(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 583 533 A1**

# (12) EUROPEAN PATENT APPLICATION

(21) Application number: **92850288.9**

(51) Int. Cl.5: **G08B 5/00**

(22) Date of filing: **10.12.92**

(30) Priority: **01.05.92 JP 112718/92**

(43) Date of publication of application:
**23.02.94 Bulletin 94/08**

(84) Designated Contracting States:
**AT BE CH DE DK FR GB IT LI NL SE**

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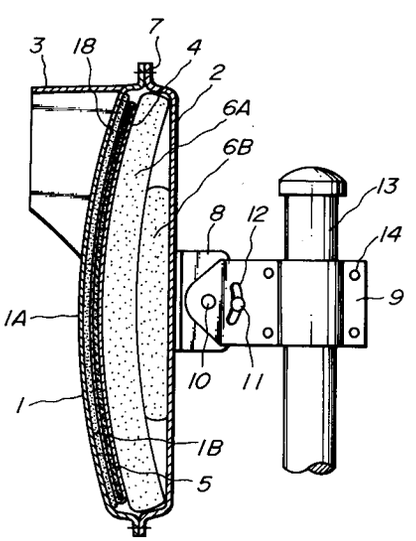
## (54) Road reflector with non-fogging function.

(57) A road reflector with non-fogging function comprises a mirror plate 1, a back plate 2 secured to said mirror plate 1 in the periphery of said mirror plate so as to make a sealed container, a regenerating agent 5 containing vessel 4 attached to the back side of said mirror plate 1 within said container as being heat transferable, a heat insulating material 6A, 6B inserted between the said vessel 4 and back plate 2, thereby said road reflector is united integrally with a mirror plate, a regenerating agent containing vessel 4 and heat insulating materials 6A, 6B.

FIG_1




EP 0 583 533 A1

The present invention relates to a road reflector having a function for preventing a road reflector from fogging which is liable to bring about at the time of a cold season.

A road reflector is a safety device placed at positions where are obstructed to see through, such as intersections, bending curves and the like, but the reflector is fogged during the cold night and morning from autumn to spring and becomes not only useless but also dangerous in traffic. Therefore, its solution has strongly been expected.

The main reason why a road reflector is fogged from the cold night to morning is as follows.

That is, the temperature of a mirror surface more lowers than the dew point temperature of ambient air by radiational cooling, and water drops are condensed on the mirror surface or ice grains are adhered to the mirror surface. Therefore, in order to prevent the road reflector from fogging, the mirror surface should be kept at higher temperature than the ambient air temperature.

Japanese Utility Model Application Laid-open No. 61-19,890, as a prior art, is proposed to form a latent heat regenerating layer between mirror surface plate and a back plate, but the road reflector is placed at various places of the whole country, and a temperature around the reflector is different by area. In order to exhibit a sufficient effect at every temperature, it is effective to utilize a latent heat regenerator having large heat regenerating energy.

Water has the largest regenerating amount. In case of a reflector, a regenerator having 3-4 times the latent heat regeneration at a certain temperature but less than half the water at the other temperature zone is not suitable for a reflector. Moreover, it is a preferable method to form a regenerating layer between a surface mirror plate and a back plate, but if heat insulation material is not provided on the back plate side, heat is dissipated from the back plate direction and the heat dissipation increase and no effect is almost caused.

Japanese Patent Application Laid-open No. 63-167,803 further proposes a method of injecting an anti-freeze into a sealed vessel made between a mirror surface plate and a back plate. The problems of this method are that a road reflector index by Japan Highway Association provides for a stainless steel mirror plate of ∅600 mm diameter in circle and 0.8 mm in thickness, ∅800 mm diameter in circle and 0.9 in thickness, and ∅1000 mm diameter in circle and 1.0 mm in thickness, and that an image distortion should be collated with a limit sample by the naked eye.

In the same manner as in Japanese Utility Model Application Laid-open No. 61-19,890, the above proposal does not provide any heat insulation material on the back plate side, heat dissipates from the back plate direction, and it has almost no effect. This proposal is to inject an anti-freeze into the inside, but a mirror is ∅800 mm in circle and an average space between the mirror surface and the back plate is 3 cm, 15 kg of an anti-freeze should be injected, so that it means to push the mirror surface to the curved direction and lower direction so as to swell in the lower part and it is not for use by distortion of an image.

