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DESIGN TO INCREASE SOLAR COLLECTOR EFFICIENCY BY INCREASING THERMODYNAMIC PERFORMANCE OF HEAT CARRIER

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The energy potential of renewable energy sources in Turkmenistan is estimated at 110 billion tonnes of conventional fuel per year, solar and wind energy are considered to be more efficient. Solar energy is considered to be the largest source of renewable energy. The Earth receives about $3.9 \cdot 10^{24}$ $J = 1.08 \cdot 10^{18}$ kWh of solar radiation per year, which is 10,000 times more than the annual energy demand of mankind and is more than the world's hydrocarbon and nuclear fuel reserves.

The most visible use of solar energy is — water and air heating. There are numerous technical solutions available in hot water supply, heating, water treatment, drying and even cooling of agricultural products by using Solar energy. The most widely uses are hot water for household needs and solar heating installations.

Solar heat systems are heat energy converters in the first phase of solar radiation. Active and passive systems are distinguished within the thermal solar systems. Active heat Solar systems include a variety of solar systems, such as a solar-powered solar collector (collector). Passive elements in themselves envision elements of building construction, such as a window on the south façade or a window shaded with the help of the roof top (roof) of a building during the summer. Solar collectors are considered to be one of the main components of solar heaters. These components include the absorption of solar radiation, its conversion to thermal energy, and the transfer of thermal energy to heat carriers.

There are different types of solar collectors (classes). Depending on the temperature of the collectors, the collectors are divided into low-temperature, medium and high-temperature. In addition, concentrating and non-concentrating collectors are distinguished. The classification of collectors in this textbook is carried out depending on the heat carriers used (liquid or air). Air used as a heat carrier in air collectors and water, non-freezing mixture (for example glycol), as well as special mixtures of salts heated to temperatures above 500°C in the liquid collectors.

Liquid collectors. There are four main types of liquid collectors: flat; with neomirror (absorber); wacuated; concentrating;

Absorber is considered to be the main element of the solar collector, Absorber is mainly made of copper and aluminum, which has a good heat transfer coefficient, and is considered to be corrosion resistant. There are also absorbers made of stainless steel or plastics (for example, polypropylene). In the non-ferrous metals markets, the price of copper is more expensive than aluminum, so the sheets of the absorber are made of aluminum and the tube is made of copper. Such a combination was made possible by the development of ultrasonic welding, which allows the copper to be heated (welded) to aluminum.

Selective Coating is a thin coating (150-200 nm) applied to the absorber and enhances the efficiency of the solar collector. The selective coating is well absorbed by short-wave radiation (i.e., solar radiation), while at the same time having low reflectivity in the infrared spectrum. The main property of selective coating evaluation is the ratio of absorption and reflectance.

$$\mathcal{E} = \alpha/\varepsilon$$

where a – is the absorption or absorption coefficient, which is defined by the absorbed part of the solar radiation falling;

ε – is the reflectance coefficient, which indicates which part of the long-wavelength spectrum is reflected;

Ɛ – The larger the coefficient, the better the selective coating. Many commercial products with $\alpha = 0.95$, $\varepsilon = 0.05$ and Ɛ = 19.

Transparent coating to light. Transparent heat insulation is considered for the solar collector. A special glass with low iron content (high concentration of iron) or a transparent plastic is used as a light transparent coating. The transmission coefficient for the solar collector is calculated as the measure of the transparent coating to light.

The transmission coefficient (τ) is the percentage of Sunlight that passes through this mirror, for example for a special mirror it is 0.97, i.e. the loss is 3% when the beam is reflected and absorbed. The insulated housing (body) serves to connect the main components of the solar collector. The housing is made of aluminum, zinc, iron, synthetic materials or wood. The housing gives the collector mechanical strength.

Insulation for the heat collector is made of standard insulation materials (eg polyurethane, fiberglass, mineral cotton). Their heat transfer coefficient is small. One of the requirements for insulation is temperature stability.

Heat carrier. Water, a mixture of water, antifreeze or a special mixture of salt can be used as a heat carrier for the solar heat collector. The heat carrier must meet the following requirements: The heat capacity coefficient must be high, the coefficient of absorption must be low, it must be harmless, and it must not cause corrosion for the pipelines of the system. To this end, I have undertaken research in this diploma project by designing heat supply through the use of solar collectors in residential buildings. Let's illustrate the scheme of the solar heating system in residential buildings.

