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(54) Designation: Solar collector for the generation of heat and electrical energy

(57) Main claim: solar collector which has:

- A flow chamber (1) with a flow chamber wall

(2) for containing a fluid absorbent medium

(3); and

- a fluid absorbing medium (3) for conversion

solar radiation energy into heat energy, the absorption germs

(4) comprises, where

the fluid absorbent medium (3) at least 90% of

radiant energy transmitted through the flow chamber wall (2).

absorbed and at the same time for heat transport

is movable in and out of the chamber (1),

wherein the flow chamber wall (2) on the fluid

absorbent medium (3) facing inside a

Coating with a semiconductor material having

absorbing material (5) for converting radiant energy

into electrical energy, wherein a

Boundary layer between the flow chamber wall (2) and

the absorbent material (5) is formed,

characterized in that the flow chamber wall

(2) both on the outside and on the inside of a

a solar radiation source facing chamber wall side

has a reflection-reducing profile (10), wherein

the absorbent material (5) conforming to the profile

(10) of the flow chamber wall (2) is adapted and a

Structure of the flow chamber wall (2) depicts.

**description**

0001
The invention relates to a solar collector according

the preamble of claim 1. A

such a solar collector is known from JP H10-205889 A

known. A similar solar collector also shows

DE 200 06 579 U1.

0002
From the prior art is a variety

various solar collectors, often also solar collectors

called, known. Central part

of all systems is a solar absorber that

absorbs light energy from the sun and converts it into heat.

The solar absorber is often in good shape

of a solid realized with a thermally insulated,

flow body through which a fluid flows

is in contact. In dependency of

A distinction is made between the insulation technology used

Flat-plate collectors that have a solid insulating material

use evacuated tube collectors, where

the insulation is achieved with the help of a vacuum,

Flat-plate vacuum collectors, characterized by a flat

design and thus an improved gross-net

Distinguish area ratio and also vacuum-insulated

are, and single absorbers, which are common

consist only of a plastic body and

have no additional thermal insulation. the

most advanced currently available on the market

Collectors typically have a

Efficiency between 60 and 75%.

0003
Based on the above classification

the present invention thus relates specifically to

Further development of a solar collector, which after

works according to the flat-plate collector principle. At the out

the prior art known flat-plate collectors

the solar radiation falls on a solar absorber,

which is preferably selected such that it

in the entire spectral range of the incident light

absorbing effect. Heated as a result of solar absorption

itself the absorber. So that the thereby freed

Heat is not lost is the solar absorber

thermally insulated from all sides, with thermal insulation

at least on the side of the absorber that

facing the sun is transparent.

This is often realized with the help of a glass cover,

where for thermal insulation between the absorber

and the glass cover a gas or vacuum layer

is provided. On the other hand it can

the heat that occurs due to the intrinsic temperature of the

Absorbers radiated from this again by emission

largely through the pane of glass itself

be restrained as glass due to its wavelength selective

transparency for longer wavelengths,

such as thermal radiation, not completely

is transparent. The thermal insulation of the glass pane

can, moreover, with the help of suitable coatings

improved on the inside of the glass pane

will.

0004

The heated absorber transfers the heat

on copper or aluminum pipes permanently connected to it

or a fluid medium contained therein,

often called heat transfer fluid. With help

of the fluid medium, the amount of heat absorbed

moved from the solar collector and with help

of a heat exchanger can be made usable.

[0005]

Often these consist of solar panels

used solar absorbers made of absorber sheets

made of aluminum or copper. In doing so, as a rule

light absorption with the help of a selective coating

additionally supported. The heat transfer

from the absorber sheets to the fluid absorber medium

takes place by means of heat conduction between

the absorber sheets and those directly connected to them

in thermal contact tubes, through

which the fluid medium is passed.

0006

It can thus be seen that from the

State-of-the-art systems at least

two heat transfers are necessary until the won

Heat has been harnessed. the

first heat transfer takes place between the absorber material

or the absorber sheets and the absorber liquid

inside the solar collector

and the second heat transfer via a heat exchanger

between the absorber fluid and a

heat consumers.

0007

DE 200 06 579 U1 discloses a solar collector

the one due to high scattering losses

low efficiency in the conversion of solar energy

into electrical and/or thermal energy.

