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NEW ENERGY RESOURCE

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Abstract

Present – day energy problems demand quest of new energy resources. One of those is known physical process – so called «osmos» (from Greek – «pressure»). This article for the first time proposes to use that for energy technics by some concrete examples.

Keywords: osmos, energy resource.

НОВЫЙ ЭНЕРГЕТИЧЕСКИЙ РЕСУРС

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Аннотация

Современные энергетические проблемы требуют поиска новых энергетических ресурсов. Одним из таких известных физических процессов является так называемый «осмос» (от греческого – «давление»). В этой статье впервые предлагается использование осмоса для энергетики на некоторых конкретных примерах.

Ключевые слова: осмос, энергетический ресурс.

Introduction. General idea mechanical acting salt gradient is subordinated by second law of thermodynamics, system entropy increasing owing to concentration identical. Accompany processes and phenomenons (hydroosmos, revers electricity dialyze, adiabatic steam expansion, electrochemical flows, mechatanical cycling compression/expansion, freeze pressure and so on) may be used for producing of applicable energy. Only hydroosmos has such potencial (millions kwt) [1] for following rivers (fresh river water – salt ocean water): Amazonka – 470, La-plata – 170, Kongo – 120, Yancy – 47, Gang – 43. Osmos pressure of that system may attain 2,5 MPa, it is level difference of this liquids near 250 meters.

The specific maximal work for thermodynamics equilibrium process of salt gradient decrease may be estimate for two concentration S_1 and S_2 , ‰ with its temperature T_1 , T_2 , K in joule/kilogram [1]:

$$L = 0,245T_1(S_1 - S_2) + 1848T_1 \ln \left(\frac{T_2 - 231}{T_1 - 231} \right) + 1540(T_2 - T_1) - 2002T_1 \ln \frac{T_2}{T_1} \quad (1)$$

Power N of installation with fresh river water $S_2=0$, stream M kg/s water:

$$N = ML \quad \text{wt} \quad (2)$$

Interesting fact: must be $T_2 > T_1$ in order to have positive efficacy, fresh water warmest than strong solution (1, 2).

Quantity N is smaller for real conditions because this necessary to take into account all wasters of energy and mass, degree of using of initial salt concentration difference those liquids. Shown above powers for rivers were calculated when S sea water equal 30‰ and $T_2=T_1=293\text{K}$. Evidence high possibility to receive energy for countries not near sea, but country with possession of suitable mineral stocks and fresh water – such as Belarus.

Until now day energy of salt gradient, different concentration no attract specialists on practical electricity technics. But new political, social, economic, ecologic, technical conditions point to necessity of elaboration new energy working out type. Unfortunately, we have very little published information on mention idea.

The study of energy from salt gradient was beginning in USSR during 80-th years, but real industrial installations was not anywhere. This Explanation is energy resources prosperity, its high potential, approachable, scientific work out. However their exhaustion, sharp price increasing, state pretensions, inconvenient geograph-

ical disposition lead to searching another new types of energy production. And first order it is necessary to create technical schemes energy producing installations, for further their calculations and recommendations.

Some technical proposals of osmostical energy installations. Hydroosmostical energy constructions and similar arrangements were considered in Brest Technical University and present below. They are ideas of possible using of new energy source in such countries as Belarus possessing by mineral salt and fresh water. Of course, we have not corresponding equipment, but simple osmostical elements may be easiness insert in known schemes and projects, even in existence power stations. Full-length calculation must be attachment to concrete conditions.

Such installations allow to refuse from fuel or to decrease consumption it, they are convenient for small and far consumers.

Now stage of idea development is devoted to work out improvements by using various amplifiers, concentrators, pumps, new materials, parameters, liquids, addition of special substances, analysis of technical requirement.

Following variants are suggested to your attentions.

1) Hydroenergy structure. This working out is favorable structure for two aquatories with various concentration of salt, for example – river and sea [2]. Such power station in principle schematic is shown on figure 1, where are presented basic elements of new energy technology.

