IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 8, Issue 4, April 2021

DOI: 10.17148/IARJSET.2021.8444

DESIGN AND FABRICATION OF TWO WHEEL DRIVE IN MOTOR CYCLE

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ABSTRACT: In these days' people concentrate more and more on the comfort and operability of automobiles. Four wheel-drives in cars have become popular and are in demand in the automotive sector. But the advancement in two wheelers was limited. The concept of two-wheel drive motorcycles was not successfully and economically implemented. Two-wheel drive motorcycle is desirable in situations where there is rough terrain and high inclination roads which are tiresome and difficult to drive with the conventional rear wheel driven motorcycles. The two-wheel drive bikes are apt for farmers, military applications, desert drive etc. The proposed design provides economical and user friendly two-wheel drive. The use of chain drive and sprockets help in reduction of power loss during transmission of power from the engine to front and rear wheels. The lightweight 'all-mechanical system' is used to obtain two wheel-drive. Under optimum traction conditions, the rear wheel is actually driving faster than the front wheel and the one-way clutch within the system allow the front wheel to freewheel under these conditions. At this point, the two-wheel drive system is effectively passive. Though the front drive system is turning, it is not actually transferring power to the front wheel. When the rear wheel loses traction, the drive ratio, relative to your forward speed, changes. The two-wheel drive system engages transferring power to the front wheel until traction is re-established at the rear wheel. This project is modelling and fabrication of electrical driven 2-wheel drive in motor cycle. With the help of an external electric source the front wheel is provided power from a hub motor.

CHAPTER 1
INTRODUCTION

A motorcycle, often called a motorbike, bike, or cycle, is a two- or three-wheeled motor vehicle. Motorcycle design varies greatly to suit a range of different purposes: long-distance travel, commuting, cruising, sport, including racing, and off-road riding. Motorcycling is riding a motorcycle and being involved in other related social activity such as joining a motorcycle club and attending motorcycle rallies.

The 1885 Daimler Reitwagen made by Gottlieb Daimler and Wilhelm Maybach in Germany was the first internal combustion, petroleum-fuelled motorcycle. In 1894, Hildebrand & Wolfmüller became the first series production motorcycle. In 2014, the three top motorcycle producers globally by volume were Honda (28%), Yamaha (17%) (both from Japan), and Hero MotoCorp (India). In developing countries, motorcycles are considered utilitarian due to lower prices and greater fuel economy. Of all the motorcycles in the world, 58% are in the Asia-Pacific and Southern and Eastern Asia regions, excluding car-centric Japan. According to the US Department of Transportation, the number of fatalities per vehicle mile travelled was 37 times higher for car.

This system is similar to the four-wheel drive system used in cars. With the two-wheel drive system the load carrying capacity, traction and cornering ability of two wheelers are increased. It also results in unmatched hill climbing ability when compared with conventional motorcycles available in the market today. Because of this they are preferred for farm lands and military applications (reconnaissance missions). It is evident from the fact that a decade ago the two-wheel drive motorcycles were limited to dirt races and mountain races. But now they are being wanted for farm and military applications and more companies are showing interest in the two-wheel drive system on motorcycles.

CHAPTER 2
LITERATURE REVIEW

According to the 2008 survey of the north-east forest data analysing department it has come into the light that the two-wheel motor cycles used in that area is getting more engine maintenance comparing to the urban vehicles. This is because of the geographical style of that area, much more areas are hilly areas. The vehicle used by the peoples, military officers

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in fact all are using the normal vehicles, but the vehicle can't give the performance because of the geographical issue. If the two-wheel motor cycles used there have a front wheel power drive, then it will be an very helpful in this type of areas. Especially for the military purpose it will be an major contribution.

CHAPTER 3
EXISTING DESIGNS

Many companies have designed two-wheel drive bikes. Some of them are already in production and are available in the market. Of which the companies Rokon, Yamaha, Christini are of more importance.

