Review Paper on Electric Bike Frame

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Abstract— Currently the human being race requires the elevated knowledge which bud vase explains the nearby and probable complexity. Relic petroleum overload is the major predicament at the present time. Considering presented rate of discussion of fossil fuels resolution let its life up to after those five decades cleanly Unwanted environmental is the red indication for not to use more fossil fuel any more. Premium option for the vehicle fuels to offer the mobility &transport to accept is sustainable electrical bike. Future e-bike is the best technical occupation as an imaginative solution for the better world and upcoming generation. E-bike comprises the features similar to high mobility effectiveness, compact, electrically powered, happy riding knowledge, and light weight vehicle. E-bike is the most flexible potential vehicle method in mind its incentive.

Keywords: Frame, Electric Bike, Methodology, Material, Angle

I. Introduction

The rise of request and constantly increasing cost of petrol and diesel has been decision India for ages; society needed an unmarketable solution especially in India. Transportation is very important and in order to expand it, people started looking for transportation by different means of energy. Electric vehicles gave a breach solution to satisfy the needs required thereby it started to flourish, by choking the difficulty. Electric Bikes are two wheeler cars which uses electricity as the source of fuel. Electric bikes are noiseless, pollution free, zero-emission, and electrically driven. The action and speed are controlled by the battery. To range the variety of e-bikes and improve the production, fuel cells and petrol-electric hybrids could be introduced which are also in the limit of development and thus improving the efficiency of the electric drive system. The usage of electric bikes has turned out to be a solution for plummeting pollution to a larger extent. To burgeon the sale of e-bikes it needs to be enhanced in quality, hence in the present-day study the e-bikes are designed with frame which is light in weight when compared to conventional bikes for the purpose of efficacy.

An electric bicycle, also known as an e-bike or booster bike, is a bicycle with an joined electric motor which can be used for impulsion In some markets, such as Germany, they are gaining in popularity and taking some market share away from predictable bicycles, while in others, such as China, they are replacing fossil fuel-powered mopeds and small motorcycles. Depending on local laws, many e-bikes are legally classified as bicycles rather than mopeds or motorcycles, so they are not subject to the more stringent laws regarding their documentation and operation, unlike the more powerful two wheelers which are often classed as electric motorcycles. E-bikes can also be defined separately and treated as a specific vehicle type in many areas of permitted jurisdiction.

II. Scope of the Research

Manufacturers try to join in the development of technology with their products with a delusion of solving the current populations demand thereby only increasing their profit, failing to consider the facts/environments such as terrain, climatic changes, increased consumption rate etc. This study concentrates on design of an e-bike, which would be effective, light weight as well as durable frame. In the present study, the electric bikes are designed and analyzed using design software namely Cero 2.0and analysis software namely Ansys 15 and 16.

III. Material Selection

The selection of the material in design depends on various factors such as load, function, climatic condition, lifetime, and overall expenditures. Taking the above factors into consideration, material selection was done in order to design an imaginative and economical type of frame. Steel Alloys, Aluminum and its alloys, Titanium, Carbon Fiber were preferred type of materials during selection. Comparatively AISI 4130 Alloy Steel was used in the present study as it is easily presented, cost effective, and has improved mechanical properties [01].

Element	Content (%)
Iron (Fe)	97.03 – 98.22
Chromium (Cr)	0.80 – 1.10
Manganese (Mn)	0.40 – 0.60
Carbon (C)	0.280 – 0.330
Silicon (Si)	0.15 – 0.30
Molybdenum (Mo)	0.15 – 0.25
Sulfur (S)	0.040
Phosphorous (P)	0.035

Table 1: Material Composition

Properties	Metric
Ultimate Tensile strength	560 MPa
Yield Tensile strength	460 MPa
Modulus of elasticity	190-210 GPa
Bulk modulus	140 GPa
Shear modulus	80 GPa
Poisson's ratio	0.27-0.30
Density	7.85 g/cm^3
Melting point	1432°C

Table 2: Mechanical Properties

IV. DESIGN

A. Selection of Rake Angle

The selection of rake angle is the crucial part in designing of bike frame. Rake Angle also called as steering head angle, which is the angle between the neck and the vertical axis of the wheel axle. It determines the type of vehicle whether it is a journey or sport type vehicle. It plays a major role in inducing steadiness of the vehicle. The angle for the front neck with respect to the vertical axis is 19°which might optimize the length of bike. The figure displays the design of rake angle [1].

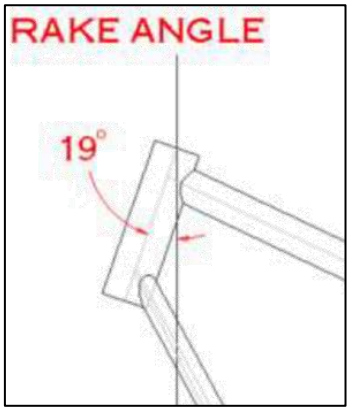

Fig. 1: Design of Rack Angle

B. Swing Arm

Swing arm is an ideal mechanical link which connects the suspension with transmission system. It was connected to chassis with the help of connecting pin. The suspension provides the action, in order to maintain the reliable contact between wheels and roads. For such sufficient action, the swing arm acts as the major platform for it. [01].