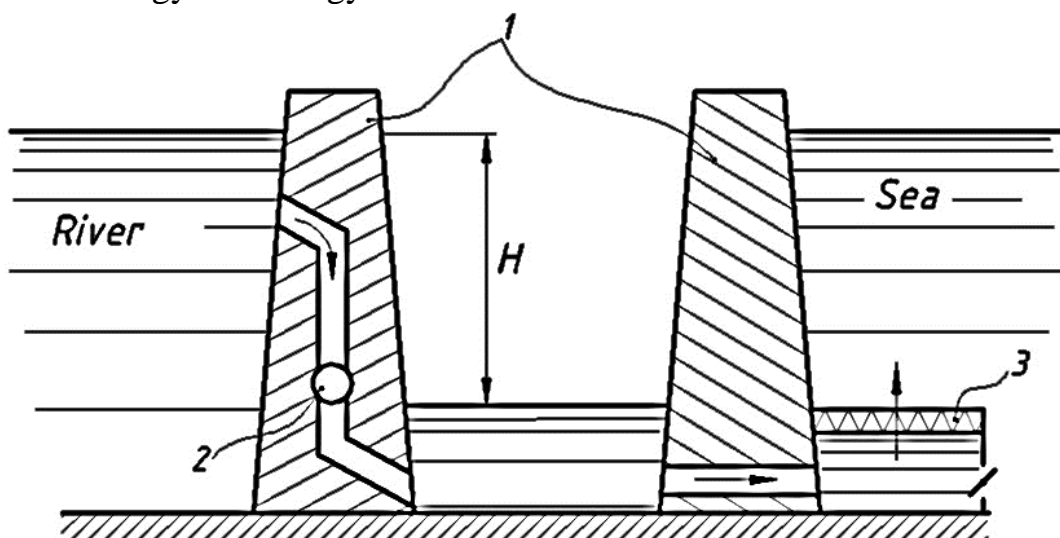


Figure 1 – Hydroenergy structure: 1 – walls of aquatories, 2 – hydroelectric power generator, 3 – osmosating equipment, H – osmos pressure, \uparrow – movement of energy water

The active charge between two walls of aquatories 1 is forming by osmos process and work in the hydroelectric power generator 2. Osmosating equipment 3 situated above caving after walls 1, on bottom of sea aquatorium. Osmosating equipment 3 may have diverse size and shape for achievement of maximum of osmos pressure H . Structure provides movement of water from river to sea and energy production without environment flooding. It is possible to build separate single shafts with leading of required water, on according to propose scheme.

Osmosacting equipment 3 consists from special film on porous partition on frames, contains starting door. The hydroelectric power generator 2 equips by electrical junctions.

Recommended power station may be built not only in water on river mouth, but on bank mainland with using of suitable channels. Also, perhaps maritime bottom channels from plastic may be used for leading of fresh water from river on big distance in salt sea, on osmos power station, which based on sea bottom.

This method of energy receipt presents the perspective for seaside countries, especially now [2].

2) Osmosacting chink. This technical arrangement may be used in procurement industry for simultaneous extraction of mineral salt and production of electricity.

Osmosacting chink (see fig. 2) represent by it the water giving tube 1 which inserted in salt deposit 5. The water giving tube 1 has some holes on lover part, in salt region. Those holes are covered by partial penetrating coat 2 from special films or ceramics walls.

