

New Cleaning Equipment for Buses

Peng He

Civil aviation Electronic Technology Co., Ltd, China.

Abstract

With the steady improvement of the fine management of urbanization, the image of buses has attracted much attention. While the number of buses is increasing year by year, the water consumption of car washing is also increasing. However, most of the car washing methods on the market are mainly by manpower. There are many disadvantages in this way of car washing, such as large waste of water resources, long process of car washing, large labor input, etc. This paper mainly introduces the development status of high-pressure cleaning machine at home and abroad, the main problems of high-pressure cleaning machine in the world, and puts forward a new design of bus cleaning equipment through microprocessor control, high temperature, high pressure and automatic air drying.

Keywords

Bus; High pressure cleaning equipment; High temperature cleaning equipment; Automatic air drying; Microprocessor.

1. Development and research status of car washing machine at home and abroad

1.1 Development and research status of car washing machine in China

China's car washing industry has only developed in recent years. This, of course, also benefits from the rapid rise of China's automobile industry after the reform and opening up. Automobile cleaning is a new industry gradually developed in our country, which adopts the industry of differentiation of different models [1], with the characteristics of low capital and technical threshold. Due to the incomplete industry standards from the state to the local level, and the lack of clear regulations and requirements on the site, environmental protection, equipment, technology, business management, etc., the car washing mode that should have been eliminated is still popular in the car washing market, while the advanced car washing modes such as waterless car washing, full-automatic computer-based mechanized car washing occupy a small market share Proportion.

1.2 Development and research status of car washing machine in foreign countries

Europe is the birthplace of automobile industry and the pioneer of car washing industry. In the development process of automobile industry, car washing industry has become an essential service field. Japan can be said to be the country with the fastest development of car washing industry, which of course benefits from the rapid development of its automobile industry and the maturity of the automobile market. It can be said that the development of Japanese car washing industry has greatly promoted the development of the world's car washing industry. In Europe, Japan and other developed countries, after years of development, the concept of scientific car washing has been deeply rooted in the hearts of the people. The car washing methods in the car washing market include full-automatic computer car washing machine, steam car washing and Anhydrous car washing, especially full-automatic computer car washing.

1.3 Current problems

(1) Quality problems of high pressure pump: as the generating device of high pressure water jet, high pressure pump is the operation core of high pressure cleaner. Therefore, the quality of high-pressure pump is directly related to the excellent performance of the whole machine. In practical work, problems such as poor wear resistance of moving parts and abnormal damage of high-pressure rubber hose often occur in high-pressure pump, which will have a negative impact on the working efficiency of the whole machine.

(2) Spray gun problems: spray gun performance, life, type and other problems, affecting the working efficiency of high-pressure cleaning machine [2].

2. Principle of automatic car washing machine

The automatic car washing machine is a kind of equipment which uses the control module to control the brush and the high-pressure water gun to clean the car. It is mainly composed of air circuit, electric circuit, water circuit and mechanical part. The automatic car washing machine uses a lot of detergent and water to wash the car body. After washing, it will be air dried by the air drying program control machine. In this way, it can blow out all the water left in the gap of the car body, protect the internal parts of the car, and at the same time, avoid the mud from scratching the car paint. The automatic car washer has advanced technology, rapid washing and various products. Through the detection of photoelectric system and the analysis of the control module, the best position of various actions is calculated to achieve the best car washing effect. It has the characteristics of fast car washing, high automation, water saving and manpower saving. According to its working mode, computer car washing machine can be divided into tunnel type, reciprocating type and water kettle contactless type.

Reciprocating automatic car washing machine is one of the most primary car washing equipment. When the car is driven into the equipment, the car position will not move any more. The gantry of the car washing machine moves forward and backward with the roller brush to complete the various procedures of car washing. Its advantage is that the price is relatively low, about one-half of the tunnel type machine; the other is that its actual floor area is small compared with the tunnel type automatic car washing machine, and it usually installs the reciprocating automatic car washing machine in a fixed room.

