JIEE Časopis priemyselnej elektrotechniky
Journal of Industrial Electrical Engineering
ISSN 2454-0900
www.jiee.eu

Design of electrical installation of the filling device

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***Abstract* — This publication deals with the description of the electrical installation of a fluid filling device. In the first part, we focused on the specification of the whole device and the design conditions. After describing the mechanical part, which was designed in Fusion360 software, we focused on the design of the electrical installation. PCBs for the electronic part were designed, together with the control module they were implemented in 3D design. Based on which the whole device was realized.**

***Keywords* — dispenser, electrical installation, Filling device, Fusion360, hopper**

I. INTRODUCTION

The aim of this work is to design and implement a device that can fill a small bottle with a volume of 30-35ml of liquid. The device will be designed in Fusion 360 and must have the following criteria:

- The device must be fully functional.
- Filling must be automated in such a way that the bottle is automatically filled when the bottle is inserted, and the button is pressed.
- The bottles are filled from a container with a volume of at least 350 ml.
- The hopper must be accessible so that it can be easily filled and cleaned.
- When the hopper is empty, its status is signaled.
- The device will have control electronics with a microcontroller.
- Components that come to contact with liquid must be food safe.
- The entire device must be detachable.
- The price of the device will be up to 100 euros.
- Possibility to use the device in the production line in combination with other devices.

II. MECHANICAL DESIGN OF THE FILLING DEVICE

The dispenser is realized as a separate device with a removable container, which is in the form of a large syringe. The sliding mechanism is only partially covered. It is exposed only from the front part, where it is necessary to know how to insert or remove the hopper. The engine storage space is longer than the engine itself, which allows the use of a larger and more powerful engine. The design for storing the magazine is extended on the sides to make the magazine easier to access. The control electronics are stored in the back and are in a separate box, so there was no need to adjust the dimensions of the device to these electronics. The control unit with which the device can be operated is located on the right side at the top of the dispenser. The whole device is mounted in the rear part by means of four screws on a stand, the base of which is a flat plate.

The 3D model of the dispenser was created in the Fusion 360 program. The dispenser consists of several parts, which were created as separate components. In Fig. 1 you can see the design of the dispenser.

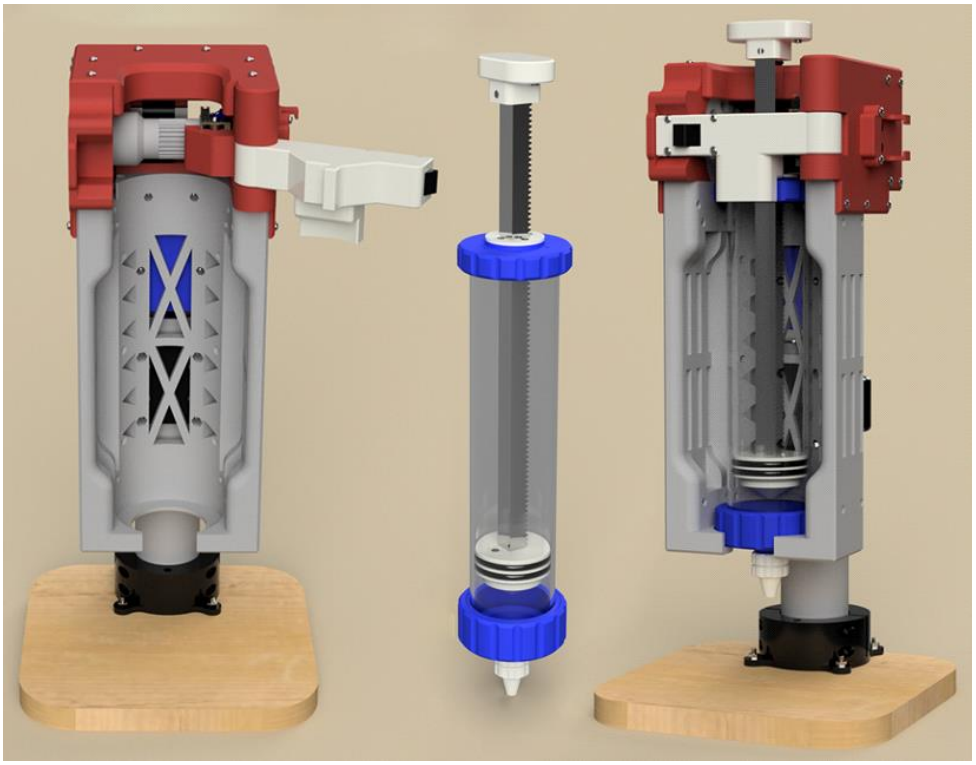

Fig. 1 3D design of the dispenser

III. Principle Of Dispenser Operation

The capacity of the container is 500ml. The hopper can be removed from the dispenser very easily and quickly. As a result, several containers can be produced for the dispenser, in which, for example, there would be different cartridges and they would be replaced if necessary. The dispenser also has an empty hopper sensor which signals this on the display. The display is located on the control unit itself. There is also a button on this control unit that starts dosing. After one press of the button, one bottle is filled. Dosing can also be started externally via an input on the control unit, for example when using a dispenser in a production line. The control unit itself is easily removable.

