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Single swing arm with belt drive transmission

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Abstract

In the world of automobile the general drive system is chain or belt drive as per particular usage as per terrain and purpose. In a general trend of modern bikes we are able to see the bikes with double support at both ends of rear wheel.

When it comes to heavy torque transmission, we can see the belt drive rather use it. For better torque once can use belt drive. Belt drive transmission system is used for most of the US and UK based companies for their bikes and cars.

In the world of custom bikes we are using this belt and swing swing arm for good torque and good aesthetics.

Keywords: Swing arm, belt drive, mono double suspension.

1. Introduction

In recent years of Indian automobile, generally automobile companies applying usual drive system for bikes. In a general drive system of bikes we have both sided swing arm. Wheel and rim is locked with central axle called as stud. Generally chain and sprocket is used for drive system.

In an engine transmission, the power is transmitted through drive shaft to a sprocket linked to it. Sprocket is having particular calculation hence the number of teeth varies. This driver sprocket is linked with driven sprocket which is linked to wheel with particular length of chain. Eventually the power is transmitted through this drive system in general power transmission in any of the bike.

But as per the swing sided swing arm drive system

(Fig 1), the power coming through the shaft of an engine is linked to sprocket and again in travels through chain drive to another sprocket of same size. Later this sprocket is connected to belt pulley on other side and finally linked with driver pulley with timing belt.

This type of transmission is called as composite drive system enables us to proceed with single sided swing arm with belt drive (Fig.2) This type of drive system provides better torque and aesthetics to also. Generally this type of drive system is made for heavy CC engines

and widely used in imported bikes but belt drive only. In these imported bikes such as Harley –Davidson, belt drive is implemented in such way that belt is coming from driver pulley which is linked to engine drive shaft. Hence there is no composite drive mechanism and ultimately rare losses of energy.

As per current scenario same drive system is implemented in automobile field

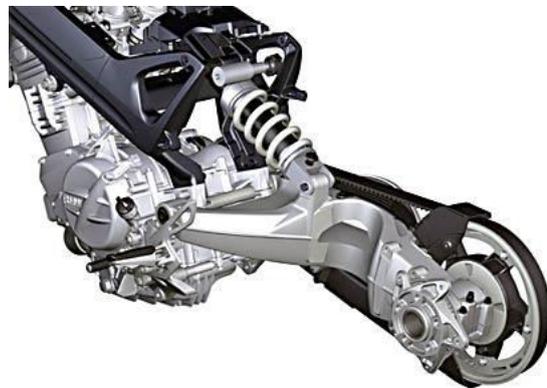


Fig 1: Single swing arm design



Fig 2: Single swing arm at actual

2. Related Work

In this section, we will review some studies on the application of using drive system for an automobile basis its application system

While starting with the single sided swing arm, we need to design it as per wheel section and sizes. Once the wheel size is confirmed once can design the required length of swing arm. This swing arm can be made in chromoly pipes which is seamless and imported.

Drafting is generally done on softwares through 3 D modeling and analyzed properly to check whether it is sustaining for required load and forces.

The said size of pipe as per design and analysis report is selected and bended later as per fixture and required length once can weld it with seam weld using CO2 welding or argon welding as per availability. For driving system generally a shaft is inserted on either sides of swing arm through bearings which is connected to wheel on either side while on other side there is pulley which is linked via belt to engine drive system

3. Requirement of Analysis

Whole system is analyzed through a software called as ansys 4.0 (Fig.3) or we can check in solidworks also. Depending upon FOS, further design calculation and manufacturing is done. Analysis is very important since all further calculations and manufacturing is inter related and if required any changes can be made in design.

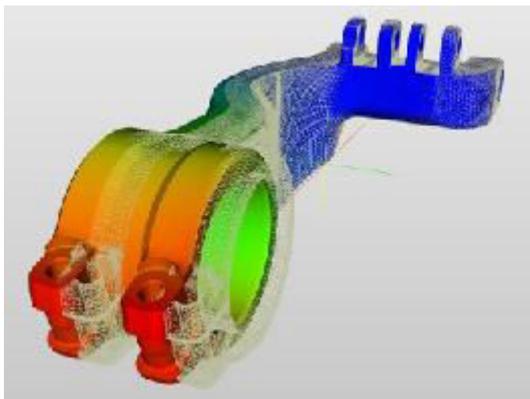


Fig 3: Swing arm Analysis

As per analysis report $FOS = 0.9$ which almost equal to 1 hence the design analysis is safe.

4. An Overview of Our System

In this section we will be studying the the whole system of transmission.

As per calculations and design material selection is done for products. Chromoly pipe is bended via CNC bending machine and all related inter parts are manufactured using lathe. Particularly the shaft required to hold pulley and wheel is manufactured on wire cut machine using electrode and further threading is provided on either sided of shaft and whole system is connected via mono shocker basis calculations (Fig.4).

Suspension design is the important part (Fig.5) of the the vehicle through which shocks are absorbed by the system and same thing is worked in lotus software.



