German utility model no. DE202023101153U1

Heat and Power Generation Utilizing Ambient Temperature

Description

The Brownian ("molecular") motion refers to the thermal movement of small particles in liquids and gases. However, in this context, it is not about small particles but the movement of gases at the molecular level.

Gas molecules move at speeds of hundreds of meters per second, depending on the temperature, and even at ambient temperature, they contain a large amount of energy. The molecules of a gas have different speeds, and the speed distribution is temperature-dependent. However, the "gas particles" travel only very short distances in a straight path as they constantly collide with each other. The mean free path of gas particles is in the order of 10^-7m (i.e., 10^-4mm, about the thickness of a simple gold leaf). Each gas molecule collides with another "gas particle" approximately 10^10 times per second. See also DE202021101169U1.

The covalent radius of, for example, nitrogen (symbol N in the periodic table) is 71pm, N2 is about 142pm, and the heat capacity is 1040 J·kg−1·K−1 at 298 K. For a liquid such as water, the oxygen-hydrogen distance (O-H) is about 96pm. With an angle of about 104 degrees between the two oxygen-hydrogen bonds, the distance between the two hydrogen atoms is about 152pm, while the heat capacity is 75.37 J·mol−1·K−1, corresponding to 4180 J·kg−1·K−1 at 293.15 K, which is very high. The sizes of the aforementioned molecules are thus comparable.

Regarding the fundamentals of energy: there is only energy and its interactions, no mass, no matter. Depending on the varying strength of the interactions between the smallest units of energy (e.g., strings), there is a "time mix" at this level, which appears as uncertainty from the outside. Fluctuations of (anti-) energy in additional interconnected dimensions—especially in a vacuum—falsely appear as if "(anti-) particles" spontaneously emerge. Through these additional, "smallest" and interconnected dimensions, tunneling currents and entanglements of energy can also be explained.

The vast majority of locally confined energy consists of objects with extremely high energy in a very small space, of which only a tiny fraction is known. Under the above assumption, the non-locally confined "vacuum energy" accounts for the known effects on a universal scale. Likewise, gravitation (see below) is a form of energy interaction. Moreover, energy interactions also explain the "space-time" description. Part of the aforementioned energy forms and interactions is used by the invention.

It is known that natural and synthetic zeolites can absorb water, generating heat/adsorption heat. For example, zeolite/a substance from the zeolite group is used in thermal storage heaters and thus serves as an energy storage medium. Similarly, gases such as nitrogen can release part of their energy to the (also constructed) environment, similar to the adsorption heat generated by water/moisture in zeolites.

My invention is based on the further development of devices for heat generation for day and night:

There are some solutions related to the invention, such as:
- DE000019811302C2, zeolites as central heating,
- EP000001239240B1, zeolites and high temperatures,
- US020190001311A1, 3D framework for methanol conversion,
- US020210048232A1, zeolites in connection with a heat pump,
- EP000000924838A1, a normal-sized single-phase generator,
- EP000003247034A1, an electrostatic induction generator,
- DE202021101169U1, power from ambient heat: other approaches include:

1. M. Josefsson et al. (2018) developed a prototype of a thermoelectric nanogenerator with a quantum dot, thus creating a thermoelectric heat engine. In this, electrons are exchanged between the two heat reservoirs, driven by a thermal potential. In their microscopically small structure, two delicate wires served as heat reservoirs with different temperatures. Between them, they positioned a tiny structure of nanowires made of indium arsenide and indium phosphide.

2. Inventions with carbon nanotubes (CNT) already exist, which conduct electricity much better than a copper wire. For example, CNTs and liquid plastic (also for clothing) are cast

into thin layers and then connected in series with alternating polarity so that electricity is generated from body heat.

The following approaches are particularly interesting in this context:

1. Thin layers of copper iodide have thermoelectric properties that are about a thousand times better than previously known comparable materials. This makes copper iodide an outstanding multifunctional material: transparent, semiconducting, or highly conductive, thermoelectrically active, and suitable for invisible energy generation, such as from body heat (C. Yang et al., 2017).