0008

It is therefore the object of the invention to provide a

Solar collector of the type described above such

further develop that he both in terms of

Extraction of heat energy as well as regarding

the generation of electrical energy from solar energy

is optimized.

[0009]

This task is accomplished by a solar collector

solved with the features of claim 1. the

dependent claims relate to advantageous ones respectively

embodiment of the invention.

0010

The solar collector according to the invention comes

without the use of metallic heat conductors

i.e. not a solar absorber in the classic sense.

Rather, the fluid medium itself serves to absorb solar radiation

and heat conversion as well

for heat transport, which makes it in its

Function significantly different from the known systems

differs.

0011

The flow chamber wall should, as well

in the collectors known from the prior art,

to a high degree thermally insulating

be designed to be released into the environment

continued to keep heat quantity low and thus a

to enable the highest possible heat yield.

The fluid medium can be water, a water-propylene glycol

Mixture, a synthetic or organic

Oil, such as silicone oil, or a saline solution

have or on one of these or more

substances are based.

0012

To increase the absorbency of the

Fluid medium is intended that this absorption germs

has, such as soot particles, inorganic

and/or organic dyes, thixotropic agents,

monocrystalline, polycrystalline or

amorphous silicon, gallium arsenide (GaAs), cadmium telluride

(CdTe) or a mixture of these.

0013

The flow chamber wall has at the

the side facing the absorbent medium

absorbing material for converting radiant energy

into electrical energy. At this

The material is one that has been tried and tested in photovoltaics

Semiconductor material such as CdTe, GaAs, or

silicon-based thin-film or thick-film cells.

Preferably, the absorbent material is

through a protective layer of the absorbent

Medium separated to avoid unwanted interaction

both substances with each other and with it

the deterioration of one or both materials

avoid. The protective layer particularly preferably contains

a proven metal oxide in solar technology.

0014

The solar collector, the absorbing

Material for converting radiant energy into

has electrical energy, characterized

from that not in the absorbent material

absorbed radiant energy to the fluid absorbing

medium is passed on. This is on

Easiest to achieve by being absorbent

Material on the inside of that chamber wall

is arranged facing the sun

is such that the incident light is in the direction of propagation

hits the absorbent material first

and thus that which is not absorbed and not reflected there

Light and any heat energy that may be produced

delivered directly to the fluid absorbent medium

can become.

[0015]

For further optimization, the flow chamber

at least at one of the radiation sources

facing chamber wall side a reflection-reducing

profile on. This is in the simplest case

a roughened chamber wall surface, for example

an etched glass surface. However, there are also

all profiles suitable that cause a

Most of the on the corresponding chamber wall

light reflected for the first time in one direction

will be in it at least one more time

meets a profile element of the same surface. the

Optimization of the light coupling follows in the course

of multiple reflections. Especially preferred

is the reflection-reducing profile made of a heat-insulating

and transmission enhancing material

manufactured. For this it is convenient that it is porous

is or a variety of evacuated or gas-filled

has cavities.

0016

The chamber wall of the invention

Solar collector exhibits both on the outside as

also on the inside of the solar radiation source

facing chamber wall side a reflection-reducing

profile on. It is envisaged that

also one on the inside of the flow chamber wall

attached absorbent material for conversion

from radiant energy to electrical energy

has an anti-reflective profile. For regulation

of radiation passage to the absorbing

Medium can be provided that the

absorbing material for converting radiant energy

into electrical energy recesses

having.

0017

To avoid laminar flow within

the flow chamber responsible for heat transfer

or heat coupling into the fluid

Medium is less suitable, a preferred looks

Embodiment of the invention that the flow chamber

Includes lead structures. Particularly

the conductive structures are preferably arranged in such a way

that they direct the fluid flow to that of the radiation source

inhibit chamber wall side facing away and thus

on the side of the chamber wall facing the radiation source

a comparatively higher fluid flow rate

enable. The expert

immediately recognizes that such an arrangement

on the one hand for a largely turbulent flow

within the flow chamber and on the other hand

ensures that in the areas of

flow chamber or those medium layers

in which there is increased radiation absorption due to the system

takes place, a higher fluid flow rate

and thus a higher exchange rate

of the absorbing medium is present.

