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Three Axis Modern Trailer

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Abstract: *The transport industry has supported significant advancements in current years, accompanying modern trailers created to meet the demands of efficient haulage. Trailer has innumerable applications in today's experience. In industrial and domestic concerns, trailer can haul a difference of products containing gravel, potatoes, seed, sand, fertilizer, heavy rocks, etc. By taking everything in mind wide scope of the problem, it is necessary commotion study and research on the topic of preview mechanism in order to manage more economical and adept. This project work Three axis up-to-date trailer has been realized having intentional the difficulty in unloading the materials. Three-axis modern trailers have happened introduced as a answer to challenges faced by traditional two-axis trailers, such as balance and maneuverability issues. The Modern Dumping mechanism preview has been fabricated by detecting the trouble in unloading the material. Existing trailer has proficiency of unloading only in backside of preview. But modern Trailer comes with competence of unloading to the Three sides that is to say backside, left side, kindliness trailer by urgent the Direction control valve triggered. The Valve is „ON" and the compressed air goes to the airy cylinder. The key component of the projected arrangement is the airy system. Compressed air is utilized to stimulate the lifting means, consisting of airy cylinders, which raise the trailer lodging in three axes. This three-axis change allows for exact positioning and controlled unloading of cars or materials from the preview Then the compressed air passes through the tube, and therefore pushes the pneumatic barrel, so that the Lifting is used. The speed of the pneumatic cylinder is different by using flow control spigot. This research paper presents the design and reasoning of a three-axis modern preview. The paper outlines the design process, including the collection of materials, the conclusion of dimensions, and the incorporation of state-of-the-art features. The study of the trailer's performance was attended using mathematical simulations, and the results show that the proposed design can bear heavy loads with better stability and maneuverability. The paper decides with a consideration on the potential impact of the three-axis modern preview on the transportation manufacturing.*

Keywords: Three-axis modern trailer, Haulage, Stability, Maneuverability, Direction control valve,Analysis

Problem Statement: Existing trailers have happened widely used in the conveyance industry for decades. However, they have some restraints such as stability and maneuverability issues, especially when accomplishing heavy loads. In case of blocked area, it takes innumerable time and face difficulty to turn automobile. The focus of this project search out study and conduct research on the topic of the excess mechanism in order to improve its financial and operational efficiency.

I. INTRODUCTION

Transportation is an integral part of any economy, and the demand for efficient haulage is on the rise. The use of trailers for material transportation in construction projects is widespread due to their high load carrying capacity and material handling capabilities. However, these trailers often encounter challenges when it comes to unloading materials, especially in areas with limited road width or congested spaces. The unloading process can be time consuming and inefficient, requiring additional time for turning the vehicle and arranging the material properly.The use of trailers for material transportation in construction projects is widespread due to their high load carrying capacity and material handling capabilities. However, these trailers often encounter challenges when it comes to unloading materials,

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especially in areas with limited road width or congested spaces. The unloading process can be time consuming and inefficient, requiring additional time for turning the vehicle and arranging the material properly Traditional two-axis trailers have been widely used in the transportation industry for decades. However, they have some limitations such as stability and maneuverability issues, especially when carrying heavy loads. In case of congested area, it takes lots of time and face difficulty to turn vehicle. In response to these challenges, modern trailers with three-axis have been introduced, offering improved stability and maneuverability. This contemporary three-axis trailer can unload a vehicle from all three sides, saving time and eliminating the need to turn the vehicle. Since the material can be unloaded in any direction, the term "three axis modern pneumatic trailer" can be used with confidence. the main effects of a modern three-axis pneumatic trailer. has eliminated the need for space, which frequently blocks roads.

A caravan is an essential component of any development project, thus it plays a crucial role in the successful completion of all site-related tasks. One of the problems with unloaders that is mentioned is the difficulty in emptying the contents to the sides while dumping in narrow streets and mines. As a result, the job work's necessity, which is about triangular, was raised.

II. LITERATURE REVIEW

Waghmare et al (2015) proposed that situations where there is a space constraint would greatly benefit from the trolley's sideways movements. By employing this process, road blockage is avoided, and time is saved and productivity is boosted. For farmers, site rubbish collectors, as well as for dumping sand, gravel, and other materials, a three-way dumping trolley is particularly helpful. Compared to typical dumpers, it completes the task faster.

Prof. Deshmukh.S.A. et al (2015) Mechanical Eng., University of Pune, India project work titled “THREE AXIS PNEUMATIC MODERN TRAILER” has been developed after research on how difficult it is to unload the stuff. Our investigation into many auto shops found that the majority of the time, challenging techniques were used to remove the goods from the trailer. The material will only be discharged from the trailer in one direction. Small roads and compact streets make it challenging to dump the items. In our project, these are fixed to make it very easy to unload the trailer from all three sides. Now that this challenge has received the majority of the project's attention, a workable solution has been developed. such that the trailer's three axes may be used to unload the automobiles without using any impact force. The Direction control valve was activated by pressing it.

