

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No. : 15/669,133 Confirmation No. 9564
First Named Inventor : PATRICK FISHER
Filed : August 4, 2017
Title : FLASH ANNEALING OF SILVER COATINGS
Group Art Unit : 1717
Examiner : Marianne L. Padgett
Customer No. : 144411

Commissioner for Patents
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DECLARATION OF PATRICK FISHER UNDER 37 C.F.R. § 1.132

I, Patrick Fisher, hereby declare as follows.

1. I am one of the joint inventors of the above-identified patent application.
2. I majored in Materials Science and Engineering (Thin Films focus) and graduated from Carnegie Mellon University in 2008.
3. Since 2014, I have been employed by Vitro Flat Glass LLC (“Vitro”) or its predecessor company. At Vitro, I work as a Research Associate at the Glass Technology Center located in Harmar, PA. I have worked in the area of solar control coating development, having worked on the development of **Solarban®** 90VT (a solar control coating which won an R&D 100 award) and *Solarban* 90, and I have been granted four patents (U.S. #8,970,329; U.S. #9,543,105; U.S. #9,625,509; U.S. #10,539,726).
4. I have reviewed the publication of the above-referenced patent application and the Office Action dated December 31, 2020 (hereinafter the “Office Action”).
5. Independent claim 1 is directed to a method of producing a coated transparency, comprising:

- a. depositing a stack of layers on a transparent substrate, the stack comprising a first dielectric layer over at least a portion of the substrate; a first discontinuous metal layer over at least a portion of the first dielectric layer; and a first primer layer over at least a portion of the first discontinuous metal layer, thereby forming the coated transparency; and
 - b. flashing the coated transparency of the depositing step at room temperature, with more than one flash of non-coherent light in the visible spectrum from a source with an intensity ranging from 1 J/cm² to 7 J/cm² for a pulse length of above 0 ms and up to 10 ms, thereby increasing visible light transmittance of the coated transparency.
6. Two (2) additional Examples were prepared: Example A and Example B. Both Example A and Example B were prepared with the following coating layers:

TABLE 1

<u>Layer</u>	<u>Material</u>	<u>Thickness (nm)</u>
First Dielectric Layer		
First Film	zinc stannate	23.8
Second Film	zinc oxide	15.2
First Metallic Layer	silver	11.6
First Primer Layer	titanium	2.3
Second Dielectric Layer		
First Film	zinc oxide	9.1
Second Film	zinc stannate	48.3
Third Film	zinc oxide	13
Second Metallic Layer	silver	13
Second Primer Layer	titanium	2.3
Third Dielectric Layer		
First Film	zinc oxide	10.2
Second Film	zinc stannate	54.3
Third Film	zinc oxide	12.2
Third Metallic Layer	silver	17.4
Third Primer Layer	titanium	2.3
Fourth Dielectric Layer		
First Film	zinc oxide	8.5
Second Film	zinc stannate	22.8

Overcoat	TiO ₂	5.4
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7. While each of Example A and Example B have the same coating layers as outlined in Table 1, each of Example A and Example B were subjected to different flashing processes. For Example A, the coated transparency was first subjected to two, 500 V flashes for 500 microseconds. The coated article of Example A was then subjected to fifteen (15) additional flashes, each flash having the voltage and duration specified in Table 2. For each additional flash, the voltage of the flash was increased until a voltage of 670 V was achieved. After each flash or group of flashes, the CIELAB L* visible light transmittance was measured using HunterLab UltraScan PRO, and the measured value was recorded in Table 2. In contrast, the coated article of Example B was only subject to one (1) flash. The single flash applied to the coated article of Example B had a voltage of 660 V and a duration of 500 microseconds. The L* visible light transmittance was measured for the coated article of Example B before and after the flash is applied, and was recorded in Table 2 below.

