

## Cycle Based Road Cleaner



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### Abstract:

The cycle based road cleaner cleans the roads with the help of a cycle where the mechanism works on the rear wheel, the chain is connected to the additional trolley and the brushes are rotated with the help of pedestal bearings, the dust is collected into the dust collectors. The water is sprinkled on the roads just before the brushes lift the dust into the dust collector so that the dust particles settle on the ground and the dust is collected easily. There is battery connected to the water pump which is located in the water tank which lifts the water as well as the nozzles is positioned in such a way that they sprinkle just before the brushes lift the dust.

This Setup is mainly helpful to clean the crown corks, leaves, cigarettes, bottles, tins etc on the roads. The main intention of this project is that every individual can help to contribute towards the society by keeping the roads clean as well as it gives us fitness while riding the bicycle. It makes the work of cleaning easy as well as effective as they are doing the work using a cycle and it saves a lot of time and takes less amount of energy when compared to walk.

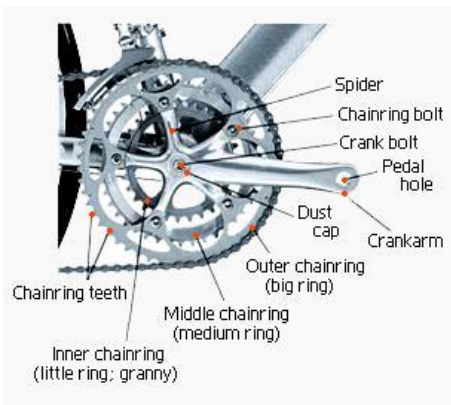
### I. INTRODUCTION:

Bicycle gearing is the aspect of a bicycle drive train that determines the relation between the cadence, the rate at which the rider pedals, and the rate at which the drive wheel turns. On some bicycles, there is only one gear and the gear ratio is fixed. Many contemporary bicycles have multiple gears and thus multiple gear ratios. A shifting mechanism allows selection of the appropriate gear ratio for efficiency or comfort under the prevailing circumstances: for example, it may be comfortable to use a high gear when cycling downhill, a medium gear when cycling on a flat road, and a low gear when cycling uphill. Different gear ratios and gear ranges are appropriate for different people and styles of cycling. A cyclist's legs produce power optimally within a narrow pedaling speed range, or cadence. Gearing can be optimized to use this narrow range as efficiently as possible. As in other types of transmissions, the gear ratio is closely related to the mechanical advantage of the drive train of the bicycle. On single-speed bicycles and multi-speed bicycles using derailleur gears, the gear ratio depends on the ratio of the number of teeth on the chaining to the number of teeth on the rear sprocket.

For bicycles equipped with hub gears, the gear ratio also depends on the internal planetary gears within the hub. For a shaft-driven bicycle the gear ratio depends on the bevel gears used at each end of the shaft.

**General Considerations:**

The gearing supplied by the manufacturer on a new bicycle is selected to be useful to the majority of people. Some cyclists choose to fine-tune the gearing to better suit their strength, level of fitness, and expected use. When buying from specialist cycle shops, it may be less expensive to get the gears altered before delivery rather than at some later date. Modern crank set chain rings can be swapped out, as can cogsets.



**Fig 1: Parts of Gear Cycle Driving System**

While long steep hills and/or heavy loads may indicate a need for lower gearing, this can result in a very low speed. Balancing a bicycle becomes more difficult at lower speeds. For example, a bottom gear around 16 gear inches gives an effective speed of perhaps 3 miles/hour (5 km/hour) or less, at which point it might be quicker to walk.

**Relative Gearing:**

As far as a cyclist's legs are concerned, when changing gears, the relative difference between two gears is more important than the absolute difference between gears. This relative change, from a lower gear to a higher gear, is normally expressed as a percentage, and is independent of what system is used to measure the gears.

Cycling tends to feel more comfortable if nearly all gear changes have more or less the same percentage difference. For example, a change from a 13-tooth sprocket to a 15-tooth sprocket (15.4%) feels very similar to a change from a 20-tooth sprocket to a 23-tooth sprocket (15%), even though the latter has a larger absolute difference. To achieve such consistent relative differences the absolute gear ratios should be in logarithmic progression; most off-the-shelf cogsets do this with small absolute differences between the smaller sprockets and increasingly larger absolute differences as the sprockets get larger. Because sprockets must have a (relatively small) whole number of teeth it is impossible to achieve a perfect progression; for example the seven derailleur sprockets 14-16-18-21-24-28-32 have an average step size of around 15% but with actual steps varying between 12.5% and 16.7%. The epicyclic gears used within hub gears have more scope for varying the number of teeth than do derailleur sprockets, so it may be possible to get much closer to the ideal of consistent relative differences, e.g. the Roll-off Speedhub offers 14 speeds with an average relative difference of 13.6% and individual variations of around 0.1%.

