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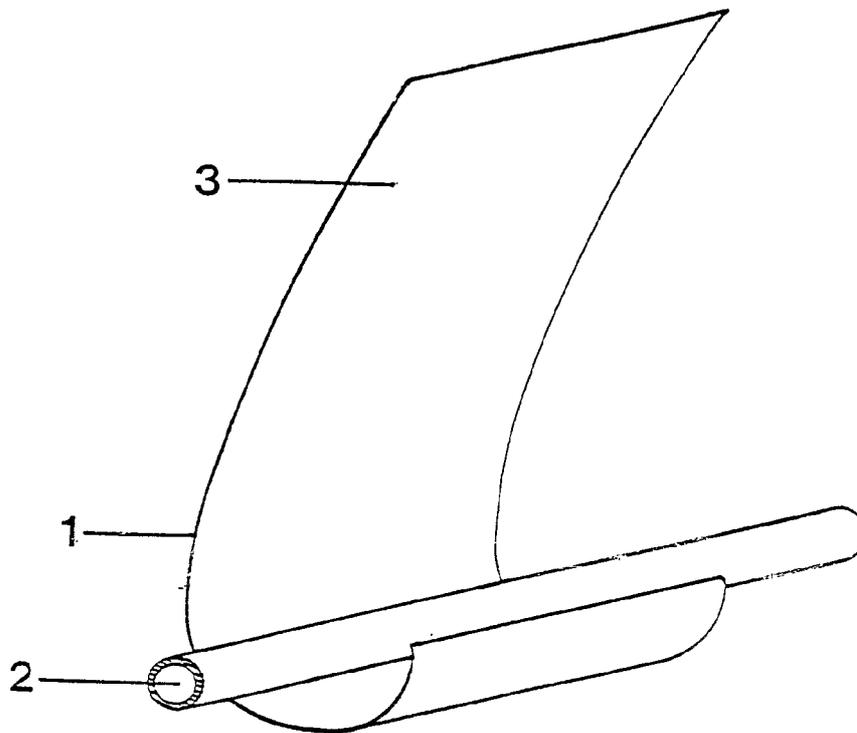
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(54) **Title:** A HYPERBOLICAL CONCENTRATION SUN MIRROR DEVICE



(57) **Abstract:** The hyperbolic concentration sun mirror device (1) according to the present invention, allows to intercept, without pursuit, the sun radiation at whatever height the sun may be, and to concentrate it onto the end part of said spiral so as to reduce dispersion to a minimum, and heat up - at any hour of the day - a linear absorber (2) placed in the focus (F) thereof.

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A HYPERBOLICAL CONCENTRATION SUN MIRROR DEVICE

The present invention concerns a new hyperbolic concentration sun mirror device.

At present, many devices are known making use of solar energy for high temperature heat, like tower systems with a central receiver and linear or punctual parabolic concentration systems.

The main negativity and the relative limit of above mentioned devices concerns the need of pursuing the sun by using parabolic mirrors rotating around an axis.

It is the aim of the present invention to avoid all structural complications bound to pursuing sun radiation, together with a relative rationalizing of the systems.

Curves and spirals are known, more complex than the parabolic ones, in particular logarithmic curves based on the Fibonacci sequence, and hyperbolic curves.

The aim set forth is reached by means of a plane mirror device with a hyperbolic spiral or reciprocal spiral section, which is a transcendent curve, inverse to the Archimedes spiral, and whose polar coordinates expression is

$$r\theta = a$$

wherein "a" is a positive number.

By applying the following transformation to the formula in polar coordinates:

$$x = r \cos \theta \quad y = r \sin \theta,$$

the parametric representation in Cartesian coordinates is obtained:

$$x = a \cos t/t \quad y = a \sin t/t,$$

wherein "t" is the equivalent to the polar coordinates θ .

The spiral has an asymptote $y = a$; for t tending to 0, the ordinate tends to a, while the abscissa tends to infinity.

The realization of a plane sun mirror according to said spiral allows to intercept, without pursuit, the sun radiation at whatever height the sun may be, and to concentrate it onto the end part of said spiral so as to reduce dispersion to a minimum, and heat up - at any hour of the day - a linear absorber placed in the focus thereof.

The advantages of the device according to the present invention are evident.

