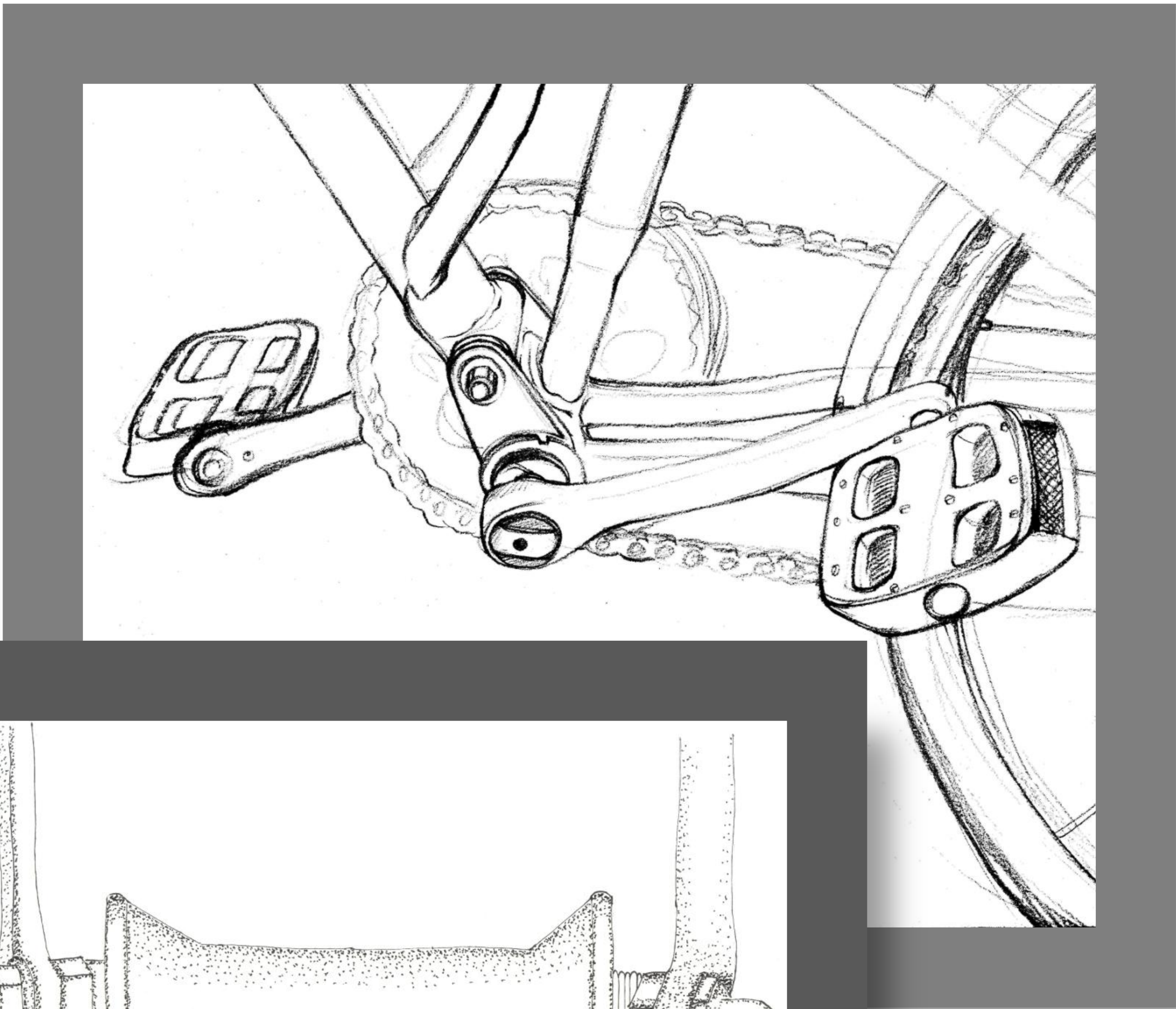
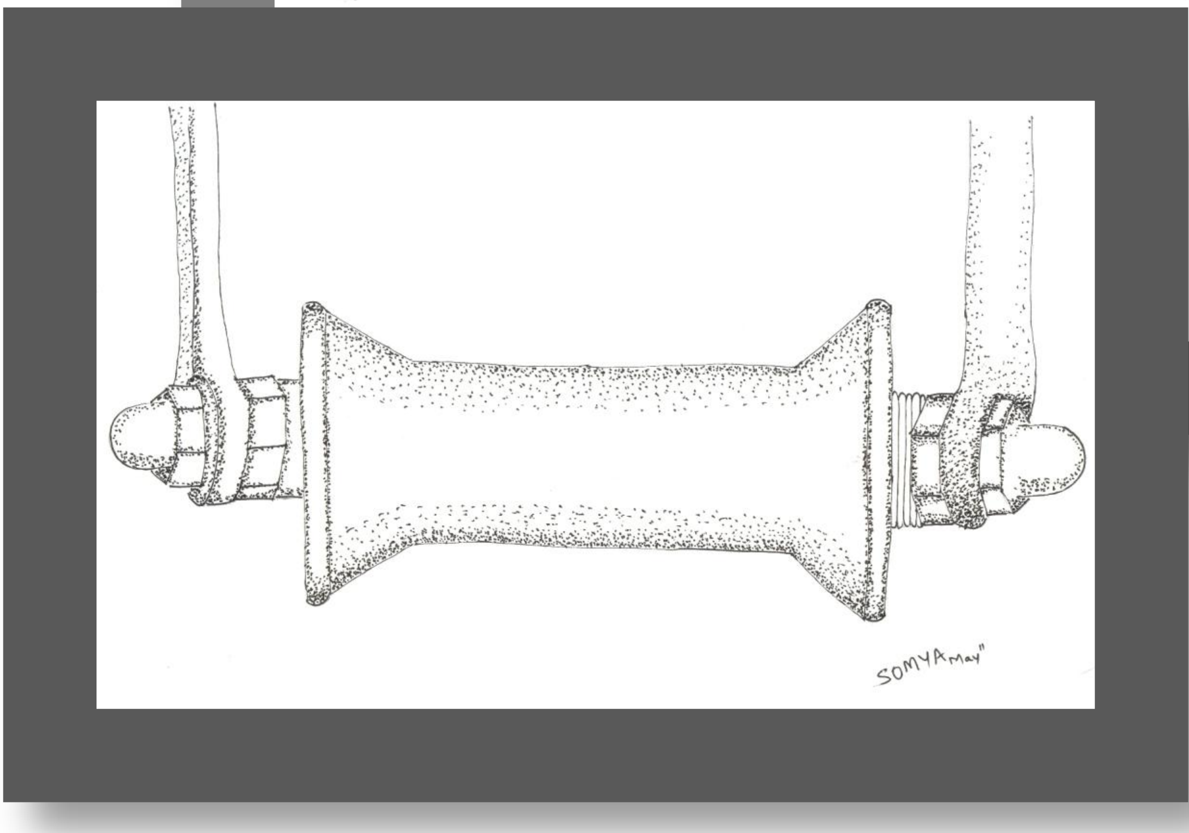
CYCLE-नामा

Bicycle Learning Expedition for Educators
Courage to Teach 2011





INTRODUCTION

Wheeling through the cobbled streets, winding its way through the milieu of trucks, cars and bikes, is the wondrous spectacle of the humble bicycle. It seems to stand out in this maze of motor mayhem, just like the invention stands out for its ingenuity and unique ability to transform the energy of the human body into great strength and endurance.

Whizzing past on the bicycle gives one the beautiful, exhilarating sense of freedom. Come to think of it, the bicycle symbolizes freedom in more ways than one.

