Design And Analysis of New Flexible And Safe Forklifts Abstract

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Abstract- *In modern life, there are many types of forklifts, from a large heavy loading truck to one operating between narrow corridors. Forklifts have become one of the basic transportation tools we use in our lives. With all the existing forklifts, we find that there are improvements that can be made to bring the forklift to better performance. The design of the existing forklift is limited in rotation and the structure has a potential safety hazard. Our new design has 180 rotating forks attached to the body of the truck at both ends. Also, it has a screed height under the user's cabinet that enhances stability. There are two subassemblies: scissor lift and lifting fork; there is a total of 37 parts in the new construction.*

Once the design is pregnant, we calculate the main component structures and subassemblies to ensure the stability of the forklift. The results show that the truck is safe to use: its gravitational center is always in a safety triangle and uses this to obtain a larger load capacity. Then we conducted a pressure analysis on key components and subassemblies using a standard factor (FEM) method. The results show that the new design is safe to use under operating conditions.

Keywords- FEM, corridors, forklifts, loading truck.

I. INTRODUCTION

Due to the variety, different shapes, different packaging, loading and unloading has always been a difficult process during transport. Forklifts are naturally developed and become a solution to this problem; save time and space. If the cargos are properly organized, the use of forklifts with appropriate attachments can be the best way to load and unload, which can make the whole process less time consuming and less efficient. In addition, forklifts improve the use of storage space by eliminating the need for more people to handle loading and unloading operations and to facilitate the accumulation of goods. Cargo height can be up to 4 ~ 5m, some up to 10m, which increases the use of storage space by at least 40%. Now, most transportation services use forklifts.

Figure 1.1 Forklifts with Paper Handling Chassis

Forklifts fall under the category of lifting and transport equipment. The forklift has a lifting system for loading packages and a mobile mobile system, such as a truck. A forklift is also called a forklift truck. It is widely used for loading and unloading standard packaged goods. With some special attachments, it can also be used for unpacked or good-looking standard items. Figure 1.1 shows an attached forklift

that takes a roll of paper. This hydraulic video clip attachment allows the operator to open and c lose the clip around the load. Products such as boxes and boxes can use this type of attachment.

Figure 1.2 Hyster Forklift Trucks Equipped with Heavy Duty Vista Masts

Figure 1.2 shows a forklift with a special attachment that allows for cargo rotation. Forklifts are manufactured by hundreds of companies worldwide. According to information on the sale of lift trucks, acquired by Worldwide Industrial Truck Statistics, Europe, North America, Japan and China are some of the biggest players in the market. Toyota 11 Industries Corporation is number 1 among all manufacturers of industrial lift trucks. It has 11 categories of forklifts, from hand-pallet trucks to countertops, from electronic to powerful engines, including more than 50 types of forklifts. Each of them can be ordered with different volume and loading width to meet different needs.

Load capacity ranges from 0.75 ~ 8.5t. The maximum height can reach 14.8 meters.

At present, all the forklift forks are attached to the truck on one side, and the lifting system uses a chain or cable. We feel that there is some improvement that can be made, and we will focus on these two aspects throughout the study.

II. LITERATURE REVIEW

Comparison of the Five Types of Fork Lifting Machine, J. B. HOLT *; D. A. BULL *

Some farm items are transported and stored in a load of up to 1 unit and fork lifting equipment the operator is able to deal with this with minimal damage. Potatoes are treated this way on some farms, boxes used to move out of the field and stored inside enclosed buildings. Some fruit growers carry apples in large quantities, and after being filled with harvesters in the orchard, the boxes are then moved to the grocery store to be packed into cool rooms.

The capacity of the boxes used depends on a number of factors, such as: material overload, exposure to damage or other damage as a result of pressure or impact, store design and the type of grip available. Attachments to the fork lift can be installed on farm tractors and this is especially convenient for handling unit loads in field conditions, but it is not always possible to use them inside buildings due to limited steering space and the harmful effects of exhaust gases. In these cases the use of factory fork lifting machines should be considered and the specific tests performed to obtain information on those machines and to compare the performance of the four industrial machines and the farm tractor with a fork hood attached to the back. .

