Research and development of intravenous infusion instrument

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Abstract: The current intravenous infusion drugs need to be deployed by medical personnel, the process of dispensing many steps needs to occupy a lot of medical personnel time and energy, and the configuration process is prone to errors. In order to solve the shortage of the existing technology, this paper designs an automatic preparation device for intravenous infusion, which can automatically deploy intravenous infusion drugs, reduce the probability of errors in the drug allocation process, and save the time and energy of medical staff.

1. Introduction

Intravenous infusion is a commonly used effective treatment measure for clinical treatment and rescue of patients. The drip of liquid drugs directly into the human blood, the absorption rate is high, and the effect is fast. Therefore, the process of preparing intravenous drip drugs needs to be strictly required. If there is a quality problem, it will directly affect human health and even endanger life.

2. Mechanical structure

The automatic preparation device for intravenous infusion includes a base, a box, a configuration tube, and a piston. The bottom of multiple configurations is connected to the output tube, the output tube is connected to the valve, the drive device is installed in the box, the drive device is connected to the piston, the controller connected to the drive device is installed at the bottom of the box, and the storage tube is installed on the base far from the side of the box. The pump is installed on the side of the tank. The pump is directly controlled by the controller. Multiple output tubes are connected to the connecting pipe. The connecting pipe is connected to the injection tube far from one end of the pump body. The insertion head is inserted at the upper end of the injection tube, and the injection tube and the connecting pipe are connected. Another set of valves, The bottom seat is under the injection tube, and a fixed support frame is installed. The bottom of the support frame is equipped with a weighing device and is connected to the controller.

The driving device includes a stepping motor, a gear transmission mechanism, a wire bar and a screw cover. The stepping motor is fixed and connected to the inner wall of the box. The controller controls the running of the stepping motor. The screw is connected to the inner wall of the box and the gear transmission mechanism is located. Between the step motor and the wire bar, A long hole corresponding to the piston is set on the box body, and an extension rod is set on the screw sleeve. The extension rod is fixed through the long hole and the top of the piston.

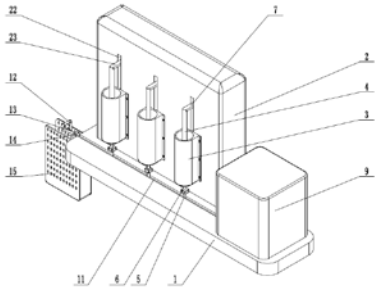

Fig.1 control system

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3. Working principles

The automatic preparation device for intravenous infusion includes a base, a box body at the top of the base, a plurality of configuration tubes on the outside of the box, a configuration tube for storing drugs needed for intravenous infusion, a piston in the configuration tube, and a piston sliding connection with the inner wall of the configuration tube. The output tube is connected to the bottom of multiple configurations, and the drug output tube can be pushed out by sliding the piston in the configuration tube. The output Guanshang is connected to the first valve. The opening and closing of the first valve controls the output of the drug. The box is equipped with a drive device. The drive device is adapted to the piston. The drive device controls the piston sliding in the configuration cylinder. The bottom of the box is equipped with a controller connected to the signal of the drive device. As the control element of the device, the controller controls the start and stop of the drive device, thereby controlling the component of the piston to introduce the drug. On the base, a water storage tank is set away from the side of the box. The water storage tank stores the saline solution used in the intravenous infusion configuration. The pump body is set on the side of the water storage tank. The pump body is connected to the controller signal. The controller controls the start and stop of the pump body. There is a connecting pipe on the pump body. Multiple output tubes are connected to the connecting pipe, and the connecting pipe is set away from the end of the pump body. The injection tube is a soft injection tube, the Guanshang insert head is injected, and the insert head is inserted into the infusion bag. When configuring drugs, the controller controls the drive device to drive the piston. Push the drug from the output tube into the connecting pipe, the controller controls the start of the pump body, enters the raw salt pump into the connecting pipe, and enters the infusion bag with the drug. The second valve is connected in series between the injection tube and the connecting tube. The second valve is opened when the drug is configured and closed after the drug configuration is completed to prevent the flow of physiological saline in the pipeline. The bottom seat is equipped with a support frame under the injection tube, the support frame supports the infusion bag, the bottom of the support frame is equipped with a weighing device, and the weighing device is connected to the controller signal. The weighing device can measure the weight of the infusion bag in real time. When the weight of the intravenous infusion in the infusion bag reaches the rated value, the controller will control the pump body to stop running and complete the entire configuration process. The configuration process can achieve the automatic configuration of the drug without the cumbersome operation of the medical staff, and the medical staff can be separated from the tedious manual labor. Come out; Reduce the probability of errors in the drug allocation process and save medical staff time and energy.

4. Data collection and processing

Using the Luoyanglanfei communication port extension module YF0A-COMM, this module extends communication with the CPU through the SPI interface. This module has a built-in 64-byte send buffer and a 64-byte receive buffer. The two are completely independent. Each frame of data can send and receive 64 bytes. The CPU module sets the content to be sent by writing data to the send buffer. Reads the received data by reading the receiving buffer.

