

Design of an Intelligent Vaccine Injection Device

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ABSTRACT : *Based on the current social situation of the development of the vaccine industry and the public's increasing demand for vaccine injection, we have designed and built an intelligent vaccine injection device to solve the problems of high demand for vaccine injection, easy measurement control and insufficient medical personnel. The device has the characteristics of intelligent control, rapid injection, human-machine interaction. It is more suitable for public medical facilities so that it will finally realize intelligent vaccine injection.*

KEYWORDS *-injection device; intelligent control; human-machine interaction*

I. Research status

Now with social population growth and small spread of influenza, there is a wide range of vaccination demand for medical workers. Boring and repetitive injection will affect vaccination efficiency, domestic understaffed phenomenon exposed, community and hospital vaccination has slightly. Intensive work is bound to reduce the efficiency and quality of vaccination, and long queues will also lead to a waste of time and the spread of public discontent.

At present, artificial injection is still used for a large range of vaccines in China, among which the more advanced device is the independent blood drawing machine, so there is a certain gap in the injection of vaccines in China. According to the analysis of statistical data, the registration number of vaccine-related enterprises is gradually increasing, so the supply of intelligent vaccine injection devices in the medical industry will continue to grow in the future.

II. Structural design of the intelligent vaccine injection device

The design concept of intelligent vaccine injection device is to vaccinate more efficiently and reduce the use of human resources for health care workers. It is necessary to enable the device to automate a series of procedures such as drug extraction, human skin disinfection and vaccine injection, and medical personnel only need to complete the observation of the vaccinated person half an hour after injection for rejection reaction, implementing the social concept of "intelligent

health". The product can not only be used to protect against large influenza and viruses, but also can be used in medical places such as hospitals.

This product is simple in design and easy to use. It also has the functions of storage, clip, injection, disinfection and corresponding information prompt, which can facilitate medical care and contribute to complete vaccine injection quickly.

The model diagram of the smart vaccine syringe is shown in Fig1.



Fig.1 Model diagram of the intelligent vaccine injection device

The vaccine injection device is composed of three parts: five core institutions, electronic control part and human-machine interaction.

2.1 Mechanical structure design

2.2.1 Vaccine delivery mechanism

The vaccine delivery mechanism is divided into two parts, the delivery part and the feeding part.

In the transporting part, the agent is stacked vertically in the fixed direction, and a single branch enters the injection port with the gravity force and the crank slider mechanism. It is an external hanging structure. As shown in Fig2.

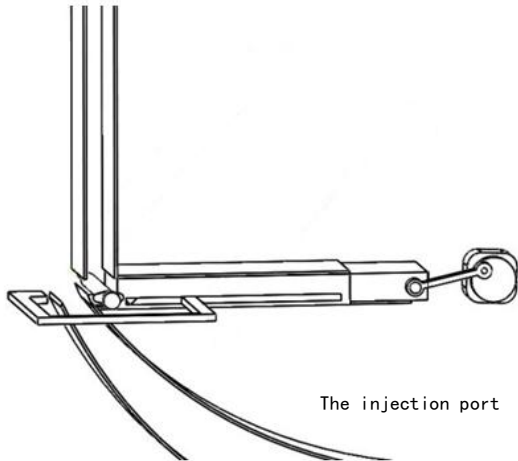


Fig.2 Transporting part

The feeding part adopts a dial wheel, which has six grooves, to receive the agent at the injection port. After the injection, rotate 60 degrees, transfer the used syringe into the recovery mechanism, and catch the new agent at the injection port. The crank slider mechanism completes the replacement of a syringe. As shown in Fig3.

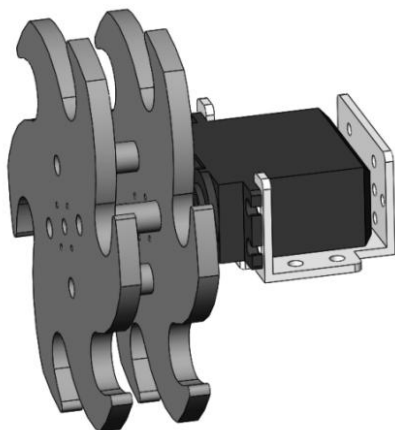


Fig.3 Feeding part

2.2.2 Packaging removal mechanism

The packaging removal mechanism adopts a fork slot structure, which peels off the protective shell of the needle with the force generated by the

syringe pull back. During the injection time, the rudder machine connects the eccentric wheel to drive the slot up, leave enough space for the injection. It will drop when the next syringe is removed. As shown in Fig 4.