Ilir Doçi a * and Vegim Imerib, Powerful Forklift Analysis during Load lifting using Modeling and Simulations,, International Journal of Current Engineering and Technology ISSN 2277 - 4106

Studying the dynamic events in the forklift during load lifting proves that it is difficult to use physical testing with current measuring devices. Creating a multi-forklift body model and using computer simulation is a very useful way to study these scenarios, which helps explain the reasons for rowing, failure and forklift hazards, and provides helpful conclusions for design and safety considerations. The aim is to determine how dynamic forces, times, speed and oscillation affect the construction of the forklift and its stability during load lifting. To do this we have designed the whole "virtual forklift" using the design of models and simulation programs

and simulations created to obtain results. Key influences influencing the forklift variable behavior will be analyzed and searchable conclusions that can be helpful in better understanding the forklift variability. This paper identifies a set of influential parameters in the main components of a forklift, and provides results with graphs and tables with naturally variable values, with high amplitudes and frequencies that directly affect the causes of fatigue or material failure.

Using modeling and simulation is a very powerful way to learn the power of forklifts. We can conclude that lifting systems in a forklift are a dynamic environment with a strong oscillation and should not be overlooked in mathematical and forklift analysis. Powerful events are most intense at the beginning of the lifting, and not until shortly after the lifting process. At this point, the process has high amplitudes of oscillations and frequencies, as shown in graphs and tables. The start of the lift and the end of the lift should be considered for the stability of the forklift. The oscillations and amplitudes of tension force on the hydraulic cylinders should be taken seriously when lifting. The end of the lifting process should be the tent slider and speed control so that there is little flexible power in the cylinders. Oscillations with high amplitudes of pressure in chains, and high frequencies obtained in the results can be the cause of their fatigue and failure. From the effects of stress on pillar lifting, it can be concluded that this component exceeds oscillation and amplitudes higher than other components, and should be controlled regularly.

The Dynamic coefficient has very high values of the vertical column, which is expressed in pressure. Lifting speed should be as low as possible in the lifting process, so that there is a smooth lifting and a small number of variable parameters. This is especially true for operators, in order to achieve faster performance

P. Dro, M.D., B. Huber, M.D., P. Dollfus, M.D., And R. Gschaedler, M.D., Abnormal Injury of the Cervical spine Caused by Fork Lifting *, International Medical Association Paraplegia, 237-241.

A case of very unusual etiology has been reported. Severe traumatic cervical spinal injuries were associated with temporary nerve phrenic nerve impairment, limited sensory involvement, and muscle weakness of the upper right leg. The nervous system was normal, with the exception of a slight weakness of the upper left leg. The inflow of artificial air was required. Recovery was slow. Neural etiology is discussed in relation to the spinal cord and / or root involvement.

High lesions of the cervical spine, especially at the level of the C1 -C2 vertebrae, are known to cause rapid breathing, due to the absence of all motor respiratory functions below the lesion level. This involvement, complete or partial, includes that of the phrenic nerve. Clinical observations have shown (Guttmann, 1973) that lesions, or more than C5, biceps and deltoid weakness are associated with those of the ipsilateral diaphragm. This is due to the proximity of the nuclei of these muscles to those of the phrenic nerve (C3 / C4 / C5).

By diagnosing cervical spine injuries it may be difficult to detect, moreover, it may be difficult to distinguish between spinal cord injury, nerve roots or upper cervical plexus, until the separation between the spine and spinal nerve roots. or severe damage to the cervical plexus nerve is concerned.

We wish to report the next case, mainly due to the unusual traumatic etiology and the uncertain diagnosis of neuropathic damage.

Careful monitoring of respiratory function should be considered in those patients with severe cervical spinal cord injury, as respiratory involvement may occur slowly and less noticeably, even when there appears to be only limited or no sensory involvement under the spinal cord site; as well as fatigue of other respiratory muscles (abdomen, intercostal and accessory) are also possible. Weaknesses of muscles such as the deltoid or biceps should be considered carefully and repeatedly if there is little doubt about the involvement of breathing.