2. Nanomaterials convert heat into electricity by suppressing long-wavelength emission and increasing the efficiency of thermophotovoltaic energy conversion (P. Dyachenko et al., 2016).

The existing solutions fulfill their function according to the circumstances (or are still in development) but do not have the possibilities of the above-mentioned invention.

A universally installable solution is desired. The invention specified in Claim 1 for heat and power generation using ambient temperature and thereby converting the kinetic energy of gas molecules meets these requirements.

An Example Embodiment:

Fine gaps, for example, with a width of 10^-4mm (0.1µm corresponding to 100 nm, about the thickness of a simple gold leaf), separated by fine plates 1 / flat "capillaries" / thinnest partitions, which can also be thicker for stability, possibly with applied "spacers" 2 (or integrated elevations and possibly depressions), in combination with significantly larger "tubes" 3 or wider layers for heat dissipation by a liquid (e.g., water with glycol/propylene glycol) or gas, are (according to Claim 2) the basis of the invention (Fig. 1).

As shown in Claim 3, the interior of the device is a sealed "cleanroom area." The finest passages are thus completely separated from the environment. Nitrogen serves here (according to Claim 4) as an example working medium and is thus a heat carrier/heat transport medium. Through the constant collisions of nitrogen molecules with the partitions 1 and possibly "spacers" 2, the nitrogen becomes colder, and the partitions and ultimately the heat-dissipating liquid (or gas) become hotter.

As shown in Claim 5, at least one "air-to-air heat exchanger" or air-to-gas heat exchanger 5 is necessary for the entire device: ambient air to "working gas" nitrogen. The energy of the heat-dissipating liquid (or gas) can be dissipated via metal fins or directed to a second heat exchanger 6.

Continuously or at intervals, the nitrogen (or another gas) cooled by collisions with the fine plates (very closely spaced plates with good thermal conductivity, such as metals like copper or silver and without or with the already mentioned smallest "spacers," which consist of the same or another material) can be regularly pushed out or replaced from the "reaction layers" (according to Claim 6).

As shown in Claim 7, with good thermal conductivity of the finest plates/films, the "tubes" / layers for heat dissipation can also be further away or even on the surface of a "stack" (several series-connected units/cells).

The working medium (here nitrogen) thus circulates (Fig. 2). It is heated (according to Claim 8) by the ambient air in a heat exchanger 5, pumped or pushed into and out of the finest gaps/layers 4, or rises or follows gravity (depending on environmental variables) and is returned to the heat exchanger 5 after cooling, closing this cycle.

As shown in Claim 9, the heated liquid or gas is pumped, for example, to "cooling fins" (similar to a refrigerator) or to a second heat exchanger 6 or follows gravity, cools there, and is then returned, so that this cycle also closes.

Various smallest chambers/depressions/recesses can also be constructed (according to Claim 10) in the finest partitions/films, which are possibly optimized for the gases used to gain as much adsorption heat as possible. If chambers or similar are made, construction principles of chip manufacturing can also be used.

As shown in Claim 11, the narrowest passages or narrow points are also conceivable (possibly additionally). Depending on the size/shape of the gas molecules, the finest gaps and other components must be optimized. Additionally, many short gap planes can be constructed on top of each other.

The heat-dissipating liquid/gas pathways/layers/tubes/lines can (according to Claim 12) have different geometric shapes and also be constructed, for example, across the finest gaps/layers or partitions/films.

As shown in Claim 13, various manufacturing methods for the finest partitions/layers/plates/"capillaries"/stacks are conceivable: Simply stack the finest plates/films with the smallest "spacers" (integrated elevations and/or depressions from the material of the films or an alternative) on top of each other and optimized lines/tubes, etc., are worked in or placed outside a unit/cell, and additionally, a frame around it, which spans and stabilizes the finest plates/films.

If the finest plates/films are too thin for special requirements, they can be made somewhat thicker for increased

stability. The gaps/spaces remain extremely narrow due to the "spacers"/integrated elevations or constructionally conditioned.

If films with the smallest "spacers" are used, they can also be wound up.

Similar to chip manufacturing techniques, the finest structures can also be produced.