Rokon: Rokon is a company with several models of two wheeldrive bikes in the market. The models are bulky in size and heavy. The bikes have big tires and a big frame to support it. The company set out to build the ultimate off road vehicle in the 1950s. It had to go anywhere and be a rugged workhorse. With this in mind a two-wheel drive vehicle with hollow wheels was designed and produced. Some call it a bike but the name tractor more closely identifies it. This is because of its huge size. Power to both wheels in a lightweight yet strong frame design gave riders nimble and versatile traction off road.

Christini: Christini Motors is one of the leading manufacturers of two-wheel drive bikes in the world. Chistini's patented mechanical all-wheel drive system delivers power from the motorcycle transmission to the front wheel through a series of chains and shafts. There is no energy robbing hydraulics involved. The lightweight all-mechanical system works similar to that of AWD systems found on four wheeled vehicles.

The AWD system (powering the front wheel) is driven at a slightly lower rate than the rear wheel (approximately 80%). Under optimum traction conditions, the rear wheel is actually driving faster than the front AWD system. One-way clutches within the front hub allow the front wheel to freewheel under these conditions. At this point, the AWD system is effectively passive. Though the front AWD system is turning, it is not actually transferring power to the front wheel. When the rear wheel loses traction, the drive ratio, relative to your forward speed, changes. The AWD system engages, transferring power to the front wheel until traction is re-established at the rear wheel. There are different models in the market manufactured by Christini. It also has a military AWD bike designed for the American Military.

Two wheel drive bike by HCE students: It was designed by a team of students from Madras-based Hindustan College of Engineering (HCE), {Rachit Aggarwal from Delhi, Arpit Tandon from Muradabad, UP, Pawan J B Rana from Nepal and Lakshman Sreedhar from Chennai}. It was designed and developed to transmit power to the front wheel using a combination of shaft and chain drive from the engine output. They used a Kawasaki Bajaj 100 RTZ and incorporated a selector mechanism obtained from a Jeep's transfer case. Thus the engagement of two wheel drive was manually done. They used a propeller shaft with two integrated CV joints, three bevel gears, two sprockets, chains etc. There's been so much interest over the years – so why aren't we all riding them?

The concept of two-wheel drive motorcycles has been around for ages and loads of manufacturers over the years have toyed with the idea. But there's still never been a concerted effort to even offer customers the option of buying such machines.That means it remains impossible to judge whether or not they'd turn out to be a success. Something similar happened in the car market, and manufacturers that had shied away from offering all-wheel-drive technology were twice proved wrong in their assumption that there wasn't a market.

It happened first just after WW2, when ex-army Jeeps flooded markets around the world and found favour among farmers and rural dwellers who valued their go-anywhere ability. Rover was the first firm to notice the trend and in 1948 revealed the Land Rover as the first proper attempt at a civilian machine with Jeep-like ability. Over the next three decades plenty of other firms joined the all-wheel-drive fray, but apart from a couple of attempts by niche players like Jensen, none could be convinced that there was a possible market for 4WD machines aimed at roads instead of muddy fields. In the late 1970s Audi was the company to break that mould, and as the 80s dawned its Quattro model proved that even where there was traction, driving all the wheels could be of benefit.

Given that both the companies that pioneered four-wheel-drive in cars – Land Rover and Audi – have gone on to huge success (along with others like Jeep and Subaru, which are equally associated with all-wheel-drive), it's surprising that no bike firm has taken the gamble on a serious effort at two-wheel drive. It's all the more surprising given that some of the niche 2WD machines out there have gained glowing reviews, and that 2WD prototypes from big firms have often been said to be impressive in their performance.

So here's our list of the top 10 2WD efforts – be they production bikes, conversion kits, prototypes or concepts. Hopefully one day more of us will get the chance to judge for ourselves whether the technology has merit.

CHAPTER 4
DRAWBACKS OF EXISTING DESIGNS

The current available designs have several disadvantages. The cheapest one among them costs above $8000 and common people cannot afford it. Also the transmission systems employed in such designs are more complex. The current designs available are using hydraulic transmissions, which thus have high power loss. The very big size of these bikes makes them suitable only for limited uses like race events etc.

