Resincap Journal of Science and Engineering
Volume 3, Issue 9 September 2019
ISSN: 2456-9976

Review of Design and Fabrication of Power Trailer for Heavy Load.

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ABSTRACT

There have been some concerns related to transportation of sugar cane mostly in villages. Transporting of sugar cane may expose to risk related to tractor efficiency as well as failure or more efforts are required to transfer from one place to another place. Heavy transfer of sugar cane through trailer which is propelled by tractor particularly in such case tractor may lift from front side or more power is required to climb or on off-roads. Through observation, a few problems related to current handling of sugar cane via trailer were identified. A power trailer was then design and fabricated to address these issues. A pilot study on the use of developed trailer for handling of sugar cane [1]. Power trailer provides full traction from tractor and trailer wheels, when climbing wheels or off-road condition or ditch condition. In this situation, better load distribution as well as wheel contact with ground surface is obtain at less power requirement from tractor to carry same load. So, in this condition less fuel consumption is achieved. Tractor and trailer becomes an all-wheel drive instead of only tractor pulls a trailer, transporting at difficult road condition or areas are now easier using this system, reduces the breakdown and damages of tractor-trailer.

Keywords

Power Trailer Drawbar pull effect Heavy load transportation Traction

1. INTRODUCTION

Transportation of heavy objects many times creates a problem. For example, transportation of sugar cane, soil, construction material, etc. Here we can consider the example of sugar cane which gets transferred from one place to another place through trailer or trucks. In rural India, the agricultural produce is primarily transported manually. Also, for carrying the agricultural implements and livelihoods trolley is incorporated attached to the tractor. The tractor trolley is suitable for on road transportation of agricultural produce, livelihoods and implements. But for transportation within the territory of agricultural fields and farmers place is not suitable. As its large size occupy more space, uncertainty in availability and is also costly. The movement of agricultural produce in villages mostly done manually by hiring local laborers requiring high manpower. In addition, conventional practices cause wastage of time and labor while loading or unloading of mass and their transportation along with drudgery to both animals and human.

For on-road transportation of agricultural produce and implements, the major categories of transport equipment used are namely conveyors, cranes, industrial trucks. Similarly, the conventional practices of good transportation are performed using donkey, ox carts, camel and also manually.

In current scenario of constructional equipment like tractor front hydraulic bucket is used, but that type of bucket has more extra attachments required like hydraulic operated valve, piston-cylinder arrangement piping and extra support are required that way the cost of this bucket is high and more complicated. The rear bucket is used to overcome or avoid that type of extra attachment as well as complicated construction due to use in rear mechanical linkage bucket. The constructive and operational improvement of tractors as mobile self-propelled agricultural means allowed the mounting or coupling of equipment, hence rendering tractors exploitable in in agriculture as well as in other branches of economy.

In agriculture, the main vehicle is a tractor with trailer. Tractor-pulled off-road machine combination may have driving wheels on the tractor and also on the trailer. The tractor can be equipped with one or more driving axles. Such machines produce significantly more traction and slip-less, because more weight is utilized for their grip with the soil on road. However, the simple addition of a driving axle can drastically increase fuel consumption and negatively impact the overall vehicle dynamic and performance. The problem is that the performance of multi-wheel-drive vehicles depends on the distribution of engine power among the driving axles, and also left and right wheels of each axle. Power distribution between the wheels is determined by the vehicle's drive line systems, which consist of a set of power driving units. Many researchers are of the opinion that, for example, the use of two driving axles instead of one unalterably increases the vehicle's fuel consumption, irrespective of the parameters of power dividing units and driving conditions. The researcher's main argument usually is that by providing motion to the driving components of the additional driving axle, higher power consumption is required. A distinctive feature of vehicles with four or more driving wheels is that fuel efficiency and mobility not depends only on the total power applied to the all the driving wheels, but also on the distribution of total power among the wheels. The same vehicle with the same total power for all the driving wheels, but with different power distribution among the driving wheels, will demonstrate different fuel consumption, mobility, and traction.

2. METHODOLOGY

Tractor is mobile energy source intended for tractive work, which is why drawbar performance is essential. The drawbar pull and tractive power are given particularly by the design parameter of each tractor. The effective power of engine

cannot be entirely converted to either the tractive power or power take-off. The whole process can be described by an equation of power balance of tractor.

Eq. (1.1). $P_e = P_t + P_H + P_m + P_\delta + P_\vartheta + P_s + P_\omega + P_a$ [W]

Where;

P_e = effective engine output,

P_t = drawbar pull power,

P_H = hydroelectric generator power,

P_m = power loss in transmission device,

P_δ = power loss by slip,

P_ϑ = power loss by rolling resistance,

P_s = power required to climb slope,

P_ω = power required to overcome air resistance,

P_a = power required for acceleration.

The conversion of effective engine power to various useful components is accompanied by losses. Part of engine power losses consist of mechanical losses, part consist of drive gear contact with the ground (slipping and rolling resistance) and part is due to driving conditions (climbing, acceleration, wind resistance, etc.)

