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Self-contained electronic display assembly, mounting structure and methods for the same

Abstract

Display assemblies and related systems and methods for mounting are provided. A side assembly with electronic display and a mounting device positioned, at least in part, rearward of the electronic display having laterally extending portion and hooked portions facing, at least primarily, in a first direction is raised relative to another mounting device with hooked portions facing, at least primarily, in a second, opposing direction. The side assembly is raised so that the hooked portions of said additional mounting device clear the hooked portions of the mounting device as the side assembly is moved laterally rearward to at least partially overlap the hooked portions of the mounting device and the additional mounting device. The side assembly is lowered to engage hooked portions of the additional mounting device and the mounting device.

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10844995	12/2019	Wang et al.	N/A	N/A
10905035	12/2020	Whitehead et al.	N/A	N/A
10925174	12/2020	Dunn et al.	N/A	N/A
10969615	12/2020	Wang et al.	N/A	N/A
10973156	12/2020	Dunn et al.	N/A	N/A
10999941	12/2020	Dunn	N/A	N/A
11013142	12/2020	Dunn et al.	N/A	N/A
11016547	12/2020	Whitehead et al.	N/A	N/A
11019735	12/2020	Dunn	N/A	N/A
11032923	12/2020	Dunn et al.	N/A	N/A
11096317	12/2020	Dunn	N/A	N/A
11117482	12/2020	Mercer et al.	N/A	N/A
11191193	12/2020	Hubbard	N/A	N/A
11336101	12/2021	Hao et al.	N/A	N/A
11338168	12/2021	Yang	N/A	N/A
11778757	12/2022	Dunn et al.	N/A	N/A
11822171	12/2022	Dunn et al.	N/A	N/A
11919393	12/2023	Dunn et al.	N/A	N/A
11934054	12/2023	Dunn et al.	N/A	N/A
11997808	12/2023	Dunn et al.	N/A	N/A
D1029778	12/2023	Dunn et al.	N/A	N/A
D1029939	12/2023	Dunn et al.	N/A	N/A
D1029940	12/2023	Dunn et al.	N/A	N/A
D1030691	12/2023	Dunn et al.	N/A	N/A
D1030873	12/2023	Dunn et al.	N/A	N/A
D1030888	12/2023	Dunn et al.	N/A	N/A
12004310	12/2023	Dunn et al.	N/A	N/A
12022624	12/2023	Dunn et al.	N/A	N/A
12039894	12/2023	Dunn et al.	N/A	N/A
12072561	12/2023	Dunn et al.	N/A	N/A
2001/0001459	12/2000	Savant et al.	N/A	N/A
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2001/0023914	12/2000	Oddsen, Jr.	N/A	N/A
2001/0032404	12/2000	Hillstrom	N/A	N/A
2001/0043290	12/2000	Yamamoto	N/A	N/A

2001/0043293	12/2000	Inoue	N/A	N/A
2002/0009978	12/2001	Dukach et al.	N/A	N/A
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2002/0084891	12/2001	Mankins et al.	N/A	N/A
2002/0101553	12/2001	Enomoto et al.	N/A	N/A
2002/0112026	12/2001	Fridman et al.	N/A	N/A
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2005/0105178	12/2004	Kim	N/A	N/A
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2007/0115686	12/2006	Tyberghien	N/A	N/A
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2007/0151664	12/2006	Shin	N/A	N/A
2007/0159035	12/2006	Mullen	N/A	N/A

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2007/0237636	12/2006	Hsu	N/A	N/A
2007/0253205	12/2006	Welker	N/A	N/A
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2009/0126906	12/2008	Dunn	N/A	N/A
2009/0126907	12/2008	Dunn	N/A	N/A
2009/0126914	12/2008	Dunn	N/A	N/A
2009/0129021	12/2008	Dunn	N/A	N/A

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2009/0241388	12/2008	Dunn	N/A	N/A
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2010/0226091	12/2009	Dunn	N/A	N/A
2010/0232107	12/2009	Dunn	N/A	N/A
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2017/0127579	12/2016	Hubbard	N/A	N/A
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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation of U.S. application Ser. No. 18/750,389 filed Jun. 21, 2024, which is a divisional of U.S. application

Ser. No. 18/233,525 filed Aug. 14, 2023, now U.S. Pat. No. 12,072,561 issued Aug. 27, 2024, which is a continuation-in-part of U.S. application Ser. No. 17/870,913 filed Jul. 22, 2022, now U.S. Pat. No. 12,010,813 issued Jun. 11, 2024, the disclosures of which are hereby incorporated by reference as if fully restated herein.

