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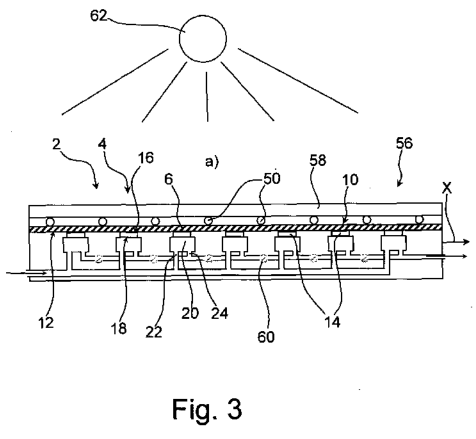

Fig. 3

(57) **Abstract**: A power generator (2) is disclosed. The power generator (2) comprises: - a heat absorbing member (6) having a heat absorbing side (10) and a heat releasing side (12). The power generator (2) comprises a plurality of thermo electric generators (14) each having a cooling side (18) and a heat receiving side (16), where the heat receiving sides (16) of the thermo electric generators (14) are attached to and being in thermal contact with the heat releasing side (12) of the heat absorbing member (6). The invention also discloses a method to manufacture a power generator (2) comprising a heat absorbing member (6) having a heat absorbing side (10) and a heat releasing side (12).

WO 2012/159634 A2

Power Generator

Field of invention

The present invention generally relates to a power generator. The invention more particularly relates to a solar panel configured to transform heat to electric power.

Prior art

Thermo electric generator technology is based on the well-known concept that a temperature differential may be converted into electricity and vice versa. Namely, the Seebeck effect which is the conversion of a temperature differential directly into electricity, and the Peltier effect which is the production of a temperature differential from a difference in electric potential. A Thermo electric generator is normally made from two different sheets of plates of semi conducting material such as e.g. semi conducting metal. The sheets are electrical separated, but thermal connected at two end points. However, the construction and use of thermo electric generators is also a well-known technical field.

Thermo electric generators hold great promise for widespread use due to their solid state structure, silent operation, high reliability and long service life. Thermo electric generators used for power generation can produce electricity from virtually any source of heat, which could enable many energy conversion processes to increase efficiency, reduce pollutant emissions and lower costs. Thermo electric generators used for heating or cooling can achieve very sensitive temperature control, and thermo electric generators used for cooling do not require volatile working fluids.

Radiation from the sun is the primary source for energy on Earth, however, depending on the location the energy contained in the radiation from the sun will vary. On the northern or southern hemisphere the effect from the sun may be between 600 and 1000 watt per square meter, closer to equator, e.g. in Sahara the effect may be as high as between 1200 and 1300 watt per square meter.

Although, use of radiation from sun too power thermo electric device have been attempted, these attempts have not been very successful as the efficiency of the thermo electric generators was to low to provide any effect that was of economical and industrial feasibility. Examples of the prior use of sunlight to power thermo electric generators are e.g. disclosed in US patent document 20080142069.

The European patent application EP 2124267 discloses a thermoelectric generator for implants and embedded devices. This thermo electric generator is capable of producing electric power to an electric device. The thermo electric generator comprise a first unit that is adapted for being embedded or implanted into a body and a second unit that is adapted for being arranged at the outer surface of the body. When the first and second units are thermally connected to each the thermo electric generator converts heat (the temperature difference between the first unit and the second unit) directly into electrical power.

This thermo electric generator is, however, not suitable for power production in the scale required in a house hold. Moreover this thermo electric generator is adapted to produce electric energy on the basis of a rather low temperature difference and thus this thermo electric generator is not suitable for being used in a power generator formed as a solar panel.

Thus, it has hitherto not been interesting to use thermo electric generators for power production in a scale that is of commercial interest as the efficiency has been to low in relation to the required investments.

A major problem associated with the prior art solar panels is that the either are optimized for producing hot water or to produce electric power. In solar panels suitable for photovoltaic power generation the energy from the sun is converted into electric power by using the photovoltaic effect. In such solar panels the solar cells will only produce power when the sun is shining. In hot water solar panels no electric power is produced.

Accordingly, there is need for a solar panel that is capable of producing both hot water and electric power.

In application in which thermo electric generators are used to transform heat available on a large surface it is practice to provide the surface with a large number of thermo electric generators in order to archive a large surface power density. Since the surface has a limited capacity to receive heat/energy (e.g. from the sun). The thermo electric generators can not be fully utilised and thus the power generated per generator is reduced.

It is an object of the present invention is to provide a power generator with thermo electric generators that has a higher efficiency.

It is also an object of the present invention to provide a power generator suitable of being used as a solar panel that has a high efficiency and is cost effective.

It is a further object of the invention to provide a method to produce a cost effective solar panel having a high efficiency.

Summary of the invention

The object of the present invention can be achieved by a power generator having the features as defined in claim 1. Preferred embodiments are defined in the dependent sub claims and explained in the following description and illustrated in the accompanying drawings.

The power generator according to the invention comprises a heat absorbing member having a heat absorbing side and a heat releasing side. The power generator comprises a plurality of thermo electric generators each having a cooling side and a heat receiving side, where the heat receiving side of the thermo electric generators are attached to and being in thermal contact with the heat releasing side of the heat absorbing member.

Hereby it is possible to provide a power generator that has a higher efficiency and that is suitable of being used as a cost effective solar panel.

It is preferred that the heat absorbing member is plate shaped, preferable shaped as a plane plate (e.g. a rectangular plate).

The heat absorbing member is provided with a heat absorbing side configured to take up and absorb heat (e.g. from the sun or another energy source). The heat absorbing member is also provided with a heat releasing side. It is referred that the heat absorbing side and the heat releasing side are provided on opposite sides of the heat absorbing member, preferably on the two largest sides of the heat absorbing member.

It is preferred that the heat receiving sides of the thermo electric generators are configured to be brought in to close thermal contact with the heat releasing side of the heat absorbing member. Preferably, the heat receiving sides of the thermo electric generators have shapes that correspond to the shape of the heat absorbing member.

It may be an advantage that the thermo electric generators are box-shaped having a plane rectangular heat receiving side configured to match a plane plate-shaped heat absorbing member.

It is preferred that the power generator is a solar panel. Hereby energy from the sun can be converted into electric power that can be used or send to the grid. Moreover, this type of solar panel is capable of maintaining a constant power generation even in cloudy weather. This is possible because the temperature of the heat absorbing member will be maintained relative constant even when shadows from clouds occasionally will fall on the solar panel.