Freedom to the little school girl for whom the bicycle made education possible;

Freedom to the woman in search of fair wages who could access those seemingly far away jobs;

Freedom to the leisure rider, riding into the sunset, talking, conversing with the whistling wind;

It brings about empowerment, whether to the women of yesteryears or the village children of today. It saves fuel for the planet, is light on your wallet and keeps you healthy all at the same time.

This booklet wants to share with you the science behind this extraordinary invention and some of its history.

Behold the bicycle! The hero of yesterday, today and tomorrow…

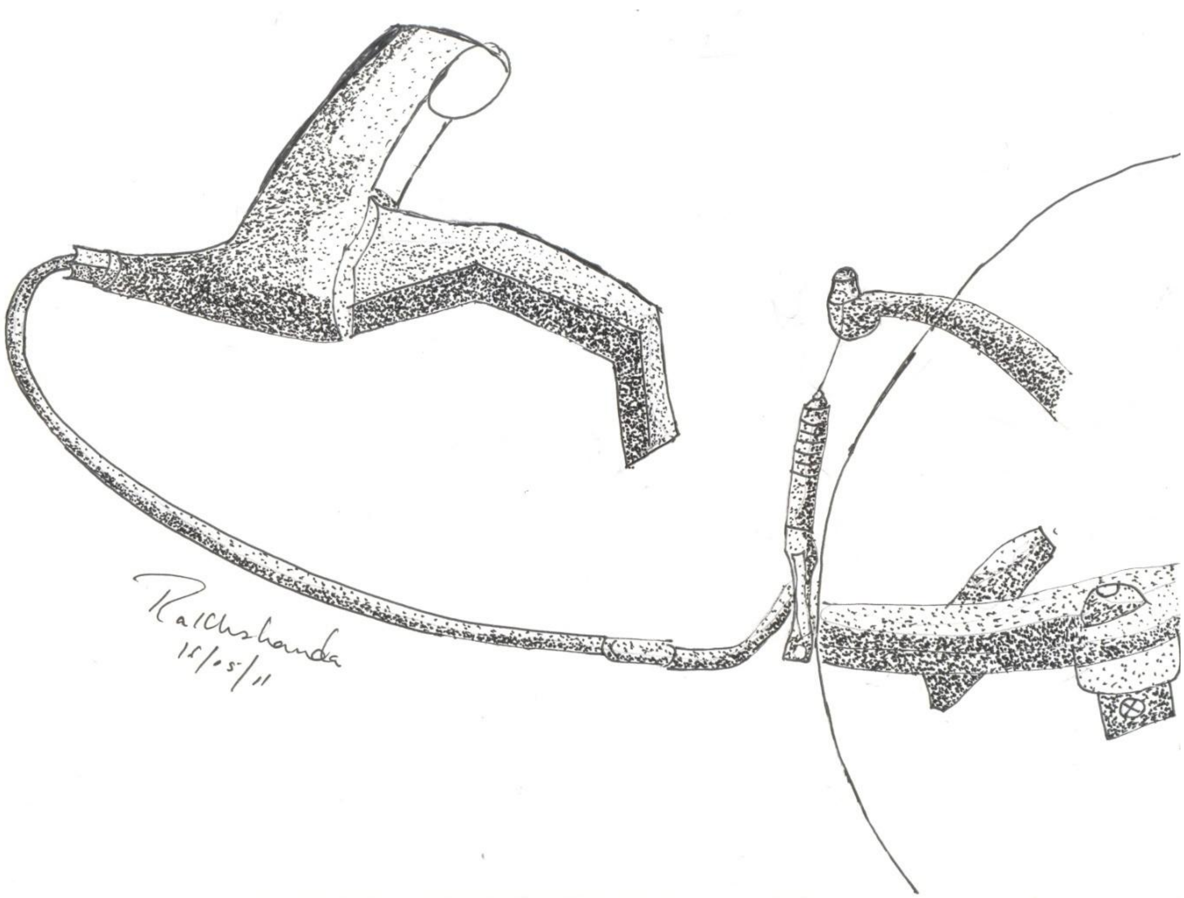
Transforming energy, transforming lives…

THE AUTHORS

The authors of this book are Educators who came together from schools all over India for a five day Learning Expedition on Bicycles. The expedition was part of the Courage to Teach programme of Disha India Centre for Experiential Learning, Gurgaon. The objective of this expedition was to enable educators to develop the understanding of how bicycles can be used as a meaningful context for developing the conceptual understanding and skills required for children. As part of the expedition educators worked on different systems and parts of the bicycle, understanding the science behind the working of each part and their role in the functioning of the bicycle. This manual is the product of research and hands-on work that educators went through in the five days of intensive learning experience.
Following parts were studied by the educators

1. Rubber Tyre - Sumita Minhas, Kapil Gyanpeeth, Jaipur
2. Frame - Gary Everett, The Daly College, Indore
3. Shift Levers - Pooja Pahwa, The Daly College, Indore
4. Handle bar and stem - Shilpa Mandloi, The Daly College, Indore
5. Brakes - Rakshanda Hafeez Khan, Kapil Gyanpeeth, Jaipur
6. Front Chain Wheel - Jyoti Bhatnagar
7. Front Fork - Jyoti Nandi, Shri Ram Vidya Mandir, Haridwar
8. Rear Free Wheel - Sonia Sharma, Shri Ram Vidya Mandir, Haridwar
9. Crank and Pedal - Nitima Arora, Suncity World School, Gurgaon
10. Spokes - Gaytri, The Heritage School, Gurgaon
11. Seat - Tapasya, The Heritage School, Gurgaon
12. Hub - Somyasmita Juneja, The Heritage School, Gurgaon
13. Metal Rim - Poonam Vig, The Heritage School, Gurgaon
14. Rear Derailleur - Namit Lohani, The Heritage School, Gurgaon

As a group we would like to appreciate and thank Parminder Raparia, Jaya Iyer, Lakshmi Singh and Meenu Tomar for designing and facilitating the expedition. We would also like to appreciate and thank Tushar Tamhane, Jayshree Iyer, Kanchan Ramkrishnan, Grade 7 students of Heritage School, Gurgaon for sharing their experiences and learning, Hema Biswas for conducting the writers workshop, Veena Karki for her art expertise, Anurag Kumar for the logistics and Tanya Tomar for typing and computer support.



BRAKES

What do I do?

I am the most important part of a cycle. I am the brake system. I help in reducing or lowering the speed of a bicycle. In ancient times bicycles had no brake systems as modifications took place much later.

Which other parts am I connected to?

Brake Lever: It's a device that holds the brake cable.

Brake Cable: It's a device passing or carrying pressure from the brake lever to the brake calipers.

FUNCTIONS

1 **<u>Brake Lever:</u>** It pushes the force down to the brake cable when pulled by the rider.

2 **Brake Cable:** When receives the pressure from the brake lever pushes down the force to the brake calipers.

3 **Brake Calipers**: The brake calipers when receives the force come close together to the tyre and jam the movement of the tyre thus bringing the cycle to a standstill.

If I become dysfunctional, how will it affect the working of the bike?

If the brake system is loose or is not performing its functions accurately the rider loses control on the speed of the bicycle and is unable to reduce or completely bring the cycle to a standstill.

When did I come into existence?

