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Modified Bullock Cart

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ABSTRACT

Bullock and bullock cart plays an important role in every farm based activity since long history. With the advent of technology, the farming methods and equipment used changed drastically. It is evident that, there is no significant development and modifications carried and incorporated in the animal driven cart used for agricultural activities. The modified bullock cart are use in iron material in manufacture. The Bullock cart are rotate in any direction and also use in lifting mechanism type of gear are use in bullock cart There are few researchers who have contributed in the developmental aspects of the cart. This paper is a review of research work carried by various researchers in this area. The work will give insight to basics of design of a bullock cart and the summary of research work done up till so that further research may be outlined. A primary solution to the problems presented invarious research papers are proposed as a conclusion of this work.

Keywords : Bullock Cart, Pedestal Bearing, Bearing

I. INTRODUCTION

Bullock Cart Is Still In Existence In Rural Areas Of India For Short Distance Transport Of Agricultural Inputs And Produce To Nearby Markets And Rail Heads. The Contemporary Scenario Of Rural India Aptly Reflects That Village Roads Are Unsuitable For Mechanical Road Transport, And Are Completely Impassable To Any Form Of Traffic During Monsoon Except Bullock Cart, As The Pot Holes On The Road Are Filled With Mud And Water. The Traditional Cart Will Continue To Operate In Rural Earthen Roads For An Indeterminate Period, Since The Poor Economy Of Rural India Will Prevent Conversion Of Earthen Roads To Metallic Roads In Near Future. Bullock Cart Is Not Friendly To Earthen Road, As Its Iron Rim Cuts Into The Road Surface And Damage It. An Improvement Of The Traditional Bullock Cart With Iron Frame And Pneumatic Tyres Has Proved Better With Respect To Draft And Power Requirements. The Present Study Was Undertaken To Evaluate The Feasibility Of Using Rubber Liner On The Wheels Of Iron Cart Of 2.0 Ton Capacity Driven By A Pair Of Small Size “Mottu” Bullocks Of Odisha On The Draft Output Of Bullocks, And The Wear Pattern Of The Rubber Liner On The Wheels.[1]

Bullock Cart Is Still In Existence In Rural Areas Of India, Mostly In The Regions Dominated By Tribal People Where It Is Used As A Mode Of Transport For Small And Even Medium Distance For Carrying The Agricultural Inputs And Produce To The Nearby Markets. The Existence Of Bullock Cart In India For Years To Come Remained True Even Today. Use Of Bullock Cart Will Also Remain In Existence In Tribal Populated Areas For Long Future Due To The

Predominance Of Bullock Farming System And Poor Socioeconomic Condition Of The People. It Has Been Estimated That There Are At Present 15 Million Bullock Carts In India, Out Of Which 80 % Are Of Conventional Type[2]

The Prime Limitations Of The Traditional Carts Are Their Low Pay Load Capacity, Lack Of Standard Design, Poor Stability And Lack Of Proper Alignment Between The Yoke And The Platform. An Improvement Of The Traditional Bullock Cart With Iron Frame And Pneumatic Tyre Has Proved Better With Respect To Draft And Power Requirements. Keeping In View Of The Importance And Need Of Cart Mechanization In Near Future Particularly For Tribal Dominated Areas And In Rural Sectors, One Organization Namely.An Improved Iron Bullock Cart (2.0 Tones Capacity) Of Design Has Been Evaluated After Putting Rubber Liner On Its Iron Wheels As A Modification, With A View To Study Its Suitability In Preventing Damage To The Surface Of Rural Roads. The Experiments Were Conducted During The Year 2012 For The Iron Cart With Rubber Liner Both In Tar And Earthen Roads Of Central Farm, Orissa University Of Agriculture And Technology, Bhubaneswar, Odisha. [3]