TECHNICAL FIELD

(1) Exemplary embodiments relate generally to self-contained electronic display assemblies as well as mounting structures and methods related to the same.

BACKGROUND AND SUMMARY OF THE INVENTION

(2) The demand for digital out of home ("DOOH") advertising units has grown significantly in recent years. However, public and private real-estate space remains highly sought after and expensive. Advertisers are increasingly looking for new areas and mediums to provide advertising and other public announcement opportunities. What is needed is a display assembly that is adapted for installation at a variety of environments.

(3) A self-contained electronic display assembly, as well as a mounting structure and methods for the same are provided. The disclosed self-contained electronic display assembly is adapted for installation at a variety of environments, such as by virtue of its largely, or entirely, self-contained nature. The mounting structure is highly adaptable for relatively simple installation in a number of different environments. Each of the electronic display assemblies may comprise a dedicated open loop airflow pathway and/or a dedicated closed loop airflow pathway. The closed loop airflow pathway may encircle an electronic display. The open loop airflow pathway may extend along a backlight for the electronic display. Other airflow configurations may be utilized.

(4) The mounting structure may be configured to flexibly accommodate a variety of electronic equipment. Some or all of the electronic equipment may not necessarily be required for operation of the electronic display assemblies. For example, without limitation, the mounting structure may be configured to accommodate and/or provide electrical power and/or network connectivity to, electric vehicle ("EV") charging equipment, power transformers, traffic control devices, parking meters, street lighting equipment, and/or other civil or government and/or privately owned equipment. This may permit increased opportunity to place units within existing street or other public spaces.

(5) The mounting structure may be configured to removably accept one or more of the electronic display assemblies. In exemplary embodiments, without limitation, the mounting structure is configured to accept two of the electronic display assemblies on opposing sides thereof.

(6) In exemplary embodiments, without limitation, the mounting structure may comprise one or more hooks. For example, a set of one or more hooks may be installed to, provided at, and/or form part of a framework for connection to a ground surface, wall, or the like, and/or directly to a wall or other structure without the need for a separate framework. A complementary set of one or more hooks may be installed to, provided at, and/or form part of the electronic display assemblies. The hooks may be configured to mate with one another, preferably in a selectively removable fashion such that the electronic display assemblies may be removably installed. The complementary hooks may be configured to permit rotational movement of the electronic display assemblies when mounted. This arrangement may be used for newly constructed and/or installed units and/or to retrofit existing street furniture and other structures, such as but not limited to bus shelters.

(7) The mounting structure may comprise a dedicated, open loop airflow pathway between the electronic display assemblies to thermally manage some or all of the electronic equipment. The open loop airflow pathway of the mounting structure may be wholly or partially separate from the open and/or closed loop airflow pathways of the electronic display assemblies, such as in accordance with various ingress protection ("IP") standards.

(8) The mounting structure may be relatively compact for transportation. The mounting structure may permit removable attachments of the electronic display assemblies such that they may be