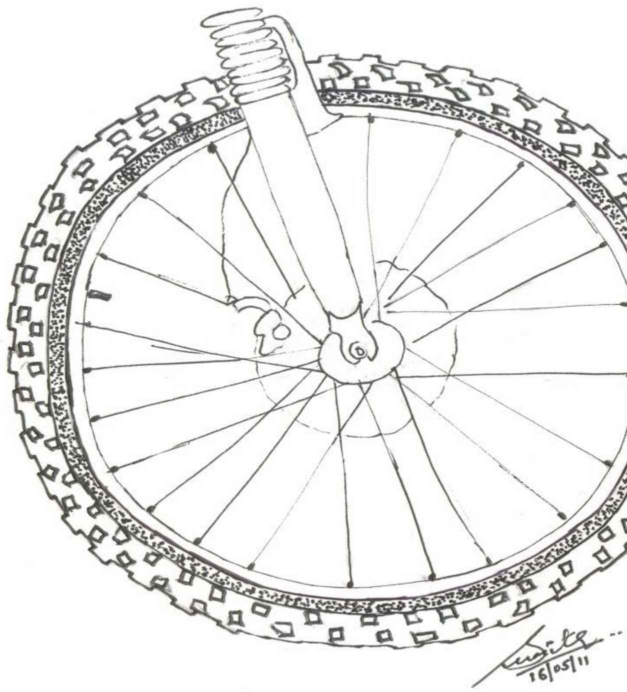
The first time I was introduced in the year 1890. This year was also known as the “Golden Age of Bicycles”.

Me now and Me then

1: **Metal Spoon Brakes:** The first time I was introduced in form of a metal spoon which was operated by the hand lever. I was pressed under the rim of the front wheel. This helped me to reduce or lower down the speed of the cycle.

2: **Stirrup Brakes:** Then I was modified as the “Pneumatic Wheels” (Air Filled) were introduced. This time I had brake pads. My brake pads exerted pressure or force under the rim of the wheel.

3: **Brake Callipers:** Now I am in the latest form of speed control system in the bicycles. I in my new version as a brake calipers exert force on the outer side of the tyres making them more precise.



THE RUBBER TYRE

What do I do?

I am the outermost edge of the wheel that makes contact with the ground and prevent headache when riding on the rough road.

I may be a clincher tyre (tube tyre) or a Tubular tyre (tubeless tyre).

What am I made of?

You know, actually, I am not made up of only rubber but I am a combination of rubber and fabric, with which the following parts are made up:-

a) **Bead:-** the edge of the tyre which holds the tyre in the rim.
b) **Fabric or side wall:** - To determine the body of the tyre and its shape, a cloth fabric is woven between the two beads.
c) **Rubber:-** it is coated on the fabric to prevent it from any damage;
d) **Tread:-** It is the rubber part that touch the road and provide a grip to battle friction.

Which other parts am I connected to?

I have a tube inside with a valve through which air is filled.

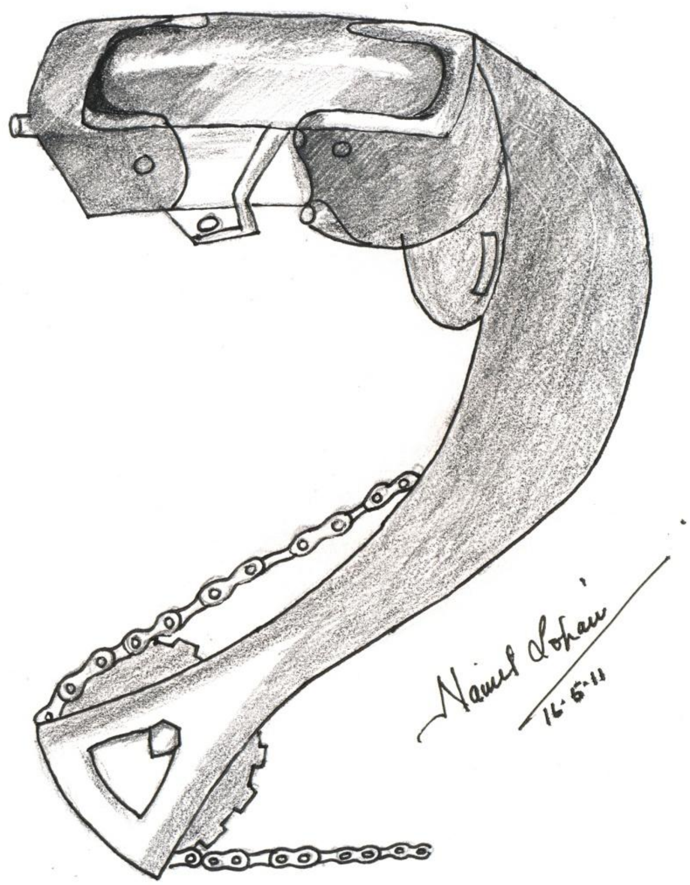
If I become dysfunctional, how will it affect the working of the bike?

Don’t ride on the bike with a flat tyre! Or even a soft tyre! The tyre, the rim and your life are at stake. Even pushing the bike with a flat tyre is bad for the tube.

When did I come into existence?

As far as my past is concerned, I was first invented for the bicycles by JOHN DUNLOP in 1888, after the invention of rubber by CHARLES GOODYEAR in 1844.

“Did you know there are over 4000 models and sizes of rubber bicycles tyres.”



THE REAR DERAILLEUR

What do I do?

Rear Derailleur is my name. I push the cycle chain from smaller gear, with fewer teeth, to a larger gear. This makes it easier for my rider to push the pedals round and move forward, and this makes me happy. The more teeth the back gear has, the easier it is to cycle uphill. When the gears are changed, the bicycles are easier to cycle up a hill and the riders thank me for this. My nickname is rear changer.

What am I made of?

Although variations exist in my body frame, I have several parts in common. Two pulleys are imprisoned in a cage like structure that guides the chain in an S-shaped pattern. My body parts may be constructed of aluminum alloy, steel, plastic or carbon fiber component. One of my types is a slant body derailleur.

Which other parts am I connected to?

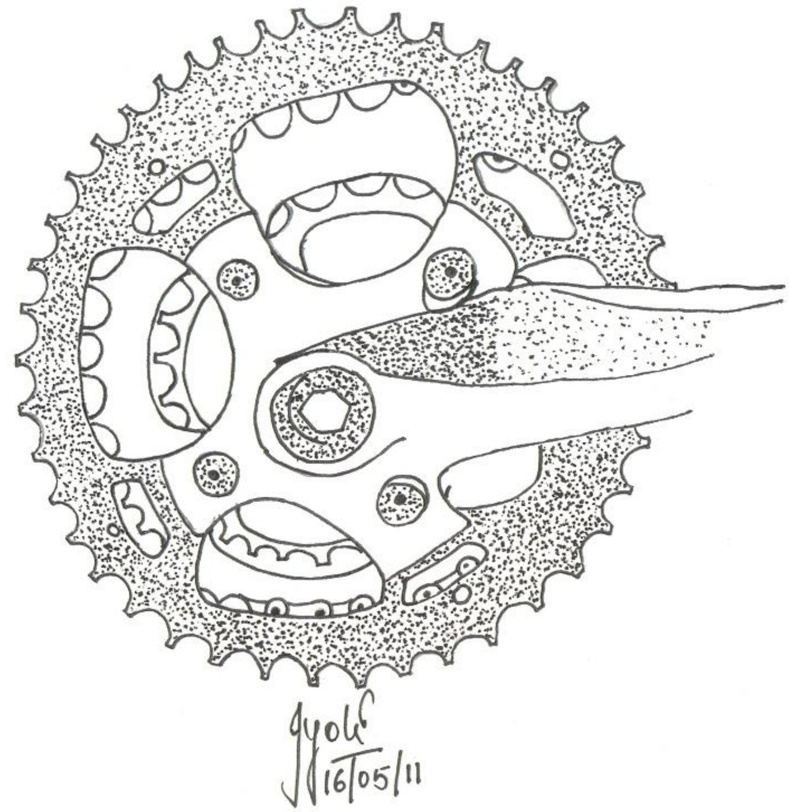
I have to feel the pain of those bolts and screws I am attached to and a chain passing through my structured body.