0018

Collectors according to the invention can be

compared to those known from the prior art

produce more efficiently and economically, since

they essentially consist of just one or two

Components that are, for example, in conventional

Have injection molding systems manufactured. Also

the realization of the absorption medium is as described,

already with the help of the simplest substances,

such as water or oils, possible for the purpose of

Optimization of absorption capacity with absorption seeds

are offset, provided they are not above themselves

have sufficient absorbency.

0019

The manufacturing process of the solar panels is

in terms of shape and color design

almost infinitely variable. So can numerous

and a wide variety of materials used

be brought to the design of the solar collectors

also with reference to the preferred manufacturing process

as well as the color and shape of the design

make freely selectable. For example

Elastomers, thermoplastics, duromers as well

Foam this, as well as compact materials for

are brought into use, which make the production of flexible,

i.e. H. non-destructive freely deformable solar collectors

allow any coloring.

0020

The solar collectors can thus in one

inexpensive mass production methods, such as that

Injection moulding, foil stamping or the RIM casting process

using only a small amount of raw materials

getting produced. Because on the use of metallic

absorber sheets can be dispensed with

allows the present invention to the

Use of expensive and heavy metallic materials

be avoided or at least drastically reduced.

[0021]

Due to the high degree of freedom in the choice

the shaping process and the choice of materials

can the collector from the design and from the efficiency

be designed optimally. The best possible

Utilization of the solar radiation is thereby in

Essentially only about the optimal configuration

of the three principles of action: absorption, transmission

and reflection of the collector.

0022

Further details of the invention are given in

the drawing based on shown schematically

embodiments described.

0023

Here shows:

1 shows a solar collector not according to the invention

in cross-section perpendicular to the direction of fluid flow;

Fig. 2 the solar collector of Fig. 1, the addition

an absorbent material for recovery

has electrical energy;

3 shows a solar collector not according to the invention

in cross-section parallel to the fluid flow direction,

with a profiled flow chamber wall;

and

4 shows a solar collector according to the invention

with a flow chamber wall profiled on both sides

and absorbent material for

Conversion of radiant energy into electrical

Energy.

0024

Figure 1 shows one not according to the invention

Solar collector with a flow chamber 1, the one

Flow chamber wall 2 has and a fluid

absorbing medium 3 for the conversion of solar

includes radiant energy in thermal energy.

The solar collector is shown in cross section, where

the fluid flow direction perpendicular to the plane of the drawing

runs. The drawn arrows symbolize

the interaction of the solar radiation with

the solar collector. The solar radiation becomes

part reflected on the surface of the flow chamber 1,

absorbed in the chamber wall 2, through this

transmitted into the fluid medium 3 and absorbed there.

In the illustrated embodiment

the absorption rate of the fluid medium 3 is chosen such that

that it is more than 90% with respect to

the incoming radiation.

0025

The materials of the flow chamber 1 are

due to high transmission and low absorption

in terms of solar radiation

and also have a good

thermal insulation. Through the to a large extent in

the fluid medium 3 taking place absorption of

Solar energy reduces the number of heat transfer

and heat transfer compared to conventional ones

thermal solar collectors.

0026

2 shows a solar collector according to FIG

Fig. 1, which is additionally attached to the fluid medium 3

surface facing the sun

Flow chamber wall 2 with a coating

an absorbent material 5 for conversion

solar radiation energy into electrical energy.

In the illustrated embodiment

following interactions of the incident

solar radiation with the solar collector. On

Part of the incoming radiation will turn on

reflected from the surface of the flow chamber 1,

one part absorbed and one part into the absorbent

Material 5 transmitted. Another part is at the

Boundary layer between chamber wall 2 and the absorbent

Material 5 reflected. That portion

of the incoming solar radiation, which is not in the

absorbing material 5 converted into electrical energy

is transmitted into the fluid medium 3

or reflected. The transmitted portion is

the fluid medium 3 largely completely absorbed.

The absorbed in the absorbent material 5

Energy is converted directly into electrical energy.

The percentage of the absorbing

Material 5 absorbed energy that is not directly in

electrical energy can be converted

delivered to the fluid medium 3 in the form of heat.

