

New water-saving tap and its control method

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Abstract: With the development of economy and the increase of population, human demand for water continues to increase, coupled with the existence of unreasonable exploitation and utilization of water resources, many countries and regions in different degree of water shortage. The most promising solution to the water shortage now appears to be the exploitation and utilization of certain non-water resources, such as desalination of sea water, exploitation and collection of groundwater, and the use of polar glaciers. But for the general public, saving water is the most practical and effective method in daily life. Through the mechanical structure and to stop water supply, the pressure variation in pipes, controlling switch at the bottom of the piston, again will pipe plug, and through a certain structure, even if the water drainage system, again also cannot open the piston, can realize the function of our group thought so.

1. Introduction

Most of the product structure adopts mechanical structure, principle of the design of our products is: unscrew the handle, in the role of the impact of the water, through the lever principle, changing the direction of the force, to achieve the tap open. When the flow of water stops, the switch is closed by the Hook Effect of the spring and the self-lock effect.

1) Handle and handle connecting rod

The combination of the handle and the connecting rod can form the controller of the faucet -- the handle. By turning the handle, the water supply of the faucet can be realized. In the design of the handle, we mainly consider that the tap is used in rural areas, so we should ensure that the handle will not break under certain bending stress. We also take into account the comfort of the handles and the maximum productivity.

Handle is an important mechanism in faucet and plays an important role in faucet operation. In the faucet mechanism, through the circular movement of the handle, drive the lower end of the handle and the connecting lever to control the opening and closing of the faucet. For the convenience of installation, we choose to use octagonal column.

Faucet handles working conditions are generally in the rural areas, the external environment is bad, easy to suffer the wind everyday for a long time, and utilization rate is very high, so you need to the higher strength and durability.

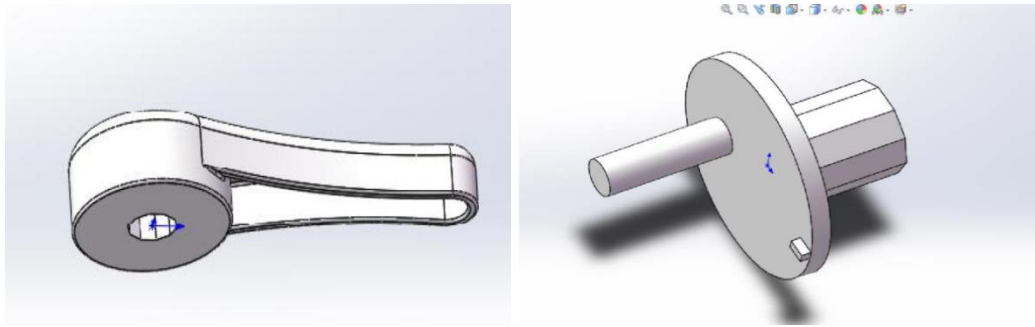


Fig.1 Diagram of the handle and handle connecting rod

2) The top

Dust can be blocked through the top cover to prevent contamination of drinking water from the tap, and the handle can be connected with the shell more tightly to prevent loosening. The top cover is a part of the faucet, which plays an important role in the faucet's dustproof and stabilization.

In the faucet mechanism, the handle is connected to the shell through the cover, and the inner wall of the shell is threaded to make the connection between the shell and the handle more stable.

Water proofing must be taken into account in the operating environment of faucet, but in the process of design calculation, the requirements for precision are not very high.

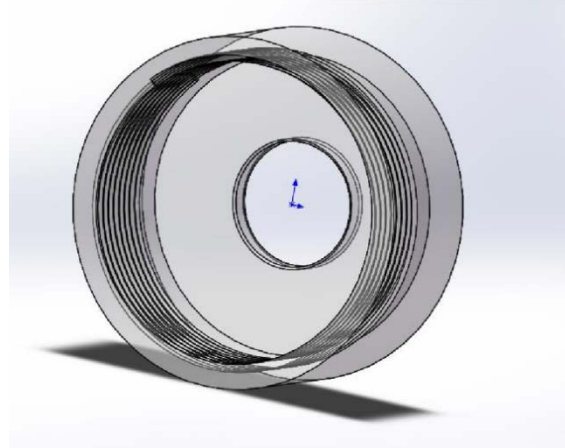


Fig.2 Diagram of the top

3) The shell

The mechanical structure is connected with the water pipe and ACTS as a restriction and fixation on the execution structure and control structure. The shell is one of the most important parts in the faucet structure and is the basic part of the faucet. In the faucet structure, water flows through the pipe through the shell, which is the water carrier. In the inner part of the shell, rubber valve and baffle are installed. In the top part of the shell, there are top cover, sealing ring, handle and other parts. All parts of the faucet are functional on the basis of the housing. The shell belongs to shell parts, and the material is cast copper alloy. As a new type of baffle-piston valve is adopted in the internal valve of the faucet, a round head keyway is designed in the vertical part of the shell to facilitate the installation and positioning of the faucet support pin. At the same time, in order to realize the function of water shut-off, the normally closed control pin and baffle are designed on the shell to realize the flow passage together. Therefore, drilling is required on the shell.

a) The two-thread connection part of the shell requires high quality and good sealing due to its sealing performance.

b) Control pin hole to ensure the control pin can work normally and live for a long time. The surface quality of the hole is high and the surface roughness is small.

c) Key way, for the convenience of installation, high precision of key way is required to ensure clearance coordination.