Lavate et al (2017) has created a three-way dumping device that operates using a pneumatic system and automatic solenoid valves. When it is necessary to dump the material on the left or right side of the vehicle, the pneumatic locking system pin at the corresponding side of the trolley engages the hinges automatically, and the trolley is hoisted by an actuator coupled to the trolley and chassis by a Universal joint. This method will make it simple for the driver to unload the trailer and will also save time and gasoline.

Bhoite et al (2017) has developed the idea of a tipper trolley, which is divided into two halves, Rotation and Dumping. The tipper is rotated using a worm and gear mechanism. The electric motor is horizontally linked to the cxWorm. Double Pole Double Throw switches are used to complete the circuit between the battery and the motor in order to power it. There are 40 teeth on the profile of the spur gear. When 10 spur gear teeth are advanced, the trolley rotates by 90 degrees from its starting position in 20 seconds. Pneumatic cylinders are used to dump material once the trolley has reached the desired angle.

Asst. Prof. S. Divya et al (2021) Department of Mechanical Engineering, This project work "DESIGN AND FABRICATION OF THREE AXIS ROTATING TRAILER USING PNEUMATIC SYSTEM" was created after researching the difficulty in emptying the materials. Our investigation of a few car garages suggests that, in general, certain difficult methods were used to remove the contents from the trailer. The material will only be discharged from the trailer in one direction. In small streets and compact roadways, it is challenging to empty the materials. Our duty has been corrected on all three sides so that the trailer can be unloaded successfully. The compressed air that the compressor engine stores and uses to power the car's engine are connected together. This compressed air is activated by the pneumatic cylinder, which opens the valve. The trailer is rotated in three directions using a spur gear, making it simple to unload.

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Prof. D.K. Thakur et al (2022) Department Of Mechanical Engineering, KCESCOEM, Jalgaon, Maharashtra, India. project work named "THREE AXIS PNEUMATIC MODERN TRAILERS"has been thought to have focused on the difficulty of emptying the materials. Our examination of a few vehicle carports revealed that the majority of the time, a few challenging techniques were used to remove the materials from the trailer. An appropriate strategy has been devised as a result of the project's current predominant focus on this issue.

Prof. Dr. Amol Lokhande et al (2023), Department of M.Tech Design,of Sandip University, School of Engineering and Technology, Nashik, Maharashtra, India. – This project work "DESIGN AND FABRICATION OF THREE AXIS ROTATING TRAILER USING PNEUMATIC SYSTEM"was created after researching the difficulty of emptying the materials. Our investigation of a few car garages suggests that, in general, certain difficult methods were used to remove the contents from the trailer. The compressed air that the compressor engine stores and uses to power the car's engine are connected together. This compressed air is activated by the pneumatic cylinder, which opens the valve. Spur gear is used to rotate the trailer in three directions and makes it simple to dump the items on narrow, winding highways and streets.

III. DESIGN

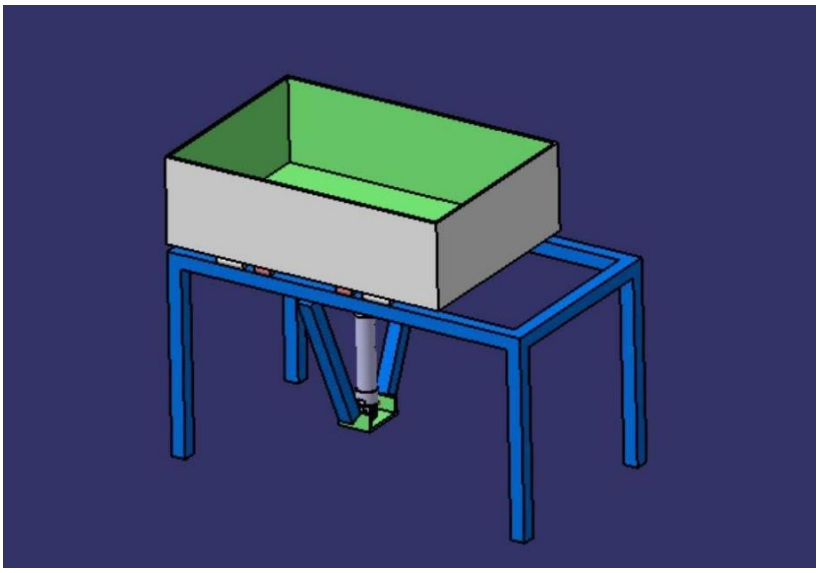

Fig 01: Three Axis Modern Trailer

IV. COMPONENTS

- Aircompressor: Compressing air to the necessary pressure is the air compressor's primary job. A storage tank's pressure rises as additional air is pumped into it by an air compressor.
- The project's air compressor has a unit rpm of 720 and a tank capacity of 160 lts.
- Directional control valve: Directional control valves are among the most essential components of both pneumatic and hydraulic equipment. They enable fluid to flow from one or more sources along several pathways. It comprises of a spool, which moves to either limit or admit the flow, controlling the flow of the fluid.
- Pneumatic cylinder: Pneumatic cylinders are mechanical devices that generate force in a reciprocating linear motion by using the power of compressed gas. Pneumatic cylinder used in project has Outer diameter - 3 cm , Length - 25 cm, Main shaft - 12 mm, Inner Shaft - 8 mm , Max. Load - 20-25 kg
- Connecting Hose: A hose is a hollow, flexible tube that is used to transport fluids from one place to another. Hoses are occasionally referred to as pipes or, more generally, tubing. A hose often has a cylindrical shape. Application and performance are combined to form the foundation of hose design.
- We had used 10 mm hose pipe in our project.