To avoid interactions between

the fluid medium 3 and the absorbent

Material 5 is the absorbent material 5 with

a protective layer 6 is provided.

0027

3 shows an embodiment option

the sun-facing flow chamber wall surface

to maximize the rate of absorption of the

incident radiant energy and to increase

of thermal insulation and heat transfer.

The flow chamber 1 shown is for reduction

of reflections as a beam trap with a profile

10 provided. The proportion of reflected radiation

can thus be reduced. the incident radiation,

which is not immediately transmitted or absorbed

is reflected several times within the profile,

resulting in increased transmission. the

heat generated on the absorbing material 5,

which is not transmitted is caused by a high

relative flow rate near the absorbing

Material 5 by means of thermal conduction in the

fluid medium 3 transferred. This effect is through

specially shaped conductive structures 11 achieved. cavities

in the profile 10, which is evacuated or filled with a gas

can be, serve for better thermal insulation,

to increase the torsional rigidity and

to maximize the transmission rate.

0028

In the illustrated in Fig. 4 according to the invention

Solar collector points facing the sun

Flow chamber wall 2 in further development

the embodiment of FIG. 3 also

its surface facing the fluid medium 3

also a profile 10 on. At the one shown

Embodiment is the absorbent material

5 for converting radiant energy into electrical

Energy conformal to the profile of the flow chamber wall

2 adapted and forms a corresponding

structure. To increase the transmission rate

of the incident solar radiation in the fluid

Medium 3 is the absorbent material 5 with

Recesses 12 provided.

**patent claims**

1. Solar collector that has:

- A flow chamber (1) with a flow chamber wall

(2) for containing a fluid absorbent

media (3); and

- a fluid absorbing medium (3) for conversion

solar radiation energy into thermal energy,

having the absorption nuclei (4), wherein

the fluid absorbent medium (3) at least 90%

transmitted through the flow chamber wall (2).

Radiant energy absorbed and at the same time for

the heat transport out of the chamber (1) and

is movable in

wherein the flow chamber wall (2) at the dem

fluid absorbing medium (3) facing inside

a coating with a semiconductor material

having absorbent material (5)

to convert radiant energy into electrical energy

Has energy, with a boundary layer between

the flow chamber wall (2) and the absorbent

Material (5) is formed,

characterized in that the flow chamber wall

(2) both on the outside and on

the inside of a solar radiation source

facing chamber wall side a reflection-reducing

Profile (10), wherein the absorbent

Material (5) conforming to the profile (10) of the flow chamber wall

(2) is customized and a structure

of the flow chamber wall (2).

2. Solar collector according to claim 1, characterized in that

that the fluid absorbent medium

(3) at least one of water, oil and saline

includes.

3. Solar collector according to claim 1, characterized in that

that the absorption nuclei (4) at least

any of carbon black particles, dyes, thixotropic agents,

monocrystalline silicon, polycrystalline

silicon, amorphous silicon, GaAs and CeTd

include.

4. Solar collector according to any of the preceding

Claims, characterized in that the

absorbent material (5) through a protective layer

(6) separated from the absorbent medium (3).

is.

5. Solar collector according to claim 4, characterized in that

that the protective layer (6) is a metal oxide

contains.

6. Solar collector according to any of the preceding

Claims, characterized in that the

Flow chamber (1) has thermal insulation.

7. Solar collector according to claim 1, characterized in that

that the profile (10) from a thermally insulating

and the transmission of solar radiation

increasing material is made.

8. Solar collector according to claim 7, characterized in that

that the heat-insulating and the

Transmission of solar radiation increasing material

is porous or a variety of evacuated or gas-filled

has cavities.

9. Solar collector according to any of the preceding

Claims, characterized in that

the flow chamber (1) encloses guide structures (11).

10. Solar collector according to claim 9, characterized

characterized in that the conductive structures (11) den

Fluid flow at the remote from the radiation source

Inhibit chamber wall side and thus on the

the side of the chamber wall facing the radiation source

a comparatively higher fluid flow rate

present.

11. Solar collector according to claim 1, characterized in that

that the absorbent material (5)

to increase the radiation transmission to the fluid

absorbent medium (3) recesses (12)

having.

4 pages of drawings follow