Yogendra Panta +, Aaron Paynter, Joseph Richmond, Sam Jarrell, Static Analysis of a Forklift,Forklifts are flexible devices used in material handling systems. They are often seen being used to move used goods in transit trucks to the factory floor, to repack items inside the factory, or to return worn-out products in transit vehicles for delivery to customers. There are various forklift models available for sale in the market; however, this static tipping analysis is performed on a specific forklift machine model, namely the Hyster Model H50. Depending on the availability of work space (warehouse or road), large and heavy forklifts are less likely to tip while lifting or lowering hold. Strong force on the forklift machine tires when the forklift is unloaded and when normal loads are lifted. In addition, the maximum load that can be lifted before being marked has been determined by a few adjustments depending on the position of the forks. Note that only the power supply and normal power created by the forklift and the load it carried were analyzed using the basic governing values of the fixed equation. It was found that the forklift calibration

point was reached when the two rear tires of the machine began to drop off, i.e. when no other stationary force remained attached to the top. This resulted in two types of calculations. First, the maximum weight that could be lifted into the air with the forks before the tip unit was obtained. Second, a steady load was added and the normal power of each pair of tires was obtained. Backward, vertical, and forward column angles were used for analysis. It was found that sloping forks can lift a lot of weight and provide better standing stability. In addition, the increase in the size of the boxes, but not the weight, caused a quick point because the center of gravity was too far from the front two wheels.

Depending on the availability of space in a particular warehouse, larger and heavier forklifts are less likely to tip when used for lifting objects. Increased angle forks that can be reversed will allow heavy objects to be handled by moving the center of gravity between axle A and axle B. In addition, the total weight of the forklift body can help combat weight. that was raised. If space was a problem in some storage areas, a viable solution to allow for larger luggage would be to add extra weight to the back of the forklift. This can increase the overall weight and alter the gravity center of the forklift, but may also put additional pressure on the mast or other parts of the forklift. Future work may involve analyzing a forklift with three dimensions and taking into account loads that may vary in width. Structural properties such as strength and compression strength of forklift components should be considered. A safety feature of 2.0 or higher is considered to be the best and the maximum load forklift elements can carry while maintaining this safety feature should be determined. The dynamic equilibrium can also be analyzed, as forklifts are usually faster and lower, as well as moving in uneven and rough terrain.

Liai Pan1, a, Qiulei Du2, b, * and Chunshan He3, c, Design Research in Forklift Hydraulic System of Working Device, 5th International Conference on Advanced Design and Manufacturing Engineering (ICADME 2015)

Like a type of industrial vehicle, the forklift plays an important role in human health. Today, to meet human needs, the forklift industry is expanding. In this paper, already based on the basic parameters of the push forklift market, a forklift operating device has been introduced. And according to the calculations and inspections, the parameters of the main structure of the elevating oil cylinder are determined. The water system has been developed and calculated. The results of the paper are of practical value that are important in the construction of a forklift service.

Forklift is an industrial power truck used for lifting and transporting goods. With a metal fork under load, lifting and transporting are done. Currently, there are many types of forklift. In terms of forklift lifting, the forklift is divided into small tones (0.5 t) and 1 t, middle tonnage (2 t and 3 t) and large tonnage (5 t and above). According to the local relationship between the goods and the forklift, the forklift is divided into positive and side forklift. And the forklift operating device is the most important part of the forklift. In this paper, a forklift operating device has been designed and the hydraulic system of the door frame is calculated.

With the development of warehouse, industrial automotive products entry into the workplace, warehouse, supermarket and more. Like most industrial vehicles, current forklift models are limited, unable to fully adapt to a variety of conditions.

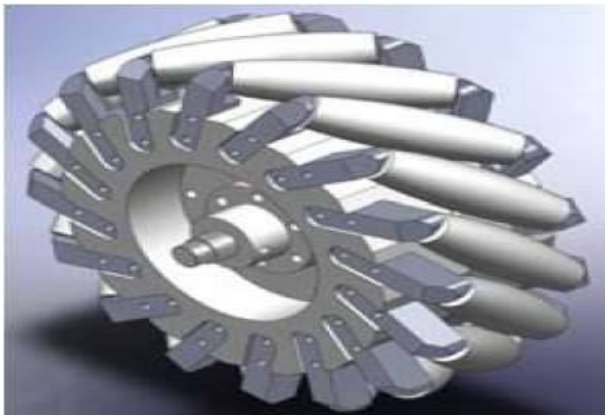

Figure 2.1 3-D Model Mecanum Wheel

III. DESIGN SYNTHESIS

3.1 Design Terms

When it comes to the construction of a forklift, there are a few things that need to be fully understood first, such as the basic components of a forklift, what kind of power source we will use, how the loading device works, what the truck capacity is, etc. Those items are the basis of a forklift design and need to be determined first, then we can move on to other details, such as the size of each component and the selection of the right wheels. In this chapter, we will look at some basic design techniques to get a complete picture of the structure of the entire truck.

