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(54) **Title:** FEEDBACK SYSTEM FOR THE GENERATION AND RECIRCULATION OF ENERGY

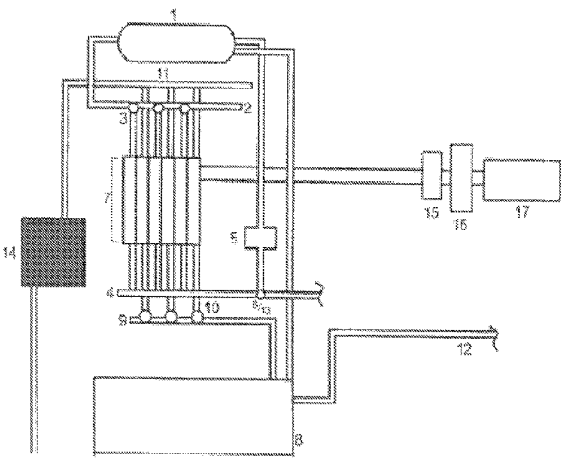

FIG. 1

(57) **Abstract:** A system for the generation and recirculation of feedback energy comprises a first portion comprising a first circuit for the recirculation of a high temperature fluid, a second portion comprising a second circuit for the circulation of a low temperature fluid, a third portion comprising a panel adapted to alternately receive the fluids coming from the first and second circuit. The panel comprises a plurality of hollow profiles in reciprocal thermal contact and configured as Peltier cells, the hollow profiles being fluidically connected to a respective circuit for receiving the respective fluid and housing within them respective electric generators suitable for transferring the electric current produced by Seebeck effect to a downstream load.

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FEEDBACK SYSTEM FOR THE GENERATION AND RECIRCULATION OF ENERGY

Description

Technical Field

The present invention finds application in the technical sector of systems for the production of energy and particularly relates to a system for the generation and recirculation of energy which integrates within it a thermodynamic plant suitable for the production of both electrical energy and thermal energy having the purpose of increasing energy efficiency, decreasing energy losses and increasing the times of use, making them independent of external environmental climatic conditions.

State of the art

Many types of systems for the generation or cogeneration of energy are known, which differ either in the source of energy used or in the means used to transform the energy. Regardless of these differences, the known methods of energy production are generally limited by having relatively low productivity and very often not continuous over time and energy yields that are not high or in any case not optimal, above all due to load dispersions and to the various forms of energy dispersion related to the movements of the several components that make up the system.

Therefore, the need is felt for a new energy generation system suitable for generating electrical and/or thermal energy for an infinite time limit and self-powering, in an eco-sustainable way to have a very low environmental impact.

Scope of the invention

The object of the present invention is to overcome the above drawbacks by providing a system for the generation and recirculation of energy which is characterized by high efficiency and productivity.

Still another object is to provide a system for the generation and recirculation of energy which is characterized by reduced energy dispersions and therefore high yields.

Yet another object is to provide a system for the generation and recirculation of energy which is not sensitively conditioned by atmospheric conditions.

Yet another object is to provide a system for the generation and recirculation of energy which allows to supply both electrical and thermal energy.

These objects, as well as others which will become more apparent hereinafter, are obtained by means of a system for the generation and recirculation of feedback energy in accordance with claim 1, to which reference is made for a more concise description. Advantageous embodiments of the invention are obtained according to the dependent claims.

Brief disclosure of the drawings

Further features and advantages of the invention will become more apparent in the light of the detailed description of a preferred but not exclusive embodiment of the system according to the invention, shown by way of a non-limiting example with the aid of the attached drawing table wherein:

FIG 1 shows a making-of diagram of the system.

Best mode of carrying out the invention

The system according to the present invention essentially consists of a first portion comprising a first circuit wherein a high temperature fluid circulates, a second portion comprising a second circuit wherein a low temperature fluid circulates, a third heat exchange portion wherein there is cogeneration of energy, a fourth portion for the generation of thermoelectric energy and finally a fifth portion which encloses the electrical part of the system, i.e. the portion designed to use the produced energy.

The first portion of the system essentially consists of a solar thermal system with distribution of the hot fluid and is provided with a boiler **1** associated with a solar thermal panel to provide the first energy production, i.e. thermal energy.