If I become dysfunctional, how will it affect the working of the bike?

If I become dysfunctional, I throw the chain off a roller. In such a situation, the changer needs to have the alignment and adjustment checked at both the high and low ends of its range. Once this is done, I am ready to move on.

When did I come into existence?

I was invented in 1964 by Suntour.



FRONT CHAIN WHEELS

What do I do?

The front chain wheel is an integral and inseparable part of the bicycle. It consists of the chain rings and two arms which are attached to the pedals. It is connected to the rear wheel through a chain.

What am I made of?

Very light on the pocket and is available in less expenses steel, aluminum alloy, titanium and carbon fibre.

Which other parts am I connected to?

The function of the front chain wheels is to convert the clock wise motion of the pedals into anti clock wise motion of the chain which makes the rear wheel move.

If I become dysfunctional, how will it affect the working of the bike?

Like a child who refuses to leave home and attend school after a long vacation if it becomes dysfunctional, the chain will not move and the bicycle will not move forward.

RIM

What do I do?

I am the indispensable part of the bicycle as I am the sturdiest and the heaviest part of the bicycle's wheel. With a circular metallic frame, I hold the spokes on my inner body and the tyre at my outer. Spokes and I work as a crew; we make the wheel a rugged structure capable of combating pressure as high as 400 pounds. Am I not reliable?

What am I made of?

Older rims were made of steel. However, steel rims are now obsolete and only found on the cheapest and crummiest bicycle. Aluminum rims have superseded steel as they are light like feathers, stronger, rust- free. Nevertheless, they provide better braking.

Deeper section rims have become a fad in recent years, the interest of aerodynamics. This has its own pros and cons so be careful while choosing the rim for your bicycle.

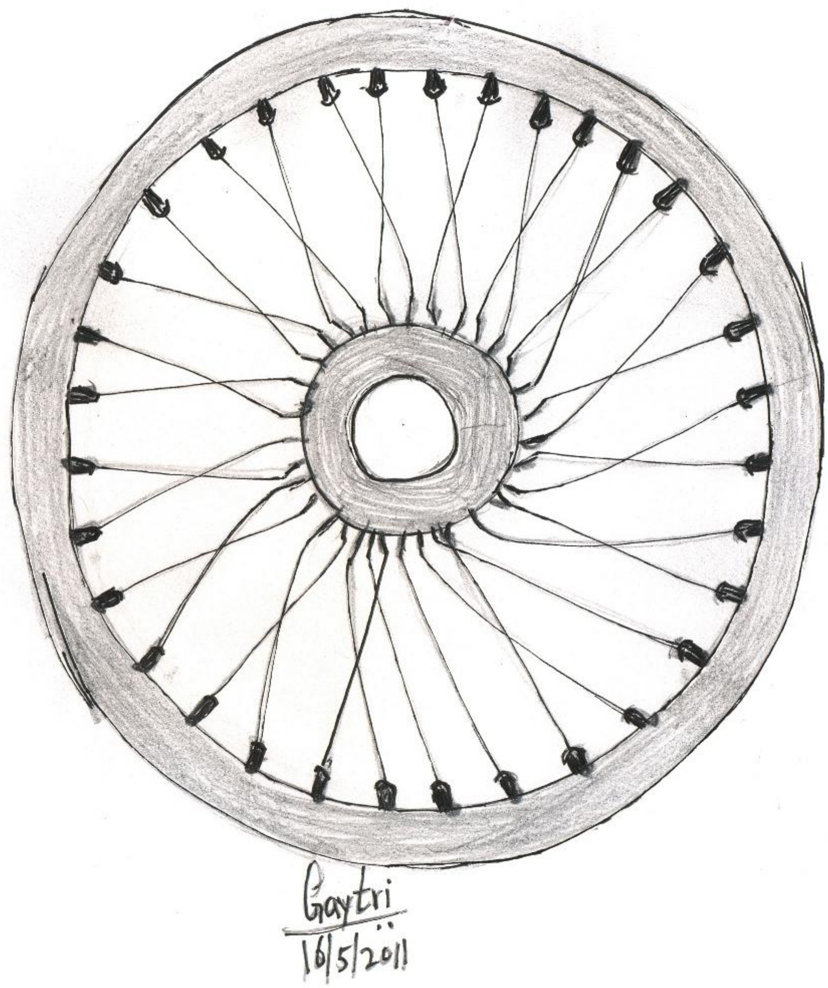
Which other parts am I connected to?

Concealed underneath a rubber tyre – 'I am the Rim'. I am a mobile skeleton which ties together the umpteen spokes and the mushy, cushiony rubber tyres. I am all potent!

Of all bicycle parts the bicycle rim can make a huge difference to how one's bike handles. The weight of your rim tremendously affects your climbing and sprinting. A flat rim is best for climbing as aerodynamics are not so important on a hill. It helps you cut through the air but in a cross wind it could cause you handling problems. Moreover, if your rims are bent or cracked you could be gambling with your life when driving.

When did I come into existence?

I have not changed much in design like the bicycle frame. I am still whirly round and always will be. Historically was made of wood but with a passage of time I travelled from steel – aluminum – carbon, if you could afford me!



SPOKES

What do I do?

Rim is evenly pulled inwards by the spokes that are laced through the hub. These spokes come from the hub then radiate outward to the rim, where they attach to little nipples resting in the rim. They play a key role in transferring the power that has gone from the rider's leg to the chain then out to the wheel. At the time of weight distribution spokes help to strengthen the rim and spread out the weight to be carried evenly. It doesn't put much stress on any single spoke.

There may be 28 to 48 spokes on a wheel depending on the style of the rim. Single riders bikes commonly have 28, 32 or 36 spokes. Some wheels can have removable spokes which can be replaced individually.

What am I made of?

Stainless spokes are the favorite for most riders for their durability, stiffness, damage, tolerance and easy maintenance.

Which other parts am I connected to?

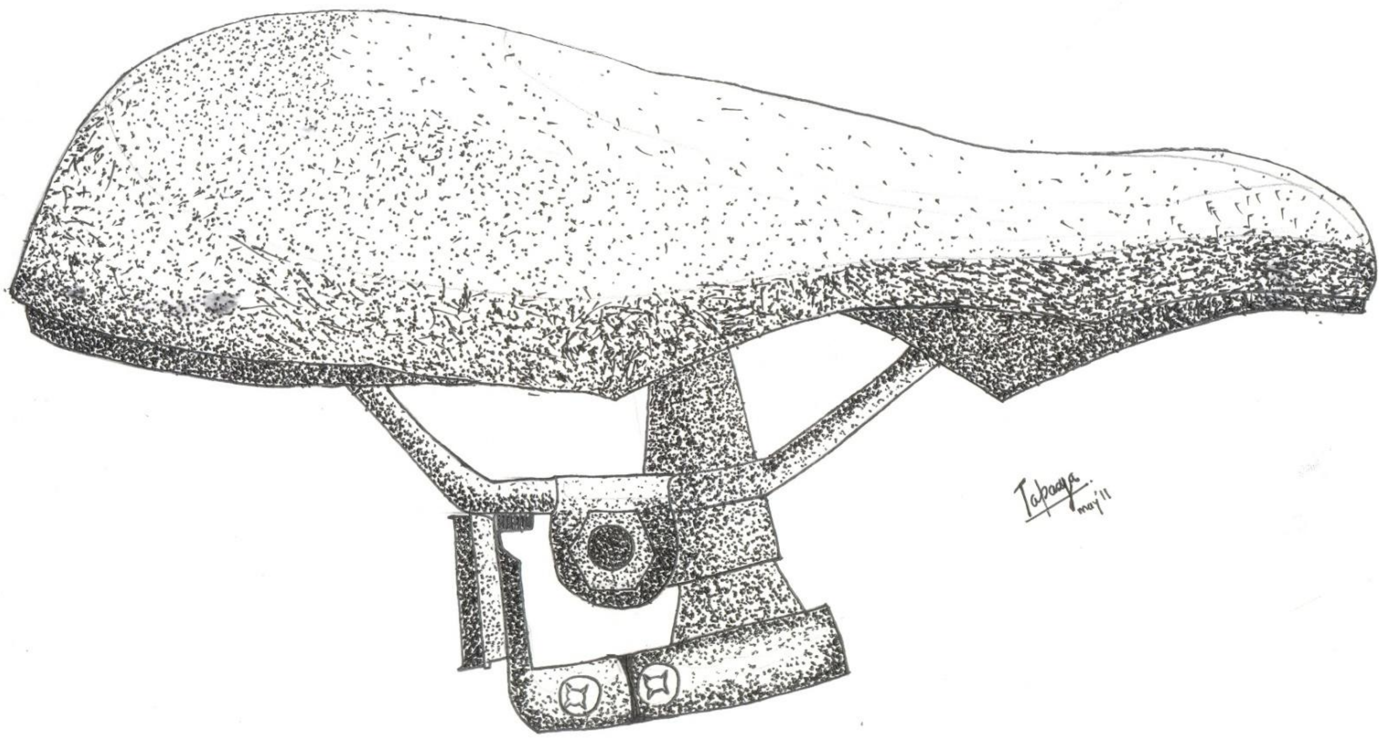
Rim, nipple and the center hub of the wheel are my neighbours.