It may be an advantage that the area (A) of the heat absorbing side of the absorbing member is larger than the total area ($\sum_{i=1}^{N} a_i$, where a_i is the area of the heat receiving side of the thermo electric generator number i) of the heat receiving sides of the thermo electric generator(s) and that the thermo electric generator(s) are spaced from each other, preferably spaced more than 5 cm from each other.

Hereby the thermal energy available on the heat receiving member may be utilised by the thermo electric generator(s) in an efficient manner.

It is preferred that the thermo electric generator(s) are basically uniformly distributed along at least in one direction. It may be an advantage that the thermo electric generator(s) are uniformly distributed along a number of parallel lines. It is preferred that the lines extend parallel to the longitudinal axis of the heat receiving member (preferably a rectangular plate member).

It is possible to use several types of thermo electric generators in the same power generator, however, it is preferred that the same type of thermo electric generators are applied in the power generator.

It is preferred that the area A of the heat absorbing side of the absorbing member is larger than two times the total area of the heat receiving sides of the thermo electric generators.

This may be expressed in the following way:

(1) $A > 2\sum_{i=1}^{N} a_i$,

(where a_i is the area of the heat receiving side of the thermo electric generator number i and N is the number of thermo electric generators)

It is even more preferred that the area A of the heat absorbing side of the absorbing member is larger than four times the total area of the heat receiving sides of the thermo electric generators.
This may be expressed in the following way:

(2) $A > 4\sum_{i=1}^{N} a_i$,

(where a_i is the area of the heat receiving side of the thermo electric generator number i and N is the number of thermo electric generators)

The heat absorbing member is preferable plate shaped, preferably shaped as a rectangular plate.

It may be an advantage that the power generator comprises a pipe system configured to heat a fluid (e.g. glycol containing water) and that the power generator is configured to produce both hot water and electric power.

Hereby it is achieved that the power generator may be used as a solar panel capable of producing hot water (e.g. for a house hold) and to produce electric power when there is produced enough hot water. This is a major advantage and during periods with sunny weather such power generator (solar panel) is capable of producing electric power and send electric power to the grid (and sell electricity to the power supplier (the electric company)).

It may be an advantage that a cooling member is attached to the cooling side of at least a selection of the thermo electric generators. Hereby a higher temperature difference may be provided between the heat receiving side of the thermo electric generators and the cooling side of the electric generators.

It is preferred that the cooling member(s) comprise a housing having an inlet and an outlet and that the housing is configured to receive a cooling fluid through the inlet and to cool the thermo electric generator provided in the housing and release the fluid through the outlet.

Hereby an efficient cooling of the thermo electric generators can be achieved. Moreover, the cooling effect may be adjusted if desired.

It is preferred that the cooling member(s) are configured in such a way that the cooling fluid is brought into direct contact with the cooling side of the thermo electric generator.

Hereby a very efficient cooling of the thermo electric generators can be achieved. Since there is no thermal barrier between the heat receiving side of the thermo electric generators and the cooling fluid an extremely effective cooling of the thermo electric generators can be carried out. The cooling fluid is preferably a liquid type cooling fluid.

It is preferred that the thermo electric generators are attached to the heat releasing side of the heat absorbing member with a thermally conductive adhesive, preferably a heat conducting glue.

Hereby the thermo electric generators can be attached to the heat releasing side of the heat absorbing member in a very expedient way. The use of a thermally conductive adhesive such as a heat conducting glue makes it possible to provide a good thermal contact between the thermo electric generators and the heat releasing side of the heat absorbing member.

It is preferred that a distribution member comprising a plurality of separation walls extending basically perpendicular to the cooling surface of the thermo electric generator is arranged in the housing and that the distribution member is configured to increase the cooling effect and reduce the required flow of the cooling fluid.

Hereby an excellent cooling of the thermo electric generators can be achieved and the energy consumption for providing the cooling can be reduced since a lower flow (of the cooling fluid) is required.

It may be an advantage that the power generator comprises a frame, where a plurality of pipes are provided within the frame, where the power generator comprises a heat absorbing member arranged within the frame, where the power generator is configured to transfer heat from the heat absorbing member to the pipes and to a fluid contained in the pipes, where the plurality of thermo electric generators are attached to and being in thermal contact with the heat releasing side of the heat absorbing member.

Hereby a power generator that is suitable for being mounted e.g. on a roof of a building can be achieved.

It may be an advantage to have a hot water system comprising a power generator according to the invention. Hereby a highly efficient and flexible hot water system that is capable of producing electricity can be achieved.

The objects according to the invention may be achieved by a method to manufacture a power generator comprising a heat absorbing member having a heat absorbing side and a heat releasing side, which method comprises the following steps:

- determining the anticipated power uptake (P) of the heat absorbing member during optimum conditions;
- determining the number (N_{opt}) of thermo electric generators that will result in the highest surface power density (P_{area}, power per unit area) with the lowest number of thermo electric generators for the anticipated power uptake;
- attaching the determined number (N_{opt}) of thermo electric generators each having a cooling side and a heat receiving side, with the heat receiving side of the thermo electric generators to and being in thermal contact with the heat releasing side of the heat absorbing member.

Hereby it is achieved that a highly efficient power generator can be achieved. The thermo electric generators are use to a maximum extend.

The anticipated power uptake of the heat absorbing member is preferable the power uptake that is available during optimum conditions. By way of example, the anticipated power uptake of the heat absorbing member may be the maximum power uptake that is expected during a summer day at noon. It may be between 600 and 1000 watt per square meter if the power generator is intended to be used at the northern or southern hemisphere. On the other hand the anticipated power uptake of the heat absorbing member may be between 1200 and 1300 watt per square meter if the power generator is intended to be used at the Sahara.

The term optimum conditions are preferably based on the specific graphical position (the latitude and longitude of the position point) of the power generator. The optimum conditions may be available from any source (e.g. from an Internet based source). In this way the power generation is optimum during optimum weather conditions, however power is also produced during periods of less power available from the sun.

The number (N_{opt}) of thermo electric generators that will result in the highest surface power density (P_{area}, power per unit area) with the lowest number of thermo electric generators for the anticipated power uptake will depend on the power output for each thermo electric generator. If the power generator comprises thermo electric generators with a high power output a small number of thermo electric generators is required compared with a power generator comprising thermo electric generators with a lower power output.