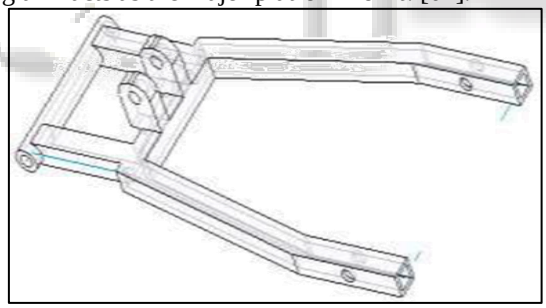

Fig. 2: Isometric View of Swing Arm

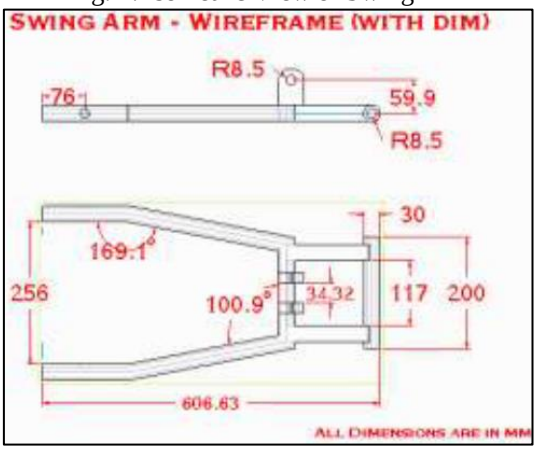

Fig. 3: Swing Arm with Dimensions

V. FABRICATION

Various methods and tools are used to fabricate the regenerative electric bike. The methods include are [4]

- Cutting.
- Drilling.
- Counter boring.
- Brushed DC motor.
- Friction wheel.
- Printed circuit board (resistor, capacitor, voltage regulator, other electrical components)
- LCD.
- Multi-meter.
- Auxiliary battery.
- Wiring.

VI. IMPACT TEST

The impact test is a method to resolve the toughness of the frame of the material under varying loading conditions. The main concept is to test the strength of the materials of the frame. During to impact loads, the materials absorb a certain amount of energy. If the absorbed energy exceeds the nominal limit of the material then break takes place. Thus the amount of energy that material could take up can be determined. Material toughness basically determines the amount of the energy that could be absorbed, if this exceeds then break occurs. With the aid of Computer Aided Engineering (CAE), the results of stresses been found out using Ansys software has been displayed below.

A. Tensional Test

The tensional test is done in order to prevent Tensional fatigue failure. Tensional Test is conducted in analyses in order to find out the presentation of the structure when a twist or tensional force is acted upon if a load is transferred starting suspension to the frame. Determination of the strength and rigidity of the material to withstand the loads is fixed. Torsion test is used to measure the tensional strength, stiffness and stress strain. Properties of the frame and to determine there are any deformations in the frame. A vehicle traveling in a rough ground environment, it causes frame deflections which are induced due to the load transfer from the suspension of the vehicles. Tensional stiffness plays an important role in these torsion tests. With the aid of Computer Aided Engineering (CAE), the results of stresses been found out using Ansys software has been displayed below.

Front impact	Side impact
Side impact The total working stress for Front impact = 220.37 MPa FOS = 460/220.37 = 2.09	The total working stress for Side impact = 262.62 MPa FOS = 460/262.62 = 1.75
Rear impact	Torsion test
Torsion test The total working stress for Rear impact = 244.71 MPa FOS = 460/244.71 = 1.88	The total working stress for Torsion impact = 180.92 MPa FOS = 460/180.92 = 2.54

Table 2: Factory of Safety

VII. CONCLUSION

The Process of completion of the research work on mobilized E-Bike under progress, whereas the other auxiliary details and various methodologies been described after its completion.

The electric bike satisfies the purpose of store some part of energy lost during braking. It also increased the discharge time of battery and hence efficiency is improved 8.33% of the vehicle. Regenerative braking system has a wide scope for further development and the energy saving. The use of more efficient systems could lead to huge savings in the market of any country.

REFERENCE

[1] Vignesh.M*1, Dr. Arumugam K1, Vinoth.S1, Hariharan.S1" Design and Analysis of Frame of an Electric Bike", Department of Mechanical Engineering, Vel tech High tech Dr.Rangarajan Dr. Sakunthala Engineering College, India, ISSN (Print): 2319 – 6726

[2] Prabhu Randhir1, Pratik Gaurshettiwar1, ShubhamWaghmare 1, Kunal Mogre1, Prof.C.K.Tembhurkar "Design and Fabrication of Electric Bicycle", International Journal of Innovations in Engineering and Science, Vol. 2, No.5, 2017.

[3] Ian Vince McLoughlin, I. KomangNarendra, Leong HaiKoh, QuangHuy Nguyen,BharathSeshadri, Wei Zeng, Chang Yao, Campus Mobility for the Future: The Electric Bicycle, 2011.

[4] Mr. Mragank Sharma1, AnshulVerma, GauravTiwari, Sunny Singh4, Mohd Nadeem5 Assistant Professor1, UG Scholar "Design and Fabrication of Regenerative Electric Bike", ISSN 2321-3361 © 2016 IJESC.

[5] Electric Power Systems Research 1988, 14(3) 183-190K.Rajashekara, R.Martin. Journal of Circuits, Systems and computers, 1995, 5(1), 109-129.

[6] Arun Eldho Alias1, Geo Mathew2, Manu G3, Melvin Thomas4, Praveen V Paul5, Energy Efficient Hybrid Electric Bike with Multi -Transmission System, 2015.