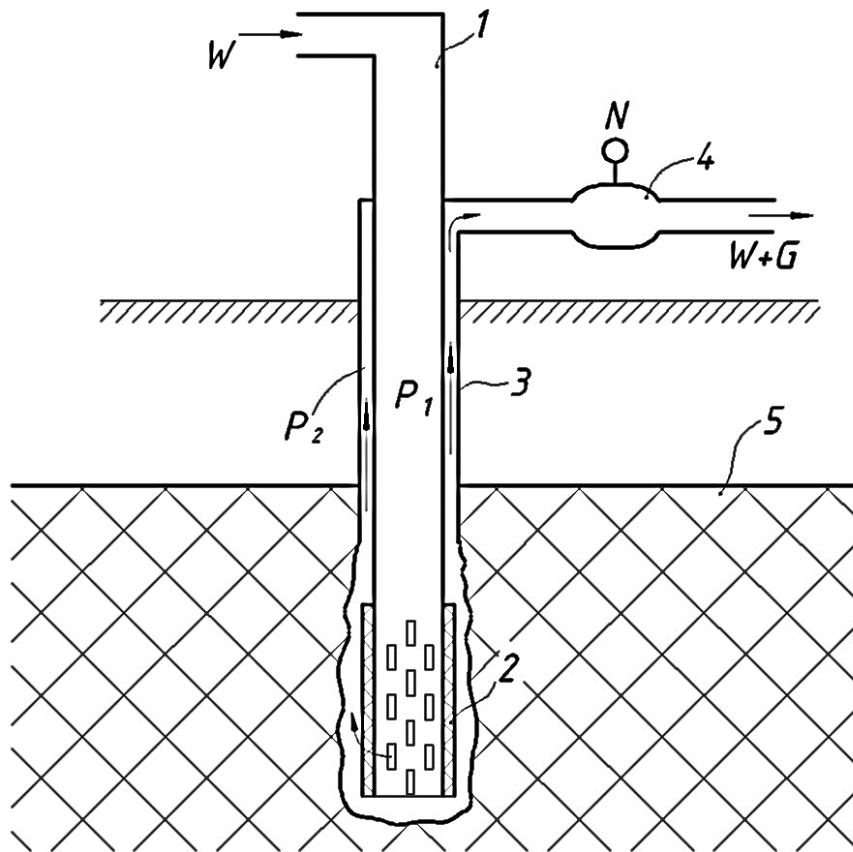


Figure 2 – Osmosacting chink: 1 – water giving tube, 2 – partial penetrating coat, 3 – power tube, 4 – electrical generator, 5 – salt deposit minerals

The geological exploited volume is connected by power tube 3 with electrical generation 4, and after it with consumer of salt.

The arrangement carry out quantity of electricity N owing to osmos pressure ($P_1 - P_2$) and quantity of salt G when water consumption W , with help from osmos acting element 2. Water and salt may be separated by consumer on known methods if it is necessary, with using superfluous of N .

Osmosacting chinks are perspective to use in countries with big salt deposits and presents of fresh water in rivers and lakes [3].

3) Electrical Generator. Activity of descriptive electrical source is work of tension into electricity reformer, conceived variable changed influence. Received osmos pressure is used as first energy. The sample is shown of fig. 3.