Racing cyclists often have gears with a small relative difference of around 7% to 10%; this allows fine adjustment of gear ratios to suit the conditions and maintain a consistent pedaling speed. Mountain bikes and hybrid bikes often have gears with a moderate relative difference of around 15%; this allows for a much larger gear range while having an acceptable step between gears. 3-speed hub gears may have a relative difference of some 33% to 37%; such big steps require a very substantial change in pedaling speed and often feel excessive. A step of 7% corresponds to a 1-tooth change from a 14-tooth sprocket to a 15-tooth sprocket, while a step of 15% corresponds to a 2-tooth change from a 13-tooth sprocket to a 15-tooth sprocket. By contrast, car engines deliver power over a much larger range of speeds than cyclists' legs do, so relative differences of 30% or more are common for car gearboxes.

### Usable Gears:

On a bicycle with only one gear change mechanism (e.g. rear hub only or rear derailleur only), the number of possible gear ratios is the same as the number of usable gear ratios, which is also the same as the number of distinct gear ratios. On a bicycle with more than one gear change mechanism (e.g. front and rear derailleur), these three numbers can be quite different, depending on the relative gearing steps of the various mechanisms. The number of gears for such a derailleur equipped bike is often stated simplistically, particularly in advertising, and this may be misleading. Consider a derailleur-equipped bicycle with 3 chainrings and an 8-sprocket cogset: The number of possible gear ratios is 24 ( $=3 \times 8$ , this is the number usually quoted in advertisements); The number of usable gear ratios is 22; the number of distinct gear ratios is typically 16 to 18.

## II. COMPONENTS OF CYCLE BASED ROAD CLEANER

- Gear Cycle.
- Trolley.
- Cleaning Brush (2x3).
- Dust Collector..
- Chains & sprocket.
- Wheels.
- Water tank
- Water pump
- Battery
- Dummy wheels
- Pedestal bearings
- Shafts

### Gear Cycle:

Two-wheeled bicycles with gear come in a range of designs. Some resemble traditional two-wheeled bikes with frame modifications to accommodate a wider axle and additional rear wheel. Others are recumbent, supporting the rider in a chair-type seat, with a frame that is low to the ground. Gear cycles 2-wheeled are known for their stability and ease of riding.

### Stability:

Two-wheeled Gear bicycles are extremely stable. While riding, the rider shifts gears according to his comfort so that the moment of the vehicle is very easy. The rider has benefits while he can actually see the change in pressure by changing gears.

### Climbing:

When it comes to climbing hills, gear cycles, especially those with multiple gears, are more capable than traditional two-wheelers. On a two-wheeled bike, the rider must maintain a certain amount of forward motion to keep the bike upright. The gear cycles rider, however, need not worry about amount of pressure he applies, so the rider can simply place the bike in a very low gear and pedal away at a comfortable pace to climb the hill.

### Trolley:

Trolley is the main component in the CBRC as the mechanism works in the trolley where the chain drives rotate the shafts with the help of pedestal bearing as well as the shafts consists of the brushes and the brushes are rotated by shafts and the dust is collected in the dust collector placed at the end of the trolley. The dust collector is a detachable one which has lock nuts to lock the dust collector. The working principle mentioned below is the extension of the working and details of the trolley. Trolley is made up m.s steel.

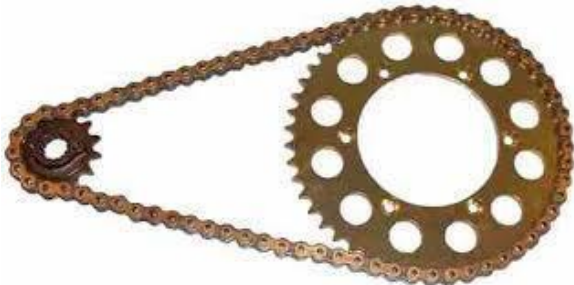


**Fig 2: Top View of Trolley**

### Chains:

A chain is a series of connected links which are typically made of metal. A chain may consist of two or more links. Those designed for lifting, such as when used with a hoist; for pulling; or for securing, such as

with a bicycle lock, have links that are torus shaped, which make the chain flexible in two dimensions (The fixed third dimension being a chain's length.)