Tunnel type automatic car washing machine is divided into several grades according to different grades. The comparison is based on the way of washing with soap water, washing with clear water and drying with cold wind. On this basis, there are several upgraded versions, some with two sets of water washing; some with hot air; some with chassis washing; some with a Polish between car washing and drying, that is, wax washing, and even some with digital signal transmission command to guide the machine to complete each set of procedures and actions.

Water axe type contactless automatic car washing machine is a new type of car washing equipment in recent years. The principle of water axe type contactless automatic car washing machine is obviously different from reciprocating automatic car washing machine and tunnel type automatic car washing machine. The difference of water axe type contactless automatic car washing machine is contactless. The water axe type automatic car washing machine mainly uses the high pressure flushing water cleaning way to clean. Water axe automatic car washing machine is a new type of product which combines the market demand after many years of inspection and research, continuous innovation and research.

2.1 Reciprocating automatic car washer

Reciprocating automatic car washing machine is also known as the gantry type reciprocating automatic car washing machine, which is widely used in Japan and originated in the United States. Reciprocating automatic car washing machine is divided into three brush, five brush and seven brush according to the type of brush. There are many kinds of brush, including foam brush, nylon brush, cloth brush and so on.

Working principle of reciprocating automatic car washer:

The working principle of the reciprocating automatic car washing machine is the same as its name. After the vehicle enters the car washing machine, it is fixed at the car position. The car washing machine moves back and forth on the guide rail according to a certain procedure, and at the same time, it carries out a series of instructions such as washing the car, washing the chassis, waxing and air drying. The biggest advantage of reciprocating car washing machine is that it occupies the smallest area and has the lowest investment cost. Its disadvantage is that the car washing speed is too slow to meet the requirements of mass cleaning. Reciprocating automatic car washing machine is more suitable for areas with small car washing volume. As shown in Figure 1-1 is the automatic computer bus washing machine produced by Shanghai Bairui company.



Figure 1. Automatic computer bus washing machine

2.2 Tunnel type automatic car washing machine

Working principle of tunnel type automatic car washer:

As the name suggests, the tunnel type automatic car washing machine is similar to a tunnel. The car washing machine itself does not move, the car is driven by the driver, and it slowly passes through the working area of the car washing machine. The car washing machine automatically runs according to the command program set by the control module through the feedback information of various detection devices, cleaning and air drying the car. According to the different cleaning models, it can be divided into: bus washing machine, trolleybus (subway, train) washing machine, etc. The biggest advantage of tunnel type automatic car washing machine is its fast cleaning speed, which can clean the car continuously, and can clean one car in one minute at most. The car washing machine is suitable for large-scale car washing yard, large-scale bus stop or large-scale parking lot, etc. its disadvantages are large water consumption, incomplete cleaning, etc. As shown in Figure 2, the th-350 / 450 large channel computer car washer produced by Nanjing Haitian Co., Ltd.



Figure 2. Th-350 / 450 large channel computer car washer

2.3 Water axe type contactless automatic car washing machine

Working principle of water axe type contactless automatic car washer:

The water axe type contactless automatic car washing machine is a more advanced product at present. The water axe type contactless automatic car washing machine system uses the photoelectric system to locate the position and shape of the car, and then controls the cleaning arm of the water axe type contactless automatic car washing machine through the control system to clean the roof, chassis, surroundings and lights of the car body. The water axe type contactless automatic car washing machine can rotate, reverse, and not damage the car and equipment. It has a good protective effect, but its disadvantages are high technical requirements, large water consumption, and high requirements for spray heads and motors. As shown in Figure 1-3, mt-380 brush free tunnel type computer car washer produced by Nanjing Haitian Co., Ltd.