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V. METHODOLOGY

The following can be used to summaries the development process for the Three Axis Modern Trailer:

- Problem analysis: The first step is to thoroughly examine the current unloading procedure for trailers in order to pinpoint its shortcomings and difficulties. This entails examining the practices now in place, evaluating the challenges encountered, and comprehending the need for development.
- Conceptual Design: The Three Axis Modern Trailer's conceptual design is created based on the problem analysis. The number of axes, the kind of mechanism used to permit multi-directional unloading, and the use of pneumatic cylinders for lifting the caravan cabin are a few examples of the things to take into account.
- Detailed Design: Following the conclusion of the conceptual design, the detailed design phase starts. Creating technical drawings, choosing suitable materials, and developing important parts like the trailer frame, pneumatic cylinder mounting system, and control mechanisms are all required in this process. Construction of the Three Axis Modern Trailer prototype follows the completion of the comprehensive design. This entails creating the trailer frame, incorporating the pneumatic cylinders, and putting everything together in accordance with the design requirements.
- Testing & Validation: The prototype is put through extensive testing to gauge its effectiveness and confirm its functionality. The multi-directional unloading capabilities must be put to the test, the pneumatic cylinder lifting mechanism must be evaluated, and the overall stability and security of the caravan while in use must be guaranteed.
- Performance Optimization: The Three Axis Modern Trailer's performance is optimized by making any necessary adjustments or upgrades in accordance with the findings of the testing. To increase effectiveness and usability, this can entail modifying the control mechanisms, optimizing the lifting system, or improving other design elements.
- Reporting and Documentation: The design, development, and testing procedures are all documented throughout the project. For a complete record of the project, this entails producing technical reports, engineering drawings, and specifications. The project's methodology, conclusions, and results are compiled in a final report.

At first connect air compressor to the connecting hose of the pneumatic cylinder and supply voltage to the 5/2 solenoid valve. When solenoid valve is in OFF condition and we provide pressure near about 40 psi to the pneumatic cylinder then pneumatic cylinder starts lifting the frame of the trailer. When solenoid valve is in On condition then pressure release from the cylinder and frame return down to base position. We have given the hinge system for the unloading.we have also given the lock unlock system to the side panel of the frame . to unload material easily without any obstacle.

If we have to lift trailer to the back side then hinges of the back side is fixed and other to side are removed. Then only frame will lift to the back side when pneumatic cylinder applies pressure.

If we have to lift trailer to the left side then hinges of the left side is fixed and other to side are removed. Then only frame will lift to the left side when pneumatic cylinder applies pressure.

If we have to lift trailer to the right side then hinges of the right side is fixed and other to side are removed. Then only frame will lift to the right side when pneumatic cylinder applies pressure.

This is how the Three axis modern trailer actually works.

VI. RESULT & DISCUSSION

In the result we have seen that trailer can easily unload the Material to the all three sides that is left, right and back. This can be achieved by using the pneumatic cylinder connected with air compressor and direction control valve. Three axis modern trailer can be further modified and improve efficiency, and consume less time gives maximum output. As a future scope we can use a hydraulic cylinder instead of pneumatic cylinder. Because hydraulic cylinder can lift heavy weight. By making some changes in the design we can fit this model into any type of heavy vehicle such as trailer, dumper, tractor, trolley, etc. Here this Three axis modern trailer is shown as a prototype that's why we are not using hydraulic cylinder, proper design fit for vehicle, actual pneumatic cylinder position. These changes can be possible to make in real project. Overall, the Three Axis Modern Trailer project presents a practical and innovative solution to

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optimize trailer unloading processes, improving operational efficiency and contributing to overall productivity and cost savings in various industries.

VII. CONCLUSION

In conclusion, A prototype which exhibits the expected results is developed. With analysis of working and with the help of pneumatic system, lifting operations can be easily carried out without much effort. The three-axis modern trailer has significant potential for the transportation industry. The design and analysis presented in this paper demonstrate that the proposed design can carry heavy loads with improved stability and maneuverability. The incorporation of advanced features such as hydraulic lifts and GPS tracking systems further enhances the trailer's efficiency. The use of three-axis modern trailers can lead to increased efficiency and safety in haulage operations, and thus, can have a positive impact on the transportation industry.By using more techniques, they can be modified and developed according to the applications. Further modifications and working limitations will put this work in the main league of use. The Three Axis Modern Trailer project presents a practical and innovative solution to optimize trailer unloading processes, improving operational efficiency and contributing to overall productivity and cost savings in various industries.

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