Moreover, Japanese Patent application Laid-open No. 2-20,508 proposes to provide a liquid regenerating agent-containing vessel on the mirror surface side between a road reflector mirror plate and a back plate, to arrange heat insulation material on the back plate side, to collect heat from the mirror surface within a time zone of high air temperature in the daytime, to warm the mirror surface from the regenerating agent when the air temperature is lowered from the night to early morning, and to maintain a mirror surface temperature higher than the ambient air temperature.

The problem in this method is that a liquid regenerating agent is circulated by convection when air temperature is increased from early morning, a temperature of the regenerating agent is increased at the upper portion, but it is slowly increased at the lower portion.

Therefore, the temperature in the lower portion of the mirror plate is delayed to increase because the temperature rise of the lower portion of the regenerating agent is delayed even when the air temperature is increased, and in this period, the temperature of the mirror plate is lower than the ambient air temperature to make the mirror surface dim. Moreover, when the air temperature is lowered from the night to the early morning, the regenerating agent within the inside is convected, the radiation of the regenerating agent is accelerated, and the regenerating effect is lowered.

As described above, hitherto proposed techniques do not fully function in broad meteorological condition.

The present invention aims to obviate said shortcoming by taking the above points into consideration.

The present invention is to provide a road reflector having a sufficient anti-fogging function from a lowering cycle to a rising cycle of temperature, since the main cause of fogging a road reflector is because water in air is condensed on a mirror surface when temperature of the mirror surface more lowers than the dew point temperature of ambient air by radiational cooling.

An object of the present invention is to provide a road reflector with non-fogging function comprising: a mirror plate, a back plate secured to said mirror plate in the periphery of said mirror plate so as to make a sealed container, a heat insulating

material inserted to back side of said mirror plate within said container, characterized in that a road reflector comprises a regenerating agent containing vessel attached to the back side of said mirror plate within said container as being heat transferable, a heat insulating material attached to back side of said vessel, thereby said road reflector is united integrally with a mirror plate, a regenerating agent containing vessel and heat insulating materials.

Another object of the present invention is to provide a road reflector wherein said road reflector further comprises a heat buffer inserted and attached between the back side of said mirror plate and said regenerating agent containing vessel.

Still another object of the present invention is to provide a road reflector wherein said road reflector further comprises a roof plate attached to the upper portion of said mirror plate, a supporting plate attached to the back side of the back plate, a connecting piece pivotary connected to said supporting plate by a pivot, an elongated groove and a positioning fitting so as to make positioning between said supporting plate and said connecting piece, a clamp fitting for securing said connecting piece to a column.

For a better understanding of the invention, reference is made to the accompanying, in which:

Fig. 1 is a partially broken cross-sectional view by slicing the essential part showing one embodiment of the present invention.

Fig. 2 is a partially broken perspective view showing one embodiment of a vessel containing a regenerating agent.

Fig. 3 is a graph showing behaviors of temperature changes by comparing and measuring performances of the road reflector (A) of the present invention and the prior products (B) and (D).

Fig. 4 is a graph showing behaviors of temperature changes by comparing and measuring performances of the road reflector (A) of the present invention and the prior products (B) and (D).

Throughout different views of the drawing in Figs. 1-4, 1 is mirror plate, 1A is mirror surface, 1B is rear surface of mirror, 2 is back plate, 3 is roof plate, 4 is regenerating agent containing-vessel, 5 is regenerating agent, 6A is heat insulation material, 6B is heat insulation material, 7 is fastening portion for mirror surface back plate, 8 is supporting plate, 9 is connecting piece, 10 is pivot, 11 is positioning fittings, 12 is elongated groove, 13 is column, 14 is clamp fitment, 15 is uniform liquid amount seal, 16 is outer peripheral seal, 16 is injection hole, and 18 is heat buffer.

Present invention is more in detail explained with respect to Road Reflector with non-fogging function.

A regenerating portion is the main portion of the present system, and as a regenerating agent, use may be made of gel-like material which regenerates latent heat having uniform specific heat within a wide temperature range.