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One of the available designs is ROKON 2WD bike, which have got a full time two wheel drive system employed. The full time two wheel drive mechanism has considerably less fuel economy. And also the size of these bikes is very high which limits the use. Another design available is YAMAHA YZ250, which is a production bike by the famous two wheel manufacturers, YAMAHA. These bikes are used only for mountain races and are equipped with high capacity engines. Also the cost of the above two designs are very high. CHRISTINI BIKES, one of the leading companies in manufacturing two wheel drive bike, they are manufacturing 2WD bikes with medium capacity engines. Even they are manufacturing medium capacity bikes, the cost is still very high. The transmission used by CHRISTINI BIKES is a combination of chain drives and shaft drives and therefore the transmission losses are less compared to other designs.

CHAPTER 5
VEHICLE SELECTED

The selected vehicle is a HERO HONDA Splendour motorcycle. It has a 97cc four stroke single cylinder engine, a centrifugal clutch, the clutch output is connected to a pulley through belt transmission and a sprocket is connected to a sprocket which drives the rear wheel through a chain drive in the ratio 4:1. It has a simple tubular frame. Thus it is easy to incorporate the two-wheel drive system in this motorcycle. Moreover, the cost is less. Thus for reducing the cost, for the ease of fabrication and simple design we have chosen a HERO HONDA Splendour.

Fig.4.1 Splendour Bike we used

Specifications:

Kerb weight	=	**112 kg**
Turning radius	=	**2.0 m**
Gear ratio	=	**4:1**
Displacement(cc)	=	**97 cc**
Bore x Stroke	=	**50x50 mm**
Max. Power	=	**8.02 Ps @8000 rpm**
Max. Torque	=	**8.05Nm @6000 rpm**

Wheels And Tyres

Tire size (front) 2.75 x 18
Tire size (rear) 2.75 x 18

CHAPTER 6
PROPOSED DESIGN

The front wheel should be given a higher sprocket ratio than the rear that is the front wheel rotates at a lower speed than the rear. This condition is given to have a differential effect when the bike is taking a turn. When a bike takes a turn the bike turns with respect to a point on the ground. Thus the front wheel will be turned at an angle to the bike and the rear wheel will be in line with the bike. If the front wheels drive faster than the rear, the vehicle will experience a pulling effect. This will make uncomfortable for the rider to make correct balance at turns. A faster rear wheel will also give directional stability while cruising at high speeds. Since the front wheel is at a lower speed, to avoid slip a free wheel should be used. A free wheel is a one-way clutch which transfers power only in one direction. Thus under optimum traction conditions, the rear wheel is actually driving faster than the front AWD system. One-way clutches within the front hub allow the front wheel to freewheel under these conditions. At this point, the AWD system is effectively passive and no power will be transmitted to the front. Thus the bike will act as a RWD vehicle. Thus the fuel consumption will not increase. So the front wheel is provided the power with the help of an lead acid battery. The battery is placed in the vehicle as per the connivance. Then from that battery a switch is set up for the easy handling of the power. From there through the connected wire the power is provided to the dc hub motor which is fixed on the front wheel. The hub motor

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will be placed with as much care because of the much complicated set up. The entire work will be done on the front portion of the motorcycle. There is no connection from the bike engine so that no power loss is occurring in the engine. The power is supplied from an another source here it is a lead acid battery. Though we are not taking the power from the engine so full power is provided for the rear wheel. So here we are not planning for a fully AWD but when we need for the front wheel drive then only we are accessing it. At some particular situation the rider fell that he need an extra power to the front wheel so that it will be very helpful the only the FWD will get activated. For the better understanding of the design we are providing a design below.
The flowchart of the entire system is given below.

