Folding and Self-Propelling Bicycle

Morteza Hanifezade and Arian Ashrafi

Abstract—**Recently there are studies on air pollution of big cities and results proved that air pollution is increased in general. This problem is the base of our research and so we should try to decrease this.**

Regarding to the point that some people for solving this problem use bicycles as a transportation .We decided to design a bicycle that is self - propelling. Also it can be folded when is needed. In this way it can be placed in a small bag .Another important point about it: Doesn't need for any external electrical supply and fossil fuel.

General system of this bicycle is in saving energy in batteries with pedal and then used as energy for moving bicycle automatically.

Index Terms—**Bicycle, air pollution, electrical energy, propel, fold.**

I. Introduction

The earliest comes from a sketch said to be from 1493 and attributed to Gian Giacomo Caprotti, a pupil of Leonardo da Vinci. In 1998 Hans-Erhard Lessing said that this last assertion is a purposeful fraud [1], [2]. However, the authenticity of the bicycle sketch is still vigorously maintained by followers of Prof. Augusto Marinoni, a lexicographer and philologist, who was entrusted by the Commissione Vinciana of Rome with the transcription of da Vinci's Codex Atlanticus. [3] Later, and equally unverified, is the contention that *Comte* de Sivrac developed a *célérifère* in 1791, demonstrating it at the Palais-Royal in France. The *célérifère* supposedly had two wheels set on a rigid wooden frame and no steering, directional control being limited to that attainable by leaning. [4] A rider was said to have sat astride the machine and pushed it along using alternate feet. It is now thought that the two-wheeled *célérifère* never existed (though there were four-wheelers) and it was instead a misinterpretation by the well-known French journalist Louis Baudry de Saunier in 1891. [5], [6] Though technically not part of 2-wheel "bicycle" history, the intervening decades of the 1820s-1850s witnessed many developments concerning human-powered vehicles often using technologies similar to the draisine, even if the idea of a workable 2-wheel design, requiring the rider to balance, had been dismissed. These new machines had three wheels (tricycles) or four (quadracycles) and came in a very wide variety of designs, using pedals, treadles and hand-cranks, but these designs often suffered from high weight and high rolling resistance. However, Willard Sawyer in Dover successfully manufactured a range of treadle-operated 4-wheel vehicles and exported them worldwide in the 1850s. [7] Bicycle historian David V. Herlihy documents that Lallement claimed to have created the pedal bicycle in Paris in 1863. He had seen someone riding a draisine in 1862 then originally came up with the idea to add pedals to it. It is a fact that he filed the earliest and only patent for a pedal-driven bicycle, in the US in 1866. Lallement's patent drawing shows a machine which looks exactly like Johnson's draisine, but with the pedals and rotary cranks attached to the front wheel hub, and a thin piece of iron over the top of the frame to act as a spring supporting the seat, for a slightly more comfortable ride. By the early 1860s, the blacksmith Pierre Michaux, besides producing parts for the carriage trade, was producing "vélocipède à pédales" on a small scale. The wealthy Olivier brothers Aimé and René were students in Paris at this time, and these shrewd young entrepreneurs adopted the new machine. In 1865 they travelled from Paris to Avignon on a velocipede in only eight days. They recognized the potential profitability of producing and selling the new machine. Together with their friend Georges de la Bouglise, they formed a partnership with Pierre Michaux, Michaux et Cie ("Michaux and company"), in 1868, avoiding use of the Olivier family name and staying behind the scenes, lest the venture prove to be a failure. This was the first company which mass-produced bicycles, replacing the early wooden frame with one made of two pieces of cast iron bolted together—otherwise, the early Michaux machines look exactly like Lallement's patent drawing. Together with a mechanic named Gabert in his hometown of Lyon, Aimé Olivier created a diagonal single-piece frame made of wrought iron which was much stronger, and as the first bicycle craze took hold, many other blacksmiths began forming companies to make bicycles using the new design. Velocipedes were expensive, and when customers soon began to complain about the Michaux serpentine cast-iron frames breaking, the Oliviers realized by 1868 that they needed to replace that design with the diagonal one which their competitors were already using, and the Michaux company continued to dominate the industry in its first years.On the new macadam paved boulevards of Paris it was easy riding, although initially still using what was essentially horse coach technology. It was still called "velocipede" in France, but in the United States, the machine was commonly called the "bone-shaker". Later improvements included solid rubber tires and ball bearings. Lallement had left Paris in July 1865, crossed the Atlantic, settled in Connecticut and patented the velocipede, and the number of associated inventions and patents soared in the US. The popularity of the machine grew on both sides of the Atlantic and by 1868-69 the velocipede craze was strong in rural areas as well. Even in a relatively small city such as Halifax, Canada, there were five velocipede rinks, and riding schools began opening in many major urban centers. Essentially, the velocipede was a

