Research on innovative design of mountain bike fender

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Abstract: Based on the analysis of the insufficient of existing mountain bike fenders, the type of mountain bike tires and the use environment of mountain bike fender, combined with the design of color and material application, This paper makes a theoretical discussion on the innovative design of the mountain bike fender, and has carried on the constructive design, which solves the problems such as single shape, poor stability and imperfect function of mountain bike fender, and has practical value and guiding significance in actual product development.

1. Introduction
The problem of traffic and pollution is becoming more and more serious, which brings a huge development space to the bicycle. Bicycle is an environmental friendly and healthy travel tool, its core consumer are students, office workers, so most of the bicycle market is in line with the aesthetic of young people mountain bike, including many children bike and ladies bicycle modelling is moving closer to the mountain bike, making the mountain bike fender has a wide range of use. In recent years, the mountain bike fenders in the market are not rich in modeling, in the use of poor stability, affecting the overall beauty of the mountain bike and other issues. There are many users who reflect that they would rather be dumped by a wheel of mud is not willing to use fender, of course, there are many users of the pursuit of personality and wildness, but this also reflects the shortage of existing products.

Modeling fashion and whether the fender and the mountain bike match is the focus of appealing to consumers’ desire to buy, of course, the price also has a certain decisive role. Therefore, the author will use the modeling elements and the formal beauty rules to have an all-round analyze the existing products, put forward innovative product solutions, and demonstrate the possibility of product realization from various aspects.

2. Analysis of existing fenders on the market
The author has investigated and studied the existing fenders in the market, and then analyzed from the five aspects of modeling, color, structure, material and practical function

2.1 Modeling analysis
The overall shape of the mountain bike fender is: wings, swallowtail, telescopic and all-inclusive fender, as a big foundation for the design of the fender. The wing shaped fender is light and elegant; telescopic fenders can be divided into two types, one kind can be rolled up when not in use, and the weight is small, but it's easy to curl up when you're using it, and can not work normally, the other is a structure similar to a fishing rod which Consists of multiple partition sections. It is nested when not in use and draw out when in use, The disadvantage is that the partition sections is too much, and the weight is increased; All-inclusive fender is a semicircle, the section is arc, is the most practical, but the shape is rigid, not in line with the aesthetic features of young people, and is not consistent with the
mountain car modeling; There is a fender——Qbicle TANGENT fender, take all-inclusive fender a arc, installed above the wheels, blocking the slurry splashed the most parts, compare with the fender on the market, it has the least influence on the overall shape of mountain bike.

No matter what modeling based on fender, in the process of design and production, will be colored, coating, surface texture, printing and other processing, in order to increase the aesthetics of the fender, some fender will be hollowed out without affecting the use effect, in order to achieve the goal of reducing weight.

2.2 color analysis
From the aspect of color, a large part of the product is pure black color, although black all-match, but would be very monotonous. There are a small number of the product is bright color, so they will be slightly fancy, it also has an impact on the integrity of mountain bikes. In addition, in the color matching, there is a more important the factors need to be considered, that whether the color of the fender is compatible with the color of the mountain bike, because the fenders belong to the accessories of mountain bikes, should ensure that the installation will not damage the integrity of the mountain bike. The author found in the field research, almost all of the mountain bikes color include black, black with bright color is the mainstream of mountain bike color matching. Therefore the mountain bike fender should match the black and bright colors, and echo the color of the bike body to form a good visual effect.

2.3 structure analysis
Mountain bike fender can play a role only in the rainy days, and some users think that the installation of fender will affect the beauty of mountain bike, so the connection between mountain bike fenders and bikes tends to be able to be disassembled rapidly, some products have manual adjustment handle, you can manually adjust the angle at any time, no tools, simple and quick, but it has brought new problems: fender used for some time, due to repeated demolition and rain splash impact, the part that regulates the angle will wear out, the stability of the fender is worse, lead to the phenomenon of the fender under the ride to the wheel.

2.4 material analysis
The material of the fender is mainly ordinary plastic, engineering plastic and stainless steel these three categories. Plastic has high strength, good toughness, impact resistance, and can be twisted and folded at 360 degrees. It is durable, difficult to break and low in price. But the color parts through the sun and rain will be aging, fading, plastic material intolerance corrosion, shorten the life of the fender. Stainless steel fender has good mechanical properties, high strength, high hardness and high wear resistance. It is an ideal shell structure and structural material. Stainless steel fender have a coating on the surface, long time in the outdoor environment storage the coating will fall off, stainless steel exposed outside, forming slight rust, and metal material suitable for making shape specifications products. If stainless steel is used as the material for mountain bike fenders, it has the disadvantage of too much quality. Mountain bike users, especially cycling enthusiasts and professional riders, hope that mountain bikes will be relatively lightweight without affecting performance, in recent years, changes in the quality of mountain bikes have been able to support this, so the stainless steel and metal materials are not suitable for making fenders. The performance characteristics of engineering plastics are mainly:

1. Compared with general plastics, it has excellent properties of heat resistance and cold resistance. It has excellent mechanical properties in a wide range of temperatures and is suitable for use as structural materials;
2. It has good corrosion resistance, less affected by the environment, good durability;
3. Compared with metal materials, it has the advantages of small quality, easy processing, high production efficiency, simplified procedures and cost saving;
4. It has good dimensional stability and electrical insulation;
(5) It is light in weight, high in specific strength, and has outstanding abrasion resistance. Therefore, in terms of material, engineering plastics are more suitable for raw materials for mountain bike fenders.