The fluid inside the boiler **1** is heated by thermal solar panels which have the task of raising its temperature due to the effect of solar radiation in accordance with the Stefan-Boltzmann law.

The heated fluid is sent to a first supply bar **2** of the high temperature fluid which in turn sends it inside a thermoelectric panel **7**, which represents the third of the aforementioned portions that make up the system and which will be described with more detail here below.

The first supply bar **2** is provided with valves or solenoid valves **3** whose task is to regulate the flow and pressures of the fluid which will be introduced into the thermoelectric panel **7**.

A plurality of flexible pipes, preferably made of iron, puts the first supply bar **2** in fluid communication with the thermoelectric panel 7.

In particular, the flexible pipes are connected via threads both to the first supply bar **2** and to corresponding introduction ducts connected, preferably by welding, both to the related flexible pipes and to the single galvanized profiles which form the body of the thermoelectric panel 7.

The hot fluid coming from boiler **1** and the low temperature fluid coming from the second portion of the system will have to flow alternately inside the relative galvanized profiles.

In the present text, the terms low temperature and high temperature must not be understood as absolute but relative, i.e. by low temperature fluid we mean the fluid having the lowest temperature while by high temperature fluid we mean the fluid having the highest temperature.

The fluids used will preferably be water, in particular water taken from the water mains, even if from a theoretical point of view it is also possible to use different fluids.

The second portion of the system, i.e. the one designed for the circulation of the fluid at low temperature, provides for the presence of one or more collection tanks **8**, the capacity of which is very important for the proper functioning of the thermodynamic system.

The circulation of the low temperature fluid towards the thermoelectric panel 7 will be delegated to one or more submersible pumps which send the low temperature fluid to a second supply bar **9** of the low temperature fluid and from this into the thermoelectric panel 7.

The second supply bar **9** is also provided with valves or solenoid valves **10** whose task will be to regulate the flow and pressures of the fluid which will be introduced into the thermoelectric panel 7 by means of small flexible iron pipes, connected by threads both to the second supply bar **9** and to the introduction ducts welded to the relative and individual galvanized profiles which form the body of the thermoelectric panel 7.

The third portion of the system according to the present invention constitutes its heart and provides for the presence of the above thermoelectric panel 7.

The thermoelectric panel 7 is essentially formed by a plurality of galvanized profiles in which the high-temperature fluid and the low-temperature fluid alternately flow.

In particular, in a preferred manner, the number of profiles in which the high temperature fluid flows will be in an odd number, while the number of profiles in which the low temperature fluid will flow will be in an even number.

A thermal carrier is applied to all the internal faces of the profiles, preferably selected from among thermal paste, PAD (thermally conductive pad) and high thermal conductivity tape.

The heat generators are positioned in the cavity that is created between all the surfaces of the profiles placed parallel to each other.

Thermogenerators are essentially Peltier cells, with small heat pumps formed by N-type and P-type doped semiconductors connected to each other by a conductive plate, usually made of copper, to exploit the Peltier effect.

They are positioned as follows inside the thermoelectric panel 7: considering that fluids will flow inside the profiles at different temperatures, the thermogenerators will be positioned according to the type of temperature reached by the two surfaces during their normal operation (Peltier effect), i.e. the part of the surface that heats up will be placed parallel to the surface of the profile where the fluid flows at high temperature, and the part of the surface that cools down will be placed parallel to the surface of the profile where the low temperature fluid flows.

Preferably, the body of the thermoelectric panel 7, made up of galvanized profiles and heat generators placed in the respective cavities, will be fitted onto a surface made up of an OSB panel, on which the profiles with the heat generators will be blocked by means of a vice formed by two pieces of wood placed laterally in close contact with the outer surfaces of the first profile and the last profile.

In this way, the two pieces of wood that act as blocks exert pressure on the entire assembly of profiles, making them compact and firm. The preferred but not exclusive choice of this method and the way in which the thermogenerators are placed with the relative system which keeps them compact with the profiles, makes it easier and quicker to maintain or replace the thermogenerators in the event of breakdowns.

In fact, it will be sufficient to replace the thermogenerators by removing them from the body of the thermoelectric panel 7 and then reinserting the new thermogenerator, avoiding technical or other problems.