The Cart Was Tested With A Pair Of Non-Descript Small Size Bullocks Having A Pair Body Weight Of 420 Kg. Small Size Bullocks Were Chosen For The Study As Bullock Cart Is Still Used As A Mode Of Rural Transport In Tribal Dominated Areas Of The State Of Odisha Where Small Size Bullocks Are Mostly Available. The Results Indicated That The Small Size Bullocks Could Sustain Pulling The Pay Loads Of 1200 Kg And 1000 Kg Continuously For Three Hours In Tar And Earthen Road, Respectively With The Work Rest Cycle Of 1 Hour Work + 15 Min Rest + 1 Hour Work + 20 Min Rest + 1 Hour Work. The Draft And Power Requirement Were Found To Be Less And The Corresponding Speeds To Be More In Case Of Tar Road Compared To The Earthen Road. There Was No Significant Difference In Percentage Of Wheel Slippage Between Tar And Earthen Road Surface Of The Rural Road. [1]

II. LITERATURE REVIEW

This chapter includes research work doneon animal energy, design and development of bullock carts and performance evaluation of bullock cart etc.

1. Animal energy

Dennis R. (1999) identified the major constraint on wider use of animal-based transport in Eastern and Southern Africa as un-affordability of carts due to a combination of high cost and lack of access to credit. Another strong constraint in some areas was a shortage of carts caused by a limited production capacity and capability. Constraints on animal ownership applied mainly to oxen and include disease, lack of grazing and high cost.[1]

Srivastava N.S.L. (2000) stated that during last 50 years, due to rapid growth of agricultural mechanization in India, the contribution of animate sources of energy, in absolute terms, had gone down from about 97.4% in 1951 to about 21.0% in 1999, it was the main source of tractive energy on Indian farms for ploughing and other field operations about 75% of the cultivated land comprising of about 107 million ha area was managed by using animate sources of energy. With the modernization of agriculture, increased availability of electrical and mechanical power in rural areas, development of improved road and transport systems, the annual use of animal energy was going down; however the use of human energy had not gone down due to mechanization. The labour force displaced due to mechanized operations get absorbed in handling and primary processing of additional agricultural produce due to increased yields.[2]

Srivastava N. S. L. (2002) stated that the draught animals, particularly bullocks, were the predominant

source of mobile power on about 60% of the cultivated area consisting of about 85 million ha. The power available from draught animals was related to its body weight. The maximum draught available from different animals, in sustained working, on whole day basis (in two shifts) using local yokes/harnesses was found as under:

Bullocks: 10-12% of body weight in summer and 12-14% in winter Buffaloes: 12% of body weight in all seasons Camels: 18% of body weight up to 7 h, 26% up to 6 h following 2 h work + 2 h rest schedule.

Donkeys: 32% of body weight up to 6 h and 36% up to 4 h in two shifts.

On the basis of the body weight draught animals were categorized as small (200-300 kg), medium (300-400kg), large (400-500 kg) and heavy (above 500 kg.) animal. From a good pair of animals weighing between 900-1000 kg, one can get about 0.75-0.78 kW power. But in most of the States the pair weight of draught animals ranged between 600-800 kg/pair and power availability from them is only about 0.50-0.55 kW/pair.[2]

Anonymous (2004) stated that bullock carts account for 56 per cent of transport of goods and personnel in the country. Also, over 80 per cent of farm produce was transported in animal-drawn carts. But considering that India has about 80 million draught animals, which were used for only 100 days a year, the potential for growth was huge. These draught animals could be utilized for another 200 days in carts. [3]

Behera D. (2006) reported that as per the livestock census of 1995, the state registered an increase of 13.95 per cent in cattle and 23.93 per cent in buffalo population over 1987 census. The super-cyclone in 1999 caused massive casualties to the livestock. According to 2001 census, the total cattle and buffalo population was 15.20 million, which showed a decrease of 1.3% over that of 1995 census. The total draught bullock population was 5.17 million with Mayurbhanj district having the highest (4,43,845) and Kendrapara district having the lowest (1754) population. From the survey, it was found that the farmers mostly depend on draught animal power for tillage by MB plough and local plough and threshing by bullock treading. The other operations like seeding/transplanting, weeding and harvesting are manually done. Threshing is partially mechanized. The average annual bullock utilization is 260 hours with 76.89 per cent utilized for tillage in *Kharif*and *Rabi* cropand the rest 23.11% is used for threshing of paddy.[4]

Pritchard (2010) reported that for thousands of years, animals had been used to transport people and goods and to provide draught power for agricultural work. Contrary to the popular view that working animals were old-fashioned and irrelevant in the 21st century, their numbers are in fact stable in many parts of the world and actually increasing in others as human population demographics, global economic issues and a changing environment underline their importance in sustaining the livelihoods of farmers.