**Fig 3: Chains and Sprockets**

### Shafts:

A shaft is a rotating machine element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque (or twisting moment) set up within the shaft permits the power to be transferred to various machines linked up to the shaft. In order to transfer the power from one shaft to another, the various members such as pulleys, gears etc., are mounted on it. These members along with the forces exerted upon them causes the shaft to bending. In other words, we may say that a shaft is used for the transmission of torque and bending moment. The various members are mounted on the shaft by means of keys or splines.

### Material Used for Shafts:

The material used for shafts should have the following properties:

- It should have high strength.
- It should have good machinability.
- It should have low notch sensitivity factor.
- It should have good heat treatment properties.
- It should have high wear resistant properties.

### Manufacturing of Shafts:

Shafts are generally manufactured by hot rolling and finished to size by cold drawing or turning and grinding. The cold rolled shafts are stronger than hot rolled shafts but with higher residual stresses. The residual stresses may cause distortion of the shaft when it is machined, especially when slots or keyways

are cut. Shafts of larger diameter are usually forged and turned to size in a lathe.

### Stresses in Shafts:

The following stresses are induced in the shafts:

- Shear stresses due to the transmission of torque (*i.e.* due to torsional load).
- Bending stresses (tensile or compressive) due to the forces acting upon machine elements like gears, pulleys etc. as well as due to the weight of the shaft itself.
- Stresses due to combined torsional and bending loads.

### Design of Shafts:

The shafts may be designed on the basis of

- Strength, and
- Rigidity and stiffness

In designing shafts on the basis of strength, the following cases may be considered:

- Shafts subjected to twisting moment or torque only,
- Shafts subjected to bending moment only,
- Shafts subjected to combined twisting and bending moments, and
- Shafts subjected to axial loads in addition to combined torsional and bending loads.

### Pillow Block Bearing:

A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Many bearings also facilitate the desired motion as much as possible, such as by minimizing friction. Bearings are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads (forces) applied to the parts. The term "bearing" is derived from the verb "to bear". The simplest bearings are bearing surfaces, cut or formed into a part, with



varying degrees of control over the form, size, roughness and location of the surface. Other bearings are separate devices installed into a machine or machine part. The most sophisticated bearings for the most demanding applications are very precise devices; their manufacture requires some of the highest standards of current technology.

**Lubrication:**

As in all bearings, proper lubrication is required to reduce wear and friction. Commercial lubricants are grouped into three generic types: greases, oils and solid films. Lubrication choices include manual lubrication and self-lubricating.

**Manual lubrication** requires a pump or a fitting mounted on the housing to deliver lubrication to the friction points of the bearing.



**Fig4: typical pillow block bearing lubrication**

Self-lubricating bearings are constructed of a material such as oil-impregnated bronze, or graphite / metal alloy that do not require external lubrication.

**Cleaning Brushes:**

A brush is a tool with bristles, wire or other filaments, used for cleaning, grooming hair, makeup, painting, and surface finishing and for many other purposes. It is one of the most basic and versatile tools known to mankind and the average household may contain several dozen varieties. It generally consists of a handle or block to which filaments are affixed either parallel- or perpendicular-wise, depending on the way the brush is to be gripped during use. The material of both the block and bristles or filaments is chosen to

withstand hazards of its application, such as corrosive chemicals, heat or abrasion. Brushes used for cleaning come in various sizes. They vary in size ranging from that of a toothbrush, to the standard household version accompanied by a dustpan, to 36" deck brushes. There are brushes for cleaning tiny cracks and crevices and brushes for cleaning enormous warehouse floors. Brushes perform a multitude of cleaning tasks. For example, brushes lightly dust the tiniest figurine, they help scrub stains out of clothing and shoes, they remove grime from tires, and they remove the dirt and debris found on floors with the help of a dust pan. Specific brushes are used for diverse activities from cleaning vegetables, as a toilet brush, washing glass, cleaning tiles, and as a mild abrasive for sanding.



**Fig 5:brushes**

**Dust Collector:**

The dust collectors are placed to the attached body or frame in such a way that they are in a shape of a half-moon where the dust can be collected easily as the brushes rotate they push the dust into the dust collector. it is made up of aluminum sheet.



**Fig 6: Dust Collector**

### Water Tank:

A water tank is a container for storing liquid. The need for a water tank is as old as civilization, linings, plastics (polyethylene, polypropylene), fiberglass, concrete, stone, steel (welded or to provide storage of water for use in many applications, drinking water, irrigation agriculture, fire suppression, agricultural farming, both for plants and livestock, chemical manufacturing, food preparation as well as many Other uses. Water tank parameters include the general Design of the tank, and choice of construction materials, linings, plastics (polyethylene, polypropylene), fiberglass, concrete, stone, steel (welded or bolted, carbon, or stainless). Earthen pots also function as water storages. Water tanks are an efficient way to help developing countries to store clean water.