IV. Electrical Installation Design

The control electronics are manufactured on a single printed circuit board, Fig. 2. The board contains a voltage regulator for 5V, a protection diode against the opposite polarity of the input voltage and a motor control controller (not fitted in the picture). The stabilizer also has a small cooler. The entire control electronics is designed for an input voltage of 12V. The printed circuit board is placed in a plastic box at the back of the dispenser. The box has ventilation holes on the walls, which are necessary to keep the temperatures of the power components as low as possible.

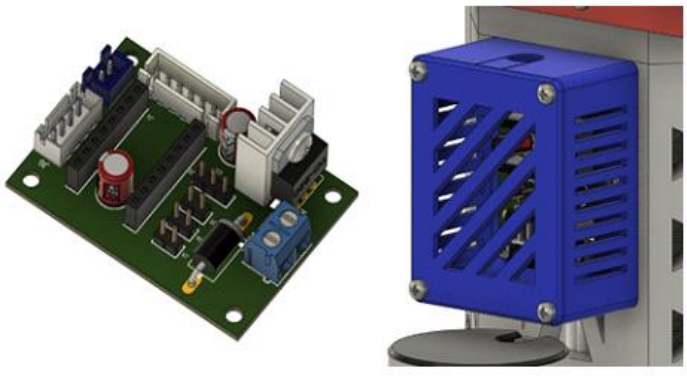

Fig. 2 3D model and cover of the control electronics

Control electronics connected via cable to the M5STICK control unit. The 3D model of the control unit itself was not created. The M5STICK is a small compact device in a plastic box containing a display, two small buttons on the side and one large button on the front. The dispenser also includes a holder for this unit, into which the M5STICK is easily slid. A connector will be inserted in the left part of the holder, which will be secured with a cover on the left using two screws. Thanks to this solution, after sliding the control unit into the holder, this unit also connects to the control electronics. At the bottom of the holder is a groove in which the cables will be routed. The whole holder is mounted to the sliding mechanism using two screws. In the picture below you can see the schematic connection of the control wiring of the system. In Fig. *3* you can see the schematic of the control electronics.

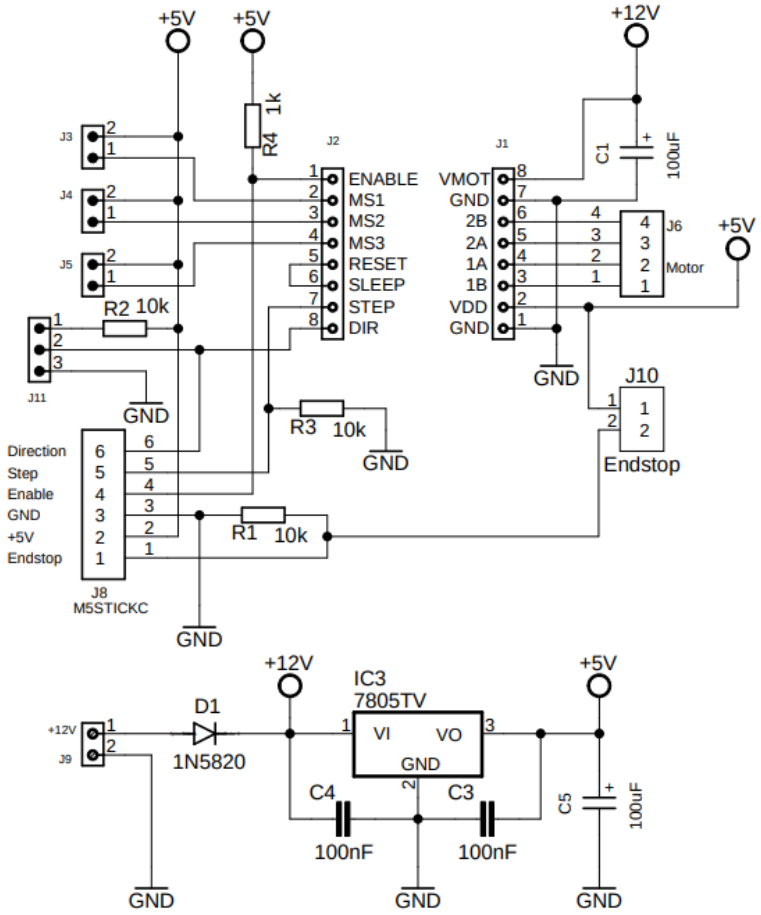

Fig. 3 Schematic of the control electronics

V. Conclusion

Control electronics connected by cable to the M5STICK control unit. The M5STICK is a small compact device in a plastic box containing a display, two small buttons on the side and one large button on the front. The dispenser also includes a holder for this unit, into which the M5STICK simply slides. The design of the electronic installation met all the features for the device to perform its operation properly. In the following work, the device will be implemented.

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