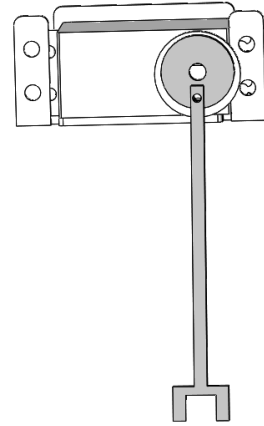


Fig.4 Packaging removal mechanism

2.2.3 Disinfection mechanism

The disinfection mechanism adopts the way of spraying disinfection, using the rudder machine to connect the eccentric wheel, control the eccentric wheel to press spray can, to achieve the purpose of spraying disinfection.

2.2.4 Injection mechanism

The injection mechanism uses the rear rudder machine to drive the front rudder machine, the rear rudder gear connects the front rudder gear through a whole 3d print, the front and rear rudder gear connects the card slot through the connecting rod, the rear steering gear controls the large card slot to jam the syringe, and the front steering gear controls the small card slot to jam the push rod of the syringe. Through the positive and reverse cooperation between the two steering gear, the feasibility of the large and small steering gear is guaranteed, and the two steering gear remains relatively static when the whole syringe is moved forward. Reduce the situation of blood drawing caused by the friction between the stuck slot and the lower plate. A bulge is designed on the big slot, moving just along the track of the upper plate, limiting the freedom of the slot. As shown in fig5.

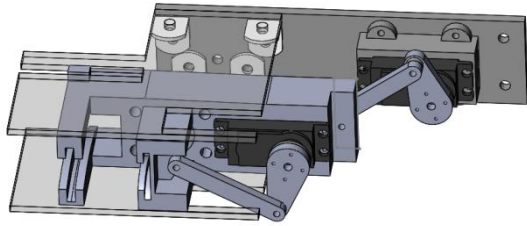


Fig.5 Injection mechanism of double steering gear

2.2.5 Arm fixation mechanism

The arm fixation mechanism is designed to prevent the wrong location of the injection, or an accidental arm spasm caused by the pain, and an unnecessary decrease in the experience of the injector. The buckle consisting of two menisci and rubber pads intensifies the vaccinated person's arm and leaves holes for injection. As shown in fig6.

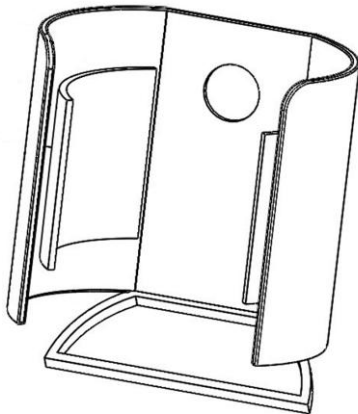


Fig.6 arm fixation mechanism

2.2 Electronic control part

This device, to achieve more functions, so more electrical parts are required, resulting in more input and output variables. The electric control core control board adopts the UNO R3 control board which has the advantages of high development efficiency, stability and compatibility. Each functional module component is controlled separately through the control board, and three

ADC signals are input through the rocker to control the three steering gear respectively, of which two steering gear control the pushrod.

2.3 Human-computer interaction part

For vaccinators, the device has a smart display to provide the user to confirm personal information before vaccination. Users only need to operate according to the intelligent display screen information and the voice broadcast function on the device, so that the user can fully understand the device through the display screen, and reduce the fear of the unknown machinery. After confirming the personal information, extend the arm to be vaccinated and wait for the device to fix the arm and vaccinate. If there is an accident during the injection, it can be stopped in an emergency. After the injection, the voice broadcast will indicate that the injection has been successful.

III. Summary

As a convenient medical device, this product achieves intelligent and efficient vaccine injection, which can relieve the current pressure of vaccination and realize intelligent vaccine injection.

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