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stepping stone that created a market for bicycles that led to the development of more advanced and efficient machines.However, the Franco-Prussian war of 1870 destroyed the velocipede market in France, and the "bone-shaker" enjoyed only a brief period of popularity in the United States, which ended by 1870. There is debate among bicycle historians about why it failed in the United States, but one explanation is that American road surfaces were much worse than European ones, and riding the machine on these roads was simply too difficult. Certainly another factor was that Calvin Witty had purchased Lallement's patent, and his royalty demands soon crippled the industry. The UK was the only place where the bicycle never fell completely out of favour. This type of bicycle was retronymed the "ordinary" (since there were then no other kind)[8] and was later nicknamed "penny-farthing" in England (a penny representing the front wheel, and a coin smaller in size and value, the farthing, representing the rear). They were fast, but unsafe. The rider was high up in the air and traveling at a great speed. If he hit a bad spot in the road he could easily be thrown over the front wheel and be seriously injured (two broken wrists were common, in attempts to break a fall) [9] or even killed. "Taking a header" (also known as "coming a cropper"), was not at all uncommon. The rider's legs were often caught underneath the handlebars, so falling free of the machine was often not possible. The dangerous nature of these bicycles (as well as Victorian mores) made cycling the preserve of adventurous young men. The risk averse, such as elderly gentlemen, preferred the more stable tricycles or quadracycles. In addition, women's fashion of the day made the "ordinary" bicycle inaccessible. Queen Victoria owned Starley's "Royal Salvo" tricycle, though there is no evidence she actually rode it. Although French and English inventors modified the velocipede into the high-wheel bicycle, the French were still recovering from the Franco-Prussian war, so English entrepreneurs put the high-wheeler on the English market, and the machine became very popular there, Coventry, Oxford, Birmingham and Manchester being the centers of the English bicycle industry (and of the arms or sewing machine industries, which had the necessary metalworking and engineering skills for bicycle manufacturing, as in Paris and St. Etienne, and in New England). [10] Soon bicycles found their way across the English Channel. By 1875, high-wheel bicycles were becoming popular in France, though ridership expanded slowly. In the United States, Bostonians such as Frank Weston started importing bicycles in 1877 and 1878, and Albert Augustus Pope started production of his "Columbia" high-wheelers in 1878, and gained control of nearly all applicable patents, starting with Lallement's 1866 patent. Pope lowered the royalty (licensing fee) previous patent owners charged, and took his competitors to court over the patents. The courts supported him, and competitors either paid royalties ($10 per bicycle), or he forced them out of business. There seems to have been no patent issue in France, where English bicycles still dominated the market. By 1884 high-wheelers and tricycles were relatively popular among a small group of upper-middle-class people in all three countries, the largest group being in England. Their use also spread to the rest of the world, chiefly because of the extent of the British Empire. Pope also introduced mechanization and mass production (later copied and adopted by Ford and General Motors), [11] vertically integrated, [12] (also later copied and adopted by Ford), advertised aggressively [13] (as much as ten percent of all advertising in U.S. periodicals in 1898 was by bicycle makers), [14] promoted the Good Roads Movement (which had the side benefit of acting as advertising, and of improving sales by providing more places to ride), [15] and litigated on behalf of cyclists [15] (It would, however, be Western Wheel Company of Chicago which would drastically reduce production costs by introducing stamping to the production process in place of machining, significantly reducing costs, and thus prices.) [16] In addition, bicycle makers adopted the annual model change [17] (later derided as planned obsolescence, and usually credited to General Motors), which proved very successful. [18] Even so, bicycling remained the province of the urban well-to-do, and mainly men, until the 1890s, [19] and was an example of conspicuous consumption [20].