Fig 4: Swing arm with suspension

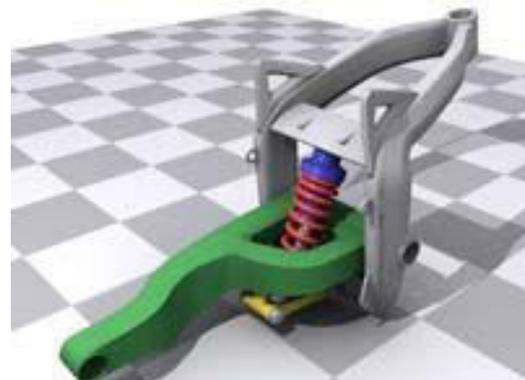


Fig 5: Swing arm with suspension design in CAD

5. Hardware Components

For the design and manufacturing of single swing arm we need chromoly pipes wither in square or tubular form.

Most of the time carbon fibre is also used for the light weight purpose. For connecting the parts definitely hardened fasteners required .For rolling moment bearings are required. Welding process either it will be CO2 welding or Argon welding is required. All parts are machined on CNC or VMC basis requirement of design. Wheels and pulley or sprocket are connected through a shaft (Fig.6). Locking moment is provided with circlips and splines over it.

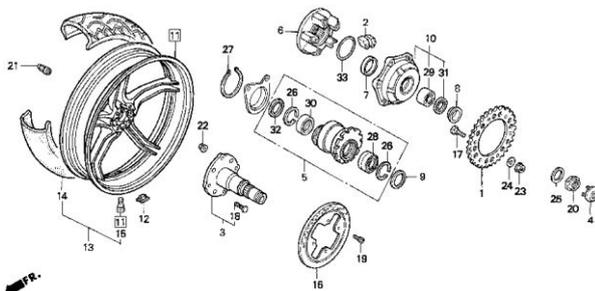


Fig 6: Reference image for wheel assembly

During the design process of single swing arm, material selection also important .Once you start with material selection we need to go through harness of the material and all related parameters. Material selection will be basis on the design data book and analysis report. While hardware components are selected basis there parameters and specifications. Mono shockers are selected basis its damping coefficient and spring hardness. Belt drive or chain basis its design and number teeth and diameter of pulley or sprocket.

Hardware components are important since they are building the system and resulting good performance.

While selecting these components all standard material specifications are studied and tested before the use. On the basis of testing and reports one can use it for further application in system.

Hence the list of the hardware component as follow:

1. Chromoly pipe
2. Belt or chain
3. Sprocket or pulley
4. Shock absorbers
5. Bearings
6. Circlips
7. Shaft with splines
8. Hardened fasteners
9. Welding apparatus
10. Nylon bushes.

6. Testing of the system

Testing the system required various tests. During these testing all the tests are carried like below,

- 6.1. NVH test
- 6.2. Vibration test
- 6.3. Hardness test
- 6.4. Damping test

During all these testing various parameters are tested through above test and matched with standard dimensions and numbers to check the system according to which the changes are carried out.

6.1. NVH test

During NVH test all noise vibration are tested to reduce if more than rated value and made certain changes in the system.

6.2. Vibration test

During this test all vibrations are eliminated via changes in the system if any existing in the system.

6.3. Hardness test

Swing arm is tested with hardness and its strength with which all bending and related things can be avoided.

6.4. Damping test

For better damping results (Fig.7), suspensions are tested through which better suspension can be achieved.

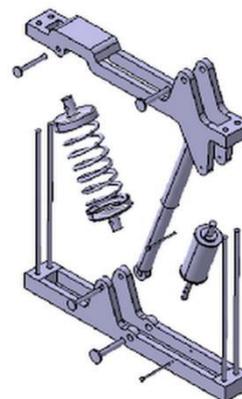


Fig 7: Suspension test

7. Application

Single sided swing arm mostly used in most of UK and US based motorcycle companies (Fig.8). On the basis which one of the new drive system is innovated .With these system weight reduction is possible and much better performance.

7.1 Advantage of the single swing arm

- 7.1.1. Weight reduction
- 7.1.2. Easy to install
- 7.1.3. Mono suspension applicable
- 7.1.4. More torque

- 7.1.5. Easy to service
- 7.1.6. Better results

7.1.1. Weight reduction

With this system weight is reduced basis material used instead the use of double sided swing arm. Basis the material whether its carbon fiber or chromoly pipes weight can be reduced with the design.

7.1.2. Easy to install

System is easy to install with design specifications.

7.1.3. Mono suspension applicable

Mono suspension can be used in single sided swing arm and more comfort can be achieved.

7.1.4. More torque

With the use of belt pulley once can get more rated toque through the system.

7.1.5. Easy to service

Single swing arm system is easy from service point of view also.

7.1.6. Better results

From the service point of view it is much better. Hence the system has good results.



Fig 8: Actual single swing arm in motorcycle

8. Acknowledgement

I would like to thank Mr.Mihir Kulkarni for valuable guidance and contribution in developing this innovative concept.

9. Result and discussion

As per the design and analysis the concern project is practically safe and applicable hence can be applied in actual vehicle transmission system. With the perfect calculations and equipments it can be implemented in regular automobiles.

10. Conclusion

Hence single sided swing arm transmission is safe and applicable in actual automobiles. It can reduce the weight of the system ultimately more output and good aesthetics also.

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