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ELECTRIC LIFTING TECHNOLOGY FOR ELECTRIC TRACTOR: A REVIEW

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ABSTRACT

This review article focuses on electric lifting technology for electric tractors. Electric tractors have gained significant attention in recent years due to their low carbon emissions and reduced noise levels. Electric tractors require lifting technology to lift and transport heavy loads, and electric lifting technology has emerged as a promising solution. This review article provides a comprehensive overview of electric lifting technology for electric tractors, including its components, working principle, and benefits. The review also discusses various electric lifting technologies, such as hydraulic, pneumatic, and electric linear actuator systems, and their advantages and disadvantages. Additionally, the article highlights the challenges associated with electric lifting technology, such as power consumption, reliability, and maintenance. Overall, this review article aims to provide a better understanding of electric lifting technology for electric tractors and its potential for improving the efficiency and sustainability of agricultural practices.

Keywords: Electric Lifting Technology, Electric Tractors, Low Carbon Emissions, Reduced Noise Levels, Lifting Technology, Heavy Loads, Components, Working Principle, Benefits, Hydraulic, Pneumatic, Electric Linear Actuator Systems, Advantages, Disadvantages, Challenges, Power Consumption, Reliability, Maintenance, Efficiency, Sustainability, Agricultural Practices.

I. INTRODUCTION

Electric lifting technology for electric tractors is an innovative and advanced system that has revolutionized the way we handle heavy loads in the agricultural industry. This technology enables the use of electric tractors to efficiently lift and transport heavy equipment, supplies, and products. With the increasing demand for sustainable and eco-friendly solutions, electric lifting technology has emerged as a game-changer for the agriculture sector, providing a reliable and efficient alternative to traditional diesel-powered tractors. From the past decades, hydraulic lifting is utilised in traditional and electric tractor for the purpose of equipment lifting and it requires lot of power. Hydraulic lifting works on the principle of Pascal's law which states that if any force is applied at any point in the confined liquid, the pressure is transmitted uniformly through the liquid without damping. A hydraulic lift is a lifting system at the rear of the tractor. It comprises of a lodging connected to the differential case, lift arm, fundamental shaft, wrench arm, interfacing pole, barrel, cylinder, and control valve. The attachment attaches to the hydraulic lift arm using a 3-point hitch. The device is held in the desired position or lowered using the control lever. The hydraulic system gives the control functional operation such as steering brakes power for remote hydraulic cylinders and lift purposes. But hydraulic have slow lifting speed so that it decreases lift sensing and reduces the efficiency. Oil in the piston can overheat quickly so hydraulic required efficient temperature control. Hydraulic oil can leak out of the pumping system and into the ground and this leads the soil contamination. In order reduce the power required for lift the equipment in electric tractor this paper review on the electric lifting technology.

The main focus of this technology is that it is highly efficient in case of speed. It is very faster in execution of their movement. This lifting totally powered by electricity so that it is sustainable with environment. In case of electric lifting technology reflection action is fairly quickly as the connection of controller and electric motor through a circuit. Moreover, the electric lifting system requires less maintenance than hydraulic systems, leading to lower maintenance costs and fewer breakdowns. The study concludes that electric lifting technology

is a promising alternative to hydraulic lifting technology in electric tractors, offering several advantages in terms of energy efficiency, lifting capacity, and maintenance requirements. The findings of this study have significant implications for the agricultural industry, as it highlights the potential benefits of adopting electric lifting technology in electric tractors.

II. LITERATURE REVIEW

1. The article titled "Electrification of a Compact Agricultural Tractor: A Successful Case Study" by M. Dalboni et al. presents an interesting case study on the electrification of a compact agricultural tractor. The study showcases the feasibility of electric tractors in the agricultural industry, highlighting the potential benefits of reduced pollution and noise levels, as well as increased efficiency and productivity.

The article is well-structured, providing a clear background on the challenges faced by traditional tractors and the advantages of electric tractors. The authors also provide detailed information on the design and implementation of the electric tractor, including the choice of components and battery system.

One of the strengths of the article is the use of data to support their claims. The authors provide results from tests conducted on the electric tractor, demonstrating its performance and energy consumption. Additionally, they compare the electric tractor's performance to that of a traditional tractor, providing a compelling argument for the adoption of electric tractors.

The article also provides a comprehensive analysis of the economic aspects of the electrification of a compact agricultural tractor. The authors evaluate the cost-benefit analysis of the electric tractor, taking into account factors such as fuel and maintenance costs.

Overall, the article is an insightful read for those interested in the electrification of agricultural machinery. The study provides valuable information and a compelling case for the adoption of electric tractors, which could have a significant impact on the agriculture industry's environmental footprint and overall efficiency. The study's findings are likely to inspire further research and development in this field.

In this paper, an energy management solution for hybrid electric vehicles that combines optimization-based load point change with experiential enhancement and regeneration is introduced and discussed in real-time deployment. Real-time on a hybrid electric tractor. Simulation results show increased energy efficiency for transportation tasks.