That is, if the regenerating agent is gel-like, there is no convention, the regenerating energy of the regenerating agent is effectively utilized for a long period of time, there is no possibility of leaking, and there is shown a preferable tendency to vibration during transportation. Moreover, it is possible to mold into desired curvature, and it is also possible to integrate the molded article by fitting to a road reflector by hand.

For the purpose of reducing manufacturing cost, such a method is possible that a vessel which base is a mirror is formed and a liquid regenerating agent is gelled therein.

As a vessel having less permeable loss, use is made of a three-layered film sandwiching an aluminum foil with polyethylene films from both sides. In this case, it is preferable to use a gel-like regenerating agent viewed from effective application of regenerating energy and fear of liquid leakage.

A preferable regenerating agent has a large regenerating amount per volume through all the area within a wide temperature range from -40 °C to +40 °C and does not freeze at low temperature as possible, such as an aqueous solution of ethylene glycol, propylene glycol, diethylene glycol and the like.

Any method can be used for gelling a regenerating agent. For example, there is a method of gelling a regenerating agent with the use of a proper amount of high water absorbing resin available on the market, or a method of adding 5-10 wt% of polyvinyl alcohol available on the market, solving at high temperature, and freezing it, or a method of adding a bifunctional monomer such as ethylene glycol, dimethacrylate and the like to a water-soluble monomer such as hydroxyethyl methacrylate and the like and carrying out a polymerization reaction. Any method can be used for gelling.

A heat insulation material, use is made of such material having independent air bubbles and a role as a buffer, such as urethane foam and expanded styrol.

The present invention will be further explained in detail by referring to example.

Fig. 1 is a cross-sectional view of a road reflector according to the present invention. Fig. 2 is a partly broken perspective view of a vessel for containing a regenerating agent.

In Fig. 1, 1 is a metallic mirror plate having a mirror surface 1A of suitable curvature, 2 is an integrally joined back plate having a space for

housing suitable contents, and 3 is a roof projected from said mirror plate upwardly. In the present invention, a heat buffer 18 is provided adjacent to the inner side of the mirror plate 1. Next, a vessel 4 for containing a gel-like regenerating agent is housed by adhering to the heat buffer 18, a gel-like regenerating agent 5 is filled within the vessel 4, heat insulation material 6A is adhesively arranged on the rear of this regenerating agent-containing vessel 4, and further heat insulation material 6B is arranged between the heat insulation material 6A and the back plate 2, thereby preventing the surface of the reflector 1 from fogging by moisture condensation.

Reference numeral 7 is a fastening portion for integrally connecting the mirror plate 1 and the back plate 2. 8 is a supporting plate fitted to the rear of the back plate 2. 9 is a connecting piece, 10 is a pivot for pivoting the connecting piece 9 to the supporting plate 8. 11 is a fittings for positioning between the supporting plate 8 and the connecting piece 9. 12 is an arc-like elongated groove for fitting the fittings 11. 13 is a column for supporting the connecting piece 9, and 14 is a clamp fitting thereof. As a regenerating agent, it is preferable to use a gel-like regenerating agent having a large regenerating amount per volume in the whole zone of a wide temperature range from about -40 °C to +40 °C, without freezing at low temperature with no toxicity, and being stable for a long period of time.

Moreover, compatibility of the regenerating agent with a vessel should fully taken into consideration.

The present invention takes the above conditions into consideration, and in case of using a mirror of 800 mmØ in diameter for example, 2.5% high water absorbing resin is added to a compounded solution of propylene glycol and water and injected into the vessel 4 for use. The gel-like regenerating agent 5 is contained in the vessel 4 and fixed between the heat buffer 18 and the heat insulation material 6A. In case of a road reflector of 800 mmØ, a suitable curvature radius of the mirror surface is 3000 mm.

It is desirable to adhere the vessel 4 for containing the regenerating agent 5 to the inside surface 1B of the mirror plate 1 via the heat buffer 18 with respect to the curve of the mirror surface. It is also desirable to make regenerating agent volumes per unit area of the center portion and the outer peripheral portion of the mirror plate 1 substantially the same. Moreover, as explained above, a use temperature is from -40 °C to +40 °C, so that it is necessary to prevent the vessel 4 from breaking by volume expansion of the regenerating agent 5 and to prevent the regenerating agent 5 from dissipating to the outside.