removed for proper orientation during transport.
(9) Alternative to a dedicated mounting structure, the electronic display assemblies may be configured for mounting to existing building walls, EV charging equipment, power transformers, traffic control devices, parking meters, street lighting equipment, and/or other civil or government and/or privately owned equipment or other buildings, structures, and/or surfaces.
(10) Further features and advantages of the systems and methods disclosed herein, as well as the structure and operation of various aspects of the present disclosure, are described in detail below with reference to the accompanying figures.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) In addition to the features mentioned above, other aspects of the present invention will be readily apparent from the following descriptions of the drawings and exemplary embodiments, wherein like reference numerals across the several views refer to identical or equivalent features, and wherein:
(2) FIG. **1** is a perspective view of an exemplary display assembly also illustrating section lines A-A and B-B;
(3) FIG. **2** is a side view of the display assembly of FIG. **1**;
(4) FIG. **3** is a front view of the display assembly of FIG. **1**;
(5) FIG. **4** is a side view of the display assembly of FIG. **1**;
(6) FIG. **5** is a front view of a mounting structure of the display assembly of FIG. **1** with side assemblies installed thereon but certain cladding components removed;
(7) FIG. **6** is a front view of the mounting structure of FIG. **5** with the side assemblies also removed;
(8) FIG. **7** is a perspective view of the mounting structure of FIG. **6**;
(9) FIG. **8** is a rear perspective view of the side assembly of FIG. **5** illustrated in isolation;
(10) FIG. **9** is a front perspective view of the side assembly of FIG. **8**;
(11) FIG. **10**A is a front sectional view of the display assembly of FIG. **1** taken along section line B-B of FIG. **1**;
(12) FIG. **10**B is a side sectional view of the side assembly of FIG. **10**A also indicating detail A and detail B;
(13) FIG. **10**C is a detailed side sectional view of detail A of FIG. **10**B;
(14) FIG. **10**D is a detailed side sectional view of detail B of FIG. **10**B;
(15) FIG. **10**E is a detailed side view of FIG. **10**C with certain components shown in isolation;
(16) FIG. **11**A is a front sectional view of the display assembly of FIG. **1** taken along section line A-A of FIG. **1**;
(17) FIG. **11**B is a top sectional view taken along section line A-A of FIG. **1**;
(18) FIG. **12**A is a front view of the side assembly separately installed to an exemplary surface in an exemplary fashion;
(19) FIG. **12**B is a side sectional view of the installed side assembly of FIG. **12**A taken along section line C-C;
(20) FIG. **12**C is a detailed side view of detail C of FIG. **12**B;
(21) FIG. **13**A is a perspective view of an exemplary mounting structure of FIGS. **12**A-**12**C shown in insolation;
(22) FIG. **13**B is a side view of the mounting structure of FIG. **13**A;
(23) FIG. **14**A is a front view of another exemplary embodiment of the side assembly separately installed to the exemplary surface in another exemplary fashion;
(24) FIG. **14**B is a side sectional view of the installed side assembly of FIG. **14**A taken along

section line D-D;
(25) FIG. **14**C is a detailed side view of detail D of FIG. **14**B;
(26) FIG. **15**A is a perspective view of an exemplary mounting structure of FIGS. **14**A-**14**C shown in insolation;
(27) FIG. **15**B is a detailed perspective view of the mounting structure of detail E of FIG. **15**A;
(28) FIG. **15**C is a detailed perspective view of the mounting structure of FIGS. **15**A-**15**B with certain components not illustrated so that other features may be better seen;
(29) FIG. **15**D is a detailed perspective view of the mounting structure of FIGS. **15**A-**15**B with certain components not illustrated so that other features may be better seen;
(30) FIG. **16**A is a perspective view of an exemplary mounted display;
(31) FIG. **16**B is a perspective view of an exemplary mounting structure of FIG. **16**A partially retrofitting to accommodate an exemplary display assembly;
(32) FIG. **16**C is the perspective view of FIG. **16**B with the mounting structure further retrofitted;
(33) FIG. **16**D is the perspective view of FIG. **16**C with the mounting structure further retrofitted;
(34) FIG. **16**E is the perspective view of FIG. **16**D with the mounting structure further retrofitted;
(35) FIG. **16**F is a side view of the mounted display of FIG. **16**E;
(36) FIG. **17**A is a detailed side sectional view of the mounted display of FIGS. **16**A and **16**F;
(37) FIG. **17**B is a detailed perspective view of the mounted display of FIGS. **16**A and **16**F;
(38) FIG. **17**C is another detailed perspective view of the mounted display of FIGS. **16**A and **16**F;
(39) FIG. **17**D is a detailed rear perspective view of the mounted display of FIGS. **16**A and **16**F;
(40) FIG. **17**E is another detailed rear perspective view of the mounted display of FIG. **17**D; and
(41) FIG. **17**F is a detailed rear view of the mounted display of FIG. **17**D.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENT(S)

(42) Various embodiments of the present invention will now be described in detail with reference to the accompanying drawings. In the following description, specific details such as detailed configuration and components are merely provided to assist the overall understanding of these embodiments of the present invention. Therefore, it should be apparent to those skilled in the art that various changes and modifications of the embodiments described herein can be made without departing from the scope and spirit of the present invention. In addition, descriptions of well-known functions and constructions are omitted for clarity and conciseness.