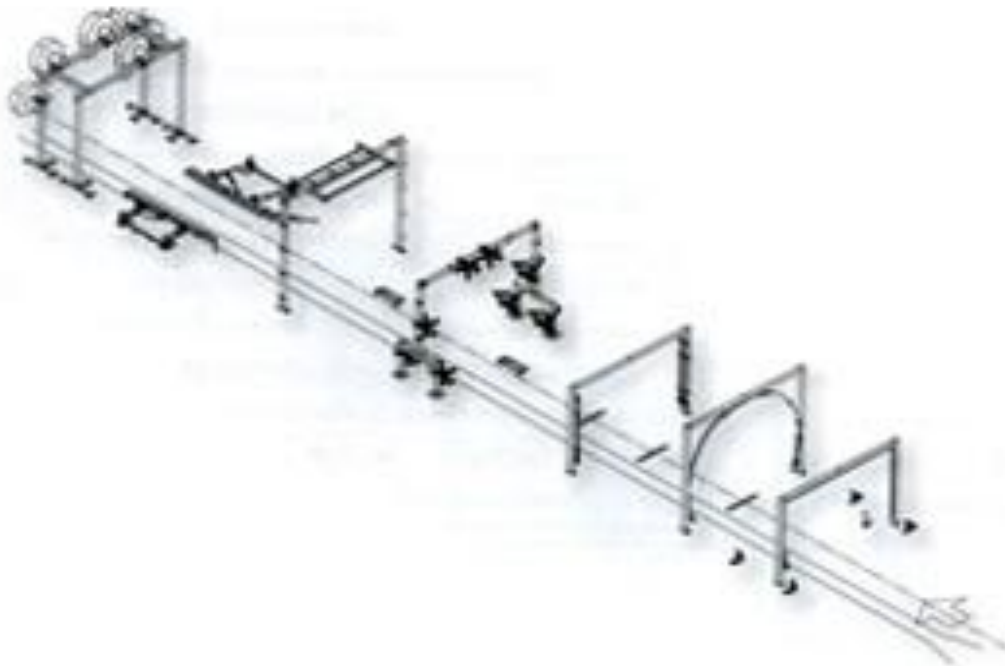


Figure 3. Mt-380 brush free tunnel computer car washer

3. Scheme analysis

Combined with the above reciprocating automatic car washing machine, tunnel type automatic car washing machine and water axe type contactless automatic car washing machine, and refer to the relevant information, according to the actual situation of the bus station itself, the number of buses to be cleaned every day, through the tunnel type computer car washing machine, reciprocating computer car washing machine and water axe type contactless automatic car washing machine. Compared with the characteristics of each car washing machine, the reciprocating computer car washing machine can wash a car for about 3-4 minutes, which is slow to clean, and it is difficult to deal with a large number of buses that need cleaning. The average washing time of the water axe type contactless automatic car washing machine is 4-5 minutes, and the equipment is expensive, and the implementation and maintenance costs are expensive. The tunnel type computer car washing machine can wash a car for up to 2 minutes at a reasonable price. Combining with the principle of high-temperature cleaning, the problem of large water consumption and high requirements of nozzle can be successfully solved, and the cleaning efficiency can be improved and can be continuously cleaned, so I designed this four brush tunnel type high-temperature and high-pressure automatic air drying car washer.

High pressure cleaning technology [3] involves many disciplines in industrial design, such as internal combustion engine, compressor, valve, hydrodynamics, injection technology, sealing technology, surface engineering, new materials, corrosion and protection, etc. In the domestic market, the market of high-pressure cleaning machine is still in the early stage of market development, and the use of high-pressure cleaning machine is not universal. However, with the improvement of people's living standards, especially the gradual popularization of cars and the gradual improvement of people's living environment, as well as the increase of our contacts with family members in developed countries, the impact of foreign life style on us is also increasing, and the domestic high-pressure cleaning machine is not widely used. The washing machine market is also expanding rapidly, and the market demand is increasing rapidly. The high-pressure and high-temperature cleaning effect is better and more water resources are saved [4]. In addition to the expansion of people's diversified life requirements, the car washing machine is bound to develop towards high-temperature and high-pressure, intelligent multi-purpose and concise.