It is preferred that the method comprises the steps of attaching the thermo electric generators to the heat releasing side of the heat absorbing member with thermally conductive adhesive, preferably a heat conducting glue.

Hereby the thermo electric generators can be attached to the heat releasing side of the heat absorbing member in a manner that provides an efficient heat transfer between the thermo electric generators and the heat absorbing member.

The objects of the present invention may be achieved by a power generator that comprises a thermo electric generator and a cooling member, where the thermo electric generator and the cooling member are integrated in a housing.

Hereby a power generator that is highly suitable for being used in a power generator unit or a solar panel can be achieved. Such thermo electric generator may be used to produce electric power from any suitable heat source such as waste heat from power plants or waste heat from exhaust gas. Accordingly, such power generator may be applied for electric power production in any suitable application.

It is preferred that the cooling member comprises a housing having an inlet and an outlet and that the housing is configured to receive a cooling fluid, preferably a cooling fluid, through the inlet cool the thermo electric generator provided in the housing and release the fluid through the outlet.

Hereby it is achieved that an efficient cooling can be provided.

It may be an advantage that the power generator comprises a plurality of thermo electric generators each comprising a cooling member, where the thermo electric generator and the cooling member are integrated in a housing.

It may be beneficial that the power generator comprises a plurality of thermo electric generators each comprising a cooling member, where the thermo electric generator and the cooling member are integrated in a housing, where the cooling member comprises a housing having an inlet and an outlet and that the housing is configured to receive a cooling fluid, preferably a cooling fluid, through the inlet cool the thermo electric generator provided in the housing and release the fluid through the outlet.

Description of the Drawings

The invention will become more fully understood from the detailed description given herein below. The accompanying drawings are given by way of illustration only, and thus, they are not limitative of the present invention. In the accompanying drawings:

Fig. 1	shows a schematic side view of three power generators according to the invention. Fig. 1 moreover illustrates graphs showing the relationship between the number of thermo electric generators and the power output for each thermo electric generator and for the whole power panel respectively;
Fig. 2 a)	shows a cross-sectional view of a power generator according to the invention;
Fig. 2 b)	shows a perspective view of housing of a cooling member according to the invention;
Fig. 3	shows a close-up view of the power generator shown in Fig. 2 a)
Fig. 4	shows a perspective exploded view of a power generator according to the invention and
Fig. 5	illustrates a perspective view of the power generator according to the invention.

Detailed description of the invention

Referring now in detail to the drawings for the purpose of illustrating preferred embodiments of the present invention, a top view of three power generators 42, 44, 46 are illustrated in Fig. 1. The power generators 42, 44, 46 are solar panels and Fig. 1 shows that each of these solar panels 42, 44, 46 comprise a heat receiving member 6.

A number of thermo electric generators 14 are attached to the heat receiving member 6 of each solar panel 42, 44, 46. The thermo electric generators 14 are arranged along mounting lines 15, 15′, 15″ provided along the longitudinal axis of the heat receiving member 6 of the solar panels 42, 44, 46.

The solar panel 42 is provided with 12 thermo electric generators 14. The thermo electric generators 14 are provided along four mounting lines 15. The distance D between adjacent mounting lines 15 is significantly smaller than the distance d between adjacent thermo electric generators 14 on the mounting lines 15.

Fig. 1 d) illustrates a solar panel 44 provided with 24 thermo electric generators 14. These thermo electric generators 14 are provided along four mounting lines 15′ and the distance D′ between adjacent mounting lines 15′ is slightly smaller than the distance d′ between adjacent thermo electric generators 14 on the mounting lines 15′.

Fig. 1 e) illustrates a solar panel 46 is provided with 48 thermo electric generators 14 that are provided along four mounting lines 15″. The distance D″ between adjacent mounting lines 15″ is slightly larger than the distance d″ between adjacent thermo electric generators 14 on the mounting lines 15″.

The thermo electric generators 14 are basically uniformly distributed along at least the direction axis X of the of the solar panels 4.

Fig. 1 a) illustrates a curve 40 showing the average electric power 36 produced by the thermo electric generators 14 at the solar panels 42, 44, 46 (shown in Fig. 1 c), Fig 1 d) and in Fig. 1 e)) as function of the number 38 of thermo electric generators 14. It can be seen from Fig. 1 a) that the curve 40 showing the average electric power produced by the thermo electric generators 14 is constant until the number of thermo electric generators 38 reaches the number 44′ corresponding the solar panel 44 shown in Fig. 1 d).

When a solar panel having a heat receiving member 6 of the size corresponding to the solar panels 42, 44, 46 shown in Fig. 1 is provided with more thermo electric generators than 44′ the average electric power produced by the thermo electric generators 14 is reduced. The curve 40 is decreasing when the number of thermo electric generators exceeds 44′. Accordingly, the average electric power produced by the thermo electric generators 14 in the solar panel 46 shown in Fig. 1 e) is lower (reduced to about 50%) than the average electric power produced by the thermo electric generators 14 in the solar panel 44 shown in Fig. 1 d).

In Fig. 1 a) the number of thermo electric generators 42′, 44′, 46′ for respectively, solar panel 42 (shown in Fig. 1 c), solar panel 44 (shown in Fig 1 d) and for solar panel 46 (shown in Fig 1 e) are indicated at the X-axis 38. The average electric power 42″, 44′, 46″ produced by solar panel 42 (shown in Fig. 1 c), solar panel 44 (shown in Fig 1 d) and solar panel 46 (shown in Fig 1 e), respectively is indicated.

It can be seen that the average electric power 42″ produced by solar panel 42 (shown in Fig. 1 c) equals the average electric power 44″ produced by solar panel 44 (shown in Fig. 1 d). This can be explained by the fact that the thermo electric generators 14 are utilised to a maximum extent in the solar panels 42, 44. The thermo electric generators 14 in solar panel 46, however, is not fully utilised at the given working conditions (availably sun intensity). Therefore the average electric power 46″ produced by solar panel 46 is lower than the average electric power 42″, 44″ produced by solar panel 42 and 44, respectively. The points 42‴, 44‴, 46‴ indicating the average electric power 42'', 44'', 44'' produced by solar panel 42, 44 and 46 is indicated at the curve 40.

