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Research Article

UNDERGROUND WATER DESALINATION DEVICE

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ABSTRACT

The article proposes devices for the desalination of water from an underground source, in particular, they mainly concern the provision of environmentally safe water supply to the population with high-quality drinking and technical water.

KEYWORDS

Water, desalination, quality, device, heat source, vacuum pumps.

INTRODUCTION

Currently, one of the world's problems of mankind is the lack of fresh drinking water. In some areas, clean water is a valuable and expensive resource. Cases have already been noted when armed conflicts began because of freshwater sources. In the future, the situation with water will only worsen due to the constant growth of the population in developing countries. More and more countries in the future will be

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forced to find new ways to extract water intensively.

Drinking water is first of all human health. According to the World Health Organization, 70% of all diseases in the world are associated with poor quality of drinking water and violation of sanitary and hygienic standards of water supply [1].

The shortage of fresh water is felt in more than 40 countries, located mainly in arid and arid regions and making up about 60% of the entire surface of the earth's land (according to calculations, by the beginning of the 21st century it will reach 120-150 109 m3 per year). This deficit can be covered by desalination of saline (salt contains more than 10 g/l) and brackish (2–10 g/l) oceanic, sea, and ground waters, the reserves of which make up 98% of all water on the globe [3].

Analysis of water desalination methods.

Water desalination is a method of removing dissolved salts and other impurities from it. This group can in turn be divided into chemical and physical methods. Let's consider them in more detail.

Chemical deposition, the method is based on the conversion of dissolved salts into insoluble compounds that precipitate and are removed. The reagents used vary depending on the salt composition of the desalinated water. For example, an excess of magnesium salts is precipitated by soda, and sulfates can be removed by treatment with barium hydroxide [4].

The desalination by freezing, this method is based on the fact that the formation of ice crystals when the temperature drops below 0 degrees occurs only from water molecules (the phenomenon of cryoscopy). As a result, freshwater is released in the form of ice from the solution. The solution becomes more and more concentrated. If you then drain the resulting brine and melt the ice, you get demineralized water [5].

Thus, water desalination is a method of water treatment in order to reduce the concentration of dissolved salts to the extent (usually up to 1 g/l) at which water becomes suitable for drinking and household purposes. The shortage of fresh water is felt in more than 40 countries, located mainly in arid and arid regions and making up about 60% of the entire surface of the earth's land (according to calculations, by the beginning of the 21st century it will reach 120-150 109 m3 per year). This deficit can be covered by desalination of saline (salt contains more than 10 g/l) and brackish (2–10 g/l) oceanic, sea, and ground waters, the reserves of which make up 98% of all water on the globe [6–10].

Underground water desalination device

This work relates to the field of desalination of water from an underground source of brackish water, in particular, they mainly concern the provision of environmentally safe water supply to the population with high-quality drinking and industrial water.

The proposed desalination plant is equipped with a heat source, and hydraulic piston vacuum

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pumps are equipped with valves at the inlet and outlet.

Hydro-piston vacuum pumps work alternately.

Figure 1 shows a diagram of a device for the desalination of well water. A submersible pump 2 is lowered into well 1, connected by pipeline 3 to an evaporator 4, equipped with a drainage pipe 5 and a heat source 6. The upper part of evaporator 4 is connected by pipes with hydraulic piston vacuum pumps 7 and 8, the outputs of which 9 and 10 are connected to storage tank 11.

The device works as follows. Pump 2 pumps out water from well 1, which is fed through pipeline 3 to evaporator 4. The evaporator is heated by heat source 6, which can be any source: gas flame, electric heater, solar heat, etc. The heated water begins to evaporate with reduced heating because connected to a hydraulic piston vacuum pump 7, both valves of which are open. Water in pump tank 7 under the action of gravity tends to flow out into tank 11, while a vacuum is formed above the liquid piston, which reduces the pressure in evaporator 4. At a reduced pressure, the boiling point decreases, and this in turn reduces the amount of required heat. Getting into the tank of the hydraulic piston vacuum pump 7, steam from the evaporator 4 condenses and gradually fills its volume. After that, the valves of pump 7 are closed, the valves of pump 8 are opened and the cycle is repeated. After the evaporation of most of the water in the evaporator 4, a brine is formed at the bottom of it, which is drained by pipe 5.

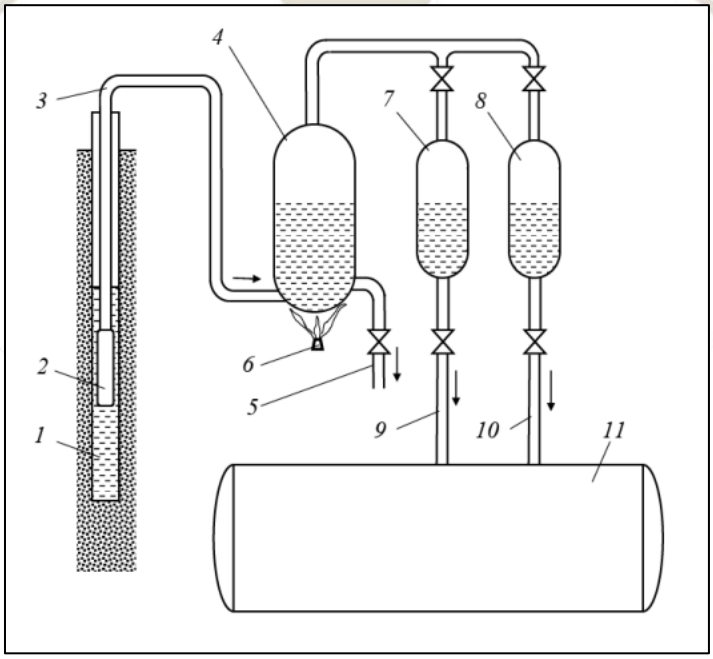

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Fig.1. Scheme of a device for desalination of well water

The main hygienic indicators of the quality of desalinated drinking water are at the level of:

- The minimum required level of mineralization - 100 mg / l;
- The optimal level for chloride-sulphate waters - 200 - 400 mg/l;
- The optimal level for hydrocarbonate waters is 250 - 500 mg/l;
- The minimum required alkalinity of water is 0.5 meq/l;
- The minimum allowable water hardness is 1.5 mg-eq / l;
- The minimum required level of calcium - 30 mg / l;
- The minimum required sodium level - 200 mg/l;
- The optimal level of fluorine content - within 0.4 - 2.5 mg / l;
- Taste and smell of water - no more than 1-2 points; the total number of microbes in 1 ml of water - no more than 100;
- Koli-index - no more than 3.

CONCLUSION

The technical result is that there is no need for the device to operate under high pressure. The device has a simpler design, and requires less thermal energy, which increases the efficiency of desalination. It is environmentally safe.

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