If I become dysfunctional, how will it affect the working of the bike?

If someone plays with me, breaks me or bends me, the rider will be in trouble and can lose the brake.

When did I come into existence?

The original type of spoke wheel with wooden spokes was used for horse drawn carriages and wagons.



SEAT

What do I do?

Who does not like to be comfortably seated?

I am the comfortable place for the rider to sit on while he rides the bicycle.

What am I made of?

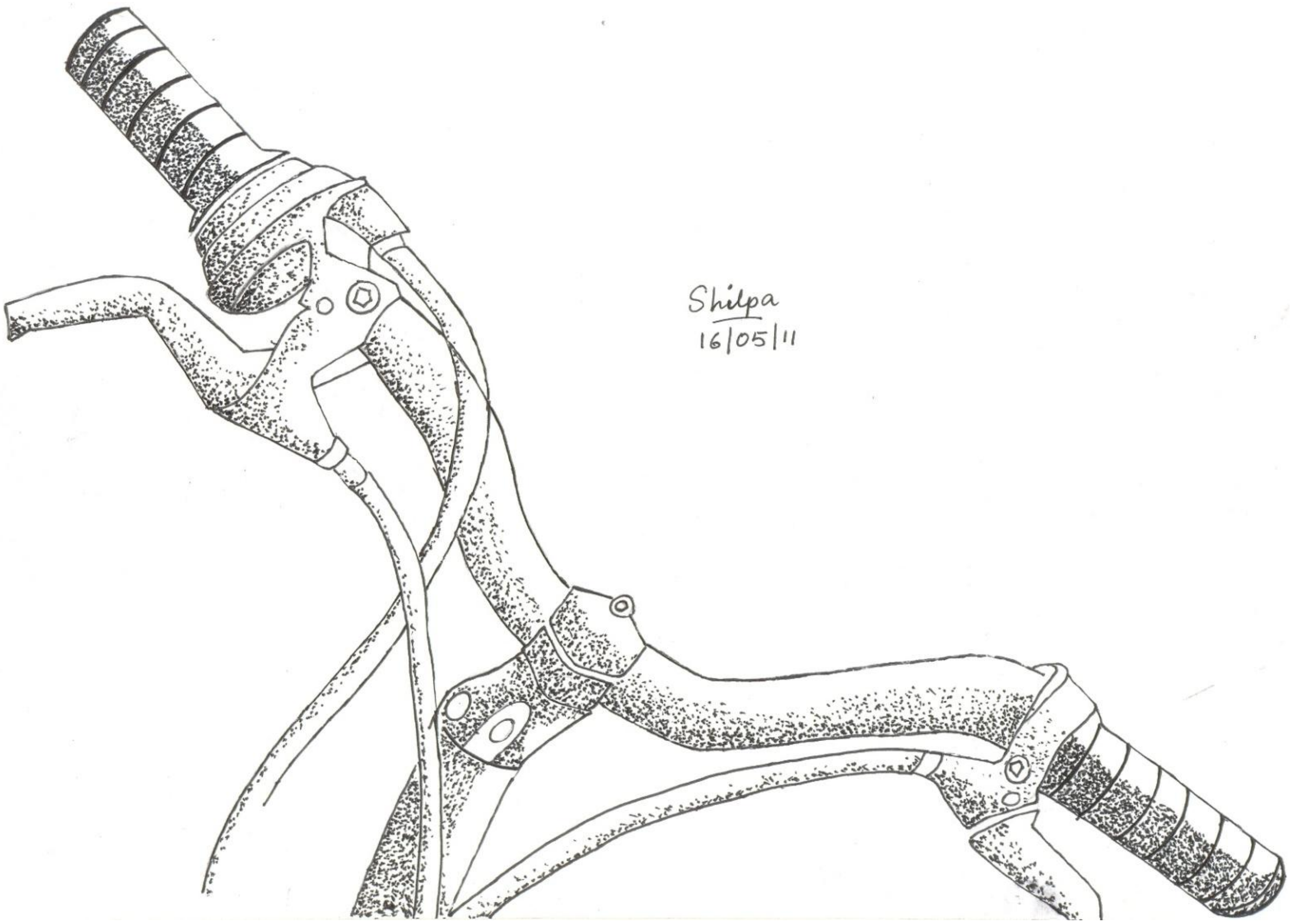
I am mostly made of three to four different materials. A rigid nylon based plastic forms the scaffold over which a padding of non-absorbent and durable foam is put. On top I am covered with any one of a number of materials, like vinyl, leather, fabric, rubber or heavy fabric such as canvas. Neoprene and urethane based adhesives helps the three materials to bond strongly.

If I become dysfunctional, how will it affect the working of the bike?

When dysfunctional, I become a source of pain and discomfort to my rider as he is unable to find a place to put his weight while riding.

When did I come into existence?

My journey started with a mere wooden plank where the seat was only for the name sake. Over the period of time I shifted places and forms. At one point, I was placed on top of the front wheel much to the discomfort of the rider. Gradually, the coming of the seat post with the safety bicycles brought in a major improvement in my looks and rider's comfort. The seat post helped the riders to move up and down as per the rider's comfort.



HANDLE BAR AND STEM

What do I do?

We are the handle bar and the stem. Both of us together form the steering mechanism of the bicycle. The part of us that helps the rider in maneuvering the cycle in a desired direction is the handle bar.

When the rider turns it left or right, it turns the wheel in the same direction with the help of our other part that is stem.

We not only help in steering or maneuvering the cycle but also bears the body weight of the rider (rider on a high seat can transfer 20 – 25 % of body weight on handle).We provide leverage to generate power. We provide point of attachment for the accessories and control. We also help in providing comfortable ride by damping road/off road vibrations.

The stem acts like the neck of the cycle and provides support to the cycle. Its lower end that is attached to the head tube of the fork has a rotating device within and thus helps turning the front wheel.

What am I made of?

We are made of metal like steel, aluminum, carbon fiber or titanium and also have crossbar pads of poly foam. We also have rubber bar ends for a better grip. Both of us are connected to each other using pinch bolts.

Which other parts am I connected to?