**Fig 3.9 Water Storage Tank**

### Mini Submersible Pump:

A submersible pump (or sub pump, electric submersible pump (ESP)) is a device which has a hermetically sealed motor close-coupled to the pump body. The whole assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevents pump cavitation, a problem associated with a high elevation difference between pump and the fluid surface. Submersible pumps push fluid to the surface as opposed to jet pumps having to pull fluids. Submersibles are more efficient than jet pumps. The submersible pump casing can be composed of different kinds of metals, like chrome or stainless steel, or polymers. Submersible pumps come in various strengths, both in energy use and pumping

speed. Most submersible pumps are rated as effective for a wide variety of liquids, but more viscous liquids at greater depths pose pressure problems that require stronger pumps for proper function.



**Fig 3.10 Mini Submersible Pump**

### Battery:

An electric battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices.<sup>[1]</sup> A battery has a positive terminal, or cathode, and a negative terminal, or anode. The terminal marked positive is at a higher electrical potential energy than is the terminal marked negative. It's a 6volt, which is used to run mini electrical submersible pump.

### III. WORKING OF CYCLE BASED ROAD CLEANER

The Cycle based road cleaner works on the chain drive and the mechanism involved is totally depending on the rear wheel. The rear wheel consists of a 26 toothed gear teeth connected to a 24 toothed gear and a hub is placed where the other gear of 16 teeth is connected to gear of 24 teeth which is located on the Trolley. The gear teeth connected is fixed on the trolley through the shaft where the gear tooth rotates the shaft with the help of pedestal bearings. Now the shaft on which the 26 toothed gears is present also consists of a 60 toothed gear which is connected to 16 toothed gears all the mechanism used here is chain drive mechanism. Now the 60 teeth gear also rotates with the help of shaft and pedestal bearing due to which the brushes present on the 16 teeth gear shaft rotates. As the gear ratio is given as 1:4 because if the 60 teeth gear rotates once the 16 teeth gear rotates 4 times that means on an average the brushes make 4 revolutions for every paddle paddled by the cycle driver. The only way this mechanism works is by paddling without paddling it is

not possible. Now there is a dust collector placed at the end of the trolley which is supported by the dummy wheels. Now each time the brush rotates the dust is pushed into the dust collector and parallel there is water sprinkle positioned just behind the rear wheel and right at the beginning of the trolley which is operated through a battery where the water sprinkler sprinkles the water in order to make it easy for the brushes to clean the dust and avoiding the dust to rise above the surface.

#### Advantages

- Manually operated robust sweeper for small areas
- Large, robust hopper with carrying handle
- Perfect for sweeping leaves, pebbles, crown corks, cigarettes, etc
- It can be further modified into floor cleaner
- It has an attachable and detachable frame/body.
- The dust particles settle down before cleaning as the water is sprinkled
- It is better than cycling and cleaning rather than doing it manually

#### Disadvantages

- Proper fitting of the parts must be done while assembly.
- Sharp turns cannot be taken as it requires a minimum of space to turn the cycle. Handling the cycle while turning must be taken care.

#### APPLICATIONS:

- Reduces a lot of work pressure to the people sweeping the roads instead they can do it using this cycle.
- People can expect fitness as well as cleanliness by cycling them on roads.
- When converted to floor cleaner they can be used in malls and universities as they become a very good source of completing the work.

#### IV. CONCLUSION:

The Paper resulted into a successfully prototype, where you can use this cycle based road cleaner for cleaning the roads without using heavy machinery and electricity. Simply by paddling the cycle we can clean the path. This is very economical as well as affordable by common man. The main agenda of this project was giving back something to the society. The minimum we could do for our society is to keep our surroundings clean and with this prototype we can keep our lanes or colony or society clean. This improves fitness as well as it is helping us clean the paths. Cleanliness and Fitness both can be taken into consideration by this Cycle Based Road Cleaner.

#### Future Scope:

This Cycle based road cleaner is detachable which helps you convert the road cleaner into floor cleaner. The brushes can be replaced by sponges or cloth's which converts the dry floor cleaner into wet floor cleaner. The Cycle based road cleaner can also be converted into floor cleaner as well as it can suck the minute particles and become a pneumatic cleaner.

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