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(51) INT CL:
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(56) Documents Cited:
US 4999059 A **US 4110010 A**

(58) Field of Search:
INT CL **F24J, H01L**
Other: **ON-LINE:WPI;EPODOC**

(54) Title of the Invention: **Solar system - 2**
Abstract Title: **Solar system with light concentrator**

(57) The invention relates to a solar system which includes at least one collector (20 Fig 2) mounted on a tower (10 Fig 2). The collector may have four modular interconnecting panels (21A-D Fig 2), and each collector has a support structure 23, for example a panel. On the support structure is at least one linear solar converter 22A-D, for example a line of solar cells, and a concentrator 24A-D for each linear solar converter which concentrates light received on the concentrator to a line parallel to said linear converter. An elongate array of mirrors (30 Fig 2) are controlled by heliostats to reflect sunlight onto the collector, the array of mirrors is substantially elongated in a direction parallel to each linear solar converter. The concentrator may be in the form of a prism 24A-D, and these may be protected by a transparent face plate 26. The face plate may be bonded to, or integral with the concentrator, and the face plate may have at least one of a UV protective layer, an anti-reflective layer, or a self cleaning layer. The panel may also include cooling pipes 25A-D.

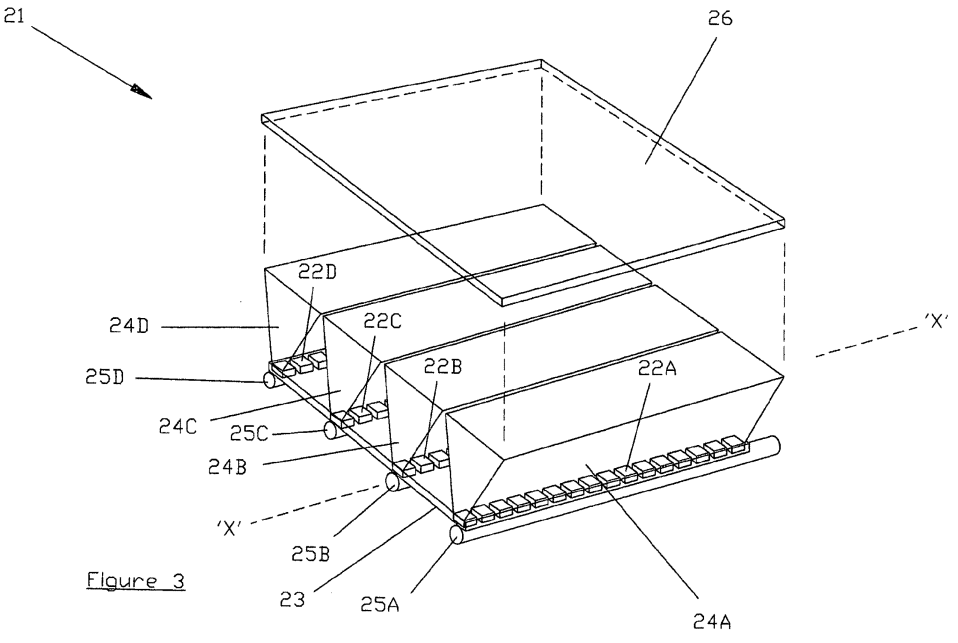

Figure 3

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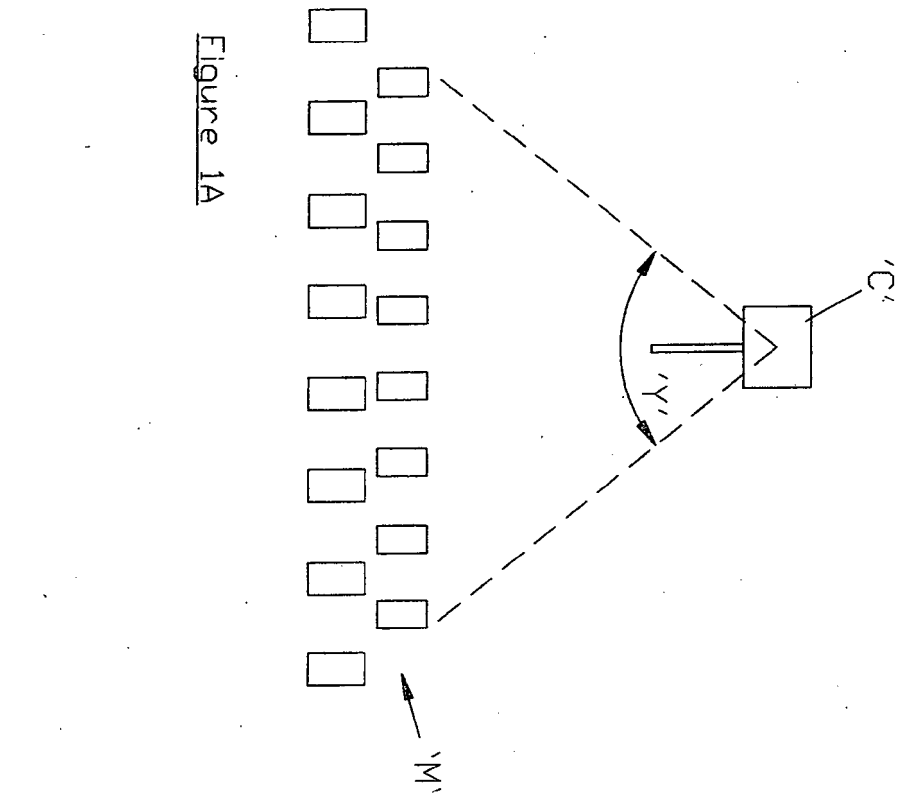