II. Helpful Hints

Air pollution is the introduction into the atmosphere of chemicals, particulates, or biological materials that cause discomfort, disease, or death to humans, damage other living organisms such as food crops, or damage the natural environment or built environment.The atmosphere is a complex dynamic natural gaseous system that is essential to support life on planet Earth. Stratospheric ozone depletion due to air pollution has long been recognized as a threat to human health as well as to the Earth's ecosystems.Indoor air pollution (see Airlog) and urban air quality are listed as two of the World’s Worst Toxic Pollution Problems in the 2008 Blacksmith Institute World's Worst Polluted Places report. [21] A substance in the air that can be adverse to humans and the environment is known as an air pollutant. Pollutants can be in the form of solid particles, liquid droplets, or gases. In addition, they may be natural or man-made. Pollutants can be classified as primary or secondary. Usually, primary pollutants are directly produced from a process, such as ash from a volcanic eruption, the carbon monoxide gas from a motor vehicle exhaust or sulfur dioxide released from factories. Secondary pollutants are not emitted directly. Rather, they form in the air when primary pollutants react or interact. An important example of a secondary pollutant is ground level ozone — one of the many secondary pollutants that make up photochemical smog. Some pollutants may be both primary and secondary: that is, they are both emitted directly and formed from other primary pollutants. Around the world, children living in cities with high exposure to air pollutants are at increased risk of developing asthma, pneumonia and other lower respiratory infections. Air pollution is also a significant contribution to environmental toxins in pregnancy. The World Health Organization reports that the greatest concentrations of particulates are found in countries with low economic world power and high poverty and population growth rates. Examples of these countries include Egypt, Sudan, Mongolia, and Indonesia. However even in the United States, despite the passage of the Clean Air Act in 1970, in 2002 at least 146 million Americans were living in non-attainment areas—regions in which the concentration of certain air pollutants exceeded federal standards. [22] These dangerous pollutants are known as the criteria pollutants, and include ozone, particulates, sulfur dioxide, nitrogen dioxide, carbon monoxide, and lead. Protective measures to ensure children's health are being taken in cities such as New Delhi, India where buses now use compressed natural gas to help eliminate the "pea-soup" smog [23].

III. Description

We attempt to put four dynamos inside the rear wheel and four ones in front wheel for saving outcoming energy of rounding wheels. In this way we can keep this energy in its batteries. When the man is going to be tired can change automatic mode by pressing a button. In this case a system transform 12w electric energy in batteries to 256w and push it to other dynamos that can transform electrical energy to a step motor (for lessen the wasted energy should to reduce the weight of the bike).This motor can adjust speed of our bike.

In first it is in first gear (specific to mechanical motion) for pedaling, thus the rider can change gear to second one to change the mode in automatic form (specific electrical motion). Now wheels continue to move and use the energy that obtained of spontaneous movement of the bike to keep moving. The most important point of this bike is this: No Pollution.

An electric battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy. Each battery consists of a negative electrode material, a positive electrode material, an electrolyte that allows ions to move between the electrodes, and terminals that allow current to flow out of the battery to perform work.