The high temperature fluid coming from the first supply bar **2** will be fed into the galvanized panels through the introduction ducts which allow it to enter (the delivery) and exit (the return).

Once the high-temperature fluid has exited the galvanized profiles, it will enter a first collection bar **4** for the high-temperature fluid. Once it has reached the first collection bar **4**, the fluid has two possibilities to continue its flow within the water circuits:

if the water circuit which carries the heated fluid to the conduit **12** for the user is closed, then the fluid, through a suitable conduit, will return to the starting point and therefore will discharge the fluid inside the boiler **1** thanks to a circulator **5** placed immediately after the bifurcation of the conduit **12**, which will repeat the delivery and return cycle;

if, on the other hand, the water circuit that carries the hot fluid to the conduit **12** for the user is open, the fluid will come out of the appropriate taps or outlets, such as sinks, double services, showers and the like, and the flow rate of the high-temperature fluid flowing inside the thermoelectric panel **7** will reduce its value.

The opening and closing of the conduit **12** will be determined by the action of a special solenoid valve **6** located on one of the two vertices of the first collection bar **4**.

In the same way, the low temperature fluid will be sent from the second supply bar **9** into the respective galvanized profiles through the relative introduction ducts, which allow the entry (delivery) and the exit (return) of the low temperature fluid.

Once the fluid has exited the appropriate galvanized profiles, it is introduced into a second collection bar **11** for the low temperature fluid.

Once it has reached the second collection bar **11**, the low temperature fluid has two possibilities to continue its flow inside the water circuits:

if the water circuit that carries the cold fluid to the conduit **12** for the user is closed, then the fluid will return through a special conduit inside one or more tanks **8** using the same pressure set by the immersion pump;

if, on the other hand, the water circuit that carries the cold fluid to the conduit **12** for the user is open, the fluid will come out of the appropriate taps or outlets, such as sinks, double services, showers and the like, and the flow rate of the low-temperature fluid flowing inside the thermoelectric panel **7** will reduce its value.

Before discharging into the tanks **8**, the low-temperature fluid will enter a radiator **14**, which has the task of making the low-temperature fluid dissipate as much as possible the heat accumulated due to the heat exchange for the production of the electricity inside the thermoelectric panel 7.

Also in this case there will be a solenoid valve **13** to determine the opening and closing of the delivery conduit **12** of the low temperature fluid.

It is observed that, both in the case of the high temperature fluid and for the low temperature one, the flow rate of the fluids introduced inside the thermoelectric panel **7** is irrelevant.

In fact, the thermoelectric panel **7** only takes into account the temperatures of the fluids, neglecting their flow speed, pressure and flow rate itself.

The power needed to be used by the circulator **5** for the high temperature fluid and the power used by the immersion pump for the low temperature fluid depends respectively on the distance between the thermal solar panel and the thermoelectric panel **7** and between the collection tank **8** and the thermoelectric panel 7.

The sum of the powers used for the two devices will have its incidence on the total efficiency of the thermoelectric panel 7.

The second energy production, i.e. electricity, takes place through the thermoelectric panel 7.

This second energy is produced by not changing the intrinsic properties of the material that generates it, i.e. the fluid, i.e. temperature, quantity of matter, pressure and volume.

Seebeck's principle is used to generate the second energy.

The high temperature fluid and the low temperature fluid flow alternately inside the galvanized profiles.

The temperature variation between one profile and another through the thermogenerators (Peltier cells) produces thermoelectric induction (Seebeck effect).

The various fluids, once out of the thermoelectric panel **7** and having reached their collection bars **4, 11**, with the respective delivery conduits **12** closed, return respectively to the boiler **1** and to the collection tanks **8**.

The peculiarity of this thermodynamic cycle is given by the fact that the operating time tends to infinity, because the value of the electromotive force generated with thermoelectric induction is closely linked to the jump in the temperature gradient.

The two temperatures never reach thermal equilibrium because, due to the conservation of energy, the fluid at high temperature remains constant thanks also to the Boltzmann relation which, through radiation, keeps the fluid at constant temperature.

For the low-temperature fluid, on the other hand, it must be considered that the water at room temperature arrives in the tanks **8** daily and is therefore from time to time cooled in a natural way.