Under consideration of these conditions, the present invention uses a round vessel as the vessel 4 by using a three-layered film made by sandwiching an aluminum foil with polyethylene film and a polyester film, but the vessel is not limited thereto. The vessel 4 for containing a regenerating agent is composed of a film 2 with a uniform liquid amount seal 15 and an outer peripheral seal 16 at certain intervals to control a permeable loss for making the gel-like regenerating agent 5 substantially the same volume over the whole mirror surface. The vessel 4 is provided with an injection hole for injecting the regenerating agent 5.

Heat insulation materials 6A and 6B are inserted between the vessel 4 and the back plate 2. The heat insulation materials 6A and 6B are made by laminating two sheets of 40 mm thick × 800 mmØ and 20 mm thick × 400 mmØ, putting in a polyethylene film bag, and waterproofing. At a time zone of high air temperature during the daytime, heat is collected from the mirror surface, transmitted to the regenerating agent 5 and regenerated. When the air temperature is lowered from the night to early morning, the mirror surface 1A is warmed from the inside by dissipating heat only from the side of the mirror plate 1, and the temperature is kept higher than the ambient air temperature. Moreover, the regenerating agent is gelled so as to dissipate quantity of regenerated heat by taking much time.

A sponge used as heat insulation material plays a role of a buffer by adhering the vessel 4 to the inner surface 1B of the mirror surface with the aid of its resilience.

Fig. 3 shows a result of comparing the road reflector A of the present invention with the prior road reflector B having a non-fogging device with the use of a liquid regenerating agent on the back of a reflector.

As shown in Fig. 3, it shows records and graphs of ten day's observation for a mirror surface temperature and its ambient temperature at 6:30 every morning in the wintertime, that the mirror surface temperature (A) of the reflector of the present invention is higher than the mirror surface temperature (B) of the reflector having no-fogging function and higher than the ambient temperature (C) over the whole zone of an observation period. The prior product (B) shows substantially the same temperature as the ambient temperature (C).

Fig. 4 shows a result of comparing the road reflector of the present invention with a road reflector having a non-fogging device of the system proposed by Japanese Patent Application Laid-open No. 2-204,508, which is called a prior product (D) hereinafter.

Fig. 4 show records and graphs of the mirror surface temperature and its ambient temperature of

both the reflectors for 24 hours, and that the mirror surface temperature of the reflector of the present invention shows a high temperature from the night to 10 o'clock in the morning as compared with the prior product (D). This is because the ambient temperature starts to lower from the evening, and regenerated temperature energy released from the regenerating agent, which is gelled in the present invention, continues its regenerating effect for long time. While, the prior product (D) which mirror surface temperature is increased without any time lag with increase of the ambient temperature from the morning cannot continue a regenerating effect by a convection action because of the use of a liquid regenerating agent.

It shows from the above comparative test result that the reflector of the present invention shows an extremely effective non-fogging effect.

The present invention relates to improvement of a road reflector provided at intersections and hardly visible places, uses a gel-like regenerating agent as a regenerating agent, and utilizes long regenerating time, so as to prevent the reflector from fogging generated at the cold season and from the night to the early morning with high humidity and to constantly perform a function of the road reflector, and has such a remarkable effect that safety of traffic can be increased.

The prior road reflector has been tried to prevent fogging variously, but a non-fogging effect is not sufficient, and hindered at the cold or humid season, but the present invention solves the problem by such a simple mechanism that a heat buffer is inserted in the inside of the mirror surface of the reflector, a soft vessel containing a gel-like regenerating agent is adhered thereto, a heat insulation material is attached to the back thereof and a back plate is heat-insulatingly buffered. As a result, fogging by surface condensation of the mirror plate can be prevented as compared with the use of an anti-freeze and liquid regenerating agent, heat is well conducting, and the mirror surface is prevented from distorting, so as to remarkably increase its effect and to be useful industrially.

## Claims

1. Road reflector with non-fogging function comprising: a mirror plate 1, a back plate 2 secured to said mirror plate 1 in the periphery of said mirror plate so as to make a sealed container, a heat insulating material 6A, 6B inserted to back side of said mirror plate 1 within said container, characterized in that, a road reflector comprises a regenerating agent 5 containing vessel 4 attached to the back side of said mirror plate 1 within said container as being heat transferable, a heat insulating material 6A, 6B attached to back side of said vessel 4, thereby said road reflector is united integrally with a mirror plate, a regenerating agent containing vessel 4 and heat insulating materials 6A, 6B.