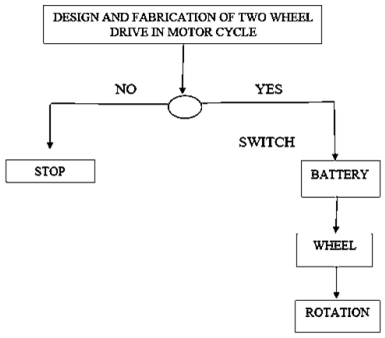

Fig. 6.1 Flow Chart of the entire system

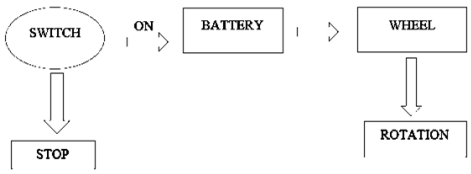

Fig. 6.2 Batter connection to the wheel

The power given to the front wheel will be comparatively less than the power suppled to the rear wheel. That is because of the many problems that come in when the front wheel will rotate in high speed. The main problem is the skidding of the vehicle when the vehicle is turned. There will be very much difficulty in the turning. The balance of the vehicle will be get disturbed. So the calculation will be more important.

6. 1 TYPES OF POSSIBILE DESIGNS

There are many methods that can be used in this AWD mechanism. Since this is done in the motorcycle there are many option available. Some of the method are simple on the other side some of the method more complicated and expensive. Since many luxuries motorcycle companies are developed there AWD Motor cycle with more expense and technology so we are targeting on the low cost and le complicated method. So these are some possible method and the reason not going toward it.

- Front wheel drive using hydraulic system.
- Front wheel drive using chain drive.
- Front wheel drive using chain and shaft drive.

6. 1. 1 Front wheel drive using hydraulic system

In this type of drive, the wheel is rotated with a motor which is given powered by the hydraulic system. The hydraulic pump is fixed on the side of the engine and from the engine chain drive to the hydraulic pump the pump will start the flow of oil which will be pumped to the motor and hence the motor is rotated them Simultaneously the wheel will also get rotated since the motor is rotated. The major disadvantage of this type is of method is the power is taken from the engine so the power to the rear wheel will be reduced and the efficiency will be gradually down. Since it is too expensive and will get the vehicle more weight that will affect majorly that's why we are not electing this method. As the part of the hydraulic method is increasing in the automobile sector this should be the future.

6. 1. 2 Front wheel drive using chain drive

A direct chain is supplied from the engine with the help of some highly mechanic set up. A gear is placed from the engine so that the output will be given to this new gear and the rear wheel simultaneously. The gear is then providing with a chain which will go to the front wheel. This setup is very much complicated because of the chain distributed from the engine to the front wheel. In this also the engine is providing power to the front wheel so the engine efficiency will be effected. Since there will a big issue in the turning of the vehicle this method and in a time where technology is

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increasing day by day this method is an old method where no technology is used and simply performing with a chain system

6. 1. 3 Front wheel drive using chain and shaft drive

In this type of drive, a single chain is not providing by on simple set up of chain and shaft is done. The front wheel will be provided power through the shaft. The shaft is rotating by the chain drive from engine. This system is not much complicated than the chain drive. But more power will be lost in this drive because of the travel of power from the chain system to the shaft system. In this type the weight of the additional attention will be get increased because of the too much of additional set up. Since the mechanism is so much complicated ad more budge I needed for the up and not in all vehicle this method can be implemented so we are not selecting this method. More over the energy loss both in the performance and b the mean of the energy loss occurring in the system. So comparing to these above methods the method that we are elected more simple less expensive and probably more accruable that this all so we are selecting this method under such circumstance.