TABLE 2

<u>Example</u>	<u>Total Number of Flashes</u>	<u>Voltage (V)</u>	<u>Duration (us)</u>	<u>T L*</u>
A	0			85.85
	2	500	500	86.25
	3	520	500	86.33
	4	540	500	86.49
	5	560	500	86.62
	6	580	500	86.73
	7	600	500	86.78
	8	620	500	86.75
	9	640	500	86.21
	10	660	500	85.81
	11	670	500	86.62
	12	670	500	86.80
	17	670	500	86.56
B	0			85.99
	1	660	500	85.48

8. On pages 24-28, the Office Action rejects independent claim 1 for being obvious over US 2014/0272465 (“Lienhart”) in view of US 2017/0291848 (“Canova”) and optionally of US 2015/0191393 (“Polcyn”).
9. Lienhart is directed to a method comprising obtaining a material comprising a substrate coated on at least one portion of at least one of its faces with a stack of thin layers comprising at least one silver layer, and a heat treatment step being carried out by irradiating at least one portion of the surface of said stack using at least one incoherent light source. However, Lienhart fails to disclose or suggest a source of non-coherent light may perform multiple flashes on a single substrate, thereby raising the visible light transmittance.
10. In contrast, independent claim 1 recites that more than one flash of non-coherent light in the visible spectrum from a source is applied to the coating composition. Applying multiple flashes of non-coherent light to the same coated transparency has the unexpected benefit of increasing the visible light transmittance of the coated transparency, compared to the same coated transparency that is only flashed once.
11. As shown in Table 2, the coated transparency of Example A is able to achieve an increase in visible light transmittance by subjecting said coated transparency to multiple flashes, instead of a single flash. For example, the unflashed, coated transparency of Example A had an L* visible light transmittance of 85.85. The coated transparency of Example A was then flashed, twice, with a voltage of 500 V for a duration of 500 microseconds for each flash. After the two flashes to the coated transparency of Example A, the L* visible light transmittance of the twice flashed coated transparency was measured and demonstrated a small increase in visible light transmittance compared to the unflashed, coated transparency. For the third flash of the coated transparency of Example A, the voltage was increased to 520 V and then the third flash was applied to the coated transparency of Example A, resulting in an additional increase in L* visible light transmittance to 86.33. The coated transparency of Example A was subjected to an additional fourteen (14) flashes, for a total of seventeen (17) flashes, increasing the voltage after each flash until a total

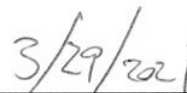
voltage of 670 V was achieved (the last seven (7) flashes were all at 670 V).

12. As evidenced by Table 2, the L* visible light transmittance of the coated transparency of Example A continues to generally increase each time the coated transparency is flashed and the voltage is increased. For example, the coated transparency of Example A is able to be flashed at a voltage as high as 670 V while still increasing the L* visible light transmittance and without damaging the coated transparency of Example A. Thus, an L* visible light transmittance as high as 86.80 can be achieved by flashing the coated transparency of Example A multiple times, which cannot be achieved with a single flash of the same substrate.
13. For example, the coated transparency of Example B was only subject to a single flash, said flash having a very high voltage of 660 V and a duration of 500 microseconds. However, contrary to Example A, the coated transparency of Example B decreased in L* visible light transmittance after flashing, from 85.99 to 85.48. This was because the coated transparency of Example B was not first subject to multiple flashes at a lower voltage, then gradually increasing the voltage until the desired voltage is achieved. A voltage as high as 660 V cannot be applied to an unflashed, coated transparency without decreasing L* visible light transmittance and also potentially damaging the substrate.
14. In order to achieve a significant increase in visible light transmittance of the coated transparency of the present application, the coated transparency must be flashed multiple times. For example, as shown in Table 2, an increase in L* visible light transmittance can be achieved, even at high voltages such as 660 V, by flashing the coated transparency multiple times and increasing the voltage incrementally until the desired flashing voltage is achieved. Without flashing the coated transparency multiple times, an increase in L* visible light transmittance, as robust as shown in Table 2, cannot be achieved.

15. I further declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statement may jeopardize the validity of the application or any patent issuing thereon.



Patrick Fisher



Date