

Design and Fabrication of Detachable Cargo Bicycle Trolley cum Hand Truck

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Abstract

Our project is about the design and fabrication of a hand truck/trolley that can be connected to the front part of a bicycle which would convert the bicycle into a tricycle in a way such that the cycle can be used as a bicycle trolley which can be used for outdoor purchasing as it can carry more load compared to the commercially available bicycles. This trolley can be detached from the cycle and can be used as our primary cart.

Keywords: Cargo bicycle, Hand cart, Trolley, Bicycle trailer, Design of trolley, Movable link

I. INTRODUCTION

The transport services are mostly expensive. There are many rural areas still where there is lack of transportation facility, so general activities like carrying products from the market to the villages becomes difficult. The cycle is one of the most commonly used vehicles in the world. Due to the efficiency and less cost, the bicycles are used in a large in both rural and urban areas for both individual purposes as well as for carrying goods.

A normal bicycle as shown below has a limited load carrying capacity. So it is not possible to carry bulky loads on a conventional cycle.



Fig. 1: Normal basket [11]

The most commonly used cycle trolleys are:-

- 1) The one in which the trolley is connected to the front of the cycle and having two tyres.
- 2) The one in which the trolley is connected to the rear part of the cycle and having four tyres.



Fig. 2: Front wheel cargo [12]



Fig. 3: Rear wheel trolley [13]

A cargo bicycle is a kind of a tricycle which may have the feature of connecting a trailer/trolley in the front or at the rear part of the bicycle. Nowadays readymade attached cargo bicycles are also available, which can be used for carrying various things. These are human powered vehicles designed and constructed for transporting loads. The design includes a cargo area consisting of an open or enclosed box, a flat platform, or a wire basket.

A hand truck/cart is an equipment or carrier which is used to lift and carry heavy loads from one place to another. It is a kind of L-shaped carriage having a handle on its top part and two or more wheels at its bottom part. The objects to be moved are tilted forward and the front part of the cart is inserted below the object and the object is then made to tilt back and it is made to rest on the cart. The hand truck is then tilted the weight of the object completely comes on the wheels of the cart; this would make the movement of the cart/truck easy.

A. Introduction to our Project:

Based on the designs of the various available cargo bicycles we have made a design of such a cargo bicycle in which the trolley i.e the hand cart can be detached and attached whenever it is necessary. So that the hand cart alone also can be used to carry goods from one place to other. In this the trolley would be attached tightly to the bicycle due to which we can carry heavy and/or bulky loads on the cargo bicycle which would not be possible on a conventional cycle.

We are making an equipment which is the combination of the above two mechanism. We have decided to make such a hand truck which can be used to carry load and objects in household purpose and also for carrying heavy things from one place to another, and this hand truck will have a provision to be attached to the front side of a bicycle by removing the front tire of the bicycle which would convert the bicycle into a cargo bicycle trolley which will be a sort of tricycle. The attachment and detachment mechanism will be such that there will be cart attachment system that will be connected to the fork at the front of the bicycle. When only the hand truck is in use then we can only use the hand truck and the cart attachment system will act as a stand for the bicycle as the bicycle won't be having its front wheel. Now the hand truck after usage can be attached to the bicycle using the connector and the bicycle turns into a cargo bicycle which can be taken out to market, etc. for purchasing and various purposes. Compared with cars, cargo bikes are also cheaper and better for the environment and faster in city traffic also there's hardly ever an issue with the parking.

B. Link System:

The link mechanism of the wheel will be such that, that while travelling through uneven and rough roads the wheels will both move according to the road in such a way that the load carried on the cargo is not disturbed. Also while taking turns the wheels will both take turn at the same angles which would make the movement of the bicycle easy.

C. Characteristics:

- 1) Heavy as well as bulky loads can be carried.
- 2) The trolley can be used with or without the cycle.
- 3) Easy to connect and disconnect the trolley.
- 4) The frame design is durable.
- 5) The link mechanism is such that it can carry loads on any uneven surfaces without disturbing the load.

D. Considerations Factor:

- 1) The materials for the bicycle trolley should be available easily.
- 2) The cargo bicycle must move easily.
- 3) The handling of the bicycle should not be affected.
- 4) The type of load to be carried.
- 5) Load should not be loaded beyond the loading capacity.

6) The base of the trolley should be strong.

E. Materials Used:

The main frame of the trolley and the link system has been completely made out of hollow alluminium alloy grade 1050. Ball bearings and thrust bearings have been used for the manufacturing of the link. Also a eye bearing is used for the connector mechanism. Two tyres for the trolley on both the sides and a basket in the front of the trolley i.e on the frame. At last a cycle with its front tyre removed.

F. The processes done in manufacturing the cargo bicycle:

- 1) Cutting process
- 2) Machining process
- 3) Welding process
- 4) Assembly of parts

G. Final Working Model of Detachable Cargo Bicycle:



Fig. 4: Front View



Fig. 5: Side View



Fig. 6: Front View with basket



Fig. 7: Top View

H. Advantages:

- 1) It can carry more loads compared to conventional bicycle.
- 2) It has detachable mechanism so it can also be used as trolley in any market place.
- 3) As the cargo bike contains three wheels it can maintain balance compare to conventional bicycle.
- 4) As it is balanced system, safety of rider is more.

I. Disadvantages:

- 1) In this system, as the cargo is attached at the front side of the cycle there will be some difficulty to steer the system
- 2) As the system, contains three wheels there will be more friction between road & wheels therefore more force would be required to ride the system compare to conventional bicycle.

J. Possible Solutions:

- Instead of aluminum material in frame, fiber plastic can also be used as it is lighter than aluminum metal and has better strength so it will reduce the weight of the body significantly.

K. Applications:

- 1) Newspaper Delivery.
- 2) Shopping.
- 3) Courier Delivery.
- 4) Tourism.
- 5) Transportation.
- 6) Handy for home use as well as carrying groceries/collecting large purchases from shops.
- 7) Farming and Gardening process.
- 8) Trash/Recycling pickup.
- 9) Newspaper delivery.
- 10) Operating supply chains.

II. CONCLUSION

The project basically consists of a frame, a cycle, a movable link, two tyres and a basket which all will be assembled together in order to form the complete attached trolley. This can be used to carry heavy loads on a cycle which cannot be done on a normal cycle. Also the trolley in its detached state without the cycle can be used to carry things and can be easily moved. The link will be helping in keeping the load on the trolley steady even on irregular surfaces.

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