Finest plates/films can possibly be sprayed with spacers on a rotating roll. Moreover, for possible reaction chambers, they can be chemically processed, for example.

Finest plates, "micro rods/small tubes" are cast around and then removed or dissolved.

Finest structures are made from a "piece" or additionally with lasers.

Finest plates/films can have one- or two-sided depressions/elevations/chambers (by supplementing with other materials, lasers/etching chemicals, etc.). Alternating smallest depressions and associated smallest elevations on the other side of the finest partitions/films lead to double-sided "spacers."

If the adsorption heat is too low for the requirements, many units/cells can be connected in series to a stack (according to Claim 14).

See also DE202023100127U1: as shown in Claim 15, heat storage is possible following heat generation. These would include latent heat storage/phase change storage. Heat storage can be equipped with various materials (water, gravel, earth, steel, stone, lava rock, concrete, (liquid) salt, etc.) or also be designed as latent heat storage/chemical storage (e.g., sodium acetate, calcium hydroxide - calcium oxide).

According to Claim 16, solar collectors and other heat sources, such as waste heat from industry, very cold air, the earth, etc., can also be used for preheating or instead of ambient air.

The modules are— as shown in Claim 17— arbitrarily scalable. Thus, all sizes are possible, from local heating (small heating, room or apartment heating, central heating) to industrial installations.

To generate electricity, a temperature difference is usually required. As mentioned earlier, ambient air at, for example, 10° Celsius (283.15 Kelvin) has an often underestimated energy content and is available without limits.

The generation of a temperature difference by the invention can thus be used in many ways for power generation (according to Claim 18).

Such heat generation and, if necessary, power generation is possible around the clock and is thus independent of the time of day and season. Solar cells/solar collectors/photovoltaics and wind power plants are sustainable and regenerative but not always productive. The goal is decentralized heat and power generation that has no disruptive infrastructure, requires no large new buildings, is hardly vulnerable to hackers, and causes low environmental impact.

Instead of extremely complex fusion or other large power plants, local alternatives should be used. There are many other reasons why locally generated energy is better than large power plants. See also DE202023100127U1.

References

P. Dyachenko et al.: Controlling thermal emission with refractory epsilon near-zero metamaterials via topological transitions, Nat. Commun., online June 6, 2016; DOI: 10.1038/ncomms11809.

M. Josefsson et al.: A quantum-dot heat engine operating close to the thermodynamic efficiency limits, Nat. Nanotechnol., online July 16, 2018; DOI: 10.1038/s41565-018-0200-5.

C. Yang et al.: Transparent Flexible Thermoelectric Material Based on Non-toxic Earth-Abundant p-Type Copper Iodide Thin Film, Nat. Commun. 8, 16076 (2017); DOI: 10.1038/ncomms16076.

List of Reference Signs

1. Partitions
2. Spacers
3. Tubes for heat transfer
4. Central heat exchanger
5. Ambient air heat exchanger
6. Heating heat exchanger

Claims

1. Heat and power generation utilizing ambient temperature, characterized in that adsorption heat is generated through the movement of gas molecules on constructed, directly adjacent structures.

2. Heat and power generation utilizing ambient temperature, according to claim 1, characterized in that fine gaps, for example, with a width of 0.1µm, separated by fine plates/flat "capillaries"/thinnest partitions/films, possibly including applied "spacers"/integrated elevations, are constructed together with significantly larger "tubes" or wider layers with a liquid (e.g., water with glycol/propylene glycol) or gas.

3. Heat and power generation utilizing ambient temperature, according to one of the preceding claims, characterized in that the interior of the device is a sealed "cleanroom area."

4. Heat and power generation utilizing ambient temperature, according to one of the preceding claims, characterized in that nitrogen or another gas is the working medium/heat carrier/heat transport medium.

5. Heat and power generation utilizing ambient temperature, according to one of the preceding claims, characterized in that at least one "air-to-air heat exchanger" or air-to-gas heat exchanger is installed in the device. Additionally, metal fins/cooling fins/a second heat exchanger/heat transfer unit is installed in the construction.