The present invention will be described more in detail hereinbelow relating to the enclosed drawings in which an embodiment is shown.

Figure 1 shows an axonometric view of a hyperbolic concentration sun mirror device, according to the present invention.

Figure 2 shows a lateral scheme of the functioning of the device according to the present invention.

Figure 3 shows the scheme of a possible primary circuit.

According to the present invention sun rays R, incident onto plane plate 1, are reflected - according to the first Snell Rule - at an angle equal to the incident angle and concentrated onto an absorber 2 placed in the focus F of the hyperbolic structure, in which a heat-leading fluid will be thus heated.

According to a possible exemplification, the device according to the present invention is realized with a mirror plate calendered according to the hyperbolic curve and stiffened by reinforcing structures 3 at its edges.

It is evident that in each practical realization, the inclination is calculated according to the height of the sun at the installation latitude, and to the optical "run" of the incident rays at the different sun hours is shown in figure 2.

Inside the circuit according to figure 3 a fluid flows for accumulating the thermic energy concentrated on said absorber 2, from sun mirror 1, while said circuit comprises:

- a reservoir 4 for the accumulation of said fluid;

- a pump 5 for the circulation of said fluid, controlled by a thermic probe 6 place on said reservoir 4, in turn being connected to a consensus thermic probe 7, place at the outlet of said absorber 2;
- a safety thermostat 8 place on said absorber 2, determining the operating of a means for blocking the radiation of said absorber in case of damage or bad working;
- a hydropneumatic accumulator 9, placed on said accumulation reservoir 4, for maintaining the pressure of the fluid, balancing possible volumetric variations caused by temperature variations;
- a secondary circuit, connected to said reservoir 4, for a plurality of devices for the exploitation of the accumulated thermic energy.

Possible applications of the hyperbolic concentration sun mirror device according to the present invention allow:

- the production of sanitary warm water;
- the production of warm water for heating systems;
- the production of electric energy;
- the realization of solar cooling systems;
- the realization of desalinization systems;
- the realization of saunas etc.

CLAIMS

1. A hyperbolic concentration sun mirror device for intercepting the sun radiation without pursuing it, at whatever height of the sun, and for concentrate it onto the end part of the spiral so as to reduce dispersion to a minimum, *characterized in* a plane mirror plate (1) with a hyperbolic spiral or reciprocal spiral section, on which incident sun rays (R) are reflected - according to the first Snell Rule - at an angle equal to the incident angle and concentrated onto an absorber (2) placed in the focus (F) of the hyperbolic structure, in which a heat-leading fluid will be thus heated.

2. A device according to claim 1, *characterized in* a mirror plate calendered according to the hyperbolic curve and stiffened by reinforcement structures (3) at the edges thereof.

3. A device according to claim 1, *characterized in* a realization inclination calculated according to the height of the sun at the installation latitude.

4. A device according to claim 1, comprising a circuit for the flow of said fluid for the accumulation of the thermic energy concentrated onto said absorber (2) from said sun mirror (1), *characterized in:*

- a reservoir (4) for the accumulation of said fluid;

- a pump (5) for the circulation of said fluid, controlled by a thermic probe (6) placed on said reservoir (4), in turn being connected to a consensus thermic probe (7), placed at the outlet of said absorber (2);
- a safety thermostat (8) placed on said absorber (2), determining the operating of a means for blocking the radiation of said absorber in case of damage or bad working;
- a hydropneumatic accumulator (9), placed on said accumulation reservoir (4), for maintaining the pressure of the fluid, balancing possible volumetric variations caused by temperature variations;
- a secondary circuit, connected to said reservoir (4), for a plurality of devices for the exploitation of the accumulated thermic energy.