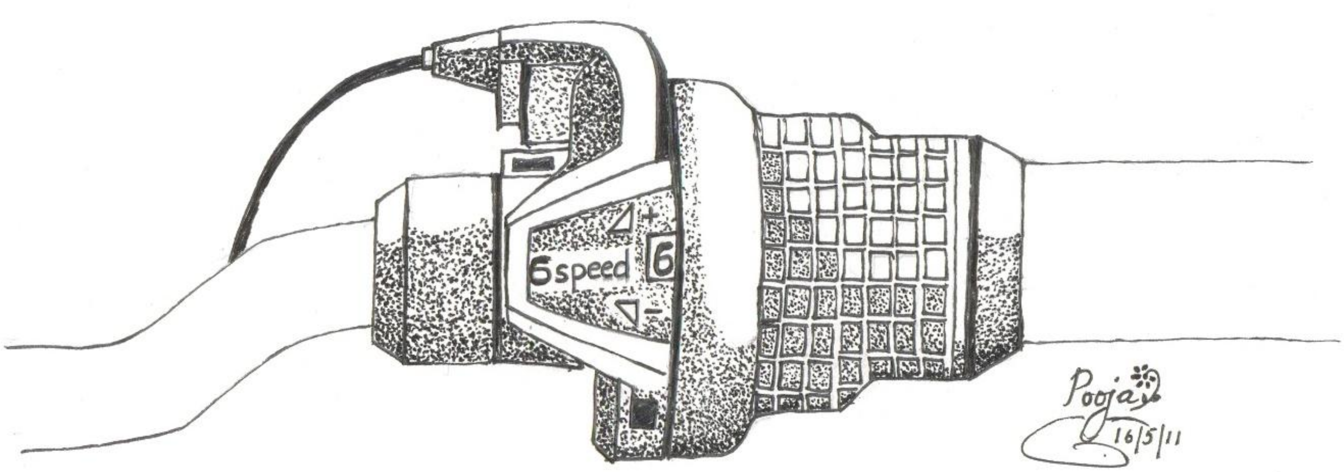
While both of us (the handle bar and the stem) are connected to each other, we are also attached to various accessories and controls like brakes, brake wire, brake lever, ring. The stem at the lower end also fits inside the head tube of fork.

If I become dysfunctional, how will it affect the working of the bike?

Imagine what happens if we become dysfunctional….! If we stop working the cycle will stop following the rider's instructions and the rider will be in trouble. Left will not be known from right…!!!

Now you know how important we are. Do take good care of us…….!

The handle bar is present in the bike from its very first model "Hobby Horse" and has evolved since then in design to suit present day needs.It ha now evolved as shallow handles that are placed below seat level for better speed.



SHIFT LEVERS

What do I do?

I am a part of the gear system. I change the gear ratio at will.. **low** for starting or going uphill and **high** for traveling on level ground. I could work best with chain-driven safety bicycle that consisted of a number of sprocket wheels of different diameters at the rear wheels. When the chain runs on a larger diameter sprocket, the gear ratio is lower than when it runs on a smaller diameter sprocket. The slack of the chain resulting because of the change in the diameter of the sprocket is taken up by derailleur. This change activates a cable. The cable pulls the derailleur mechanism to one side making the chain derail from one sprocket to another.

What am I made of?

I am made of any durable material, like, iron, steel, brass, bronze and various die-casting alloys. Precision die-casting produces accurate, durable gears at low cost. Fiber, nylon, Teflon and plastic gears have outlasted steel in some applications.

Which other parts am I connected to?

I am connected to a control on the steering column or a shaft stick located on the floor. Both are powered by me.

Changing of gears as per the level of the ground made driving easier even without the shift gears, which means if somebody wants to ride on a level ground it is okay, but going uphill or accelerating would be difficult without me.

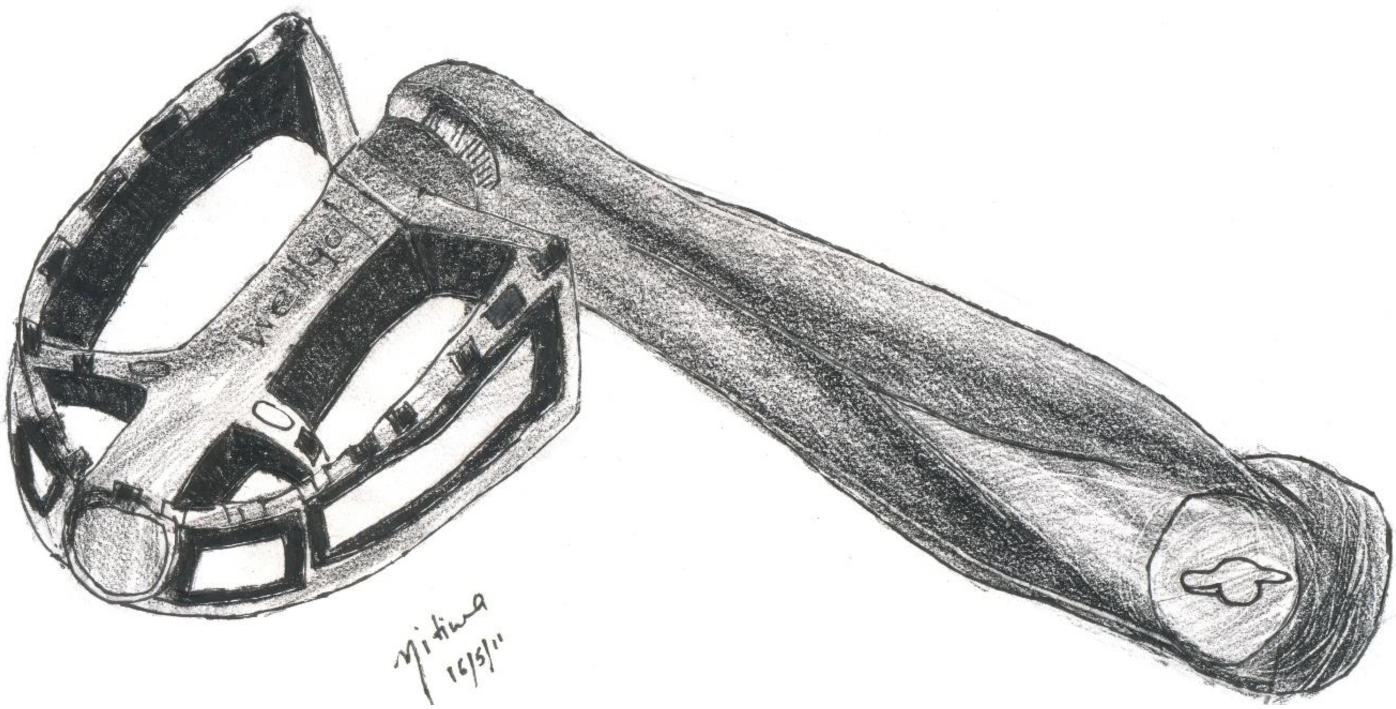
Some important tips for using me are:

a. avoid back pedaling especially when shifting
b. do not shift gears when your chain is under severe strain
c. do not shift the chain over too many cogs at once
d. do not move both shift levers at the same time
e. when approaching a hill, first gain momentum in a high range gear. Gradually change to middle range

When did I come into existence?

Over the years, many different kinds of shifters have been used. The trend in development has been to reduce the need of the rider to direct attention away from riding. Originally, gear control levers consisted of a simple lever. Then came the shift levers.

In the 1990s, shifters were placed closer to the hand positions on the handle bars so that the right shifter controls the right derailleur and the left shifter control the front derailleur.



CRANK AND PEDAL

What do I do?

I provide the connection between the cyclist foot and the crank. I allow efficient transfer of energy in both downward and upward forces exerted by the cyclist.