6. Heat and power generation utilizing ambient temperature, according to one of the preceding claims, characterized in that the working medium/heat carrier/heat transport medium is continuously or intermittently directed between the finest partitions/films with good thermal conductivity (e.g., metals like copper or silver).

7. Heat and power generation utilizing ambient temperature, according to one of the preceding claims, characterized in that, with good thermal conductivity of the finest plates/films, the "tubes"/layers for heat dissipation are further away or even on the surface of a "stack" (several series-connected units/cells).

8. Heat and power generation utilizing ambient temperature, according to one of the preceding claims, characterized in that the working medium/heat carrier/heat transport medium is heated by the ambient air in a heat exchanger, pumped or pushed into and out of the finest gaps/layers, or rises or follows gravity (depending on environmental variables) and is returned to the heat exchanger after cooling, closing this cycle.

9. Heat and power generation utilizing ambient temperature, according to one of the preceding claims, characterized in that the heated liquid or gas is pumped to "cooling fins" (similar to a refrigerator) or to a second heat exchanger or follows gravity, cools there, and is then returned, so that this cycle also closes.

10. Heat and power generation utilizing ambient temperature, according to one of the preceding claims, characterized in that the finest chambers/depressions/recesses are additionally created in the finest partitions/films. Construction principles of chip manufacturing can also be used here.

11. Heat and power generation using ambient temperature, according to one of the preceding claims,
characterized in that (possibly additionally) very narrow passages or constrictions are also constructed. Depending on the size/shape of the gas molecules, the finest gaps and other components are optimized. Additionally, many short gap planes/plates can be constructed on top of each other.

12. Heat and power generation using ambient temperature, according to one of the preceding claims,
characterized in that the heat-dissipating liquid (e.g., water with glycol/propylene glycol) or gas paths/layers/tubes/pipes have various geometric shapes and can also be constructed, for example, perpendicular to the finest gaps/layers.

13. Heat and power generation using ambient temperature, according to one of the preceding claims,
characterized in that various manufacturing processes for the finest partitions/layers/films/plates/"capillaries"/stacks are conceivable:

Simply stack the finest plates/films with the smallest "spacers" (incorporated elevations and depressions of the partition or additionally applied from the same or another material) on top of each other and integrate pipes/tubes, etc., or place them outside a unit/cell and additionally a frame around it that stretches and stabilizes the finest plates/films.

The finest partitions/plates/films can be made thicker for stability. For films with the smallest "spacers," these can also be wound up. Similar to chip manufacturing techniques, the finest structures can also be produced.

Finest plates/films can possibly be sprayed onto a rotating roller with placeholders. Additionally, these can be chemically processed for reaction chambers, for example.

Finest plates, micro rods/small tubes are cast around and then removed or dissolved.

The finest structures are produced from a "piece" or additionally with lasers.

Finest partitions/plates/films can have depressions/elevations/chambers on one or both sides (by adding other materials, laser/etching chemicals, etc.). Alternating smallest depressions and associated smallest elevations on the other side of the finest partitions lead to bilateral "spacers."

14. Heat and power generation using ambient temperature, according to one of the preceding claims,
characterized in that many units/cells are connected in series to form a stack.

15. Heat and power generation using ambient temperature, according to one of the preceding claims,
characterized in that following the heat generation, a heat storage is constructed. These include, among others, latent heat storage/phase change storage. Heat storage can be equipped with various materials (water, gravel, earth, steel, stone, lava rock, concrete, (liquid) salt, etc.) or also designed as latent heat storage/chemical storage (e.g., sodium acetate, calcium hydroxide - calcium oxide).

16. Heat and power generation using ambient temperature, according to one of the preceding claims,
characterized in that solar collectors and other heat sources, such as waste heat, among others, from industry, very cold air, the ground, etc., are used for preheating or instead of ambient air.

17. Heat and power generation using ambient temperature, according to one of the preceding claims,
characterized in that the device/modules are scalable as desired, for example, constructed as local heaters (small heaters, room or apartment heaters, central heating) up to installations of large plants.