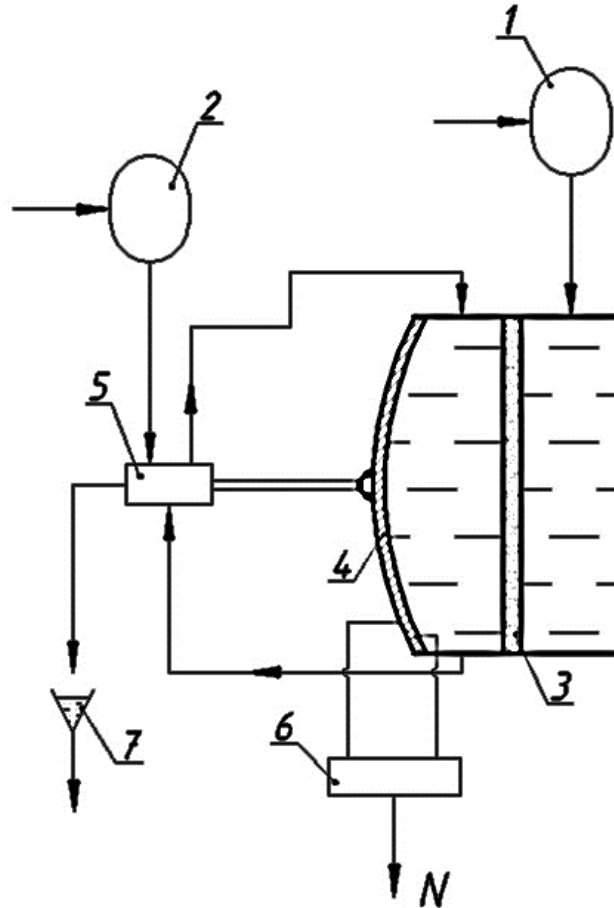


Figure 3 – Electrical generator: 1 – fresh water, 2 – salt solution, 3 – partial penetrating plate, 4 – flexible wall, 5 – regulator, 6 – receiver, 7 – pour off

The electrical generator consists of sources of fresh water 1 and salt solution 2, which feed capacity with partial penetrating plate 3 into it. One of half this capacity (left on fig. 3) has bottom as flexible wall 4. Both sides of this wall have adhesive reformers of tension into electricity, connected with receiver 6. Flexible wall 4 mechanical act on regulator 5. The installation is provided by pour off 7 for waste move away.

Periodical filling up of left half of capacity by salt solution and moving away of work off solution (because flexible wall 4 must oscillate with essential amplitude) is organized by regulator 5.

Thus, working speed is acting osmos while wall 4 displace outside, reformers of tension into electricity give maximum energy to receiver 6. Then wall 4 returns on initial place owing to flexibility, and the cycle is repeated, regulator 5 u receiver 6 produce N necessary electrical stream [4].

4) Heat energy installation. The efficacy of usual well-known heat energy power stations depends of working medium (steam, gas) pressure, which is created by com-

plicated special arrangement – so called «feeding pump», consuming of much energy. Osmos process permits to use high pressure in order to escape from it.

The principal ideological scheme of such osmos power station is shown on fig. 4. New special elements – boiler 1 and osmos element 5 are adder to well – know parts: turbine 2, electricity generator 3, condensator 4, economizer 6, auxiliary heat exchanges 7.