(43) Embodiments of the invention are described herein with reference to illustrations of idealized embodiments (and intermediate structures) of the invention. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, embodiments of the invention should not be construed as limited to the particular shapes of regions illustrated herein but are to include deviations in shapes that result, for example, from manufacturing.

(44) FIG. **1** through FIG. **4** illustrate an exemplary display assembly **100**. The assembly **100** may comprise a mounting structure **102**. The mounting structure **102** may be configured to accept one or more side assemblies **104**. The side assemblies **104** sometimes also being referred to electronic display assemblies **104**, or individually as an electronic display assembly **104**. In exemplary embodiments, without limitation, the mounting structure **102** may be configured to receive a first side assembly **104**A on a first side of the mounting structure **102** and a second side assembly **104**B on a second side of the mounting structure **102**, which may oppose the first side of the mounting structure **102**. However, the mounting structure **102** may be configured to accept any number of side assemblies **104** in any arrangement.

(45) The mounting structure **102** may be configured to for connection to a surface, such as but not limited to, a ground surface, a sidewalk, parking lot, a street, a building wall, poles, electrical boxes, transformers, ceilings, floors, combinations thereof, or the like. Alternatively, or additionally, the electronic display assemblies **104** may be configured for mounting directly to a ground surface, a sidewalk, parking lot, a street, a building wall, poles, electrical boxes,

transformers, ceilings, floors, combinations thereof, or the like, without the need for a dedicated mounting structure **102**, and/or such items may serve as part or all of the mounting structure **102**.
(46) The mounting structure **102** may comprise one or more structural members formed into a frame. Any number, size, and/or shape of structural members formed into any size and/or shape frame may be utilized. The mounting structure **102** may comprise one or more cladding components, panels, combinations thereof, or the like. For example, without limitation, the cladding components, panels, or the like may be snap fitted, fastened, adhered, hung, and/or otherwise connected to the structural members to form at least part of a housing.
(47) The mounting structure **102** may comprise one or more apertures or other features configured to accept fasteners, adhesives, structural members, combinations thereof, or the like, for connecting the mounting structure **102** to a surface. The mounting structure **102** may comprise one or more apertures, pass through devices, combinations thereof, or the like, for accepting electrical and/or communication network wires and/or cables, such as for connecting components to utility power and/or communications networks such as the world wide web.
(48) In exemplary embodiments, without limitation, the mounting structure **102** may be configured to accept the side assemblies **104** in a manner which permits movement of the side assemblies **104**, such as between a closed position where the side assemblies **104** rest against, and/or are secured to, the mounting structure **102** and an opened position where the side assemblies **104** are moved away from the mounting structure **102**. Movement may be provided in a hinging manner or otherwise.
(49) The mounting structure **102** may comprise, or be configured to accept, electric vehicle (“EV”) charging equipment **110**. In exemplary embodiments, the display assembly **100** may comprise a recessed compartment **116** which extends within a portion of the mounting structure **102** and which is configured to accept certain EV charging equipment **110** such as, but not limited to, cables, connectors, plugs, outlets, user interfaces, point of sale devices, pulleys, retractable coils, combinations thereof, or the like. In exemplary embodiments, a user facing portion of the EV charging equipment **110** may be located at, or within, external facing portions of the recessed compartment **116** while other components of the EV charging equipment **110** may be located at, or within, the mounting structure **102**.
(50) The assembly **100** may comprise one or more intake areas **106**. In exemplary embodiments, the mounting structure **102** may comprise a first intake area **106**B and each of the side assemblies **104** may comprise an additional intake area **106**A, **106**C, though one or more common intakes **106** may be utilized. The intake areas **106** may comprise, for example, without limitation, one or more apertures, grates, filters, screens, combinations thereof, or the like. The intake areas **106** may be configured to accept ambient air from outside the assembly **100**. Alternatively, the mounting structure **102** may comprise the additional intake areas **106**A, **106**C which may be in fluid communication with the side assemblies **104**.
(51) The mounting structure **102** and/or the side assemblies **104** may comprise one or more exhaust areas **108**. In exemplary embodiments, without limitation, one of the exhaust areas **108**A, **108**B may be associated with each of the side assemblies **104**A, **104**B. For example, without limitation, the exhaust areas **108**A, **108**B may be provided at a lower portion of the side assemblies **104**A, **104**B or at the mounting structure **102** along the lower edge of the side assemblies **104**A, **104**B. A first one of the exhaust areas **108**A may be associated with a first one of the side assemblies **104**A and located at a first side of the assembly **100** while a second one of the exhaust areas **108**B may be associated with a second one of the side assemblies **104**B and located at a second side of the assembly **100** in exemplary embodiments, without limitation. Each of the exhaust areas **108**A, **108**B may be in fluid communication with a respective one of the intake areas **106**A, **106**C, such that each of the airflows is kept separate, though such is not required. The exhaust areas **108**A, **108**B may be located elsewhere.
(52) One or more additional exhaust areas **1080**, **108**D may be provided for the intake area **106**B associated with the mounting structure **102**. The additional exhaust areas **108**C, **108**D may be