Figure 1A

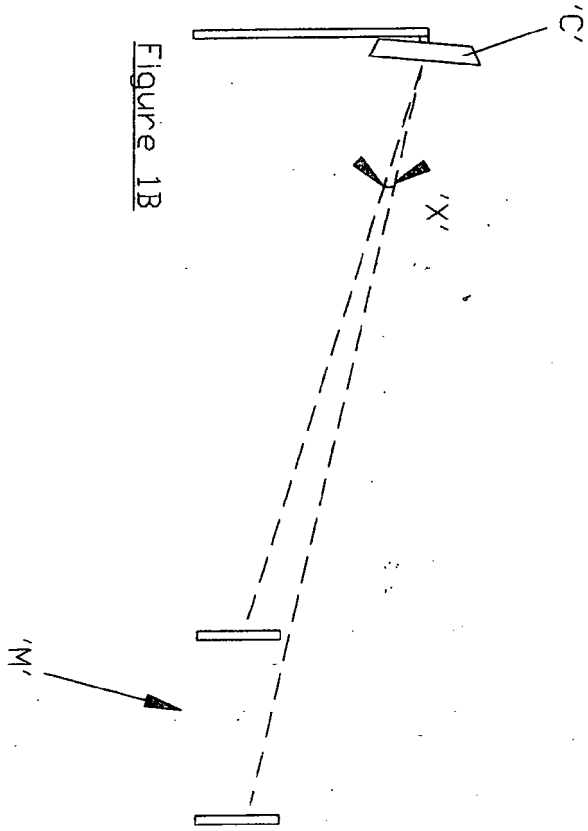

Figure 1B

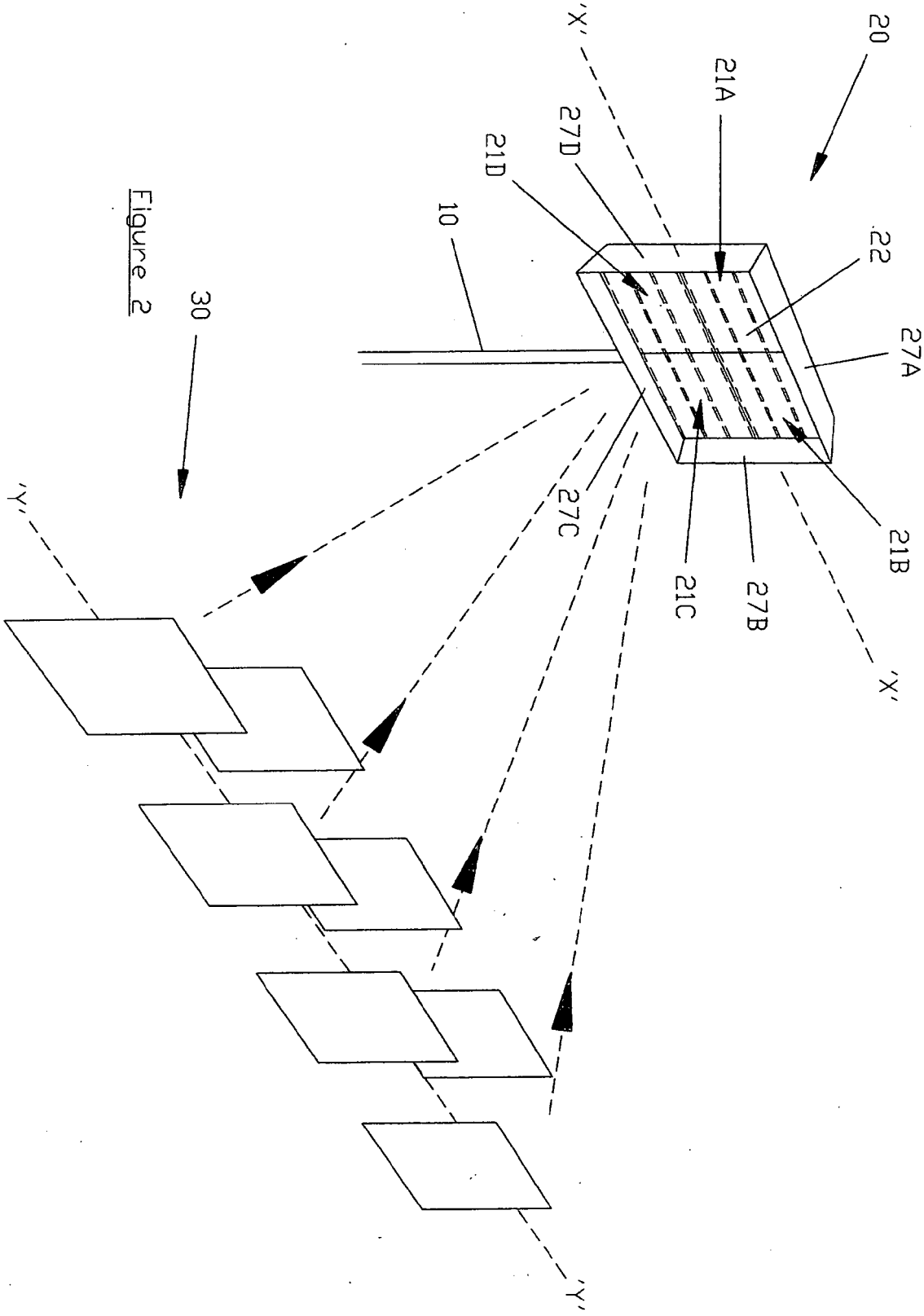

Figure 2

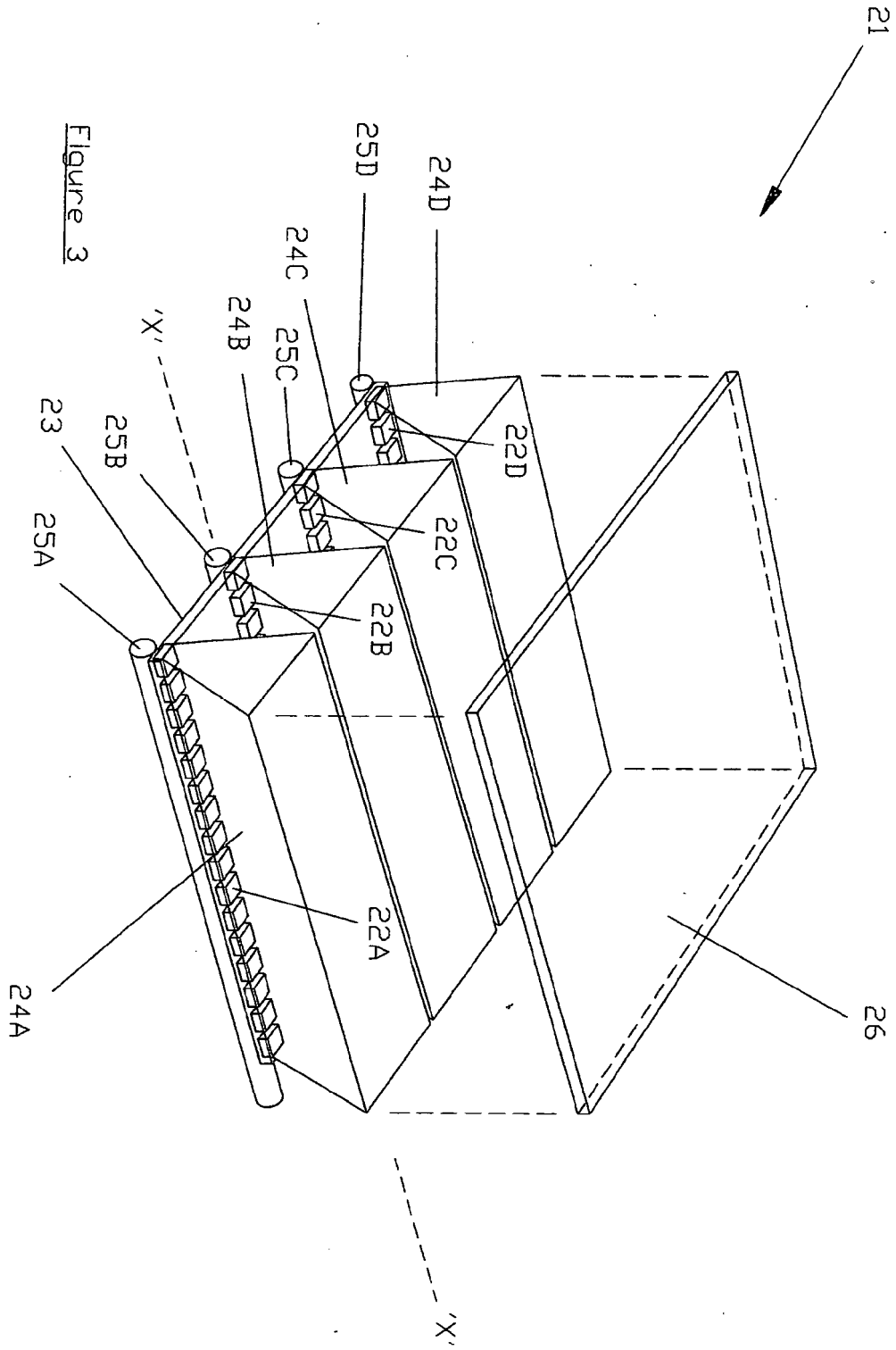

Figure 3

Title: Solar System

The invention relates to a solar system.

Figure 1A shows a front view and Figure 1B shows a side view of a known type of solar system in which sunlight is reflected from a horizontal elongate array of mirrors M onto a collector C on a tower T. It will be seen from Figure 1A that light received from the extreme ends of the array of mirrors onto collector C is a larger angle Y, whereas in Figure 1B the light received from the closest and further mirror in any vertical plane is a smaller angle X.

It is known to create a solar collector which has a plurality of optical light concentrators which concentrate light in two planes onto an array of solar cells spaced apart in rows and columns. Such concentrators are often only efficient if the angle of incidence on their light receiving surface is high. If it is attempted to use concentrators to concentrate light received at angles such as "Y" in Figure 1, the concentrators may be inefficient.

The invention seeks to provide a solution to this problem.

According to the present invention there is provided a solar system comprising:

a) at least one collector mounted on a tower, each collector having a support structure and at least one linear solar converter in side by side relationship on the support structure, and a concentrator for each linear solar converter to concentrate light received on the concentrator to a line parallel to said linear converter, and

b) an elongate array of mirrors controlled by heliostats to reflect sunlight onto a collector, said array of mirrors being substantially elongated in a direction parallel to each linear solar converter.