III. PROBLEM DEFINITION

Traditional carts can carry a load of around one tonne if the animals are stretched to the limit. Of late, carts with pneumatic tyres have become popular especially for towing sugarcane to factories. These can carry a load of 3 tonnes and require one-third the effort on the part of the animals as compared to the traditional cart. The design of the ubiquitous bullock cart has been modified to make it into a profitable enterprise by overcoming its main drawback -- the inability to work under slushy conditions and undulating terrain of rural areas. It is hoped introduction of rubberised iron wheels with rubber coating a few other modifications will make the carts more efficient not only in carrying agricultural produce but also as a means of commercial transport.

IV. MATERIALS AND METHODOLOGY

Constructional Detail

In this chapter the study conducted on modified bullock cart is detailed. The procedure adopted for evaluating the performance of these carts is explained. Assessment of the test result to figure out setbacks of existing bullock carts is accounted and methodology used for modification of cart is explained.

1. Size, material of construction and design details

Size of bullock carts depends on size of bullocks, material of construction of bullock cart and availability of material in market. To find average sizes, dimensions and material of construction of different bullock carts being used in Shegaon the pro-forma was filled. Different dimensions such as dimensions of wheel, axle, carrier etc. were measured and their material of construction was noted.

Bullock carts were manufactured by local artisans according to the needs of farmers. Hence these carts are not designed considering the basic design considerations. To get the general idea about the prevailing design details of these carts some measurements such as distances between axle and rear legs, axle and yoke, axle and ground clearance at front and back were noted.

2. Different parts of bullock carts

The parts of traditional bullock cart are mostly made up of locally available material (iron). The dimensions of these parts vary according to size of bullock cart. These parts of bullock cart have different local names.

COMPONENT

1. Wheel

Wheels are locally known as *Chakka*in Shegaon region. The most of the wheels of traditional cart have been replaced by iron wheels. These wheels have different parts such as *Gudada, Ara*etc. Gudada or hub is central part of wheel which houses the axle assembly in wheel. Size of hub in traditional bullock cart is fixed by local carftman without any design considerations. Ara or Spoke is a part of wheel which connects hub to outer rim. Depending upon the size of wheel and payload the size of ara changes.

Figure 4.1 Wheel

2. Frame

Frame is either made up of iron or iron. Currently iron frame has become more common because of more life and less maintenance. Frames of traditional carts are trapezoidal in shape. Length of frame defines the size of bullock cart. Frame is connected to axle using nuts and bolts. Arrangement for side support is provided on frame. Frames of traditional bullock cart are not fabricated using proper design considerations.

Figure 4.2 Frame

3. Axle

Axle is mainly made up of iron. It rests in hub without any bearing hence it causes most of the friction and noise in cart. As axle supports the main frame, which cart total load, it is most sensible part for failure.

Figure 4.3 Axle

4. Platform

Platform of traditional bullock cart is mostly trapezoidal in shape. Iron is used as material of construction. Only iron is used as material of construction because the surface of other material becomes in hot summer season. Side boards are provided to the platform to increase the carrying capacity of cart.

Figure 4.4. Platform

5. Yoke

Yoke is energy harnessing part of the bullock cart. It is made up of iron. It is fabricated so that, during carting operation no harm to hump of bullock will cause. Some time padding is provided in between the hump and contact area of yoke which reduce the harm to bullock

Figure 4.5 . Yoke

6. Bevel Gears

Bevel gears are gears where the axes of the two shafts intersect and the tooth-bearing faces of the gears themselves are conically shaped. Bevel gears are most often mounted on shafts that are 90 degrees apart, but can be designed to work at other angles as well. The pitch surface of bevel gears is a cone. Two important concepts in gearing are pitch surface and pitch angle. The pitch surface of a gear is the imaginary toothless surface that you would have by averaging out the peaks and valleys of the individual teeth. The pitch surface of an ordinary gear is the shape of a cylinder. The pitch angle of a gear is the angle between the face of the pitch surface and the axis.

The most familiar kinds of bevel gears have pitch angles of less than 90 degrees and therefore are cone-shaped.

