



## Mechanical Engineering

Elixir Mech. Engg. 70 (2014) 24303-24305

Elixir  
ISSN: 2229-712X

### Concept of User Friendly Modified Folding Bicycle

A.K. Singh, A.S. Bobade, A.K. Ghodmare, B.C. Bisen, H.H. Walmik, P.C. Padole, V.U. Gaikwad, N. K. Mandavgade and C.K. Tembhurkar

Priyadarshini College of Engineering, Nagpur, India.

#### ARTICLE INFO

##### Article history:

Received: 4 January 2014;

Received in revised form:

10 May 2014;

Accepted: 20 May 2014;

##### Keywords

Bicycle,  
Compact Joint,  
Handling,  
Parking space.

#### ABSTRACT

Bicycle is recognized as a transportation solution helping to improve various environmental, economical and social aspects. A variety of bicycle design and setups for utility are used to carry personal belongings, groceries, children and much more. One particular utility bicycle is the folding bicycle. Its design allows users to easily transport the bicycle using less space when the bicycle is "folded" in to a compact size. When using a folding bicycle with a bicycle-transit journey, it allows individuals ability to board transit vehicles. The versatility of a folding bicycle is also appropriate for air travel and for when inadequate parking and bicycle theft is a significant concern.

© 2014 Elixir All rights reserved

#### Introduction

A folding bicycle is a bicycle designed to fold into a compact form, facilitating transport and easily park. When folded, the bicycle can be more easily carried into buildings and workplaces or on public transportation and more easily parked in compact living quarters or aboard a car, boat or plane. Folding mechanisms vary, with each offering a distinct combination of folding speed, folding ease, compactness, ride, weight, durability and price. Distinguished by the complexities of their folding mechanism, more demanding structural requirements, greater number of parts, and more specialized market application, folding bicycle may be more expensive than comparable non-folding models[1]. The choice of model, apart from cost considerations, is a matter of resolving the various practical requirements: a quick easy fold, compact folded size, or a faster but less compact model. There are also bicycles that provide similar advantages by separating into pieces rather than folding. Folding bicycles for accommodating different riders, because the frames are usually only made in one size. While folding bicycles are usually smaller in overall size than conventional bicycles, the distances between center of bottom bracket, the top of the saddle and the handlebars, the primary factors in determining whether a bicycle fits its rider, are usually similar to that of conventional bicycles. The wheelbase of many folding designs is also very similar to that of non-folding bicycles.<sup>[2]</sup> Many public transportation systems ban or restrict unfolded bicycles, but allow folded bicycles some of the time. For example Transport for London allows folding bicycles at all times in Underground. Some transport operators only allow folding bicycles if they are enclosed in a bag or cover. The material used for the folding bicycles are Carbon fiber, Aluminum, Steel etc. Selection of material depends upon the weight, cost, rigidity, stress. Etc. Different material have different property depending on the material is selected for the bicycle. By knowing this, the question raises, why we should used this type of bicycle? The bicycle is the one of the most convenient way of transportation or traveling from one place to another. There are different ways of traveling such as bike, train, bus, But this all are costly as camper to bicycles. The cost of

bicycle is nearly 10-12 times lesser than bike. No doubt that bike required less energy than bicycle but bicycle helps to make our self fit & fine. It do-not required fuel or any types of charges for its working. As the folding bicycle can be folded in a compact form, it is very easy to carry it in a bag from one place to another and it can be again unfold in a shorter period of time. There are different countries that, using folding bicycles as a main source for traveling. In this way they are not only saving the quantity of fuels but also the human resources. It also helps to be a fit and fine. Japan is the one of the country who's around 75-80% people's uses folding bicycles for travelling. Even different country such as U.S.A, France, and many more uses folding bicycles for traveling. Need for the folding bicycle? We all are aware from the cost of fuels and at what speed it is increasing in such condition it is not possible for everyone to use the services which runs on fuels. In such condition the folding bicycle plays a very important role it not only saves the fuels but also helps to keep our self healthy and it do not affect the work which we will complete it by making the use of other travelling services such as bike. As the weight of the folding bicycle is less than the conventional bicycle it is easy to carry from one place to another. Generally the weight of the bicycle is around 13-15kg and the weight of the folding bicycles are around 6-8kg with same rigidity. This is due to the material used in folding bicycle.

#### Literature review

Here an attempt is made to review the status of literature in folding bicycle based on various criteria. The work done by various authors are explained below.