Preferably the or each solar converter is a line of solar cells.

Preferably the solar cells are arranged in a horizontal line on the support structure, and the elongate array of mirrors is horizontal.

Preferably the or each concentrator uses total internal reflection. The or each concentrator may be a tapered prism.

Preferably cooling is provided for the support structure. Preferably cooling is a flow of coolant along a pipe. Preferably a pipe runs adjacent each line of solar cells.

Light from any one mirror from the mirror field superimposes on light from other mirrors.

In one embodiment each collector is formed from interconnecting modular panels, with each panel supporting one or more concentrators and one or more lines of solar cells. Preferably each panel further comprises one or more cooling pipes.

Preferably and Anti reflective coating is provided on a collector face plate which receives light.

Two or more concentrators may formed as unitary product with a protective face plate, or face plate may be provided with concentrators bonded to it.

Preferably an over heat protection device is provided. The over heat protection device may be a shutter which can shield the collector from light reflected from the mirror field.

Preferably mirrors are provided around each collector to divert stray light onto a collector. The mirrors may be hinged to the side edges of a collector. The mirrors may act as a shutter to shield the collector from light reflected from the mirror field and so act as an over heat protection device.

An embodiment of the invention will now be described with reference to the accompanying drawings in which:

Figure 2 shows schematic perspective view of a solar system, and

Figure 3 shows a schematic view of a modular panel forming part of the collector.

Referring to Figure 2 a solar system 1.

System 1 has a tower 10 with a collector 20 mounted on the tower. Collector 20 is made up of four modular interconnecting panels 21A,21B,21C,21D as described below with reference to Figure 3. Collector 20 has eight parallel horizontal lines of solar cells 22 which receive light from optical concentrators which concentrate light to a line parallel to said line (as depicted by dotted line X-X) of solar cells.

An elongate array of mirrors 30 are provided to reflect sunlight onto collector 20. The array of mirrors is substantially elongated on a line (as depicted by line Y-Y) parallel to each line of solar cells. In practice each mirror may be substantially the same size as collector 20 but collector 20 has been shown enlarged in this drawing for ease of illustration. Light on the collector from any one mirror from the mirror field superimposes on light on the collector from other mirrors.

Referring now to Figure 3, there is shown a modular panel 21 representing one of the four interconnecting panels 21A,21B,21C,21D in Figure 2.

Panel 21 has four spaced parallel lines of linear solar converters in the form of solar cells 22A,22B,22C,22D. The solar cells in each line are in side by side relationship and mounted on a support structure in the form of panel 23 which also serves, inter alia, to dissipate heat from the cells 22A,22B,22C,22D.

An optical concentrator 24A,24B,24C,24D is provided for each line of solar cells to concentrate light received on the concentrator to a line parallel to said line of solar cells 22A,22B,22C,22D. Optical concentrators 24A,24B,24C,24D may be formed from solid transparent material such as borosilicate glass and may use total internal reflection. Concentrators 24A,24B,24C,24D are in the form of tapered prisms as shown. Although the line of solar cells is shown as being only one cell wide, the line could be more than one cell wide, e.g. 3 cells wide.

Cooling pipes 25A,25B,25C,25D run adjacent each line of solar cells 22A,22B,22C,22D through which cooling fluid can be passed to dissipate heat from the panel 23 and hence the solar cells. The pipes can also have high internal surface area.Other cooling devices may be used such as a cold plate system with a high surface area for a cooling fluid to flow through.

A transparent face plate 26 is provided to protect the concentrators 24A,24B,24C24D and which receives light from mirrors in the mirror field. Face plate may include a UV protective layer, an anti reflective coating layer, and/or self cleaning layer. The concentrators 24A,24B,24C,24D may be formed as a unitary product with the face plate 26, or face plate may be provided separately with the concentrators bonded to it.

Referring to Figure 2, the mirrors 27A,27B,27C,27D are hinged to the side edges of the collector 20 to divert stray light onto the collector.