Fig. 1 b) illustrates the total power 36' produced by the solar panels 42, 44, 46, respectively. The curve 48 shows the total power 36' as function of the number of thermo electric generators 14.

In Fig. 1 b) the number of thermo electric generators 42', 44', 46' for respectively, solar panel 42 (shown in Fig. 1 c), solar panel 44 (shown in Fig 1 d) and for solar panel 46 (shown in Fig 1 e) are indicated at the X-axis 38' in the same manner as in Fig. 1 a).

The total amount of produced electric power 42'''', 44'''', 46'''' produced by the solar panels 42, 44, 46, is indicated at the Y-axis 36' and the points 42''''', 44''''', 46''''' corresponding to the produced electric power 42'''', 44'''', 46'''' are indicated on the curve 48.

It can be seen that the curve 48 showing total power output from the solar panels as function of the number 38' of thermo electric generators 14 is increasing up to the number 44' (corresponding to the number 44' of thermo electric generators 14 in solar panel 44). When a larger number of thermo electric generators 14 is used the total power produced by the solar panel is not increased since the average electric power 36 (see Fig. 1 a) decreases.

Accordingly, the most optimum solar panel is the solar panel 44 shown in Fig. 1 d).

The solar panels 42, 44, 46 are plate shaped and the heat receiving member 6 has a rectangular geometry.

Fig. 2 a) illustrates a cross-sectional view of a power generator 2 according to the invention. The power generator 2 may be used as a solar panel 4 and comprises a heat absorbing member 6 provided within a frame 56. A glass plate 58 is provided at the outer side of the frame 56. The heat absorbing member 6 is provided under the glass plate 58 and a plurality of pipes 50 are sandwiched between the glass plate 58 and the heat absorbing member 6. The pipes 50 extend basically perpendicular to the longitudinal axis X of the power generator 2.

The heat absorbing member 6 has a heat receiving side 10 and a heat releasing side 12. The heat absorbing member 6 may be provided with a coating. A plurality of thermo electric generators 14 are attached to the heat releasing side 12 of the heat absorbing member 6. The thermo electric generators 14 are have a cooling side 18 and a heat receiving side 16. The heat receiving side 16 is brought into thermal contact with the heat releasing side 12 of the heat absorbing member 6.

Each thermo electric generator 14 is cooled by a cooling member 20 that is configured to cool the cooling side 18 of the thermo electric generators 14. The cooling members 20 are equipped with an inlet 22 and an outlet 24. The inlets 22 are connected to a main inlet pipe 52 delivering cooling fluid to the cooling members 20 through the inlets 22. The cooling fluid enters the inlets 22 and is brought into thermal contact with the cooling side 18 of the thermo electric generators 14 and hereafter the cooling fluid leaves the cooling members 20 through the outlets 24 and further through a main outlet pipe 54. The direction of the cooling fluid is indicated by arrows. A number of check valves 60 are proved at the outlet pipe 54. The main inlet pipe 52 enters the frame 56 at the left side while the main outlet pipe 54 enters the right side of the frame 56. Both the main inlet pipe 52 and the main outlet pipe 54 extend parallel to the longitudinal axis X of the of the power generator 2.

The thermo electric generators 14 are basically uniformly distributed along at least the direction axis X of the of the power generator 2. The solar panel 4 are configured to produce hot water by heating a fluid in the pipes 50. The solar panel 4 is also capable of producing electrical power. The solar panel 4 is adapted to initially heat the fluid in the pipes 50 and hereafter produce electrical power. Initially the thermal energy absorbed by the heat absorbing member 6 is used to heat the fluid in the pipes 50. When the fluid is heated the temperature at the heat absorbing member 6 increases and thus more electric power is produced by the thermal electric generators 14.

Fig. 2 b) illustrates a perspective view of a housing 32 of a cooling member 20 according to the invention. The housing 32 is provided with an inlet 22 and an outlet 24. The inlet 22 and the outlet 24 are provided at the bottom of the housing 32. The housing 32 is adapted to receive a thermal electric generator 14. At use a cooling fluid enters housing 32 through the inlet 22 and leaves the housing 32 through the outlet 24.

It is preferred that the cooling fluid is brought into direct contact with the cooling side 18 of the thermal electric generator 14.

Fig. 3 illustrates a close-up view of the power generator 2 shown in Fig. 2 a). The power generator 2 is a solar panel 4 arranged in a position in which the sunlight from the sun 62 is received by the heat receiving member 6 of the solar panel.

Fig. 4. illustrates a perspective exploded view of a power generator 2 according to the invention. The power generator 2 comprises a housing 32 like the one illustrated in Fig. 2 b). The housing I basically box-shaped and has an inlet 22 and an outlet 24. The power generator 2 moreover comprises a distribution member 34 that is basically plate-shaped and extends along a first axis Y and a second axis Z. The

distribution member 34 comprises a plurality of wall members 68, 70 extending basically perpendicular to the first axis Y and the second axis Z. The wall members 68, 70 are configured to increase the cooling effect of the distribution member 34 so that a lower flow (of the cooling fluid) is required.

The power generator 2 also comprises a thermo electric generator 14 having a heat receiving side 16 and a cooling side facing against the housing 32. The cooling fluid circulating through the housing 32 will enter the housing 32 through the inlet 22 and flow through the distribution member 34 where the cooling fluid will be distributed. Hereafter the fluid will leave the housing 32 through the outlet 24. The housing 32 is configured to receive the distribution member 34 and the thermo electric generator 14 (where the distribution member 34 is adapted to be sandwiched between the bottom of the housing 32 and the cooling side of the thermo electric generator 14). The cooling fluid will have direct contact with the cooling side of the thermo electric generator 2. Accordingly, a highly efficient cooling of the thermo electric generator 2 can be provided.

The thermo electric generator 14 comprises two electric cables 64, 66 for electric connection with e.g. an inverter or another electric circuit (not shown).

The power generator 2 is adapted to generate electric power from any suitable heat source. Therefore, the power generator 2 may be use in various applications.

It is preferred that the power generator 2 is integrated in the housing 32 like illustrated in Fig. 5. In Fig. 5 the power generator 2 comprises a thermo electric generator that is moulded into the housing 32. The power generator 2 comprises a box-shaped housing 32 and a distribution member 34 like the ones shown in Fig. 4. The distribution member 32 and the thermo electric generator 14 are integrated into the housing 32 by a moulding process. Other process may be use as alternatives to a moulding process. The thermo electric member 14 may be attached to the housing 32 mechanically or by use of glue by way of example.