Combined with the market analysis, I come to a conclusion that in the city, the dust and some adsorbable solid particles and some stubborn stains make the bus unclean. The structure of the automatic car washing machine in this design is derived from the structure of the tunnel automatic car washing machine, and the bracket is used to limit the walking range of the vehicle. The cleaning system is fixed on the bracket. There are five wheel brushes in the cleaning system (the number of wheel brushes can be increased appropriately). Two side brushes are respectively distributed on both sides. The side brush is mainly responsible for cleaning the car for two weeks and before and after and for secondary cleaning [5], and the top brush is responsible for cleaning the Roof [6]. In this design, we first wash the car body through the high temperature and high pressure nozzle to wash away the sediment on the car body so as to prevent the car paint from being scratched during the next treatment, and heat the car body, which is conducive to the catalysis of the next detergent, then spray the mixed solution of clean water and detergent and brush it through the roller brush of the tunnel car wash machine. After this treatment, almost most of it is removed. After that, the high-temperature and high-pressure nozzle is used to wash the stains, effectively removing the residual detergent and fine sediment. Finally, the large-scale fan at the tail is used for air drying to avoid the dust absorption of the car body in the high humidity state.

This design scheme can be realized by a variety of control means. Here, only one-sided machine control mode is introduced. The hardware of the control system is shown in Figure 4 below. The configuration of equipment parameters is shown in Table 1 below.

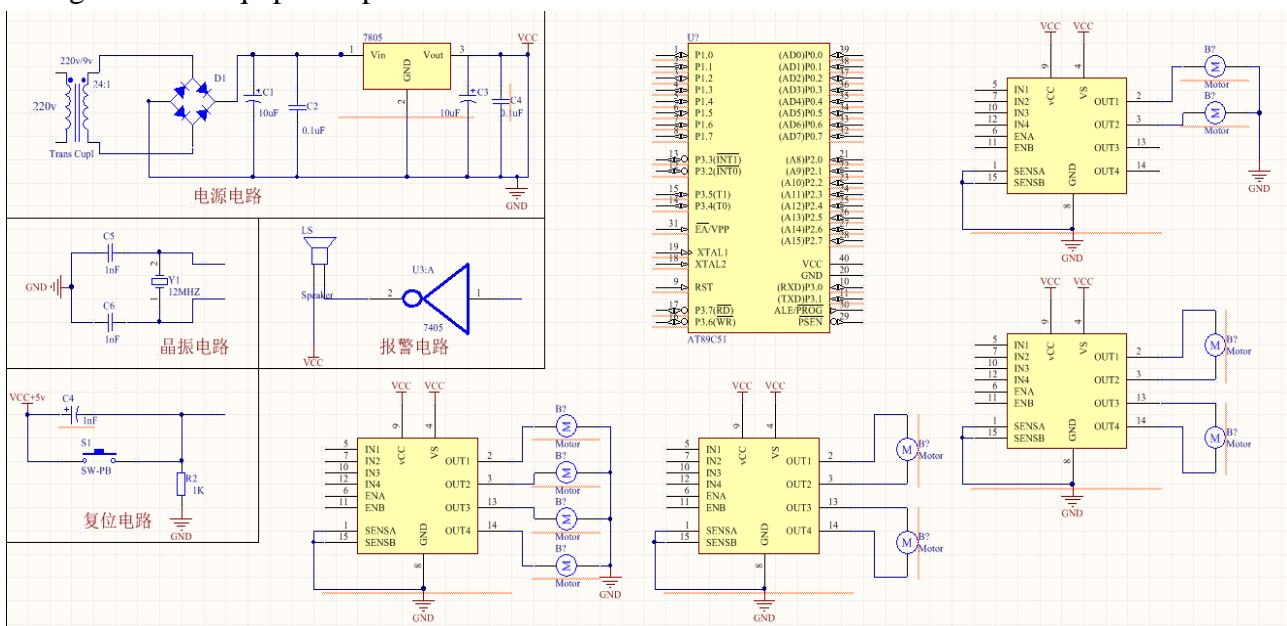


Figure 4. Control system hardware diagram

Table 1. Equipment configuration parameters

Suitable vehicle type	All types of bus passenger vehicles
Car wash size	12000mm (long) ×2500mm (wide) ×3600mm (high)
water consumption	150L
Car wash time	100-200 second
Power capacity	AC380V Three phase four wire10KW
Air drying configuration	Drying unit
Car washing method	Ground tunnel type
Manufacturing materials	Galvanized antirust steel
Machine configuration	One set of top brush; two sets of large side brush; high pressure water spray system; high temperature heating system; control system
Antirust technology	Phosphating zinc plating and baking paint

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