**Hajime Ishida (1977):** This invention, which provides a folding bicycle, comprises a foldable frame structure including a front support assembly having handlebars and arranged to be rearward foldable. According to the invention, the user can very quickly and easily fold by manually rearward folding the front support assembly which includes upper and lower section interconnected by hinge.<sup>[1]</sup>

**Robert D. Shomo (1981):** The author has put forward the concept of folding bicycle, As the folding bicycle of the present invention comprises a large-wheel folding bicycle which exactly

Tele:

E-mail addresses: [ayushkumar29@gmail.com](mailto:ayushkumar29@gmail.com)

duplicates the looks, and feel, rigidity, strength, weight and ride quality of a conventional and popular 10/12 speed touring bicycle. The folding bicycle of the present invention includes a compact frame which is foldable, with the front half of the frame being rotatable about a hinge means to position it against the rear half of the bicycle for easy and efficient transportation. The folding bicycle of the present invention is adapted to be inserted into a carrying bag, if desired. The handlebars employed with the folding bicycle of the present invention are foldable into a collapsed position and the pedals are reversible.<sup>[2]</sup>

**Kao P. Cheng, Changhu Taiwan (1994):** An improved locking hinge for use in a folding bicycle is equipped with a lever arm which is in pivotal connection to a locking hook at the bottom end thereof. The locking hook also pivotally mounted onto the handlebar of a bicycle has a retaining recess which is made to engage with a locking pin mounted onto the steering stem of the bicycle so as handlebar which is put in linear alignment with the to get a folding bicycle in use as long as the lever arm is pushed toward the erected steering stem already. Besides, a securing spring plate is used to retain the lever arm in place so as to prevent the locking hook from disengagement from the locking pin as the bicycle is in use. To get the bicycle folded, the Securing spring plate is lifted upwardly too permanently to permit the lever arm to pried outwardly, resulting in the locking hook disengaged with locking pin. Then the handle bar and the steering stem are separated with each other and put side by side in a folding manner.<sup>[3]</sup>

**Jaime Herder, Perth, Australia (1998):** A folding bicycle in which all the pivoting members have horizontally pivot axes and all the members are indirectly connected to a single collar that slides up and down a seat post. In order to achieve an open or closed state, the collar is made to slide along the post and is then secured by tightening a quick release lever on the collar. Two front tubes mending between the Steering head and the lower Part Of the seat post are parallel.<sup>[4]</sup>

#### Gaps in literature

- The weight of the bicycle is more.
- Difficult to carry in bag.
- As compare to conventional bicycle has a less rigidity .
- Joint used in bicycle is hinged which is less reliable than compact joint.

#### Objective of research

##### The objectives of research are as follows:

- Portability is a term which means any object or project can be easily port. Portability play very important role in every filed Such as machines, construction sides etc.
- The bicycle design must be a portable so that it can be easily carrying from one place another place.
- Weight can be calculated by product of mass & gravity. Weight plays a very important in a folding cycle which is generally used for carry it from one place to another place.
- If the weight of the bicycle is not maintained properly, then it will provide lots of difficulties for the portability of folding bicycle Factors which are consider for reducing the weight of material, of the bicycle are design of bicycle and its dimensions.

#### Component of folding bicycle

- Frame (1) - it is a main supporting part of the bicycle.
- Compact Joint (2) - it is a joint which provides on the frame so that front and rear portion can be overlap.
- Handle (3) - it is the front portion of bicycle which use to control the direction of bicycle.
- Transmission mechanism (4): - it is the mechanism which transmits the power from pedal to rear wheel.