The power generator 2 shown in Fig. 5 has a pipe-shaped inlet 22 and a pipe-shaped outlet 24 extending basically perpendicular to the longitudinal axis X' of the power generator 2.

List of reference numerals

2	-	Power generator
4	-	Solar panel
6	-	Heat absorbing member
6′	-	Heat absorbing plate
8	-	Coating
10	-	Heat absorbing side
12	-	Heat releasing side
14	-	Thermo electric generator
15, 15′, 15″		Line
16	-	Heat receiving side
18	-	Cooling side
20	-	Cooling member
22	-	Inlet
24, 26	-	Outlet
28	-	Connection
30	-	Inlet
32	-	Housing
34	-	Distribution member
36, 36′	-	Power
38, 38′	-	Number of thermo electric generators
40	-	Curve, showing the average power generated by the thermo electric generators
P	-	Power
A, a	-	Area
N, N_{OPT}	-	Number
P_{area}	-	Surface power density (power per unit area)
D, D′, D″		Distance
d, d′, d″		Distance
X, X′	-	Longitudinal axis

Y, Z	-	Axis
42	-	First solar panel
42′	-	First number of thermo electric Generators
42″	-	Average power generated by the thermo electric generators
42‴	-	Point
42⁗	-	Power generated by the first solar panel
42′′′′′	-	Point
44	-	Second solar panel
44′	-	Second number of thermo electric Generators
44″	-	Average power generated by the thermo electric generators
44‴	-	Point
44⁗	-	Power generated by the second solar panel
44′′′′′	-	Point
46	-	Third solar panel
46′	-	Third number of thermo electric Generators
46″	-	Average power generated by the thermo electric generators
46‴	-	Point
46⁗	-	Power generated by the third solar Panel
46′′′′′	-	Point
48	-	Curve showing the total generated power by the solar panel
50	-	Pipe
52	-	Inlet pipe
54	-	Outlet pipe

56	-	Frame
58	-	Glass
60	-	Check valve
62	-	Sun
64, 66	-	Cable
68, 70	-	Wall member

Claims

1. A power generator (2) comprising:

- a heat absorbing member (6) having a heat absorbing side (10) and a heat releasing side (12) **characterised in** that
- the power generator (2) comprises a plurality of thermo electric generators (14) each having a cooling side (18) and a heat receiving side (16), where the heat receiving sides (16) of the thermo electric generators (14) are attached to and being in thermal contact with the heat releasing side (12) of the heat absorbing member (6).

2. A power generator (2) according to claim 1 **characterised in** that the power generator (2) is a solar panel (4).

3. A power generator (2) according to claim 1 or claim 2 **characterised in** that the area (A) of the heat absorbing side (10) of the absorbing member (6) is larger than the total area ($\sum_{i=1}^{N} a_i$) of the heat receiving sides (16) of the thermo electric generator(s) (14) and that the thermo electric generator(s) (14) are spaced from each other, preferably spaced more than 5 cm from each other.

4. A power generator (2) according to claim 3 **characterised in** that the power generator (2) comprises a pipe system (50) configured to heat a fluid (e.g. glycol containing water) and that the power generator (2) is configured to produce hot water and electric power.

5. A power generator (2) according to one of the preceding claims **characterised in** that a cooling member (20) is attached to the cooling side (18) of at least a selection of the thermo electric generators (16).

6. A power generator (2) according to claim 5 **characterised in** that the cooling member(s) (20) comprise a housing (32) having an inlet

(22) and an outlet (24) and that the housing (32) is configured to receive a cooling fluid, through the inlet (22) and cool the thermo electric generators (16) provided in the housing (32) and release the cooling fluid through the outlet (24).

7. A power generator (2) according to claim 6 **characterised in** that the cooling member(s) (20) are configured in such a way that the cooling fluid is brought into direct contact with the cooling side (18) of the thermo electric generator(s) (14).

8. A power generator (2) according to one of the preceding claims **characterised in** that the thermo electric generators (14) are attached to the heat releasing side (12) of the heat absorbing member (6) with a thermally conductive adhesive, preferably a heat conducting glue.

9. A power generator (2) according to claim 6-8 **characterised in** that a distribution member (34) comprising a plurality of walls (68, 70) extending basically perpendicular to the cooling surface (18) of the thermo electric generator (14) is arranged in the housing (32) and that the distribution member (34) is configured to increase the cooling effect and reduce the required flow of the cooling fluid.

10. A power generator (2) according to one of the preceding claims **characterised in** that the power generator (2) comprises a frame (56), where a plurality of pipes (50) are provided within the frame (56), where the power generator (2) comprises a heat absorbing member (6) arranged within the frame (56), where the power generator (2) is configured to transfer heat from the heat absorbing member (6) to the pipes (50) and to a fluid contained in the pipes (50), where the plurality of thermo electric generators (14) are attached to and being in thermal contact with the heat releasing side (12) of the heat absorbing member (6).

11. A hot water system comprising a power generator (2) according to one of the preceding claims.

12. A method to manufacture a power generator (2) comprising a heat absorbing member (6) having a heat absorbing side (10) and a heat releasing side (12) **characterised in** that the method comprises the following steps:
- determining the anticipated power uptake (P) of the heat absorbing member (6) during optimum conditions;
- determining the number (N_{opt}) of thermo electric generators (14) that will result in the highest surface power density (P_{area}, power per unit area) with the lowest number of thermo electric generators (14) for the anticipated power uptake (P);
- attaching the determined number (N_{opt}) of thermo electric generators (14) each having a cooling side (18) and a heat receiving side (16), with the heat receiving side (16) of the thermo electric generators (14) to and being in thermal contact with the heat releasing side (12) of the heat absorbing member (6).

13. A method according to claim 12 **characterised in** that the method comprises the steps of attaching the thermo electric generators (14) to the heat releasing side (12) of the heat absorbing member (6) with thermally conductive adhesive, preferably a heat conducting glue.

14. A power generator (2) comprising a thermo electric generator (14) and a cooling member (20) **characterised in** that the thermo electric generator (14) and the cooling member (20) are integrated in a housing (32).

15. A power generator (2) according to claim 14 **characterised in** that the cooling member (20) comprises a housing (32) having an inlet (22)

and an outlet (24) and that the housing (32) is configured to receive a cooling fluid, preferably a cooling fluid, through the inlet (22) cool the thermo electric generator (16) provided in the housing (32) and release the fluid through the outlet (24).