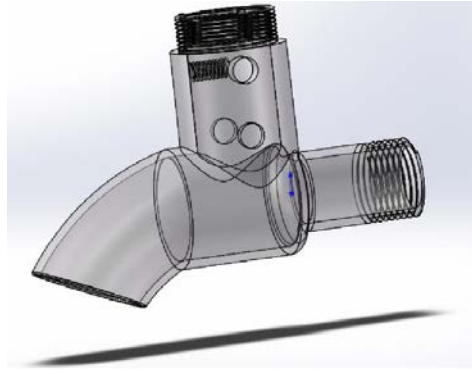


Fig.3 Diagram of the shell

4) The actuator

The most important and core structure of water-saving tap, the lower part is the piston which can cooperate with the water pipe to block the water flow. In the middle is the lever, which changes the direction of the force through the lever, so as to realize the change of the direction and control direction of the flow force. At the top of the actuator is a groove that allows water to flow through a pin connected to the housing without flushing the piston away.

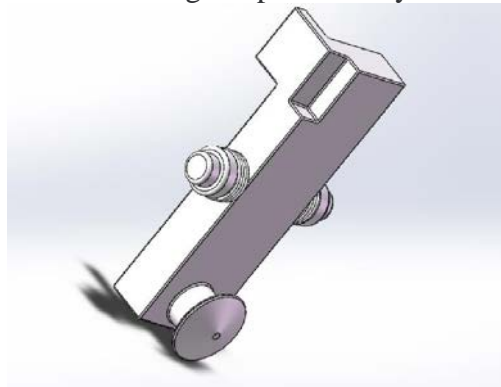


Fig.4 Diagram of the flap shutter

5) The pin

The coupling and control functions can be realized by matching the top structure of the pin with the groove of the actuator.

The main function of the part is that when the water pipe stops suddenly, the pin moves inward under the force of the pull rod, which blocks the rotation of the rotating baffle and blocks the flow of water. It can be seen that the force on the pin is mainly the shear stress on the convex platform. Other surface processing precision is not high, but the slope roughness of the convex platform must be low.

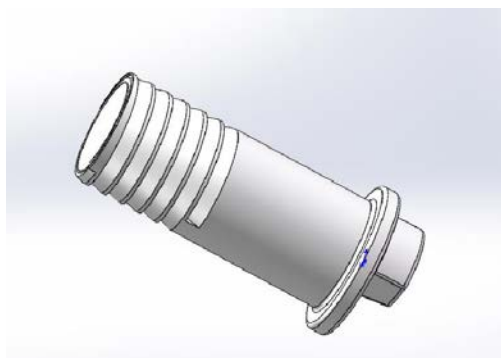


Fig.5 Diagram of the pin

6) The faucet

Current final mechanical structure drawing. The working process is firstly, during the water supply period, the switch is opened, and the pin acts on the protruding position of the actuator

groove, which can keep the piston open all the time due to the force of water flow. When the water supply is finished, the pin can be restored to the groove through a spring, so that the faucet is closed, and the faucet cannot be opened without manual control of the pin at the next water supply.

2. Principle

The faucet works in four ways:

1) There is water in the water pipe and the faucet is off.

At this time, the faucet is closed, and the pull rod drives the pin to catch the rotation of the fender. The faucet is in a double closed state.

2) There is water in the pipe and the faucet is on.

If you want to turn off the tap, turn off the tap handle. If the water is suddenly stopped in the water pipe, due to the lack of water pressure at the bottom of the baffle, the upper part of the baffle rotates under the pull of the spring.

3) There is no water in the water pipe and the faucet is off.

Turn on the faucet at this time, need to turn the faucet handle, pull the pull rod. And when the pull rod is released, the pull rod will still drive the pin to seize the baffle.

There is no water in the pipe and the tap is on.

Because there is no water in the water pipe and there is no water pressure at the bottom of the baffle, the upper part of the baffle rotates under the pull of the spring. The pull rod drives the pin to jam the baffle, leaving the faucet in a closed state. So this state doesn't exist. As the waste of water resources caused by the opening of the tap when the water is stopped (the fourth state) and the failure to close the tap when the water is incoming. The design of this project makes the fourth state impossible, so it also prevents the waste of water resources and achieves the goal.

3. Analysis

In the design of the process of transmission, we need to consider the pressure problem is generally hydraulic pressure on leverage, moreover because of the special structure, we also need to consider spring can stress in a number of problems, has the stress of the lever. The material used in the lever is stainless steel 0Cr18Ni9, which can reach the allowable stress of 137MP through solid solution treatment. Spring material is spring steel, through quenching, allowable stress of 471 MP. According to th national standard, the water pressure of tap water is 0.28 MP.

Determine water pressure:

$$[\sigma_{H1}] = 0.28 \text{ Mpa}$$

Water supply pipe:

$$S = \pi d^2 = 0.007^2 \pi = 1.5 \times 10^{-4}$$

Stress is:

$$F = \sigma \times S = 0.28 \times 1.5 \times 10^{-4} = 43 \text{ N}$$

Faucet contact area:

$$S_1 = 1.7 \times 10^{-4}$$

Lever pressure:

$$[\sigma_{H2}] = \frac{F}{S_2} = 0.25 \text{ Mpa} \leq 168 \text{ Mpa}$$

The first intensity item can meet the condition.

Check the strength of the spring on the other end of the lever.

The tooth load distribution coefficient the length ratio of the two ends of the lever is 1:1

Determine the strength at the spring:

$$F_1 = \frac{F_2 \times L_2}{L_1} = F_2 = 43N$$

Determine the fatigue strength of spring:

$$\tau = \frac{8KFC}{\pi d^2} 13.5Mpa \leq 471Mpa$$

The spring strength also satisfies the condition.

4. Conclusion

- 1) Simple structure and principle, simple operation.
- 2) Easy to manufacture and lower cost.
- 3) It can be closed automatically when water is stopped in the rural environment of regular water supply and delivery.
- 4) Save water.

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