CHAPTER 7
ASSEMBLING & WORKING

A Chamber as to be set for the perfect placement of the battery that ha to provide the power. Welding is a fabrication process that joins materials, usually metals or thermoplastics, by using high heat to melt the parts together and allowing them to cool, causing fusion Welding is distinct from lower temperature metal-joining techniques such as brazing and soldering, which do not melt the base metal For that SMAW (Shielded metal arc welding) is used and at the front of the vehicle a cage made of iron rod is set up. Since the vehicle that Is selected has pace on the front portion so it will be easier. We are not using the battery that is already available in the vehicle because this process need more energy o that the basic necessary. Welders are often exposed to dangerous gases and particulate matter. Processes like flux-cored arc welding and shielded metal arc welding produce smoke containing particles of various types of oxides. The size of the particles in question tends to influence the toxicity of the fumes, with smaller particles presenting a greater danger. This is because smaller particles have the ability to cross the blood–brain barrier. Fumes and gases, such as carbon dioxide, ozone, and fumes containing heavy metals, can be dangerous to welders lacking proper ventilation and training. Exposure to manganese welding fumes, for example, even at low levels (<0.2 mg/m3), may lead to neurological problems or to damage to the lungs, liver, kidneys, or central nervous system. Nano particles can become trapped in the alveolar macrophages of the lungs and induce pulmonary fibrosis The use of compressed gases and flames in many welding processes poses an explosion and fire risk. Some common precautions include limiting the amount of oxygen in the air, and keeping combustible materials away from the workplace.

Fig. 7.1 Fixing of DC hub motor

Hub motor is a motor which be such placed on the wheel. Since we are targeting the front wheel drive so we have to fix the hub motor on the front wheel rim. So the wheel has to be modified completely since the vehicle that we are selected as a ADC CRC Iron Rim. So the hub motor has to be placed with proper care and the brake system will also be change. If we have to keep a disc brake, then the setup has to be mad drum brake is already available in the hub motor mechanism so it will be applicable.

Fig. 7.2 Assembling Rim

The rim has to be totally changed for the fixing of the hub motor. The placement is also very important because slight mistake in this process will be result in to the failure. After the placement of the hub motor the rim should be designed as the requirement. That part is also very important because the smooth rotation of the wheel will be affected more.

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Fig. 7.3 Fixing Sprocket

Connection of the switch

Switch is to be placed in such a place that the access should be very easy so the perfect position is on the handle. So the connection should be from the battery to the switch then to the hub motor. If need them a speed control switch should also be placed. By this power can be controlled and the rotation of the wheel can be controlled. If more power is needed, then we should up the switch to the higher level and if less power is needed then it should be lower. As this drive is not used frequently so we can place the switch on the left side of the handle The wiring is done in such a way that the chance of start circuit will be very less. The switch not should have to be identical then this will result in very danger. If needed, then the display screen of the vehicle can be connected to the witch o that the power input will be displayed in it. But the vehicle that we selected has no display screen so this is not practically possible.

CHAPTER 8
CONCLUSION

The rear wheel drive motorcycle which we initially started with was successfully converted into a two-wheel drive motorcycle with automatic engagement within the given span of time. Automatic engagement of the front wheel was made possible by using a free wheel. At optimum running condition the vehicle behaves same as a rear wheel drive vehicle and do not produce any problems. The turning radius of the vehicle is found to be 2.5 meter, with an increase of only 0.5 meter from the initial condition. Since we made simple design the weight of the vehicle increased by only 6kg and hence there is no much variation in the fuel efficiency of the motorcycle.

As we used the electrical drive system, there is no power loss from the engine as designed by the top manufacturing companies like Yamaha and Roken etc. As the power can be controlled so the risk is very low. The load carries capacity of the vehicle also get increased a little bit The part is the cost that is very much affordable and has simple mechanism compared to the rest of the methods we have, the weight of the vehicle is not increased in a large manner that is also some basic advantage that we wanted. It will be very helpful in sloppy and hilly areas. The balance of the vehicle is stabled and the power will be increased. As we tested a trial on the sloppy area the power of the vehicle is increased and has proven a great result. There is no vibration in the vehicle is the other method has some kind of vibration so this is perfect on that behalf

REFERENCES

[1]. William H. Crouse and Donald L Anglin, Automotive Mechanics (New York: McGraw-Hill, 1994).
[2]. Joseph Edward Shigley, Mechanical Engineering Design (New Delhi: Tata McGrag-Hill Education, 2001).
[3]. Khurmi. R. S and J.K. Gupta, A Textbook of Machine Design (New Delhi: Eurasia Publishing House, 1979)
[4]. Mahadevan. K and Balaveera Reddy. K, Design Data Handbook, 3rd edition (New Delhi: CBS Publishers, 1987)