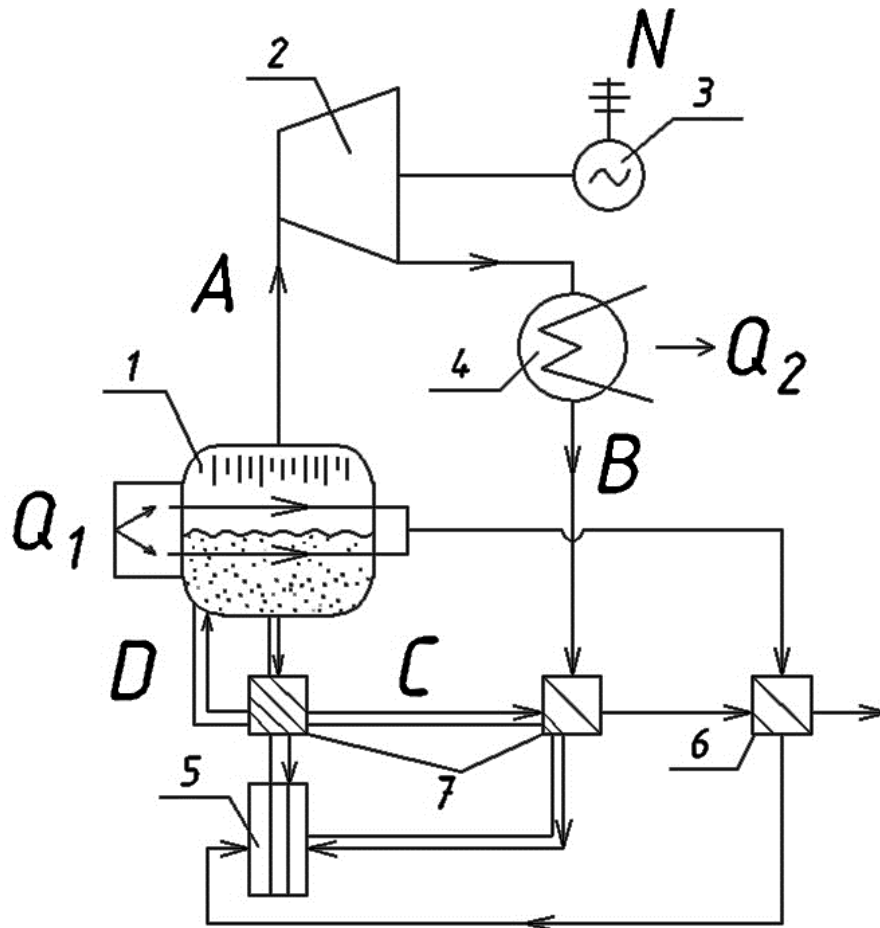


Figure 4 – Heat energy installation: 1 – boiler, 2 – turbine, 3 – electricity generator, 4 – condensator, 5 – osmos element, 6 – economizer, 7 – heat exchanges, A – water steam, B – condensate, C – high concentration, D – work off solution, N – installation power, Q – heat of entrance and exclude.

The installation consumes heat Q_1 after burning fuel, throws out heat Q_2 according to II law of thermodynamics, produces electricity N . Material flows: A – water steam, B – water condensate, C – nigh concentration solution, D – work off solution. The points reflect salt part of medium.

Advantage of this technical decision is absence of salt waste. Salt circulates in equipments 1-7-5, separate from water in boiler when boiling, unite in osmos element. High pressure steam without salt move to turbine, water after condencator return in osmos element. High pressure boiler is working in turbine.

Thus heat energy installation act with reduce expenses on own needs [5].

5) Solarosmostical power station.

Division of water and salt may be done by evaporation of water from solution for it works in osmos element. Solar energy is desirable to do it with this target. This

scheme of power station permits to use single loading of salt in the equipment of station. Only permanent water expenditure is needed from external source. Water as steam will go to atmosphere by Sun and wind, not transgression of water balance. Water is carrier of salt, which circulate in station scheme.

Solarostomical power station in plain view is shown on fig. 5. Parts A and B are identical equal equipments, they add and supply each other for variable pulsating working.