provided at a bottom portion of the mounting structure **102** in exemplary embodiments, without limitation. The additional exhaust areas **108**C, **108**D may be in fluid communication with the intake area **106**B. A first one of the additional exhaust areas **108**C may be provided at a first side of the assembly **100** and a second one of the additional exhaust areas **108**C may be provided at a second side of the assembly **100**, for example, without limitation. The additional exhaust areas **108**C, **108**D may be located elsewhere.

(53) The exhaust areas **108** may comprise, for example, without limitation, one or more apertures, grates, filters, screens, combinations thereof, or the like. The exhaust areas **108** may be configured to exhaust the ambient air previously ingested through the intake areas **106**. In exemplary embodiments, without limitation, each of the exhaust areas **108** may be fluidly connected with just one of the intake areas **106**, though common intakes **106** and/or exhausts **108** may be utilized. In other exemplary embodiments, airflow through the assembly **100** may be reversed such that the items shown and/or described as intake areas **106** may serve as exhaust areas **108** and the items shown and/or described as exhaust areas **108** may serve as intake areas **106**.

(54) The mounting structure **102** may be configured to interchangeably accept the electronic display assemblies **104**, blank covers, static poster holders, combinations thereof, or the like. The electronic display assemblies **104**, blank covers, and/or static poster holders may be removed for transportation such that a number of the electronic display assemblies **104**, blank covers, and/or static poster holders may be transported in their desired and/or proper orientation, such as with the mounting structure **102**. For example, without limitation, all such components may be placed within a single shipping crate in this fashion.

(55) The mounting structure **102**, in exemplary embodiments, without limitation, may be first secured at an installation site, such as by passing one or more bolts into an adjacent surface. Power supplies and/or network connectivity wires may be passed into the mounting structure **102**, such as but not limited to, by way of one or more pass-through devices, holes, or the like. The electronic display assemblies **104**, blank covers, and/or static poster holders may thereafter be installed. The certain components of the assembly **100** may be connected to the power supplies, network connectivity wires, and/or other electronic components, directly or indirectly, as required for operation.

(56) FIG. **5** illustrates the assembly **100** with certain cladding and/or panels removed so as to expose exemplary electronic equipment **112** installed within a lower cavity **115** of a lower area **105**. The lower area **105** may comprise an area located below the side assemblies **104** when installed at the mounting structure **102**. The lower area **105** and associated lower cavity **115** may be defined, at least in part, by the mounting structure **102**.

(57) The electronic equipment **112** may comprise, for example without limitation, EV charging equipment **110** (e.g., power modules, transformers, power distribution modules, power controllers, bulk energy storage devices, AC/DC converters, wiring or cable, combinations thereof, or the like), and/or equipment for side assembly **104** and/or assembly **100** functionality, including but not limited to, power modules, transformers, video players, network connectivity equipment (e.g., wireless transmitters/receivers, routers, radios, antennae, combinations thereof, or the like), sensors (e.g., air quality, pressure, temperature, humidity, accelerometer, magnetometers, combinations thereof, or the like), cameras, microphones, location tracking devices, position measurement systems, communications equipment, electronic storage devices, processors, controllers, edge computing devices, user interfaces, tablet computers, touch screen controllers, point of sale devices, government and/or private equipment (e.g., parking meters, electric meters, utility power supply equipment, traffic controllers, communications network equipment) combinations thereof, or the like. Any type or kind of electronic equipment **112** may be provided. Various structure for accommodating the electronic equipment **112**, such as but not limited to, one or more plates, panels, rails, shelves, server racks, combinations thereof, or the like, may be provided within the lower cavity **115**.