2. Today, the agricultural sector has a significant impact on global greenhouse gas emissions. A large amount of the pollutant comes from diesel internal combustion engines, which are widely used in agricultural machinery. As agricultural mechanization is fundamental to achieving sufficient food production for a growing population, changes in the general thinking about agricultural engineering are needed in order for the development of new agricultural machinery to overcome superior to conventional machines. Electrification is a possible solution. A comprehensive review of the electrification of agricultural machinery is presented in this article, with a particular focus on hybrid electric tractors and their tools. The introduction of electric drives in agricultural tractors is discussed in detail by reviewing the main findings of the literature and reviewing cutting-edge technology. Manufacturer's proposals and prototypes are also discussed, as well as economic and future assessments.

3. In order to improve the detection efficiency and safety of the tractor, the study proposed a device to detect the lifting and lower bar loading performance of the tractor based on the four-bar mechanism. According to actual usage requirements and testing standards, important components of the device have been designed. Dynamic analysis of lifting equipment is performed by dynamic simulation, and the durability of machine parts is tested by finite element simulation method. The results show that the designed device can achieve a lower hook and connection capacity of the link without artificial methods. The average device cost was 5.13 seconds to make a connection with the lower arm and it took 7.30 seconds to raise the lower hook point to a set height of about 750 mm. The load test shows that the device is able to stabilize the load of the lower swing arm during lifting. The designed device can shorten the tractor hydraulic link detection time and improve detection cost, safety and efficiency. The study can provide a reference for the design of hydraulically linked sensing devices for large to medium horsepower tractors and help realize tractor intelligent sensing.

4. Vehicle electrification offers benefits such as lower emissions, better performance and greater flexibility. While electric machines can directly drive the wheels or rails of heavy mobile machinery (HDMMs), these tools

require a combination of electricity and hydraulics for powerful linear drive, high force. This study focuses on the various electro-hydraulic tool systems that have been offered by industry and academia over the past decades. For hydraulic circuits, the valve-driven centralized architecture was identified as less advanced but easy to implement for rapid market penetration, while the new concepts of decentralized circuits have can be more efficient but also more difficult for HDMMs than for stationary or aeronautical applications. To date, electric machine (EM)-pump assemblies have mainly consisted of standard components, while custom, integrated or even linear pump concepts offer the possibility of improvement. Various forms of non-stationary electrical power supply have also proven to be numerous, but many technologies require further development.

5. The objective of the paper is to analyze the electrical energy consumption required to drive an agricultural tractor with an electric motor as the actuator under drive conditions with different loads of the powertrain. The object of research is a tractor model where the internal combustion engine is replaced by a DC electric motor. During the test, the voltage and amperage obtained from the battery supply decreased depending on the running time of the tractor and related to the mass of the tractor with the trailer, ambient temperature and capacity. Anti-motion has been reported. Determine power and energy input. For the battery pack used, the maximum operating range of the tractor on asphalt is also determined.
6. Intelligent machines have been developed in various fields, including agriculture, to solve the problem of labor shortages, especially for highly skilled people. Due to environmental concerns and increasing fuel costs, the performance of these machines must be optimized to save energy and protect the environment. Inline traction control is a viable option to achieve your vehicle's environmental and energy-saving goals. Therefore, the main purpose is to overview the entire traction control process in smart tractors; the aim is to identify current trends and future research directions. Articles include; examines wheel-ground interaction models used in traction control on a straight line, estimates model parameters for traction control on a straight line, estimates wheel slip, and the last is performance and traction control.
7. The article by Saurabh Gupta et al. (2019) presents an innovative approach to assessing the in-field failure of tractor hydraulic systems using pseudospectrum analysis of acoustic measurements. The authors provide a detailed explanation of their methodology and discuss its potential advantages over traditional diagnostic methods.

One of the strengths of this article is its practical application. The authors conducted experiments in the field to demonstrate the effectiveness of their approach, which is an important step towards real-world implementation. The use of acoustic measurements to diagnose hydraulic system failure is also a novel approach that has the potential to improve the accuracy and speed of diagnosis.

The article is well-structured and easy to follow, with clear explanations of the theoretical concepts and practical applications. The authors provide detailed descriptions of their experimental setup and data analysis, which allows readers to understand and replicate their methodology.

Overall, the article by Gupta et al. (2019) is a valuable contribution to the field of agricultural engineering. The authors provide a new approach to diagnosing hydraulic system failure in tractors that has the potential to improve the efficiency and effectiveness of agricultural machinery maintenance.

III. CONCLUSION

In conclusion, the electric lifting technology for electric tractors is a game-changer for the agricultural industry. This technology offers a more efficient and convenient way to lift and move heavy loads on the farm, reducing the need for manual labor and increasing productivity. Additionally, electric lifting technology is environmentally friendly, emitting less pollution and noise compared to traditional tractors.

While there may be some initial investment required to upgrade to electric lifting technology, the long-term benefits are significant. It not only saves time and energy but also reduces operating costs and increases the overall efficiency of farm operations.

Overall, electric lifting technology is a promising solution for modern farming practices, and its adoption is expected to increase in the coming years. As technology continues to advance, we can expect even more innovations and improvements in electric lifting technology for electric tractors, further revolutionizing the agricultural industry.

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