You just have to apply force on me and I will turn the muscular energy to the kinetic energy which just means I move and get the cycle to move.

Which other parts am I connected to?

My spindle is threaded to match a thread hold at the outbound end of the crank. Initially I was attached directly to the front wheel crank but as you see me today in a safety bicycle I am attached to the crank set.

If I become dysfunctional, how will it affect the working of the bike?

If I become loose, tight or noisy just use a strong, flat, open-ended wrench on flats on the spindle right next to the crank. The right pedal tightens clockwise and the left pedal tightens counter clockwise.

When did I come into existence?

It was 1860's that crank and I became acceptable and hobby horse defunct.

1867 it was , when I was attached to the velocipede . Now the machine began to glide as though I were alive.

"You push me with your feet

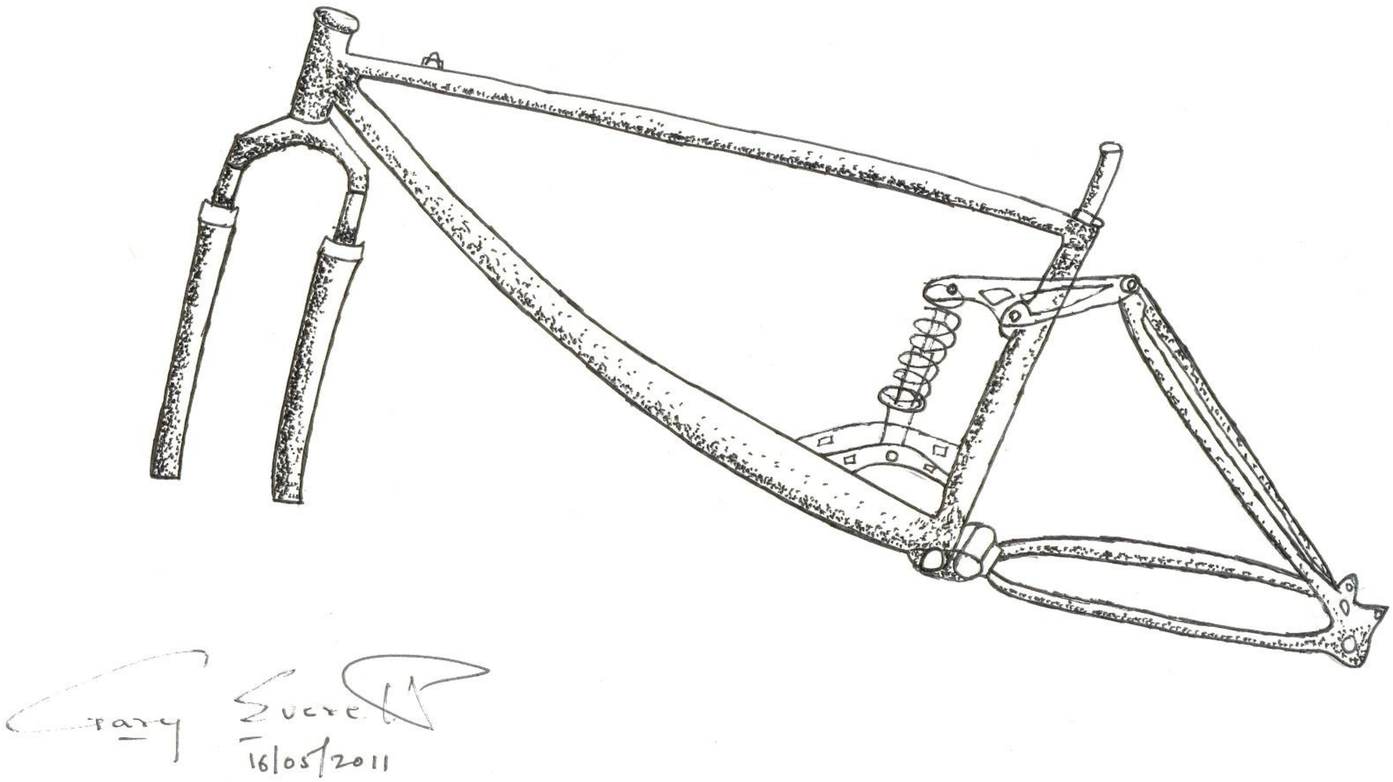
to make the bike go

I have a metal and rubber

Platform , you know

'Draisene' or 'hobby horse' did not have me though.''

When you pedal chose to
check your need !!!



BICYCLE FRAME

What do I do?

I am the Mother or you can say the main component of a bicycle, on to which wheels and other components are fitted. The modern and most common frame design for an upright bicycle is based on the safety bicycle, and consists of two triangles, a main triangle and a paired rear triangle. This is known as the diamond frame.

What am I made of?

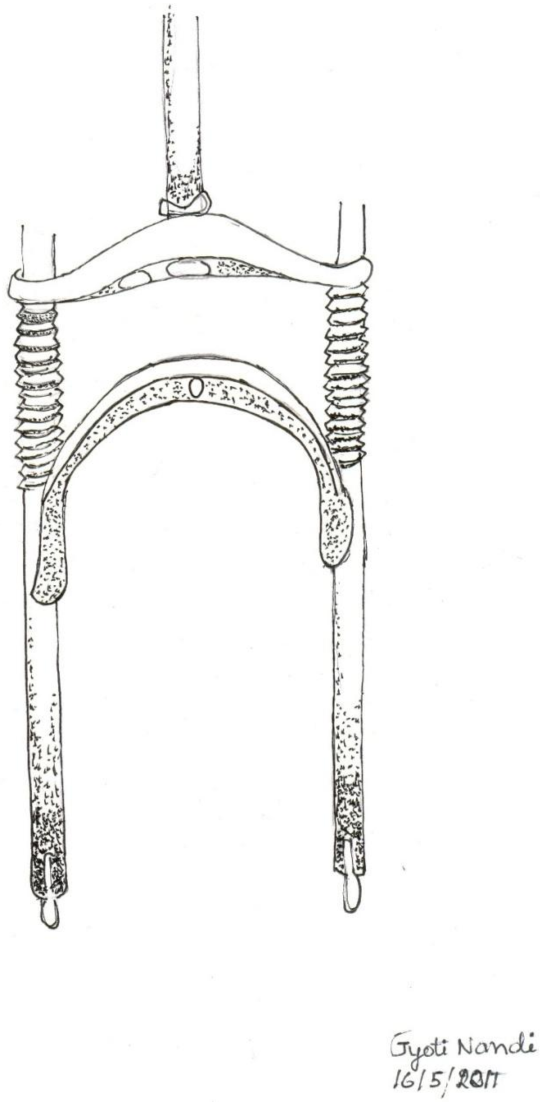
The most common mater bicycle frame has been steel. Steel frames can be very inexpensive carbon steel to highly specialized ones using high performance alloys. Frames can also be made from aluminum alloys, titanium, carbon fiber.

Which other parts am I connected to?

I am the center or the skeleton to which most of the parts are fixed namely the wheels, axel, pedals, handle, seat and stand.

When did I come into existence?

I have been in existence since the very beginning of the history of the Bicycle back in the early 19th century.



FRONT FORK

What do I do?

I am responsible for holding the front wheel. The rider is able to steer and balance the wheel only because of my fork like arms. I have two to shock absorbers which contain the ball bearings that do a good job of absorbing the shock and make the bike steer easily.

What am I made of?

I am made up of a variety of materials like steel aluminium , carbon fibre, titanium , magnesium and various combinations. I can have carbon fibre blades with aluminium crowns.

