



US009990869B1

(12) **United States Patent**
Hall

(10) **Patent No.:** **US 9,990,869 B1**
(45) **Date of Patent:** ***Jun. 5, 2018**

- (54) **MODULAR DISPLAY PANEL**
- (71) Applicant: **Ultravision Technologies, LLC**, Dallas, TX (US)
- (72) Inventor: **William Y. Hall**, Dallas, TX (US)
- (73) Assignee: **ULTRAVISION TECHNOLOGIES, LLC**, Dallas, TX (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days. days.

This patent is subject to a terminal disclaimer.

- (56) **References Cited**
- U.S. PATENT DOCUMENTS
- 1,816,254 A 7/1931 Heath
- 3,150,455 A 9/1964 Indorf
- (Continued)

- FOREIGN PATENT DOCUMENTS
- CN 2706836 Y 6/2005
- CN 2733499 Y 10/2005
- (Continued)

- OTHER PUBLICATIONS
- Lighthouseled, "Possibilities" and "Specifications," Aug. 9, 2013, 1 page.

- (21) Appl. No.: **15/880,295**
- (22) Filed: **Jan. 25, 2018**

Related U.S. Application Data

- (63) Continuation of application No. 15/369,304, filed on Dec. 5, 2016, now Pat. No. 9,916,782, which is a (Continued)

- (51) **Int. Cl.**
G09F 13/00 (2006.01)
G09F 13/22 (2006.01)
(Continued)

- (52) **U.S. Cl.**
CPC **G09F 13/22** (2013.01); **F21K 9/20** (2016.08); **F21V 23/023** (2013.01); **F21V 31/005** (2013.01); **G06F 1/1601** (2013.01); **G06F 1/182** (2013.01); **G06F 1/183** (2013.01); **G06F 1/188** (2013.01); **G06F 1/189** (2013.01);
(Continued)

- (58) **Field of Classification Search**
CPC G06F 3/1446; F21V 23/023
See application file for complete search history.

- (Continued)
- Primary Examiner* — Kristina N Junge
- (74) *Attorney, Agent, or Firm* — Slater Matsil, LLP

- (57) **ABSTRACT**
- Embodiments of the present invention relate to integrated modular display panels. In one embodiment, modular display panel includes a shell with a first thermally conductive material, a printed circuit board disposed in the shell, and a plurality of LEDs attached to a first side of the printed circuit board. A driver circuit is disposed in the shell and coupled to the plurality of LEDs from a second side of the printed circuit board. The panel further includes a power supply unit for powering the LEDs. The printed circuit board are disposed between the power supply unit and the plurality of LEDs. A second thermally conductive material is disposed between the power supply unit and an outer back side of the panel. A protective structure is disposed over the first side of the printed circuit board, where a display side of the panel, opposite the outer back side, is waterproof.

30 Claims, 64 Drawing Sheets