16. A power generator (2) comprising a plurality of thermo electric generators (14) according to one of the claims 14-15.

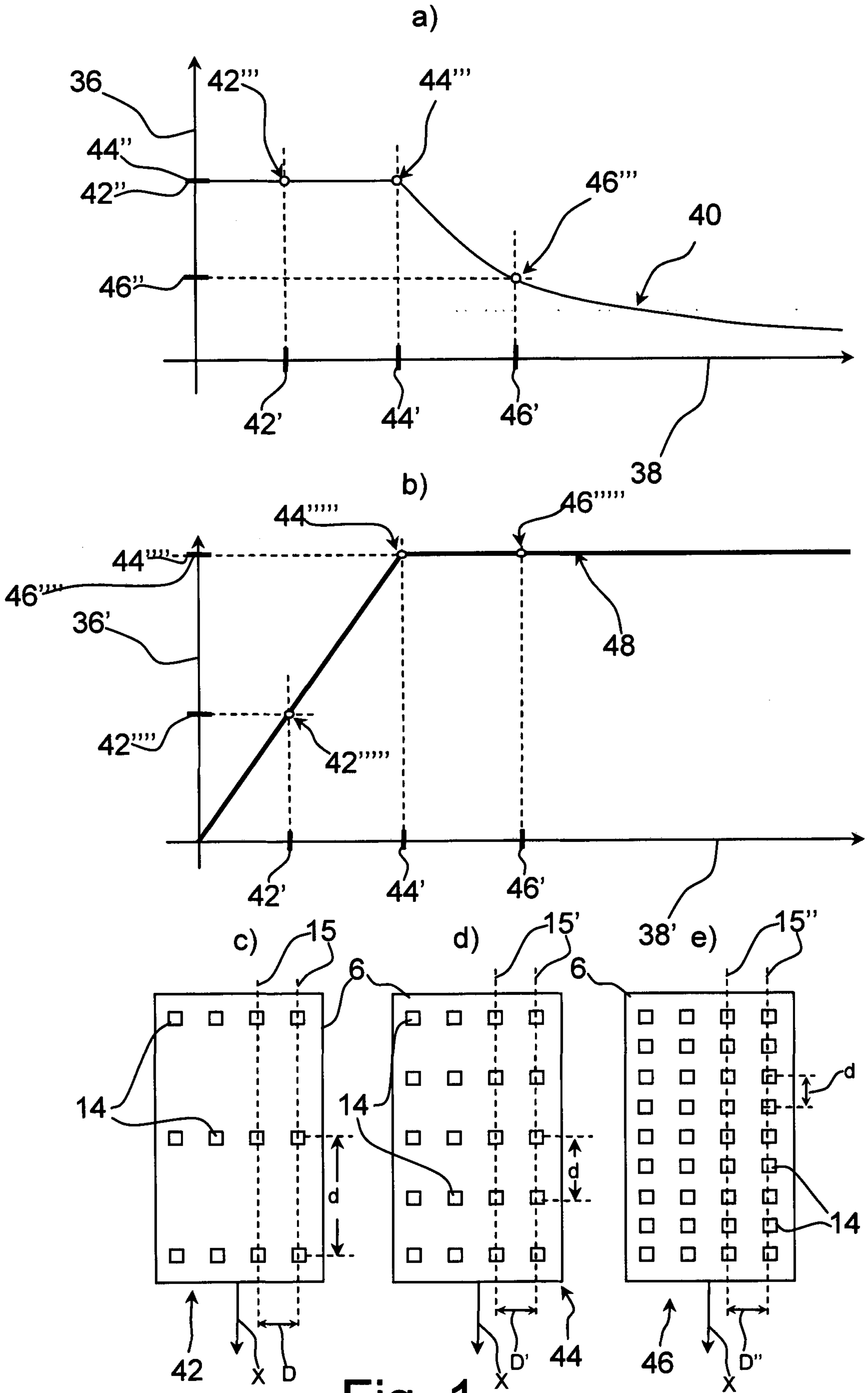
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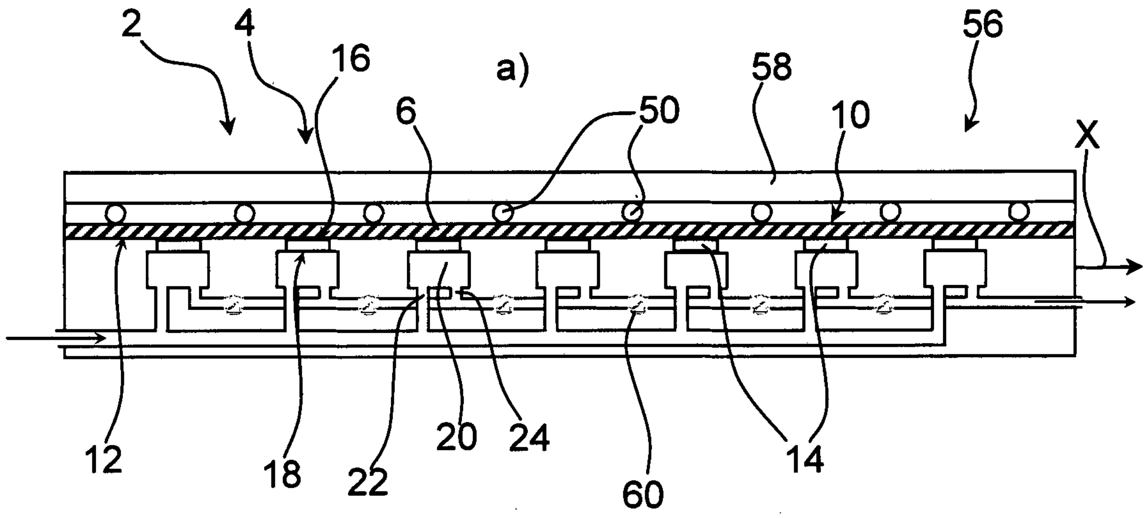
Fig. 1