2. Road reflector as defined in claim 1, wherein said road reflector further comprises a heat buffer 18 inserted and attached between the back side of said mirror plate 1 and said regenerating agent 5 containing vessel 4.

3. Road reflector as defined in claim 1, wherein said road reflector further comprises a roof plate 3 attached to the upper portion of said mirror plate, a supporting plate 8 attached to the back side of the back plate 2, a connecting piece 9 pivotary connected to said supporting plate 8 by a pivot 10, an elongated groove 12 and a positioning fitting 11 so as to make positioning between said supporting plate 8 and said connecting piece 9, a clamp fitting 14 for securing said connecting piece 9 to a column 13.

FIG_1

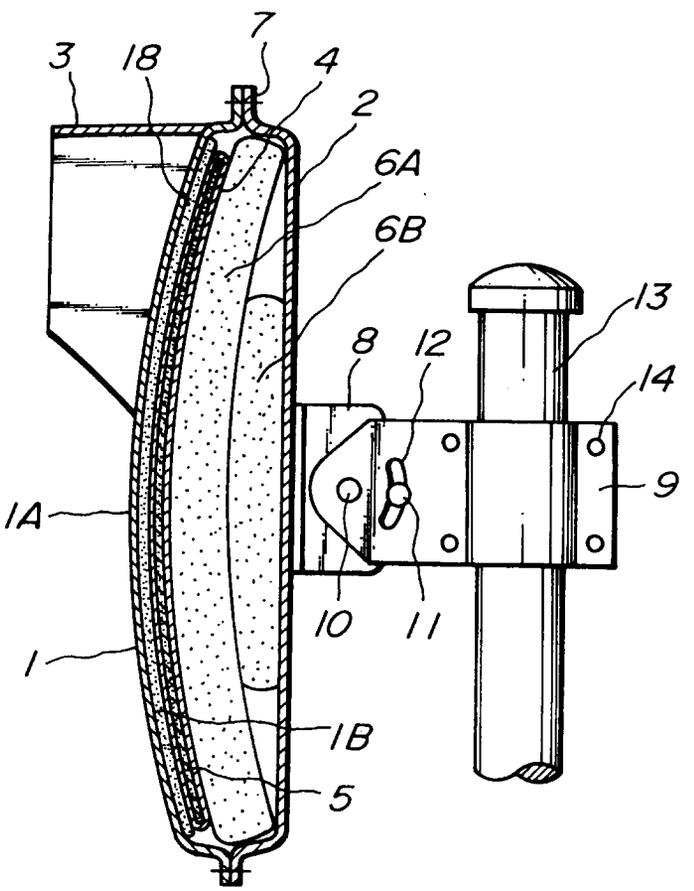


FIG_2

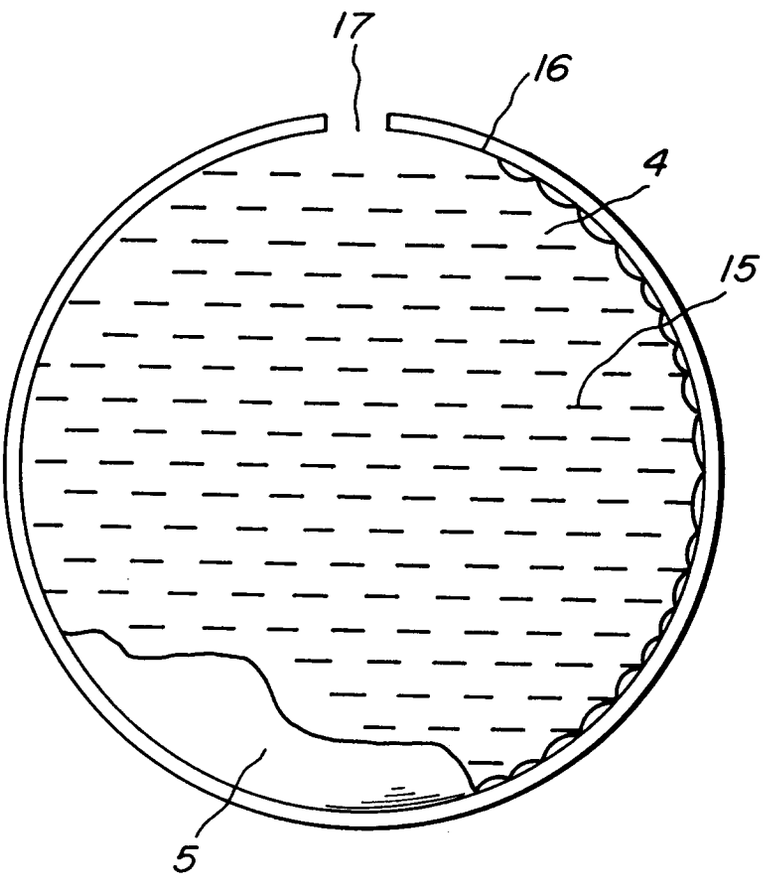


FIG_3

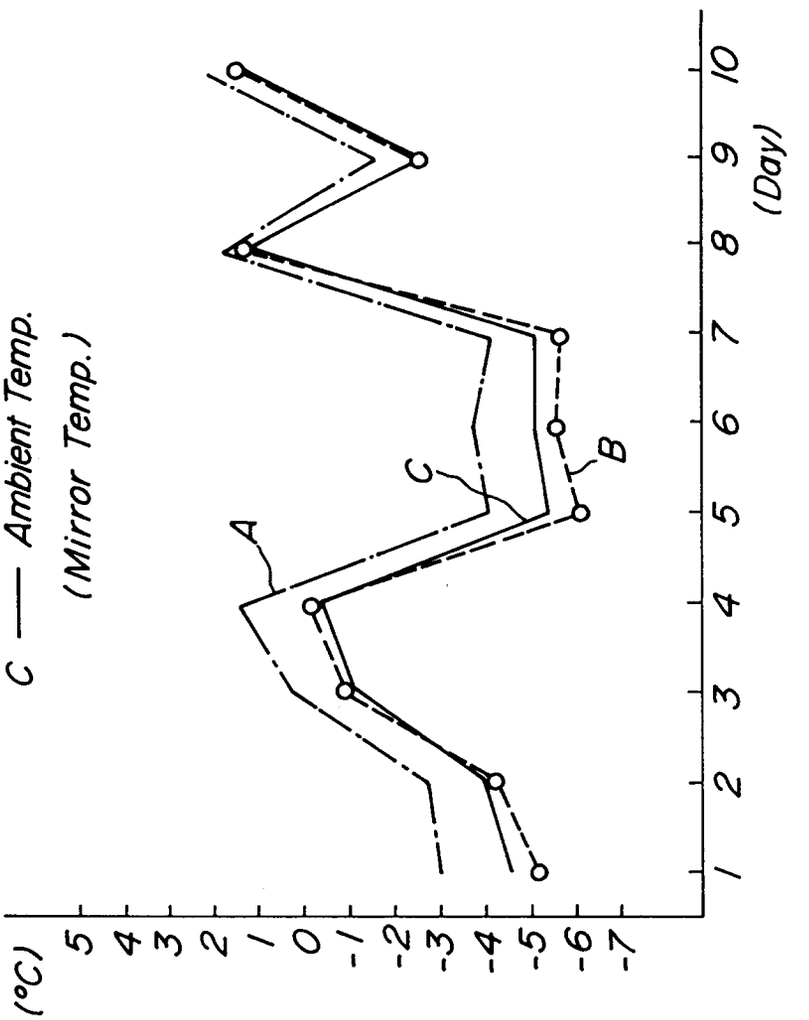
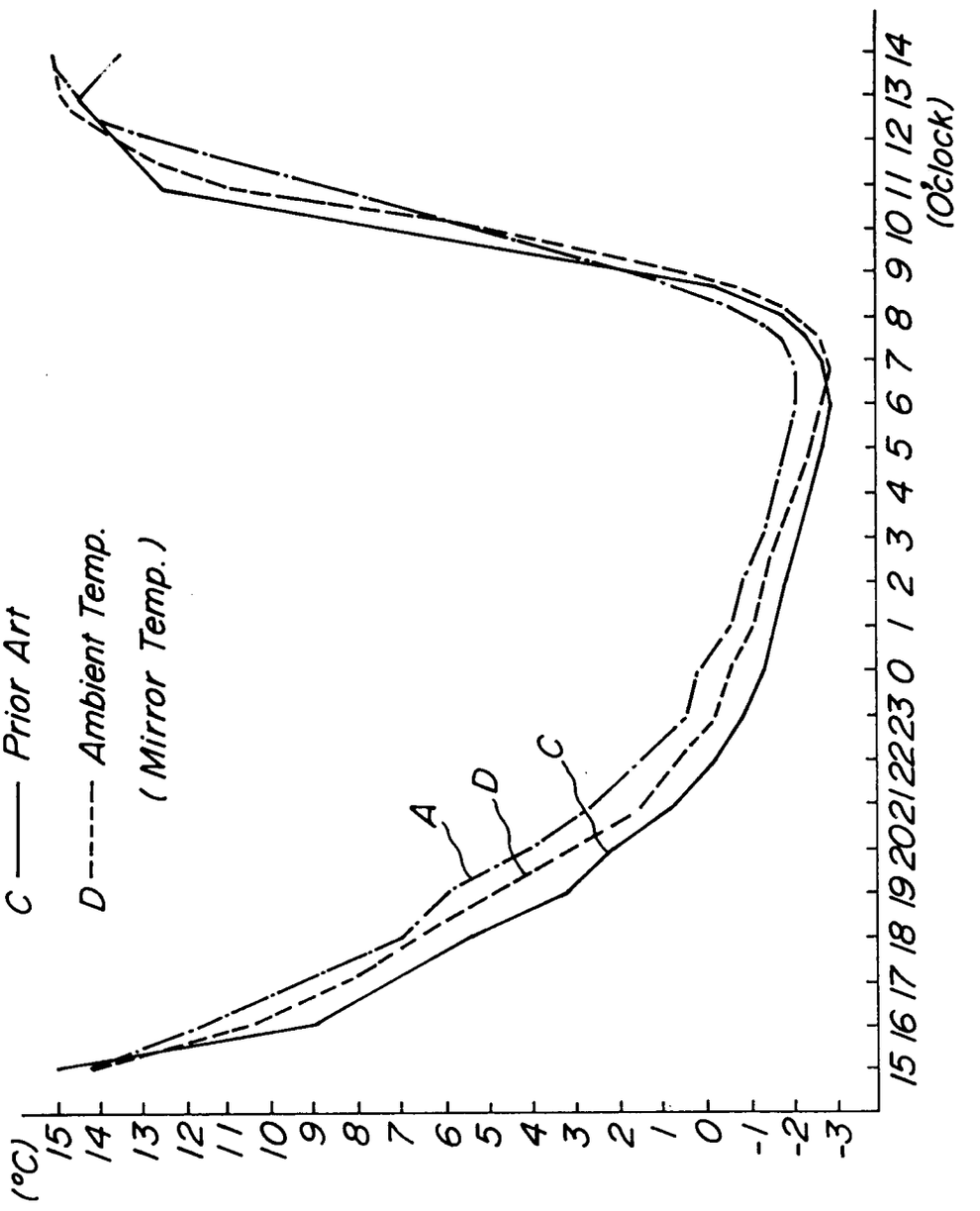

A —·— Present Invention
B o----o Prior Art
C —— Ambient Temp.
(Mirror Temp.)
(°C)
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
1
2
3
4
5
6
7
8
9
10
(Day)
A
B
C

FIG. 4


A —·— Present Invention
C —— Prior Art
D ----- Ambient Temp.
(Mirror Temp.)
(°C)
15
14
13
12
11
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6
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-2
-3
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D
C
15 16 17 18 19 20 21 22 23 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
(O'clock)

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# EUROPEAN SEARCH REPORT

Application Number

EP 92 85 0288

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
|---|---|---|---|
| D,X | PATENT ABSTRACTS OF JAPAN<br>vol. 14, no. 499 (M-1042)1990<br>& JP-A-22 04 508 ( HIROSHI NAKAJIMA ET AL. )<br>* abstract *<br><br>----- | 1,3 | G08B5/00 |

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

G08B
E01F

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| BERLIN | 11 NOVEMBER 1993 | PAETZEL H. |

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