The cooling of the cold fluid is linked both to the size of the tanks **8**, for which the proportionality index is valid, i.e. the larger it is and the longer it will take to reach thermal equilibrium, and also by the fact that the fluid leaving the panel thermoelectric **7** passes inside the radiator/dissipator **14**, releasing the heat acquired during the heat exchange which took place during the production of electricity.

The energy produced by the thermoelectric panel **7** is proportional to the temperature difference and also to the number of thermogenerators used.

In fact, even the variation of the thermal flow, once the optimal temperatures have been reached, where the thermal difference between one and the other is very large, and the speed of motion of the thermal conductivity is neglected, over time can generate an electric field induced.

We therefore speak of thermoelectric induction, in which the electric voltage and the temperature are intimately connected, they are proportional in nature, as is the proportional electromotive force generated.

It is then observed that in a thermodynamic system it is possible to have a cycle of continuity for an infinite time without changing the intrinsic properties of matter such as mass, volume, pressure and temperature.

Even if there are heat exchanges inside the thermoelectric panel **7**, in the end the temperature will always remain constant for the entire time of the production of both energy, thermal and electric.

The fifth part of the system is the one assigned to the exploitation of electricity.

The thermogenerators/Peltier cells are connected to each other according to the two series/parallel electrical diagrams, in order to have the right balance of power understood as the product between voltage (V) and current (A).

From the overall connections, the current will flow from two cables, i.e. the positive (+) and the negative (-), initially connected to an MPPT **15**, i.e. a charge regulator whose task is to stabilize the current and voltage and make the Peltier cells at the maximum possible power.

After the work performed by the charge regulator **15**, the electrical energy is accumulated inside one or more accumulators or batteries **16**.

The voltage coming out of the thermoelectric panel 7 must always be greater than that of the accumulators **16**, however in a contained manner, i.e. by a few more Volts, in order not to run into technical problems such as their fusion.

Finally, there is an inverter **17** which has the task of bringing the input voltage (low voltage) into an output voltage (high voltage), with a generally range of 12V/220V-24V/220V.

Claims

1. A feedback system for the generation and recirculation of energy, comprising:

- a first portion comprising a first circuit for the recirculation of a high temperature fluid;
- a second portion comprising a second circuit for the circulation of a low temperature fluid;
- a third portion comprising a panel (**7**) adapted to alternatively receive the fluids coming from said first and second circuits;

characterized in that said panel (**7**) comprises a plurality of hollow profiles in mutual thermal contact and designed as Peltier cells, said hollow profiles being fluidically connected to a respective one of said first and second circuit to receive the respective fluid and housing thereinside respective electric generators designed to transfer the electric current produced by Seebeck effect to a load located downstream.

2. System as claimed in claim 1, characterized in that said first circuit comprises a solar thermal plant with one or more solar panels associated with at least one boiler (**2**) for heating the respective fluid.

3. System as claimed in claim 2, characterized by the fact that said first circuit comprises a first supply bar (**2**) of the high temperature fluid adapted to place in fluidic connection said at least one boiler (**1**) with the respective hollow profiles of said panel (**7**), said first supply bar (**2**) being provided with valves (**3**) for regulating the flow at each of said hollow profiles in fluidic connection therewith.

4. System as claimed in claim 2 or 3, characterized in that said first circuit comprises a first collection bar (**4**) for the high temperature fluid leaving said panel (**7**), said first collection bar (**4**) being provided downstream with a conduit (**12**) for delivering the high temperature fluid to one or more external users, said delivery conduit (**12**) being provided with a solenoid valve (**6**) for the opening/closing thereof.

5. System as claimed in any preceding claim, characterized in that said second circuit comprises one or more collection tanks (**8**) for the low-temperature fluid provided with means for circulating the fluid towards a second supply bar (**9**) for the low temperature fluid adapted to put in fluidic connection said one or more tanks (**8**) with the respective hollow profiles of said panel (**7**), said second supply bar (**9**) being provided with valves

(10) for regulating the flow at each of said hollow profiles in fluidic connection therewith.