## Methodology

The methodology used for research work is summarized in figure 1.1

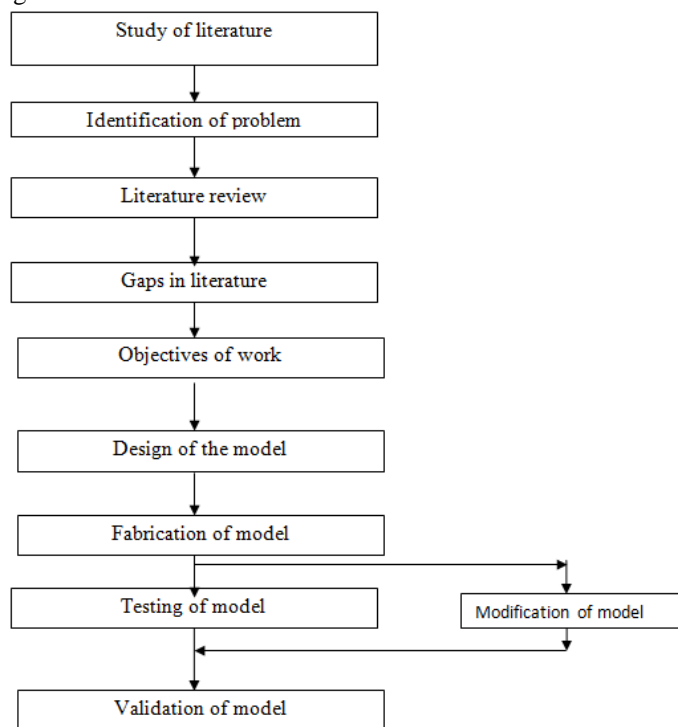


Figure no- 1.1

## Working concept

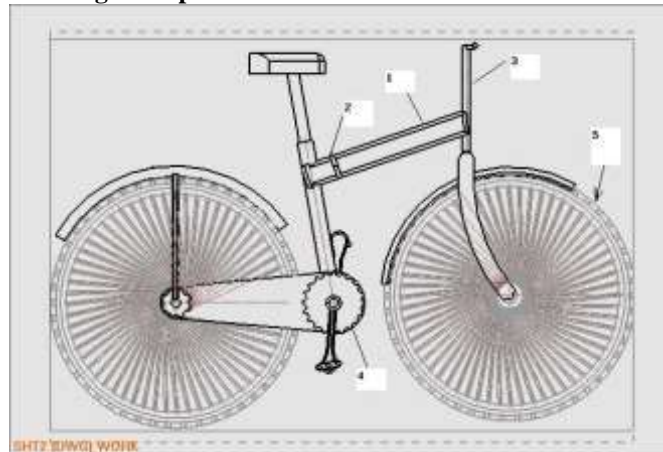


Figure no- 1.2

A folding bicycle with a compact frame comprising a front portion and a rear portion. The front and rear frame portions are connected by a hinge structure which permits the front frame portion to be rotated about the vertical axis of the hinge structure to a position against the rear frame portion for easy carrying or for insertion into a carrying bag. The folding bicycle is provided with a folding handlebar assembly which can be quickly adjusted from a standard ten speed driving configuration to a more relaxed touring handlebar configuration, or to a fully collapsed compact carrying position. The folding bicycle is provided with an adjustable soft ride seat, and with pedals which are reversible to reduce the overall width of the collapsed bicycle. The folding bicycle shown in the accompanying drawings has a front wheel assembly comprising a front wheel mounted on a fork above which is mounted a pair of handlebars each of which can be folded downwardly to lie alongside the wheel. Each handlebar has a tubular portion extending into a sleeve of circular cross-section carried above the fork so that it can pivot within the sleeve relative to the fork and front wheel.

In the unfolded position a stop mounted on the fork and located between the pivots of the handlebars prevents them from moving towards one another beyond the position shown in FIG 1.2 and the handlebars are held in this position by a link. The link is hooked at one end and flexibly secured at its other end to one of the handlebars. The hooked end of the link can be hooked to the other handlebar so as to extend between them, the length of the link being such that the handlebars are flexed slightly towards one another in order to provide rigidity to the handlebars when they are unfolded. Unhooking the link allows the handlebars to be folded downwardly.

The pivoting axes of the two handlebars are arranged to converge slightly in the forward direction so that, when unfolded, the hand grips are slightly splayed outwardly for the comfort of the rider of the bicycle and so that, when folded the grips be substantially parallel to the front wheel. The front wheel assembly including the handlebars and wheel pivot about a conventionally inclined steering pivot carried in the front part of a main frame member, the front part being pivoted to the rear part of the main frame at. The pivot comprises a tubular portion on the front part received within a cylindrical portion on the rear part so as to be capable of rotation therein. The pivot is provided with a releasable clamping mechanism which frictionally clamps the two parts against relative pivoting and which will be described in greater detail hereinafter, the clamping mechanism enabling the parts to be clamped relative to one another in both the erect and the folded condition of the bicycle. The rear end of the part carries a tubular seat support member in which is received a tubular seat strut which in turn receives a seat post carrying a saddle.

The height of the seat can be adjusted by sliding the post in the strut and then clamping it with a clamp. The saddle support strut is also slid able relative to the saddle support member and can be clamped relative to the latter by a clamp. At its lower end

the saddle support member carries a horizontal pivot about which a rear wheel frame in which the rear wheel is mounted can pivot during folding and unfolding of the bicycle. It will be appreciated that this pivot is located below and behind the axis about which the chain wheel of the bicycle rotates; the importance of this will become apparent when the operation of folding the bicycle is explained hereinafter. The chain wheel is provided as usual with pedals and the left hand pedal can also be folded so as to make the bicycle in its folded configuration as compact as possible.

#### **Conclusion**

- There is significant interest in folding bicycle among park-and-riders provided they can take their bike on the train.
- There is significant interest in folding bicycle among people with regular-sized bike who already take their bicycle on the train.
- Improved bicycle infrastructure is positively and significantly correlated with higher rates of commuting by bicycle that could include promotion of folding bicycles.
- Most people understand the general concept of a folding bicycle but do not recognize the overall value of improved product designs given that few people are willing to pay for additional costs.

#### **References**

- (1) Hajime Ishida (1977) US patent 111447.
- (2) Robert D. Shomo (1981) US patent 4417745.
- (3) Kao P. Cheng, Changhua Taiwan (Feb 17 19974)
- (4) Jaime Herder Perth ( Feb 18 1998) US patent6032971.
- (5) Guinness World Records 2000 Millennium Edition, 2000, p. 301
- (6) Airline Baggage Regulation for Bicycle International Bicycle Fund. Retrieved 2013