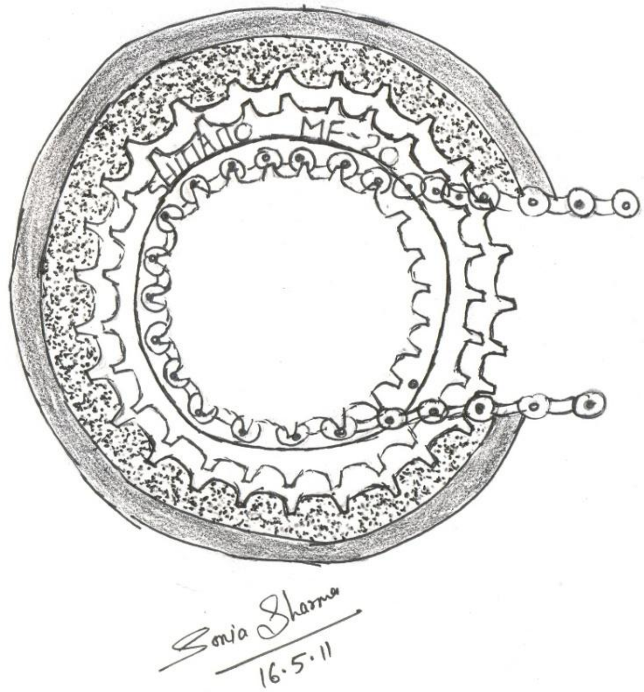
Which other parts am I connected to?

I am connected to the front wheel hub and head tube of the bike frame. Fork may have attachment points for breaks , racks and fenders.

If I become dysfunctional, how will it affect the working of the bike?

If I become dysfunctional it would be difficult for a rider to balance and steer. He would not be able to give directions , when the handle will give commands it will not turn left or right.

I was invented in 1816 by Karl Von Drais De Sauerbrun. He was a German baron.



REAR FREE WHEEL

What do I do?

I am the most important part of a bicycle as I bear most of the weight. I am comprised of a hub, rim, spokes, tyre, tube and a valve. I am called a free wheel because I am connected by the sprocket of the driving wheel to its hub in an ingenious manner.

It is easy to see that such a device makes getting on and off a moving bicycle much easier than when the sprocket and wheels are attached without a free wheel.

The free wheel helps the people to get on and off safely and one could coast down a hill without having to pedal constantly.

I engage the wheel to the sprocket when it rotates in the forward direction and also help the wheel to role freely.

The penny farthing was the first really efficient bicycle invented in 1871 that had a smaller rear wheel which was pivoted on a simple tubular frame with tyres of rubber.

GLOSSARY

Aerodynamic: having a shape which reduces the drag from air moving past.

Axle: a rod or spindle passing through the centre of a wheel.

Bead: the inner edge of the tyre.

Brake lever: a device that holds the brake wire.

Corrosion: a gradual destruction.

Crank: a wheel-like structure that rotates.

Derail: to come off track.

Durable: able to stand wear and tear, damage and pressure.

Endurance: the capacity of something to last or withstand wear and tear.

Fissures: grooves on a tyre.

Force: push or pull

Fork: a fork-shaped part which joins the handle bar to the front wheel.

Friction: a force that opposes motion.

Gear: A toothed wheel that works with others to alter the relation between the speed of the driving wheel and the speed of the driven part.

Intermesh: interlocked; the teeth of gears lock with each other as they move.

Lug: a frame joint.

Maneuvering: to carefully guide or manipulate in order to drive a bicycle.

Mechanical energy: the energy possessed by a body on account of its position or its motion.

Metal flanges: hub shells.

Mounting: a step from which a rider mounts a cycle.

Propel: drive, push, typically forward.

Resistance: the power of a body which acts in opposition to the pressure of another.

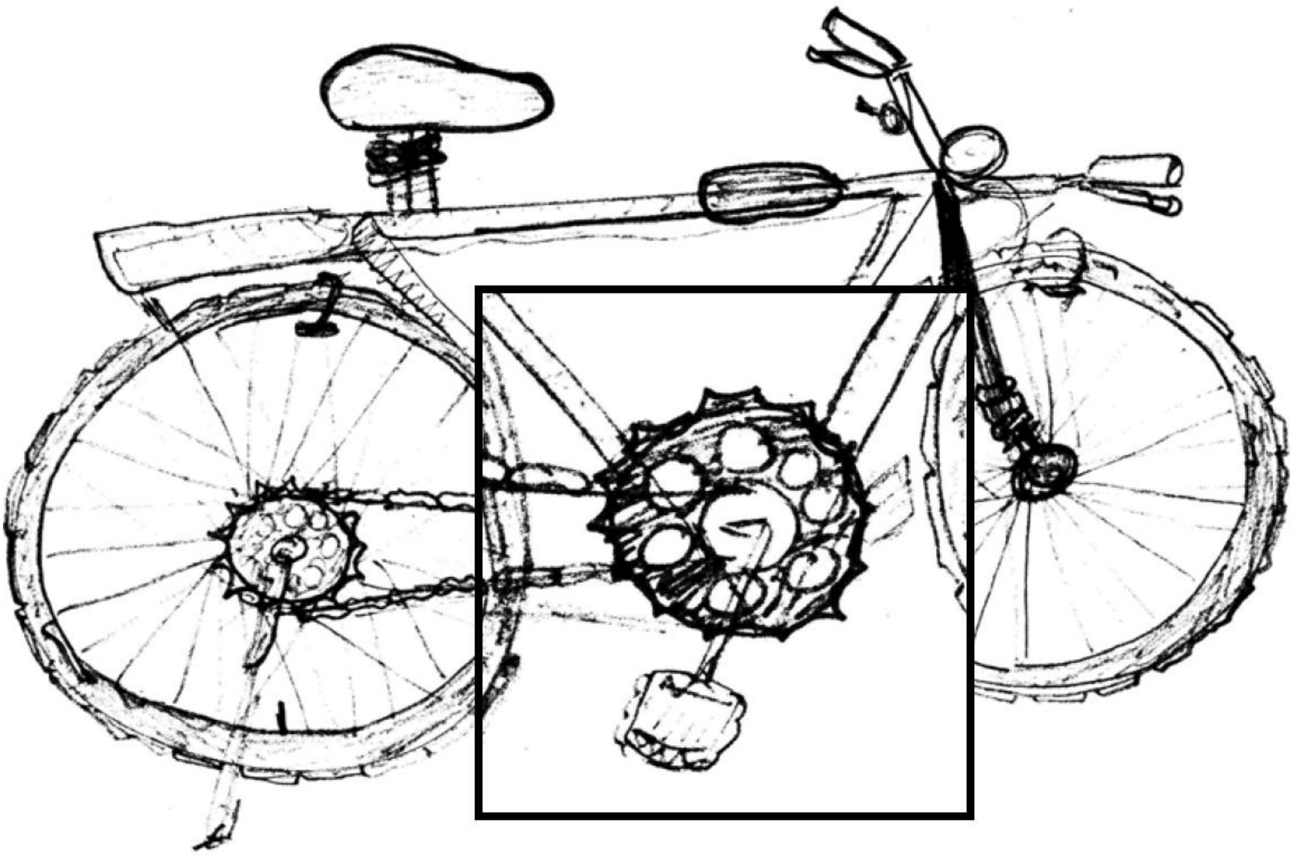
Rolling resistance: resistance that occurs when a round object such as a tyre rolls on a flat surface. It is caused mainly by deformation of the object or surface and depends mainly on the material of the tyre and the sort of ground.

Saddle: a seat with a raised ridge at the front of the bicycle.

Shock absorber: a device for absorbing jolts and vibrations, especially on a vehicle.

Traction: attraction, drawing towards.

Wrench: box end, open end, and crescent are all wrenches, a tool used to open or loosen



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