6. System as claimed in claim 5, characterized in that said second circuit comprises a second collection bar **(11)** for the low temperature fluid leaving said panel (7), said second collection bar **(11)** being provided downstream with a conduit **(12)** for delivering the low temperature fluid to one or more external users, said delivery conduit **(12)** being provided with a solenoid valve **(13)** for the opening/closing thereof.

7. System as claimed in any preceding claim, characterized in that said hollow profiles are made of a respective thermally conductive material and are placed in mutual thermal connection by respective thermal carriers, selected from the group comprising thermal paste, thermally conductive pad, high thermal conductivity tape.

8. System as claimed in any preceding claim, characterized in that said panel (7) comprises a support plane on which said hollow profiles are fixed by means of a clamp adapted to allow the extraction thereof in a direction transverse to the clamping direction.

9. System as claimed in any preceding claim, characterized in that said Peltier cells are connected to each other in series or parallel and are electrically connected at the output to a charge regulator **(15)** adapted to stabilize the current and voltage thereof.

10. System as claimed in claim 9, characterized by the fact that said charge regulator **(15)** is connected to one or more accumulators **(16)**, an inverter **(17)** being also provided to bring the voltage from an input low voltage value to a high voltage output value.

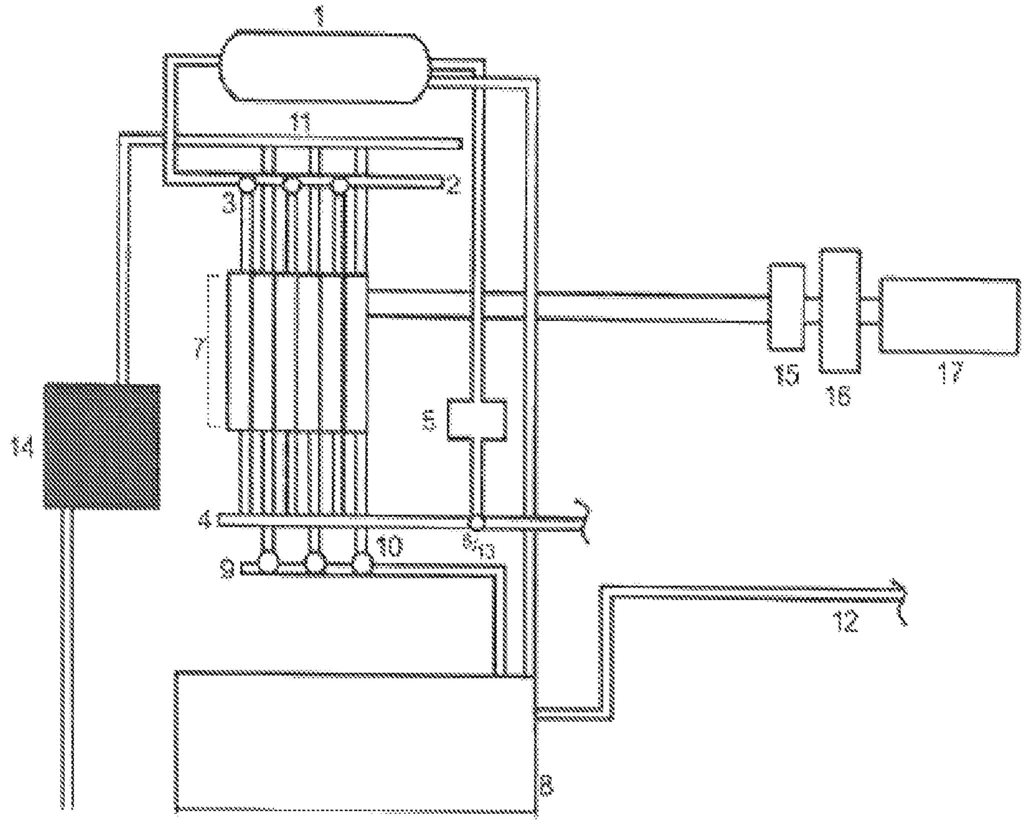

FIG. 1

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
INV. H10N10/17 H02J3/38
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H02J H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2010/101621 A1 (XU JUN [US]) 29 April 2010 (2010-04-29) figures 1,2 -----	2-6,10

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2023/050585

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2023/050585

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