18. Heat and power generation using ambient temperature, according to one of the preceding claims,
characterized in that the generated temperature difference is combined and used in constructions with various power generators.

Fig. 1

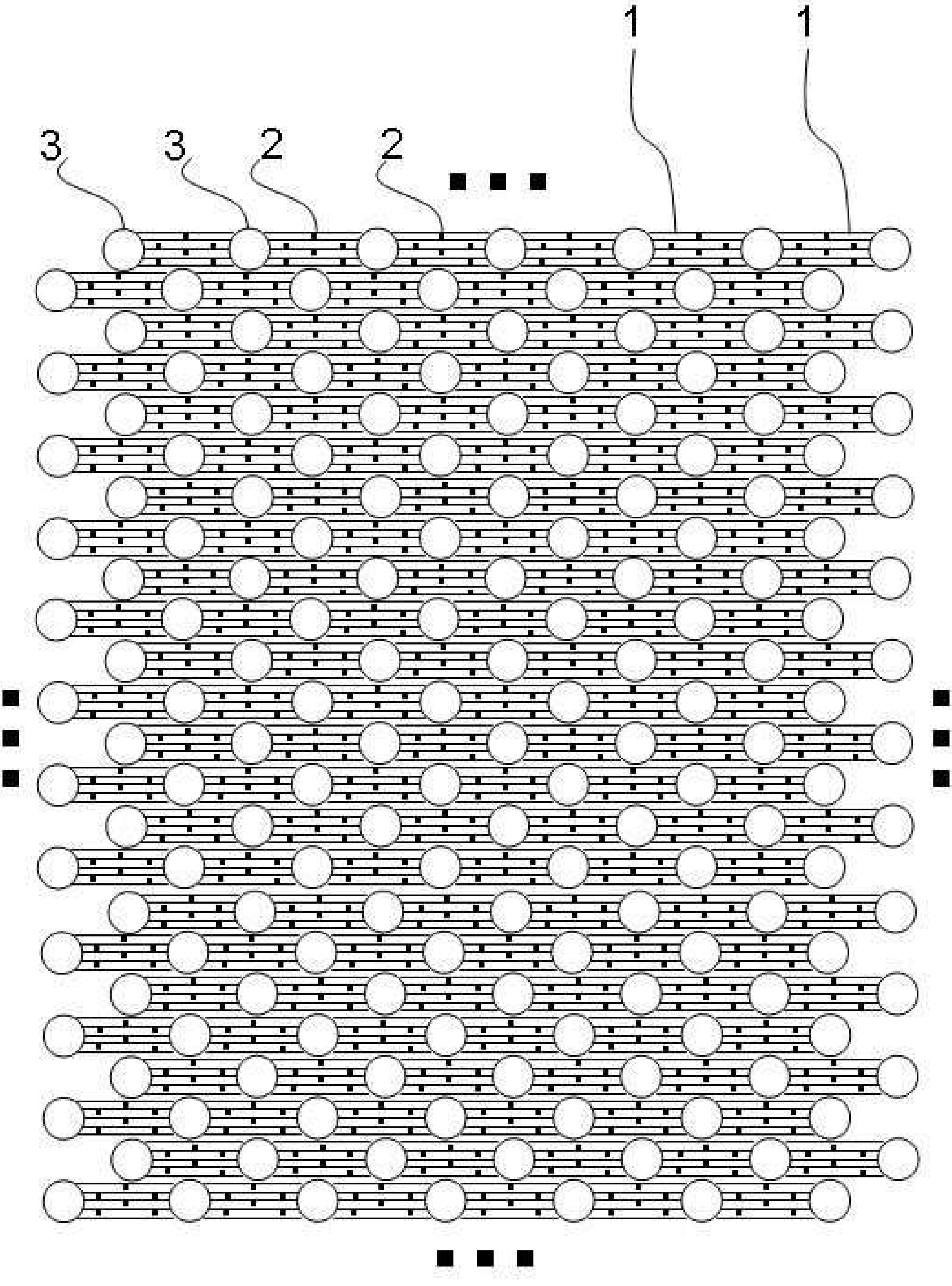

Fig. 2