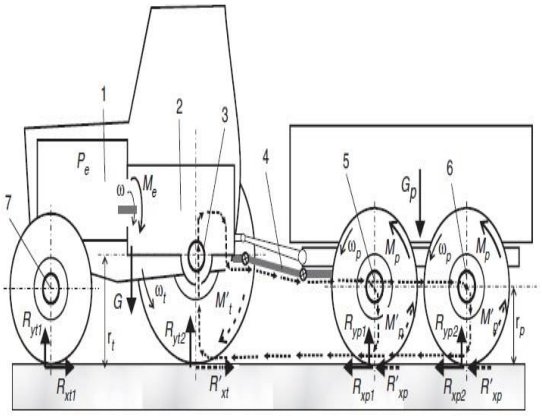

Fig. No 1 "Tractor-Trailer" kinematic diagram, when all the wheels are driven, except the front axle of the tractor.

- Engine
- Transmission of the tractor
- Rear driving axle of the tractor
- Power take-off (PTO)
- Driving front axle of the trailer
- Driving rear axle of the tractor
- Front axle of the tractor.

In our existing model, we use hydraulic system for distribution of power to heavy loaded trailers in order to enhance a tractor performance at same specification. This power obtained from tractor engine is supplied to already implemented hydraulic system in tractor. Then this power is configuring to differential of trailer though this hydraulic media. This configuration achieves a power trailer. This implementation consumes a less power to carry same load. The tractor and trailer becomes a four-wheel drive instead of two-wheel drive.

3. PROPOSED TRAILER SETUP

Transportation in villages, there are many problems during heavy load condition because of climbing roads, muddy roads, off-road or ditch [1]. In this situation, more tractive effort, high torque from engine and good transmission mechanism is being viewed as future scope for heavy load vehicles. Thus, introducing a power trailer in which we are going to make some modifications by using hydraulic system in which it takes power from the pump and drive the trailer wheels. The power flow is as shown in figure 1. The system needs partial or no modification in the existing designs. In heavy loaded applications such as trailer, unbalanced forces cause lifting of tractor from front side thus insufficient tractive effort is available at the tractor wheels. More specifically speaking, this effect causes due to drawbar pull. Drawbar pull of tractor is influenced by various factors. A very significant parameter influencing the drawbar pull is tyre pressure. It has been improved by measurement of drawbar pull at various tyre pressure and tests showed that drawbar pull is vastly improved at lower tyre pressure. Also, the studies found that for an agricultural tractor four-wheel drive achieved a better drawbar performance in comparison with the rear wheel powered tractors [2]. Hence the concept we are implementing has a brief advantage in particular situations of heavy transportation in slopes or off road condition due to achievement

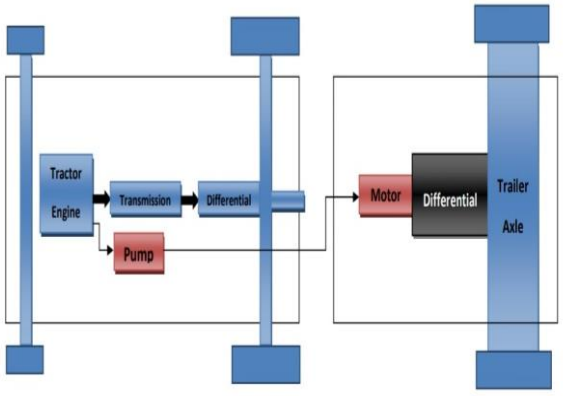

Fig. No 2 Layout

CONCLUSION

After implementation of system, transportation on difficult road condition or areas is now easier thus we can increase the load carrying capacity with better distribution of load. It uses same or less power from existing model, wheels gives better contact with ground and can contribute on hills. By implementing this concept, we achieve efficient power transmission as the hydraulic pump consumes very less power from engine and produce required torque which helps to move trailer in hard conditions of road. Also the transmission losses

are very less in hydraulic system as compare to mechanical arrangement.

REFERENCES

[1] Radin Zaid Radin Umar, Nadiah Ahmad, Isa Halim, Poh Yan Lee, Malek Hamid, "Design and Development of an Ergonomic Trolley-Lifter", Volume 10, Issue 3, Pages 227-335, September 2019.

[2] R Abraham, R Majdan, R. Drlicka, "Possibilities of improving the wheel tractor drive force transmission to soil", Volume 61, 2015.

[3] Adam Polkar, Lucas Lensin, Jiri Votava, "Drawbar pull effect and its effect on the weight distribution of a tractor", Volume 65, November 2017.

[4] Savita Kumari, Dr. K. K. Jain, "Development of hydraulic operated tractor mounted hay rake cum loader", 2019.

[5] Sagar Kailas More, Sushil M. Magar, Pradip B. Dhole, "Design and fabrication of tractor rear loader for constructional applications".

[6] Algirdas Janulevicius, Gediminas Pupinis "Power circulation in driveline system when the wheels of the tractor and trailer are driven" Volume 28(30): 313-321, 12 December 2012.