Primary (single-use or "disposable") batteries are used once and discarded; the electrode materials are irrevesibly changed during discharge. Common examples are the alkaline battery used for flashlights and a multitude of portable devices. Secondary (rechargeable batteries) can be discharged and recharged multiple times; the original composition of the electrodes can be restored by reverse current. Examples include the lead-acid batteries used in vehicles and lithium ion batteries used for portable electronics. Batteries come in many shapes and sizes, from miniature cells used to power hearing aids and wristwatches to battery banks the size of rooms that provide standby power for telephone exchanges and computer data centers. According to a 2005 estimate, the worldwide battery industry generates US$48 billion in sales each year, [24] with 6% annual growth. Batteries have much lower specific energy (energy per unit mass) than common fuels such as gasoline. This is somewhat mitigated by the fact that batteries deliver their energy as electricity (which can be converted efficiently to mechanical work), whereas using fuels in engines entails a low efficiency of conversion to work. Batteries convert chemical energy directly to electrical energy. A battery consists of some number of voltaic cells. Each cell consists of two half-cells connected in series by a conductive electrolyte containing anions and cations. One half-cell includes electrolyte and the negative electrode, the electrode to which anions (negatively charged ions) migrate; the other half-cell includes electrolyte and the positive electrode electrode to which cations (positively charged ions) migrate. Redox reactions power the battery. Cations are reduced (electrons are added) at the cathode during charging, while anions are oxidized (electrons are removed) at the anode during discharge. [25] The electrodes do not touch each other, but are electrically connected by the electrolyte. Some cells use different electrolytes for each half-cell. A separator allows ions to flow between half-cells, but prevents mixing of the electrolytes.Each half-cell has an electromotive force (or emf), determined by its ability to drive electric current from the interior to the exterior of the cell. The net emf of the cell is the difference between the emfs of its half-cells. [26] Thus, if the electrodes have emfs \mathcal{E}_1 and \mathcal{E}_2, then the net emf is \mathcal{E}_{2}-\mathcal{E}_{1}; in other words, the net emf is the difference between the reduction potentials of the half-reactions. [27] The electrical driving force or \displaystyle{\Delta V_{bat}} across the terminals of a cell is known as the terminal voltage (difference) and is measured in volts. [28] The terminal voltage of a cell that is neither charging nor discharging is called the open-circuit voltage and equals the emf of the cell. Because of internal resistance, [29] the terminal voltage of a cell that is discharging is smaller in magnitude than the open-circuit voltage and the terminal voltage of a cell that is charging exceeds the open-circuit voltage.[30] An ideal cell has negligible internal resistance, so it would maintain a constant terminal voltage of \mathcal{E} until exhausted, then dropping to zero. If such a cell maintained 1.5 volts and stored a charge of one coulomb then on complete discharge it would perform 1.5 joules of work. [29] In actual cells, the internal resistance increases under discharge [30] and the open circuit voltage also decreases under discharge. If the voltage and resistance are plotted against time, the resulting graphs typically are a curve; the shape of the curve varies according to the chemistry and internal arrangement employed.The voltage developed across a cell's terminals depends on the energy release of the chemical reactions of its electrodes and electrolyte. Alkaline and zinc–carbon cells have different chemistries, but approximately the same emf of 1.5 volts; likewise NiCd and NiMH cells have different chemistries, but approximately the same emf of 1.2 volts. [31] The high electrochemical potential changes in the reactions of lithium compounds give lithium cells emfs of 3 volts or more [32].

A dynamo is an electrical generator that produces direct current with the use of a commutator. Dynamos were the first electrical generators capable of delivering power for industry, and the foundation upon which many other later electric-power conversion devices were based, including the electric motor, the alternating-current alternator, and the rotary converter. Today, the simpler alternator dominates large scale power generation, for efficiency, reliability and cost reasons. A dynamo has the disadvantages of a mechanical commutator. Also, converting alternating to direct current using power rectification devices (vacuum tube or more recently solid state) is effective and usually economic.

The word dynamo (from the Greek word dynamis; meaning power) was originally another name for an electrical generator, and still has some regional usage as a replacement for the word generator. A small electrical generator built into the hub of a bicycle wheel to power lights is called a hub dynamo, although these are invariably AC devices,[citation needed] and are actually magnetos.