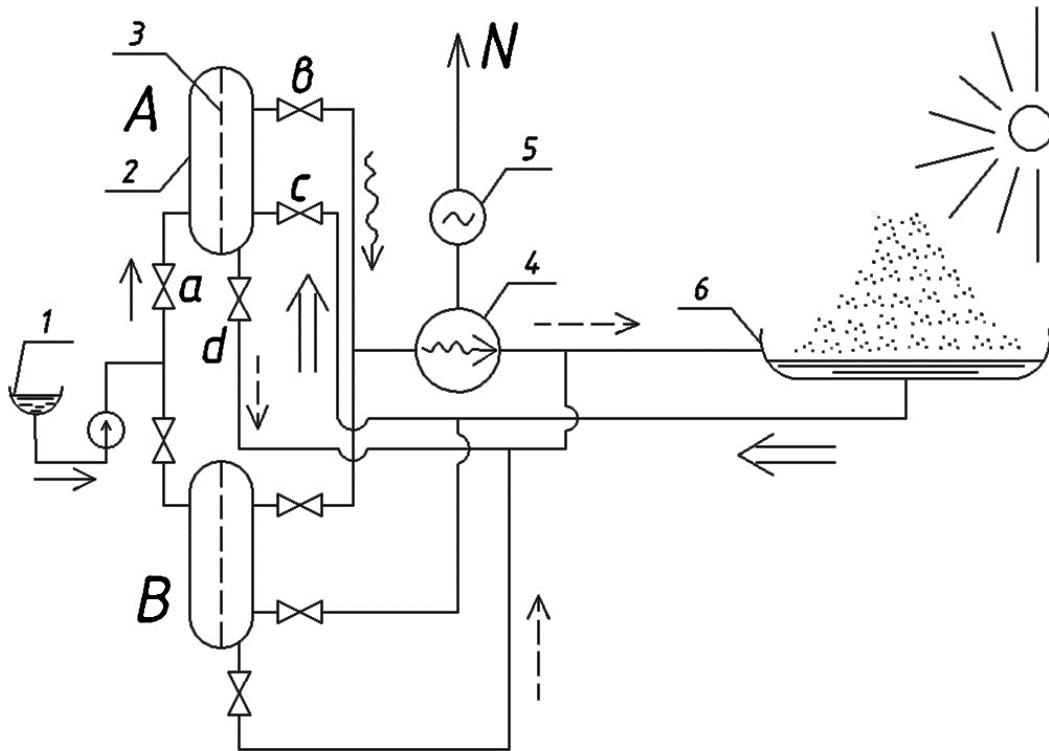


Figure 5 – Solarostomical power station streams: 1 – fresh water container, 2 – capacity, 3 – partial penetrating plate, 4 – engine, 5 – electric generator, 6 – solar evaporator, a – fresh water, b – power substance, c – salt solution, d – pour off, A, B – identical parts of station, N – produced electricity

Water from any source 1 move to capacity 2 with partial penetrating plate 3 (line «a»). Arrived power substance «b» work on engine 4 with electrical generator 5, to obtain energy N. Work off solution after engine 4 goes to solar evaporation 6. Sun acting promotes salt concentration, and nigh concentrator solution is return into capacity 2 (line «c»). Low concentration solution pour off (line «d») from capacity 2 to solar evaporator 6. Hence, part «A» may do periodically, therefore it is necessary second part «B». There is acting so-called «againstphase». «A» and «B» function of energy N is straighten in time.

Phenomenon of compression/expansion of solid body when we have immersement/removal in/out solution with different salt concentration may be used in constructions from long elements under/in two baths. The Mechanical-chemical installation rotates electricity generator. Such installation may be proposed so described above hydroostomical arrangements. The principle of mechanical acting compression/expansion was successful examined on special engines with long bodies [6, 7], when wet/drying was applicated.

Peculiarities of new direction realization. Although osmostical energy method has outstanding advantages and preferences, there are some of difficulties and troubles.

1) Diffusion acting with little stream demand very big surface of crossing, therefore installation gabarits are heap, and inconvenient for small producers, they accommodation is straitened. Design, construction attempt help not enough.

2) Material of porous partions and membrans is very high price and is working out on complicated technology.

3) Capilar cleaning of osmostical elements presents difficult problem, especially for natural river or economical water.

4) Produced diluted brine must be removed out permanently. Therefore, we have complex utilization of waste. It is problem for surrounding environment and ecology country.

5) The energy stream density is not enough yet in known energy osmostical installation.

6) We have not development connection of known energy produced method with osmostical energy manner. It is necessary to use energy of fuel, Sun, water currents, wind into new energy production.

7) Main restraining factor of technical using of this method is absens detailed investigations, experimental technical installations, attention to new energy resources.

Conclusion. Evidently, practical commercial using osmostical energy installations is yet far, but possession by such energy resources as mineral salt and fresh rivers and lakes water suppose the intensive development of new energy branch.

1) It is necessary to investigate not only theoretical properties of salt-water streams in osmos phenomenon, and technical embodiment for power stations.

2) Information about new discriped sources and its technical using must be widen and deepened in order to convince of research workers and political managers to new interest task.

3) Recommended to use in energetics physical process when will be science development may to create new technical direction – «osmostical energetic».

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