The spectrophotometer's communication format has been fixed by the manufacturer. The computer terminal adopts a serial debugging tool to obtain its communication format. The communication format is a free communication format that uses ASCII format to send and receive data. When sending, the command word needs to be resolved into ASCII and sent. When receiving the data, the ASCII data is resolved into binary numbers and then integrated into a true and valid decimal number. The data-processing program is shown in Figure 1.

PLC needs to obtain energy values, magnification, dark currents, blank energy and other values from spectrophotometers. It also needs to set wavelengths and signals such as communication online and offline. In PLC, the operation of setting wavelength, reading magnification, reading energy values, on-line and offline sub-functions to complete the corresponding data reading. The absorption degree of bacteria liquid is treated by the following type.

Pass rate T =(sample energy-dark current at current magnification) /(blank energy-dark current at current magnification)

Absorption =-LG permeability

The turbidity analysis requires a large number of data processing formulas and data operations. Writing corresponding programs in PLC will be very complicated, and the error rate will be high, and errors will not be easily discovered. Beijing Kunlun Tongtai touchscreen VB script provides a very powerful data processing script function, and it is very convenient to write data processing programs. The instrument is adopted by PLC, analyzed and calculated by the touch screen, and forms a report print. The specific formula applied can see the contents of the corresponding chapters in the New Pharmacopoeia. Due to space limitations, it will not be repeated.

5. PLC program

Using PLC's sequential control design method, the state flow chart is first compiled, and the control program is compiled with step and step control instructions. The relevant calculation formulas are written in the upper computer script program. Including main procedures and washing, testing, temperature control and other subprograms. The temperature PID control program code is shown below.

```
LD M8000
FROM K0K7D50K1
LD M8000
DESUB K200 K0 D20
DESUB K1000 K0 D22
DEDIVD20D22D24
DEMUL D24 D50 D48
INT D 48D62
LD M8000
ANI M39
PID D226 D62 D200 D64
LD M8000
ANI M39
DESUB K1000 K0 D30
DESUB K32767 K0D32
DEDIVD30D32D34
DEMUL D34 D64 D38
INTD38D66
LD M8000
ANI M39
TOP K4 K0 H111K1
TOK4K1D66K1
LD M8000
AND M39
PID D226 D62 D300 D68
LD M8000
AND M39
DESUB K1000 K0 D40
DESUB K32767 K0D42
DEDIVD 40 D 42 D 44
DEMULD 44 D68 D28
INTD28D70
LD M8000
AND M39
TOP K4 K0 H111K1
```

6. Person interface

Using the Human-Computer interface as a monitoring system, the real-time data in the PLC is displayed, recorded, stored, and processed to meet various monitoring requirements. Taking into account the compatibility and extensibility of the system, the Beijing Kunlun Tongtai touchscreen is used. The monitoring interface includes user permission screen, parameter setting screen, automatic monitoring screen, database screen, alarm screen and other interfaces.

In the automatic monitoring screen, the system starts to stop and other buttons, changes the configuration policy, displays the pharmacy inventory, shows the movement status of each component, etc..

The user permission interface, the medical staff with permission can enter the corresponding operating interface, password input error three times, will lock the screen and alarm prompt, need to have the permission operator to unlock after normal use.

Parameter setting interface, the communication parameters of PLC and spectrophotometer, the running speed of stepper motor and pipeline cleaning and other functional parameters are set.

The database interface establishes a TABU Table between drugs. After the pharmacist approves the TABU Table database, it is determined that TABU TABU will not be generated. The basic information and medication records of patients are added to the system database, which can be consulted at any time during subsequent treatment, and reasonable treatment plans are determined by reference to previous medication records.

7. Experiments

7.1 Programmes

The conventional drug preparation method for five insoluble drugs, such as ornithine, sodium Meiluoxilinnashubatan, sodium Kaolaning, omeprazole sodium injection, and imine penance Dingna, was used as a control group. Using the method of “automatic preparation instrument for intravenous infusion” as the experimental group to observe and compare the experiment, the drug configuration was completed until it was completely dissolved to clarify the transparent liquid timing.

7.2 Results

The drug experimental groups such as ornithine, Meiluoxilinnashubatan sodium, Kaolaning, omeprazole sodium injection, and imine penantastatin sodium were completely dissolved to clarify the average time required for transparent liquids. significantly less than the control group. The difference of total dissolution time was statistically significant before and after the improvement of the five drugs(P<UNK> 0.05).

7.3 Statistical analysis

Using SPSS19.0 statistical software for data analysis, the average number of measurements is ± The standard deviation(X ± s) indicates that the average number between groups is compared with two independent sample T tests, and the correction T test is performed when the variance is uneven. The difference in $P \leq 0.05$ is statistically significant. The control group and the experimental group of five insoluble drugs such as ornithine, sodium Meiluoxilinnashubatan, sodium Kaolaning for injection, omeprazole sodium injection, and imine penantastasol had a statistically significant difference in the total dissolution time of the experimental group(P<UNK> 0.05).

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