2.5 practical function analysis
The practical function of the fender is determined by the size, shape, installation angle, tire type and pavement condition. Al-inclusive fender has the most complete practical function, its mud effect is the best. Wings and swallowtail fenders don't work as well the all-inclusive fenders, if the pavement water more, the cross section of the wheel is wider or the tire have a darker texture, these kinds of fender can not completely block the wheel of the wheel splashing muddy water. The telescopic fenders are very portable, but these two types of retractable fenders have their drawbacks.

3. Two factors affecting the design of mountain bike fender

3.1 Mountain bike tire type
Mountain bike tires are closely related to the design of fenders. From the end of 18 Century, the French Syvrac invented the earliest bike, to the present the modern bicycle has been very perfect, the wheel has always been an essential part of the bicycle. At present, mountain bike wheels are generally 26 inches in diameter, and some ladies mountain bikes and children mountain bike wheels are generally 24 inches in diameter, and of course there are a small part of wheels with smaller diameter, but only a minority. The section width of the bicycle wheel is usually between 1.0 and 2.5 inches (the value here is the width of the tire inflation), 1.0 to 1.5 inches are usually bald tire, designed specifically to run the road, the wheels don't throw mud water to cyclists in a rainy day, bicycles that install this wheel do not have to install the fender. More than 1.75 inches, there are clear lines, the deeper the lines, the more muddy water, some wheels to avoid side slip, the side of the wheel will also have grooves, which requires the width of the fender larger, can block more muddy water.

3.2 Analysis of the use environment of mountain bike fender
The main role of the fender is to block the muddy water that the wheel carry from the ground, to avoid the muddy water flung to the rider's body. Mountain bikes are mainly used outdoors, the environment is complex, work exposed to in the air, will be placed in minus 10 degrees centigrade or even tens of degrees centigrade between the tens of degrees centigrade, often affected by the rain and the sun, and the corrosion of dirt, sometimes also be hit. Therefore, the material of the mountain bike fender must be affected by the environment less, high temperature and low temperature, it can withstand winter 30 degrees below zero weather and about 30 degrees hot weather in summer, it can withstand sun and rain, not rust, in the natural environment will not be too fast aging, resistance to impact and tear, it is easy to clean. In the increasingly serious environmental problems today, green production is a problem that all countries attach great importance to. Therefore, the fender in the production and processing should be as little as possible cause environmental pollution.

4. A design scheme of mountain bike fender
Mountain bike fender design should be able to meet people's requirements: (1) the quality of light, as far as possible to reduce the burden of mountain bike; (2) durable, resistant to high temperature and low temperature, not easy aging, fade, easy to clean, meet the long time outdoor using; (3) resistant to impact, not afraid of extrusion; (4) quick disassembly and easy operation; (5) can be manually adjusted between fender and mountain bike angle, no tools are required; (6) sophisticated materials, excellent workmanship, stable quality, long time using is safe and reliable; (7) rich colors, installation doesn't affect the integrity of mountain bikes.

In the design process of the mountain bike fender, the author has made many improvements in the design process, combining the advantages of the all-inclusive fender and the fashion fender. The size of the front fender is: length 30 cm and width 8 cm; the rear fender size is: length 58cm, width 8 cm.
The fender cross section is similar to the all-inclusive fender, this shape is more practical than the other shapes under the same width, the 8 cm width of arc fender can meet the common mountain bike tire type. The fender has streamlined lines, representing speed and motion, the overall color matching is similar to the mountain bike body color matching, based on black, on different fender, line has blue, red, green, white, black, color is not monotonous, meet different types of consumers, can be matched by the color of bicycle, make the colors between the two echoes.

Because of the extremely poor working conditions of the fender, its material requirements have the properties of cold resistance, wear resistance, stress cracking, atmospheric aging resistance, solvent resistance and chemical corrosion resistance, so as to meet the requirements of impact resistance, anti-aging, anti-breakage, etc., at the same time, to achieve light weight and easy to process. There are two kinds of materials to meet these conditions, one is low carbon steel plate, one is engineering plastics, but the two phase comparison, the density of engineering plastics is smaller, can directly process the shape of complex parts, not need surface treatment process, not only the lightweight design, but also save the production cost, can be recycled, is considered as green industrial material, has replaced the traditional metal, widely used in various parts of the vehicle. The fender made of engineering plastics is durable and hard to fade, and the quality of the engineering plastics is small, not adding too much weight to the bicycle. After the fender is installed, the angle can be adjusted, no tool is needed, the adjusting parts of the tooth design are larger than the fender in the market, and the mechanical properties of the engineering plastics are good, high abrasion resistance, increase the stability of the fender, and solve the problem of the fender under the fender.

5. Conclusion
The design that can more meet the consumer demand, the better design, the current mountain bike fender has its limitations, can not be perfect. Designers in the design should pursue the characteristics and not to perfect, highlight the point and take into account the comprehensive, to provide more good design scheme is the mountain bike fender development direction.

Reference
[1] Yao Qizhi, Song Min. Product design procedures and methods [M]. Nanjing: Nanjing University press, 2015,1
[2] Tang Jun. Product design integrated modeling foundation [M]. Beijing: Tsinghua University press, 2012,8
[3] Cui Lin. Development and application of automotive plastic fenders [J]. modern plastic processing applications, 1992,5:24 - 48
[4] Qiao Jie. Design color [M]. Liaoning: Science and Technology Press, 2013,11
[5] He Linsong, Jiang Yong, Zhang Quan. Product design materials and technology [M]. Beijing: Publishing House of electronics industry, 2014,5