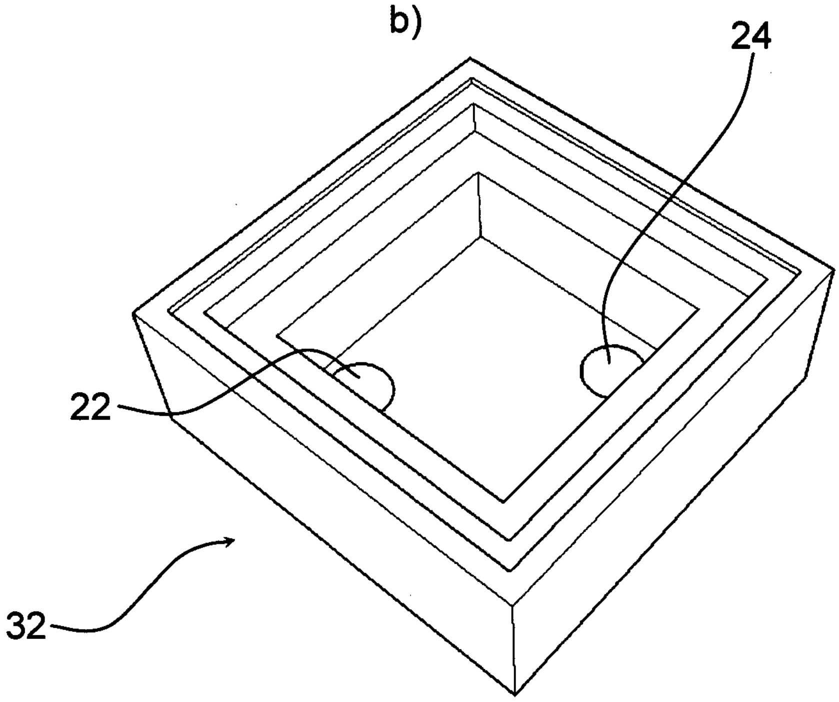


Fig. 2

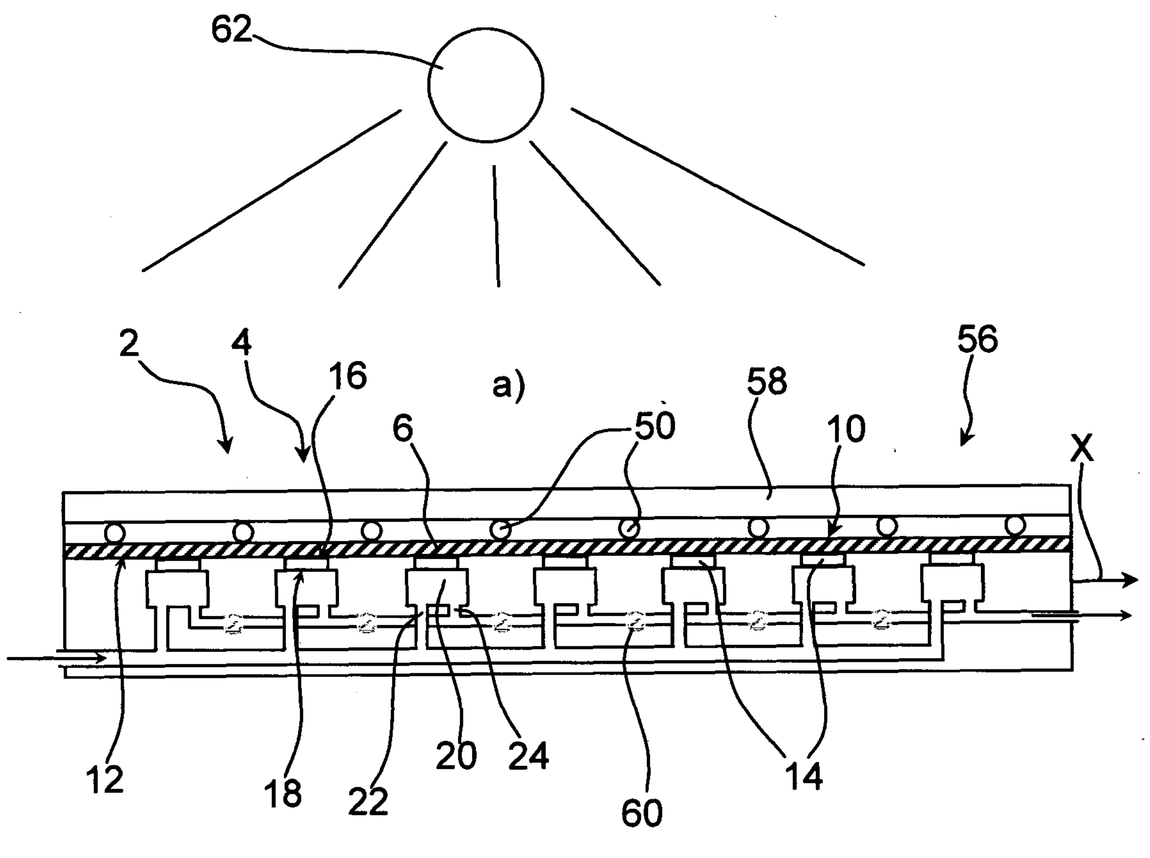


Fig. 3