This type of bevel gear is called external because the gear teeth point outward. The pitch surfaces of meshed external bevel gears are coaxial with the gear shafts; the apexes of the two surfaces are at the point of intersection of the shaft axes.

Figure 4.6. Bevel Gear

7. Hydraulic jack

A jack is a device that uses force to lift heavy loads. The primary mechanism with which force is applied varies, depending on the specific type of jack, but is typically a screw thread or a hydraulic cylinder. Jacks can be categorized based on the type of force they employ: mechanical or hydraulic. Mechanical jacks, such as car jacks and house jacks, lift heavy equipment and are rated based on lifting capacity (for example, the number of tons they can lift). Hydraulic jacks tend to be stronger and can lift heavier loads higher, and include bottle jacks and floor jacks.

How it Works ?

Depend on force generated by pressure. Essentially, if two cylinders (a large and a small one) are connected and force is applied to one cylinder, equal pressure is generated in both cylinders. However, because one cylinder has a larger area, the force the larger cylinder produces will be higher, although the pressure in the two cylinders will remain the same. Hydraulic jacks depend on this basic principle to lift heavy loads: they use pump plungers to move oil through two cylinders. The plunger is first drawn back, which opens the suction valve ball within and draws oil into the pump chamber. As the plunger is pushed forward, the oil moves through an external discharge check valve into the cylinder chamber, and the suction valve closes, which results in pressure building within the cylinder.

Figure 4.7. Hydraulic jack

8. Pedestal Bearing (204)

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts.

Rotary bearings hold rotating components such as shafts or axles within mechanical systems, and transfer axial and radial loads from the source of the load to the structure supporting it. The simplest form of bearing, the plain bearing, consists of a shaft rotating in a hole. Lubrication is often used to reduce friction. In the ball bearing and roller bearing, to prevent sliding friction, rolling elements such as rollers or balls with a circular cross-section are located between the races or journals of the bearing assembly. A wide variety of bearing designs exists to allow the demands of the application to be correctly met for maximum efficiency, reliability, durability and performance.

The term "bearing" is derived from the verb bearing being a machine element that allows one part to bear (i.e., to support) another. The simplest bearings are bearing surfaces, cut or formed into a part, with varying degrees of control over the form, size, roughness and location of the surface. Other bearings are separate devices installed into a machine or machine part. The most sophisticated bearings for the most demanding applications are very precise devices; their manufacture requires some of the highest standards of current technology

Figure 4.8. Bearing

5. Working

- ✓ In working process firstly we have to select the proper material (iron)
- ✓ As required. Then we cut the iron material in proper size
- ✓ In our project we used bevel gear for rotation of the base
- ✓ Also we used the hydraulic jack for the lifting purpose

- ✓ Fig shows the structure of frame. Currently iron frame has become more common because of more life & less maintenance.
- ✓ Axle is mainly made up of iron hence it causes most of the friction & noise in care
- ✓ Then we construct the platform. It is in trapezoidal in shape side boards are provided to the platform
- ✓ Yoke is made up of iron. It is fabricated so that during carting operation no harm to hump of bullock will cause
- ✓ We also know that a jack is a device that uses force to lift heavy loads
- ✓ Also in axle pedestal bearing can be used that can be rotate the bevel gear
- ✓ Then we assemble all the parts in standard form.
- ✓ For unloading the material in trolley move the axle in clock wise direction with the help of bevel gear the trolley can rotate in all direction
- ✓ With the help of hydraulic jack pumping trolley will move in upward direction and material in the trolley will be unloaded.

V. CONCLUSIONS

Bullocks are main source of power in field as well as for carting operation. Bullock cart is being used for transportation of agricultural good since ancient time. In rural part of India, the bullock cart is being used for agriculture purpose. Bullock cart is best mode of transport for marginal farmers. . Most of the farmers are marginal and small farmers; they can not afford tractor. There are about 14 million bullock carts are available in India but among them only 1million are improved about 0.4 million carts are available and almost all of them are not improved.the bullock cart is very useful for us. So It has been thriving through ages together. Age after has passed ; but the bullock cart has maintained the same position all through out.We added rotating and lifting mechanism with the help of bevel gear and hydraulic jack for improving efficiency of bullock cart.And increase load capacity of bullock cart.

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