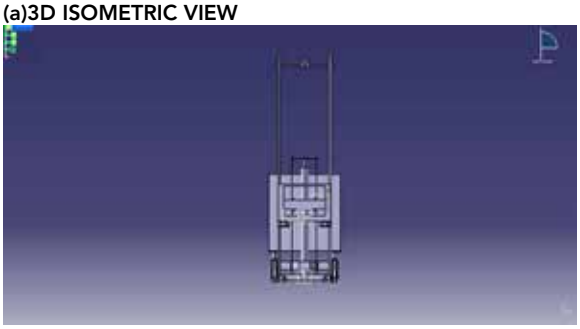
(f) 2D PROJECTION VIEW

Fig.5. Drafting of mast

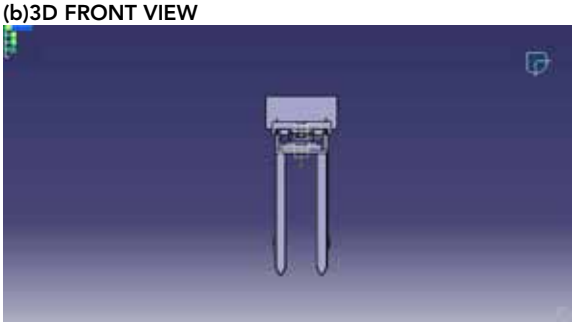
5.4MODULINNG OF ASSEMBLED STACKER:



(a)3D ISOMETRIC VIEW



(b)3D FRONT VIEW



(c) 3D TOP VIEW

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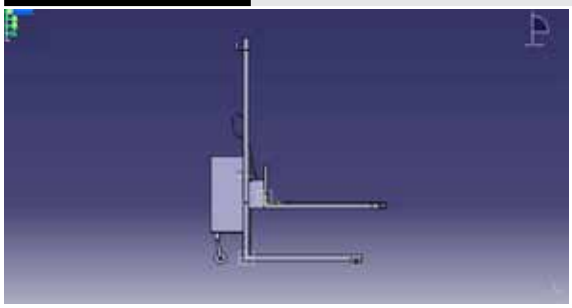
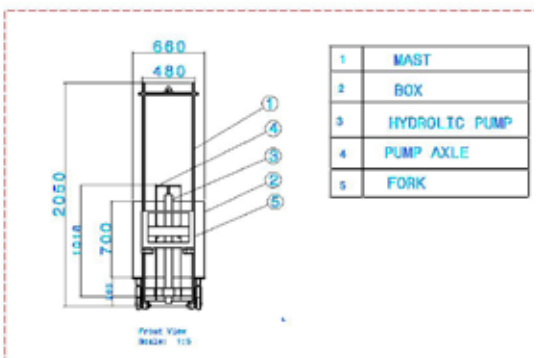
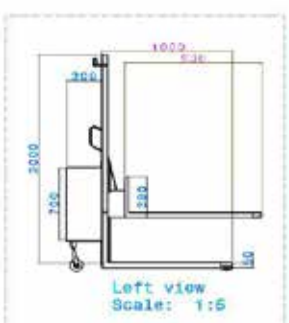


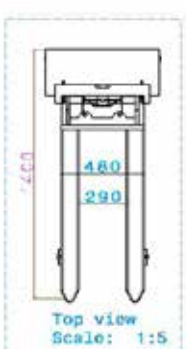
(d) 3D SIDE VIEW
Fig.6. Different views of assembled stacker



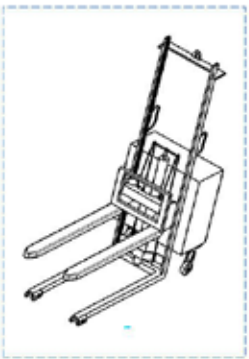
(a) 2D FRONT VIEW



(b) 2D SIDE VIEW



(c) 2D TOP VIEW



(d) 2D ISOMETRIC VIEW
Fig.6. Drafting assembled stacker

6.ANALYSING

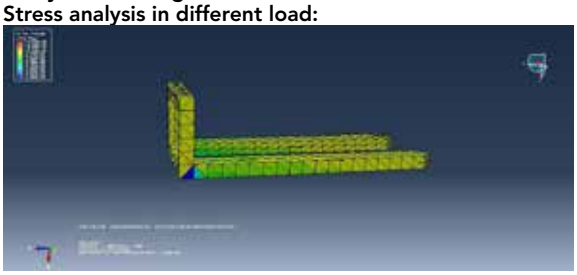
6.1ABAQUS

Introduction: Abaqus a suite of powerful engineering simulation programs based on the finite element method, sold by Assault Systems as part of their SIMULIA Product Life-cycle Management (PLM) software tools. The lectures in MANE 4240/CILV 4240 will cover the basics of linear finite element analysis with examples primarily from linear elasticity.

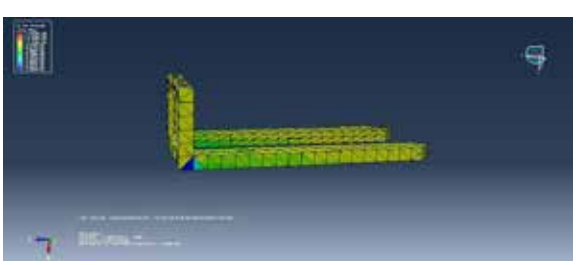
6.2ANALYSIS OF SEMI AUTOMATIC STACKER

Analysis of carriage fork

Stress analysis in different load:

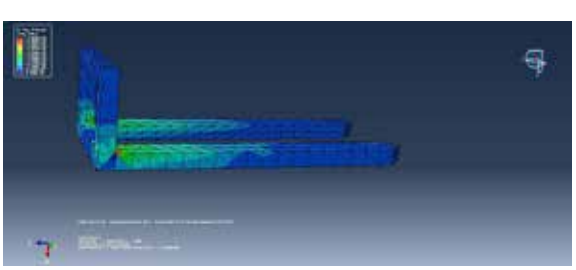


(a)Maximum principle Stress on load 1000kg



(b)Minimum principle Stress on load 1000kg

Above(a)and(b) shows the max & min principle stress on the carriage fork load applied on the fork is 1000kg, material of fork is mild steel young's modulus 2e11N/m2 .Poisson ratio 0.3. And stress produced by max load are max stress is 6.731e5N/m2 and min stress is 2.035e5 N/m2



(a)Maximum principle Stress on load 800 kg

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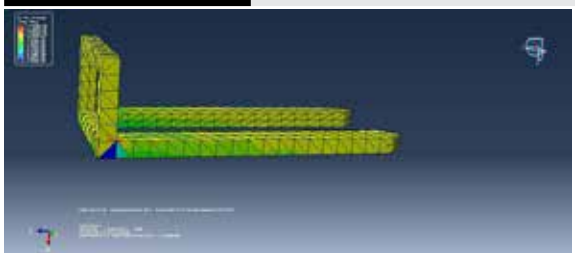
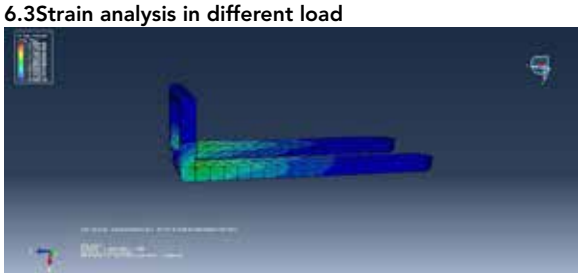


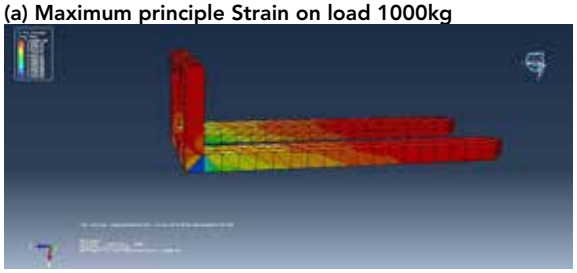
(b)Minimum principle Stress on load 800kg

Above(a)and(b) shows the max & min principle stress on the carriage fork load applied on the fork is 800kg, material of fork is mild steel young's modulus 2e11N/m2 .Poisson ratio 0.3. And stress produced by the load are max stress is 5.32e5N/m2 and min stress is 1.625e5 N/m2.

6.3Strain analysis in different load



(a) Maximum principle Strain on load 1000kg

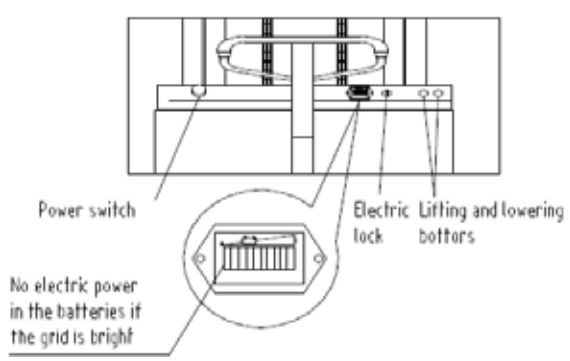


(b) Minimum principle Strain on load 1000kg

Applied on the fork is 1000kg, material of fork is mild steel, young's modulus 2e11N/m2. Above shows the max & min principle strain on the carriage fork load Poisson ratio 0.3. And strain produced by max load are max strain is 2.003e-5 and min strain is 1.932e-7.

WORKING

Check that the stacker lifting and lowering is operating normally



- Turn on the stacker by unlocking the electric door lock. Move the stacker near the load to be transported.
- Press the lowering button and adjust the height of the forks to a proper position with pallet of load. Insert the forks slowly and as deep as possible into the pallet.
- Press the lifting button to raise the forks to a proper height with the shelf or racking.
- Move the goods slowly to the correct position of the shelf or rack and press the lowering button; slowly put the goods carefully on the shelf or rack.

ADVANTAGES

1. Simple in construction. 2. Simple and convenient lifting operating system. 3. Light and easy manual steering system, equipped with a parking brake. 4. Smooth control of precise lifting and lowering. 5. Special design is available according to customers' requirements.

APPLICATION

Stackers are widely use for following purpose

1. Storage of product and equipment in industries.
2. Moving the equipment from one place to other place.
3. It is use for vertical lifting.
4. Replacing the product and equipment 18

RESULT AND CONCLUSION

Semi automatic Stackers are robust in construction and are smooth in operations. Semi automatic stackers are able to work efficiently for pallets on high rack. Smooth control of precise lifting and lowering. By this project man power effort can be reduce and time of work can reduce. And we designed and analyzed of carriage fork and power pack box with different load. This system has a significant importance on the equipment and material handling system. Considered the aspects of noise and vibration. The objective of this work is to present an improved methodology, based on numerical and experimental analysis; to evaluate the life of the semiautomatic stacker system. It can be improve the industrial work. And also improve the material handling equipment system. In the last several years material handling has become a new, complex, and rapidly evolving science. For moving material in and out of warehouse many types of equipment and system are in use, depending on the type of products and volume to be handled. The equipment issued, in loading and unloading operations, for movement of goods over short distances. The handling of material in warehouse isrestricted to unitized forms, which require smaller size equipment. However, for bulk handling of material at logistics nodes such as semi automatic stacker can be use for the appropriate need of improved industry.

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