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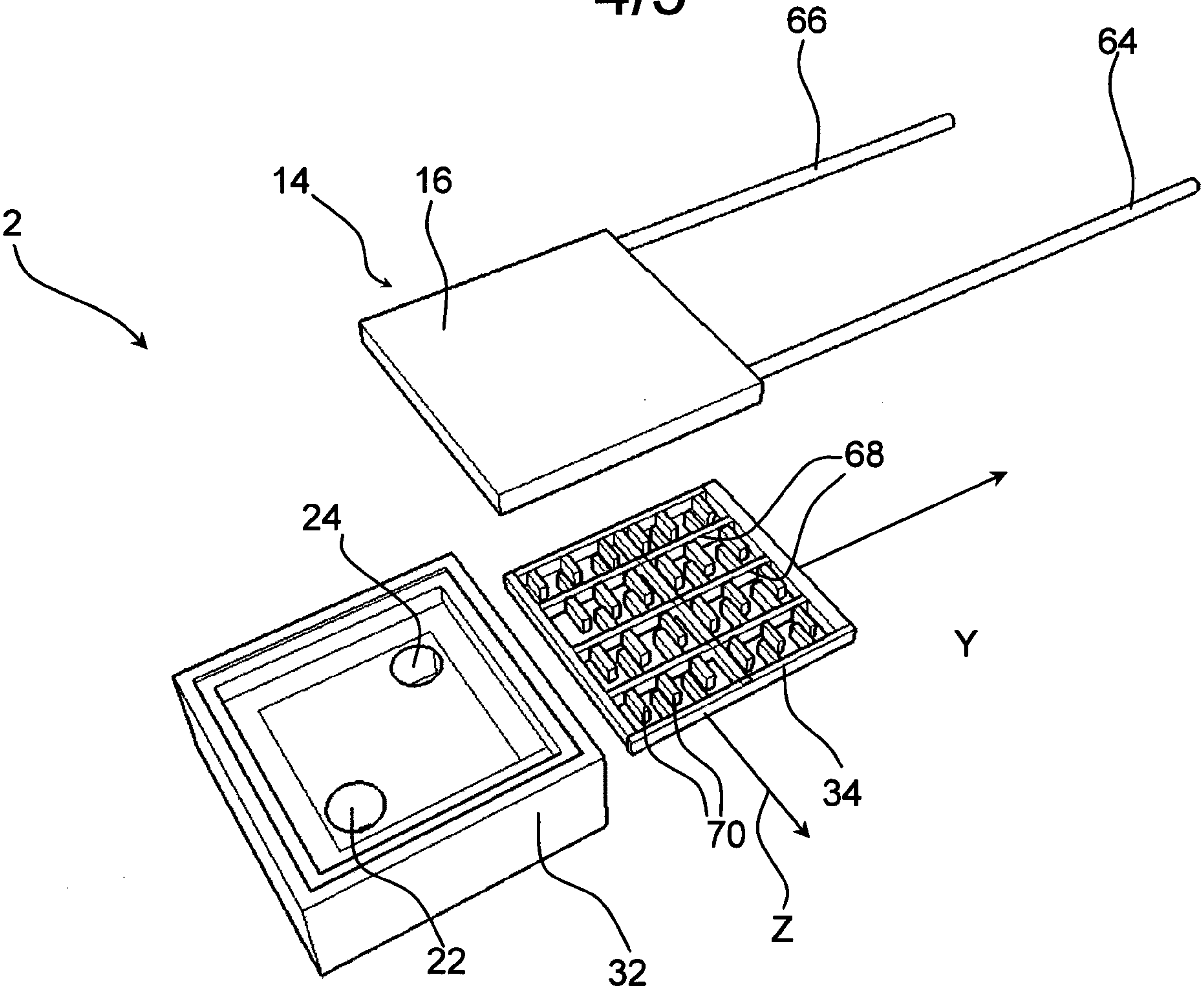

Fig. 4

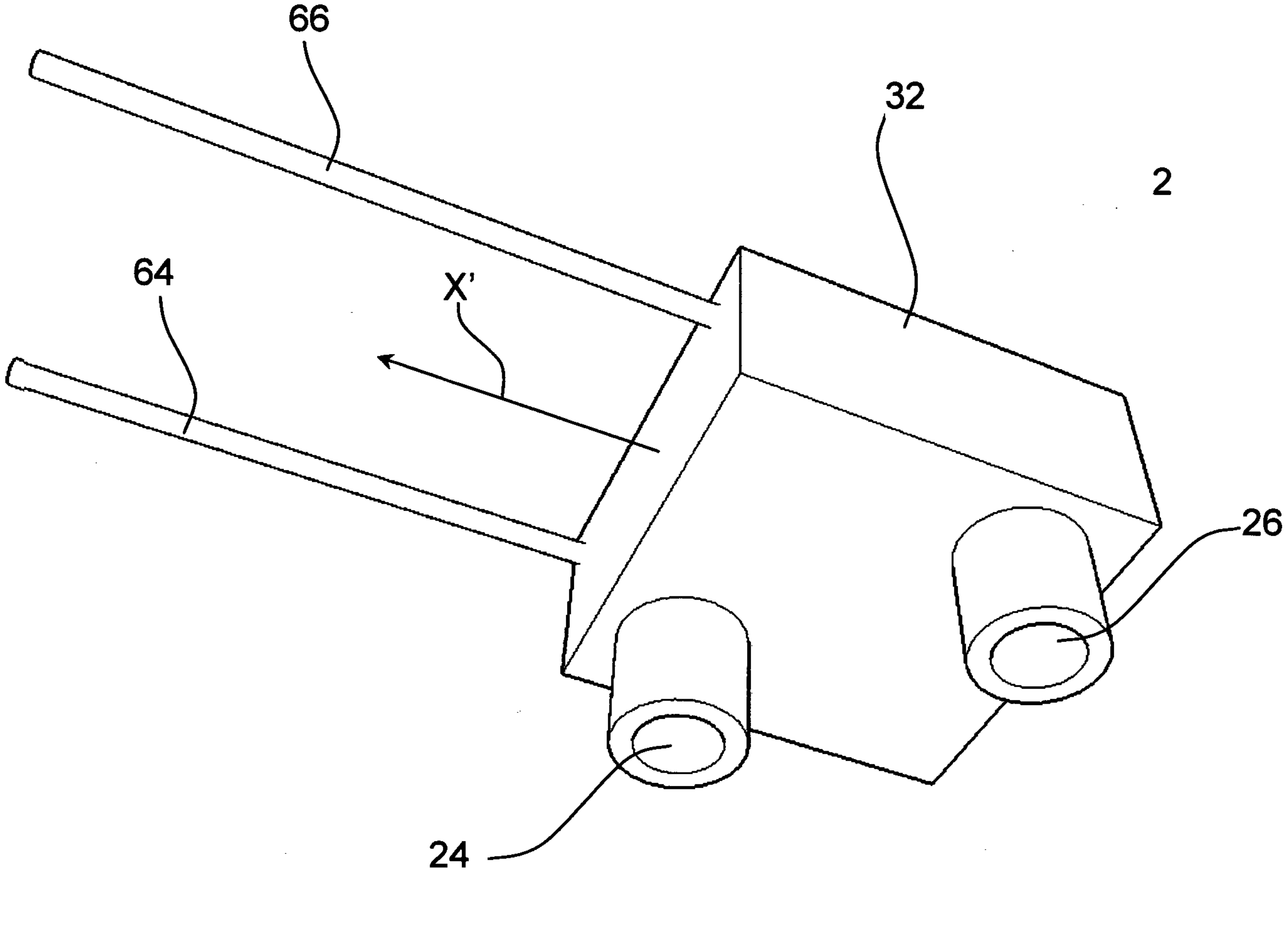

Fig. 5