In order to prevent overheating of the cells in the collector 20, an over heat protection device may provided. The over heat protection device may be a shutter which can shield the collector from light reflected from the mirror field. The mirrors 27A,27B,27C,27D may act as a shutter to shield the collector from light reflected from the mirror field and so act as an over heat protection device.

Because the concentrators only concentrate light to a line parallel to the line of solar cells, light from a vertical plane from mirrors such as shown in Figure 1 with a smaller angle of X will be concentrated, whereas light from the extreme ends of the array of mirrors such as shown in Figure 1 at larger angle Y will not be concentrated but will still reach the solar cells.

Instead of the lines of cells on the collector being arranged horizontally with the array of mirrors being elongated to the left and right of the tower, the lines of cells could be arranged vertically in with the array of mirrors elongated on a line towards the tower, whereby the mirrors would still be substantially elongated in a line parallel to each line of solar cells.

The present invention may incorporate a system or a tower and collector described in my co-pending applications nos ....., ... and ..... the contents of which are hereby incorporated by reference. Also the mirrors or other reflective lenses in a mirror field may be of a type described in my co-pending applications no .....and..... the contents of which are hereby incorporated by reference.

The invention may take a form different to that specifically described above.

Further modifications will be apparent to those skilled in the art without departing from the scope of the present invention.

CLAIMS

1. A solar system comprising:

a) at least one collector mounted on a tower, each collector having a support structure and at least one linear solar converter in side by side relationship on the support structure, and a concentrator for each linear solar converter to concentrate light received on the concentrator to a line parallel to said linear converter, and

b) an elongate array of mirrors controlled by heliostats to reflect sunlight onto a collector, said array of mirrors being substantially elongated in a direction parallel to each linear solar converter.

2. A solar system according to claim 1, wherein the or each solar converter is a line of solar cells.

3. A solar system according to claim 1 or 2, wherein the solar cells are arranged in a horizontal line on the support structure, and the elongate array of mirrors is horizontal.

4. A solar system according to claim 1, 2, or 3, wherein the or each concentrator uses total internal reflection.

5. A solar system according to claim 4, wherein the or each concentrator may be a tapered prism.

6. A solar system according to any preceding claim, wherein cooling is provided for the support structure.

7. A solar system according to claim 6, wherein cooling is a flow of coolant along a pipe.

8. A solar system according to claim 7, wherein a pipe runs adjacent each line of solar cells.

9. A solar system according to any preceding claim, wherein light from any one mirror from the mirror field superimposes on light from other mirrors.

10. A solar system according to any preceding claim, wherein each collector is formed from interconnecting modular panels, with each panel supporting one or more concentrators and one or more lines of solar converters.

11. A solar system according to claim 10, wherein each panel further comprises one or more cooling pipes.

12. A solar system according to any preceding claim, wherein an Anti reflective coating is provided on a collector face plate which receives light.

13. A solar system according to any preceding claim, wherein two or more concentrators may formed as unitary product with a protective face plate, or face plate may be provided with concentrators bonded to it.

14. A solar system according to any preceding claim, wherein an over heat protection device is provided.

15. A solar system according to any preceding claim, wherein the over heat protection device is a shutter which can shield the collector from light reflected from the mirror field.

16. A solar system according to any preceding claim, wherein mirrors are provided around each collector to divert stray light onto a collector.

17. A solar system according to claim 16, wherein the mirrors are hinged to the side edges of a collector.

18. A solar system according to claim 16 or 17, wherein the mirrors act as a shutter to shield the collector from light reflected from the mirror field and so act as an over heat protection device.

19. A solar system substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

Application No:	GB1300273.8	**Examiner:**	Brian A Woods
Claims searched:	1-19	**Date of search:**	6 July 2013

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
A		US4110010 A (HILTON) See whole document noting tracking the sun and concentrating the rays onto a fluid heater or solar collector.
A		US4999059 A (BAGNO) See whole document noting mirrors 1 reflecting light to a receiver 19 which includes solar PV and a water based heat transfer system.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

F24J; H01L

The following online and other databases have been used in the preparation of this search report

WPI;EPODOC

International Classification:

Subclass	Subgroup	Valid From
F24J	0002/06	01/01/2006
H01L	0031/052	01/01/2006