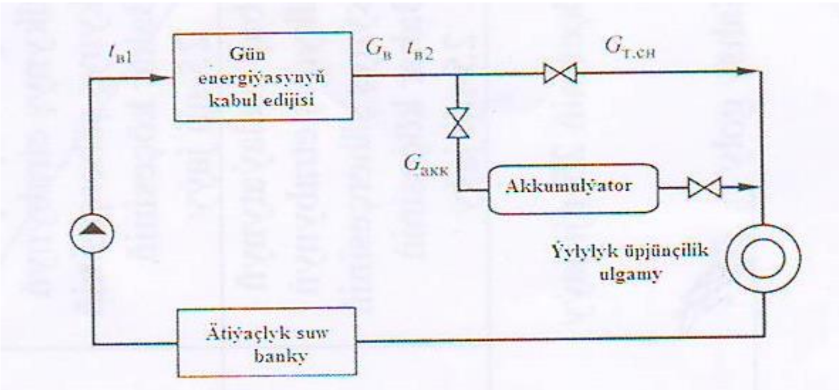

Fig. 1 – Schematic diagram of the solar heating system in residential buildings

The daily heat consumption of the heat supply system is determined by the formula:

$$Q_{day} = 24 \cdot 3600 \cdot Q_{y.uy} = 24 \cdot 3600 \cdot 1 = 86{,}4\ Mj.$$

where 24 is the number of hours of the day;

3600 – seconds in one hour;

Q – The power supply system of the building under consideration.

The equilibrium heat balance of the solar energy receiver can be written as follows:

$$Q_{day} = Q_{rec}$$

From this equation, it is possible to determine the surface area of the flux-shaped F solar plate receiver: $24 \cdot Q\ y.uy = E \cdot \eta_{rec} \cdot F \cdot \tau_{illum.}$

The amount of water consumed by the solar energy receiver is determined:

$$24 \cdot Q_{\ y.uy} / E \cdot \eta_{rec} \cdot F \cdot \tau_{illum} = 24 \cdot 1 \cdot 10^3 / 550 \cdot 0{,}8 \cdot 5 = 24/2{,}2 = 10{,}9\ m^2$$

The amount of water consumed by the solar energy receiver is determined:

$$G_s=\frac{Qday}{Cp*(ts2-ts1)*\text{Ţ}ill*3600}=\frac{24*Q\text{ý}.u\text{ý}}{Cp*(ts2-ts1)*\text{Ţ}illum}=\frac{24*1*10}{4{,}19*(45-32)*5}=0{,}088kg/sec$$

where C_p is the heat capacity of the water C_p=4,19kJ/kg*K

t_{s1} t_{s2} – the initial and final temperatures of the working body (water).

$$G_s=\frac{Qsut}{Cp*(ts2-ts1)*\text{Ţ}illum.*3600}=\frac{86{,}4*10}{41900*13*5*3600}=\frac{86{,}4}{980{,}5}=0{,}088kg/sec$$

Water consumption to the building's heat supply system is calculated according to the following formula:

$$G_{\text{ý}.u\text{ý}}=\frac{Q\text{ý}.u\text{ý}}{Cp*(ts2-ts1)}=\frac{1}{4{,}19*(45-32)}=0{,}018kg/sec$$

The water consumption of the accumulative heat energy accumulator is determined:

$$G_{akk}=G_s-G_{\text{ý}.u\text{ý}}=0{,}088-0{,}018=0{,}07kg/sec$$

The capacity of the battery can be determined by the following formula:

$$V=G_{akk}*\text{Ţ}\text{ý}ag\frac{1}{\rho}=0{,}07*5*3600*\frac{1}{1000}=1{,}26m^3=1260$$

Where p = 1000 kg/m^3

Conclusion: We can see the heat energy supplied to the heat supply system at the expense of solar collectors. 115 1 hot water per person per day is consumed. Q = 407 watts of energy is consumed. If we get 994kW of energy from the heat of the smoke and the energy we use from the solar collector, it saves 1155107.0 m^3 / h in 1 year.

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РАСЧЕТ СОПРОТИВЛЕНИЯ СРЕЗУ ЖЕЛЕЗОБЕТОННЫХ БАЛОК С ЭФФЕКТИВНО РАСПОЛОЖЕННЫМ АРМИРОВАНИЕМ

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Применение в балках перевода (отгиба) части продольной предварительно напрягаемой арматуры из нижней зоны в пролете, в верхнюю на опорах способствует значительному повышению трещиностойкости наклонных сечений при существенном снижении количества поперечного армирования приопорных зон, а в ряде случаев позволяет и вовсе отказаться в конструкциях от поперечного армирования. При использовании отгибаемой предварительно напряженной арматуры создаются благоприятные условия для экономии бетона за счет уменьшение толщины стенки и сокращения веса конструкции за счет придания им целесообразных форм. При применении конструкций с ломанным нижним поясом возникает возможность при прямолинейном армировании добиться тех же преимуществ, что при использовании отогнутой арматуры. Однако, как показывают результаты исследований [1, 2, 3], роль предварительно напряженных отгибов канатов в оценке сопротивления действию внешних усилий имеет неоднозначность и даже определённую противоречивость.

Концепция классической модели ферменной аналогии впервые была предложена в начале XX века инженерами W. Ritter [4] и E. Mörsch [5], которая в первом