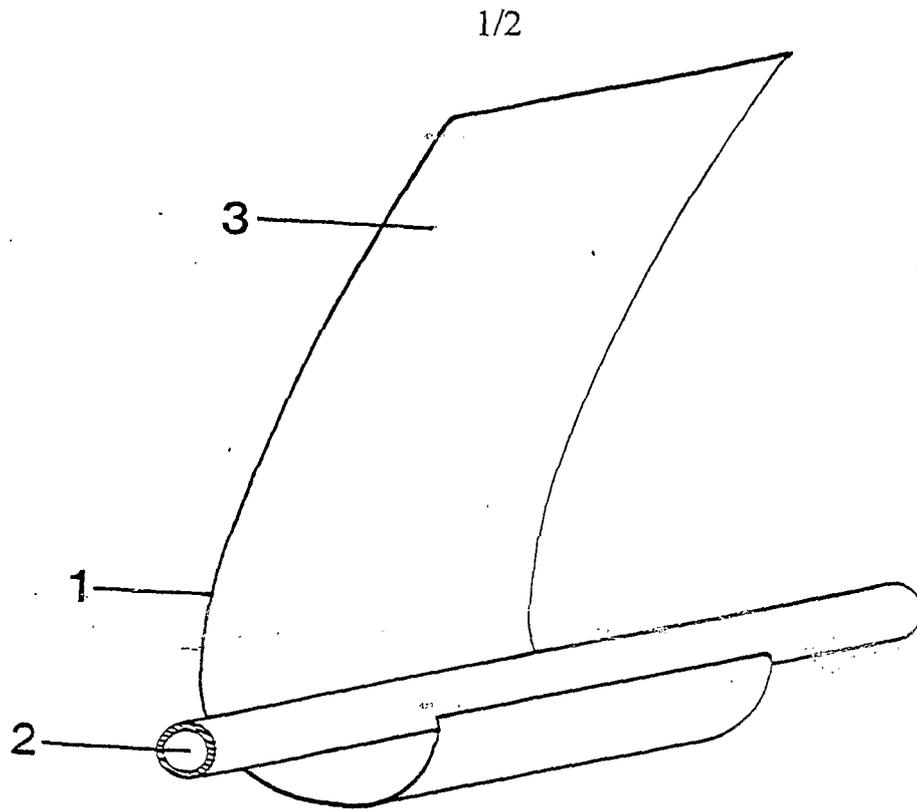


FIG. 1

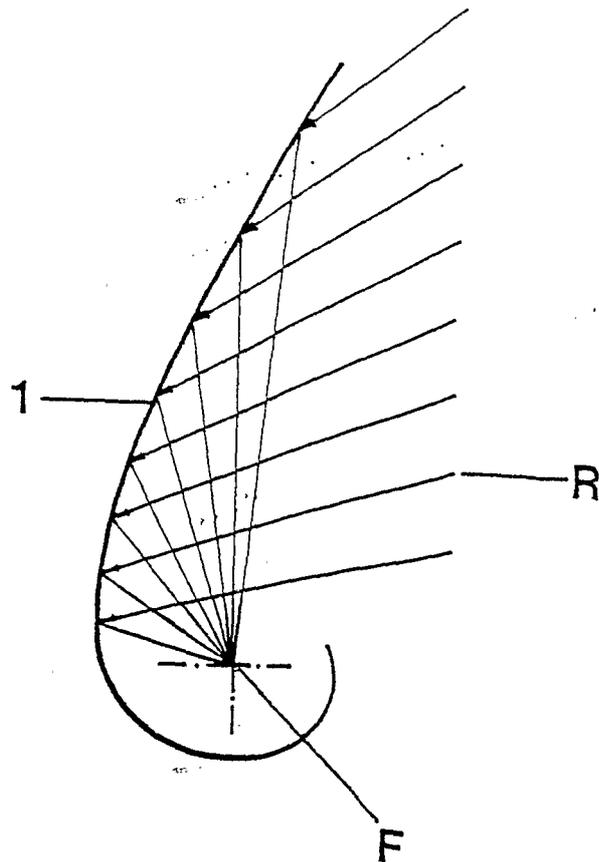


FIG. 2

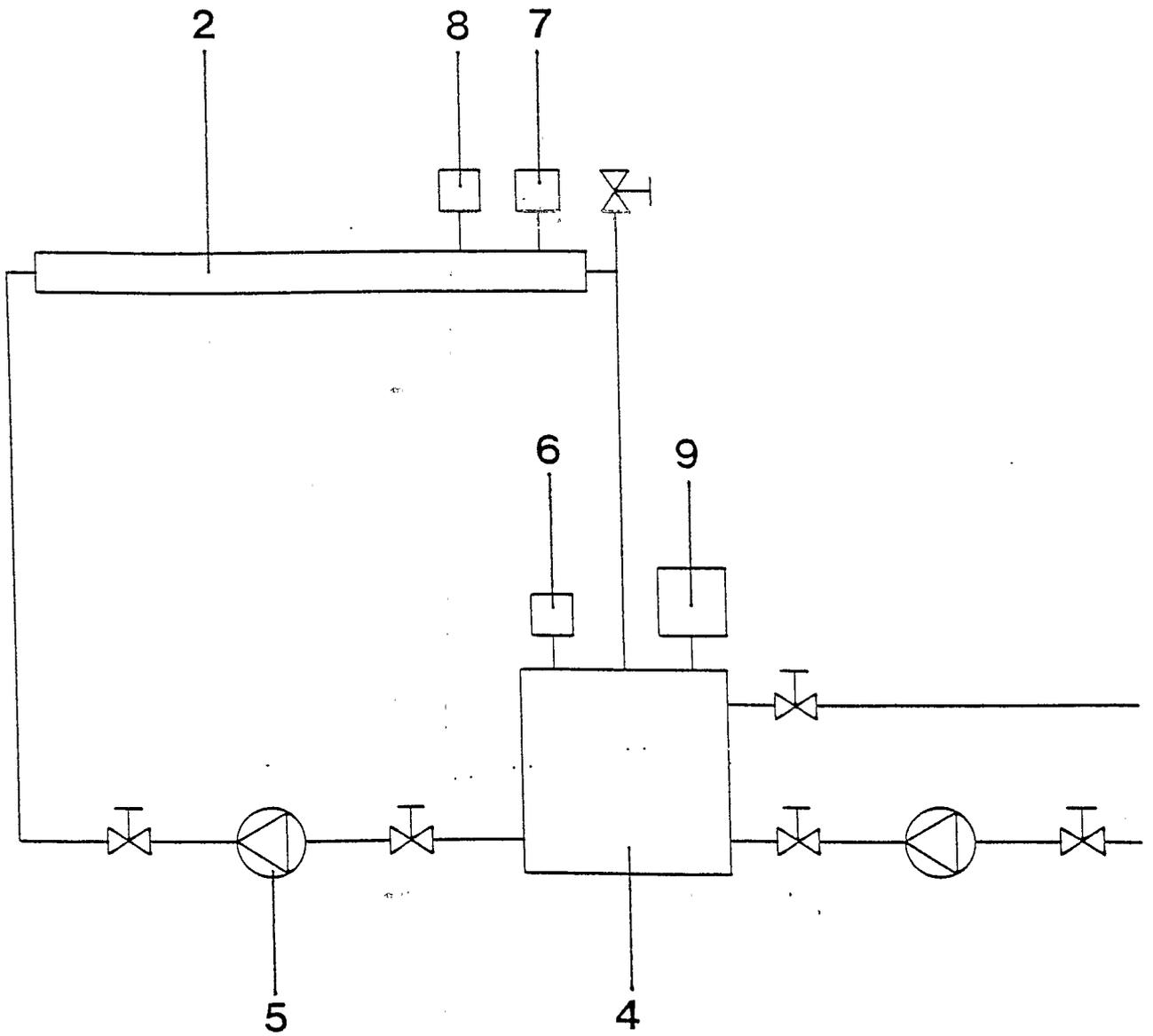


FIG.3

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER

INV. F24J2/00 F2402/10 F2402/12 G02B17/06

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)
F24J G02B

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 practical, 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
X	GB 1 508 950 A (LIGHTFOOT D) 26 April 1978 (1978-04-26) the whole document	1-4
X	US 3 974 824 A (SMITH RONALD H) 17 August 1976 (1976-08-17) column 3 - column 6 figures 2,4,8,11	1-3
X	US 4 287 880 A (GEPPERT JOHN M) 8 September 1981 (1981-09-08) figures 1-4 column 1 - column 4	1-3
A	DE 30 36 310 A1 (POLY VERBUND ELEMENT GMBH [DE]) 15 April 1982 (1982-04-15) pages 7,10,12; figure 5	1-4

D Further documents are listed in the continuation of Box C

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* Special categories of cited documents

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'X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 1508950	A	26-04-1978	NONE
US 3974824	A	17-08-1976	NONE
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DE 3036310	A1	15-04-1982	NONE