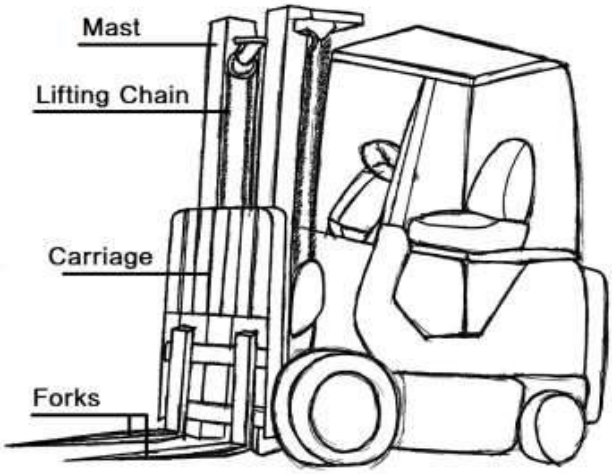

Figure 3.1 Different Parts of Forklift Loading Device

3.1.1 Basic Parts

First we will discuss the basic structure of our forklift.

Truck Frame: this is the base of the forklift where the loading device, counterweight, power source and wheels are all attached. The frame may already have gasoline and hydraulic tanks built as part of the frame assembly.

Loading Device: This section includes a pillar, cart, lifting chain, and forks, as shown in Figure 3.1. The mast is a straightforward organization that performs lifting and lowering the load. It is driven by hydraulic, and is operated by one or more hydraulic cylinders. It will be installed in front of the forklift frame in our construction. The cart is the place where the forks or other attachments are mounted. It is connected to mast rails by chains or connected directly to a hydraulic cylinder and moves up and down. The lifting chain connects the pillar and the cart together. Forks are parts that come in direct contact with the material when working.

Counterweight: This is the weight attached to the back of the forklift truck frame. The purpose of a counterweight is to measure the recommended load. When a forklift is driven electrically, a large lead acid battery itself can be counted as part of a counterweight.

Power Source: One of the main options for a combustible internal combustion engine is LP gas, CNG gas, and gasoline or diesel. Another option is an electric forklift powered by a battery or fuel cells that power on electric motors. The electric motors used in the forklift can be DC or AC types. We choose the electric battery for our forklift, and the battery can be removed as part of a counterweight.

Tires: The type of tire depends on different operating conditions. If the forklift is very active in the house, we should choose strong tires; if used externally, the pneumatic type may be better. Our truck is used indoors, so solid wheels can be our choice.

Cabinet: This is the part where the operator lives inside and drives and loads. It has an operator seat and control pedals, steering wheel, levers, switches and dashboard containing readable operator. The cabin area can be open-air or enclosed, but it should be covered with additional guards to ensure the safety of the driver.

Overhead Guard: This part is usually a metal roof based on poles on each corner of the cabin that protects the driver from any falling objects, so it is very important. Whether it is a separate assembly or other forklift, the top guard is an integrated part of the truck frame assembly.

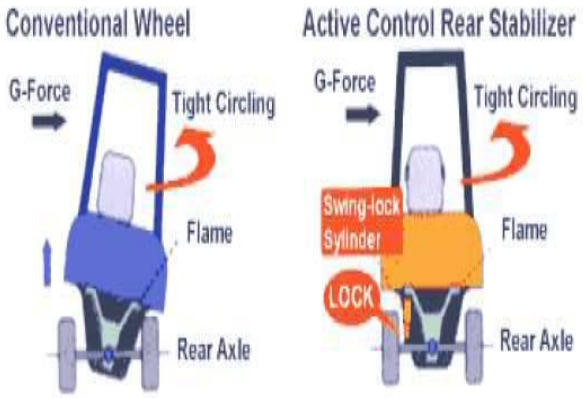

Figure 3.2 Demonstration of System of Active Stability (SAS)

Email attachments: when it comes to forklift attachments, various types of grip attachments are available. We will need to modify or add those special attachments when dealing with different types of load.