Fossil fuels are fuels formed by natural processes such as anaerobic decomposition of buried dead organisms. The age of the organisms and their resulting fossil fuels is typically millions of years, and sometimes exceeds 650 million years. [33] Fossil fuels contain high percentages of carbon and include coal, petroleum, and natural gas. [34] They range from volatile materials with low carbon: hydrogen ratios like methane, to liquid petroleum to nonvolatile materials composed of almost pure carbon, like anthracite coal. Methane can be found in hydrocarbon fields, alone, associated with oil, or in the form of methane clathrates. The theory that fossil fuels formed from the fossilized remains of dead plants[3] by exposure to heat and pressure in the Earth's crust over millions of years [4] (see biogenic theory) was first introduced by Georg Agricola in 1556 and later by Mikhail Lomonosov in the 18th century.

The Energy Information Administration estimates that in 2007 the primary sources of energy consisted of petroleum 36.0%, coal 27.4%, natural gas 23.0%, amounting to an 86.4% share for fossil fuels in primary energy consumption in the world. [35] Non-fossil sources in 2006 included hydroelectric 6.3%, nuclear 8.5%, and others (geothermal, solar, tidal, wind, wood, waste) amounting to 0.9%.[36] World energy consumption was growing about 2.3% per year.

Fossil fuels are non-renewable resources because they take millions of years to form, and reserves are being depleted much faster than new ones are being made. The production and use of fossil fuels raise environmental concerns. A global movement towards the generation of renewable energy is therefore under way to help meet increased energy needs.

The burning of fossil fuels produces around 21.3 billion tonnes (21.3 gigatonnes) of carbon dioxide (CO2) per year, but it is estimated that natural processes can only absorb about half of that amount, so there is a net increase of 10.65 billion tonnes of atmospheric carbon dioxide per year (one tonne of atmospheric carbon is equivalent to 44/12 or 3.7 tonnes of carbon dioxide). [37] Carbon dioxide is one of the greenhouse gases that enhances radiative forcing and contributes to global warming, causing the average surface temperature of the Earth to rise in response, which the vast majority of climate scientists agree will cause major adverse effects.DC brush motors rotate continuously when voltage is applied to their terminals. Stepper motors, on the other hand, effectively have multiple "toothed" electromagnets arranged around a central gear-shaped piece of iron. The electromagnets are energized by an external control circuit, such as a microcontroller. To make the motor shaft turn, first, one electromagnet is given power, which magnetically attracts the gear's teeth. When the gear's teeth are aligned to the first electromagnet, they are slightly offset from the next electromagnet. So when the next electromagnet is turned on and the first is turned off, the gear rotates slightly to align with the next one, and from there the process is repeated. Each of those rotations is called a "step", with an integer number of steps making a full rotation. In that way, the motor can be turned by a precise angle.

A folding bicycle is a bicycle designed to fold into a compact form, facilitating transport and storage. When folded, the bikes can be more easily carried into buildings and workplaces or on public transportation (facilitating mixed-mode commuting and bicycle commuting), and more easily stored in compact living quarters or aboard a car, boat or plane. Folding mechanisms vary, with each offering a distinct combination of folding speed, folding ease, compactness, ride, weight, durability and price. Distinguished by the complexities of their folding mechanism, more demanding structural requirements, greater number of parts, and more specialized market appeal, folding bikes may be more expensive than comparable non-folding models. The choice of model, apart from cost considerations, is a matter of resolving the various practical requirements: a quick easy fold, compact folded size, or a faster but less compact model. [38] There are also bicycles that provide similar advantages by separating into pieces rather than folding [39].

IV. Materials

1) Saddle
2) Battery
3) Dynamo
4) Step Motor
5) Gear for mechanical movement
6) Gear for electrical movement
7) Front wheel
8) Back wheel
9) Gear change lever
10) Step motor turn button (release the battery power)

V. Conclusions

The third millennium is human requirements to thought and new energy. The Present design is a unique method for protection, production and management of energy. Use of this technology can be increase in a huge range. Thus, the people in lake of power for movie and have physical problems can use this vehicle.

The unique advantages of this machine is easy transportation without any acoustic and chemical pollution. In the future by use of this technology for automobiles, trains, planes and shuttles can be so effectual and effortful for protection of environment.

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