For example, if loads are weak and difficult to maintain during transport, we may need to add a load stabilizer, see Figure 3.2. The loading stabilizer holds the load slightly from the top. It is very useful for those fragile and isolated loads that may remain in place during forklift transport.

What we need to consider here is that any attachment to a forklift will reduce its load capacity, which is calculated by stock fork and forks. So when we use additional attachments, the actual load rate may be much lower.

Those are the main components of our forklift, the details of their design will be discussed in more detail in Chapter

3.1.2 Stability & Developmental Triangle

The most important consideration when designing a forklift is a safety issue, while the truck is loading and moving.

The forklift stability system consists of 3 contact points:

2 front wheels and a central rear axle of the forklift with 4 wheels, or the rear wheel of 3 trucks. Without these 3 contact points, the forklift could not even sit safely in an uneven position.

If the forklift lifts loads, apparently its gravitational center may shift to the front wheel line due to the extra load we put on it, see Figure 3.3, which ensures that the truck will remain motionless without moving. A number of manufacturers have included features to control the mast angle, especially with the recommended load. For example, Toyota Active Mast

The Task Manager is sensitive and responds to instability by limiting the angle of the column and the speed in terms of height and weight of load. This feature helps to prevent forward pointing due to a decrease in the lifting capacity caused by the column tilting function.

The second safety issue we need to take care of is side tipping over the forklift transport. See Figure 3.4. The stability of a forklift is constantly changing due to the speed and rate of forklift conversion. In this regard, there are actually two ways to prevent this problem.

The first solution is to introduce a new system called SAS - System of Active Stability. The program was initially designed by engineers of Toyota Material Handling Company to reduce the chances of the side riding.

IV. ADVANTAGES, DISADVANTAGES AND APPLICATIOS

The Beauty Of The New System :

- Compared to the existing forklift on the market, our design has 180 ° rotating forks (connected to a cabin on both sides) with the help of lifting scissors pushing the driver's cabinet.
- full loading width
- The car is stable with the support of a scissor lift.
- In our design, these forks can be easily adjusted to use other attachments, tailored to different loading needs.
- the whole structure is stable and economical
- environmentally friendly fuel burners.

Disadvantages of Existing System :

- Space problem
- Limited vertical movement of the fork Security issues
- Failure of the forklift itself,
- Includes breakage,
- Fatigue
- Repeated pressure
- It causes premature wear
- Failure of large parts

Applications :

- Used for loading and unloading standard packaged goods.
- For special attachments, it can also be used for unpacked or goodly standard packaged goods.
- Products such as boxes and boxes can use this type of attachment.

Compared to the existing forklift on the market, our design has 180 ° rotating forks (connected to a cabin on both sides) with the help of a scissors that propel the operator's cabinet. In our design, these forks can be easily adjusted to use other attachments, adjusted for different loading needs. With an electric battery in the back as part of the counterweight, the entire structure is stable and economically and environmentally friendly compared to those burning gasoline.

V. CONCLUSION AND FUTURE SCOPE

Conclusion

This project is mainly about the new forklift design. We have researched products that are already on the market for use. Then we read more details about how forklifts work and the main structure and some new design ideas were proposed. Compared to the existing forklift on the market, our design has 180 ° rotating forks. the whole structure is stable and economically and environmentally friendly.

The scope of the future for research purposes :

In this study, we are investigating a new and different forklift design from existing designs. The new design offers two features: one is that the forklift is attached to the body of the truck at both ends, and the other is that the new lifting mechanism is highly integrated. The rest of the thesis describes these new features in more detail.

To achieve our new design goals, we need to do research on the existing forklift design and what type of product transport uses forklifts. Based on that research, we need to find out what the shortcomings of the existing projects are. The new design offers both new and improved features, in addition to what is currently available. Next, we will use CAD modeling to create a new 3D design. Finally, we will use analysis and calculation in the model to ensure that it is stable and safe under operating conditions.

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