(58) FIG. **6** and FIG. **7** illustrates the mounting structure **102** with the side assemblies **104** removed. The recessed compartment **116** may be any size and/or shape. In exemplary embodiments, without limitation, the recessed compartment **116** may be sized such that external EV charging equipment **110** is fully recessed within the compartment **116** when properly stowed, though such is not required. The mounting structure **102** may at least partially define an upper cavity **114**. The upper cavity **114**, in exemplary embodiments without limitation, may be further defined by the side assemblies **104**, such as rear surfaces thereof, and the recessed compartment **116**. The upper cavity **114** may be located above the lower cavity **115**. A series of apertures **118** may extend between the upper cavity **114** and the lower cavity **115** in exemplary embodiments, without limitation. Some or all of the electronic equipment **112** may be located in the upper cavity **114**, though such is not required.
(59) The intake area **106**B, the upper cavity **114**, the lower cavity **115**, and/or the exhaust areas **108**C and/or **108**D may, at least partially, define a central airflow pathway for ambient air. The central airflow pathway may provide a dedicated airflow of ambient air for thermal management of the electronic equipment **112** in exemplary embodiments, without limitation. The central airflow pathway may form an open loop within the assembly **100**. The central airflow pathway may be separate from other open loop airflow pathways, such as those provided at the side assemblies **104**, such as under various ingress protection ("IP") standards. One or more fan assemblies **107** may be located at the intake area **106**B for moving ambient air through the central airflow pathway. Each of the fan assemblies **107** may comprise one or more fans, which may be axial type fans, centrifugal type fans, combinations thereof, or the like.
(60) FIG. **8** and FIG. **9** illustrate one of the side assemblies **104**A, shown in isolation. Each of the side assemblies **104** may comprise the same, or substantially, the same components in the same, or substantially the same, arrangement, though such is not required. Illustration and/or discussion is sometimes made herein with regard to one of the side assemblies **104**A, though similar such components may be provided at other ones of the side assemblies **104**B with corresponding item numbers with the addition of a "B" (e.g., **124**A to **124**B, etc.).
(61) The side assembly **104**A may comprise one of the intake areas **106**A. The side assembly **104**A may comprise a rear cover **124**A. A series of side assembly exhausts **122**A may be located along a lower edge of the side assembly **104**A. The side assembly exhausts **122**A may be in fluid communication with the exhaust area **108**A. The side assembly **104**A may comprise a front cover **120**A. Additional details of the side assemblies **104** may be as further provided herein.
(62) FIG. **10**A through FIG. **11**B illustrate various sectional views of the assembly **100**, including the side assemblies **104**. Each of the side assemblies **104**A, **104**B may comprise a cover layer **120**A, **120**B. The cover layers **120** may each comprise multiple layers which are transparent or translucent (e.g., glass, acrylic) and connected by an optically clear adhesive. However, a single layer may be utilized. One or more polarizers and/or anti-reflective films may be provided at forward or rear surfaces of any of the layers of the covers **120**. Each of the side assemblies **104**A, **104**B may comprise a display layer **126**A, **126**B. The display layers **126** may each comprise one or more liquid crystal cells, though any type or kind of electronic display may be utilized (e.g., plasma, OLED, projection, cathode ray tube, etc.). Each of the side assemblies **104**A, **104**B may comprise an illumination device **130**A, **130**B. The illumination device **130** may comprise one or more light emitting diodes ("LEDs") in exemplary embodiments, without limitation. For example, without limitation, multiple LEDs may be mounted to one or more printed circuit boards arranged to provide direct backlighting to the display layers **126**, though any type of lighting and/or arrangement (e.g., edge lighting) may be utilized. A corrugated layer **146**A, **146**B may extend between each of the illumination devices **130** and a second layer **125**A, **125**B.
(63) A front channel **128**A, **128**B may extend between the cover layer **120**A, **120**B and the display layer **126**A, **126**B of each of the side assemblies **104**A, **104**B. A rear channel **136**A, **136**B may extend between the second layer **124**A, **124**B and the rear covers **124**A, **124**B. The front channels

128 may be fluidly connected to the rear channels **136** of the respective side assemblies **104**. In exemplary embodiments, without limitation, the front channels **128** and rear channels **136** may define a closed loop airflow pathway for circulating gas within a respective one of the side assemblies **104**. The closed loop airflow pathway may surround at least the display layer **126** and the illumination device **125**. Alternatively, or additionally, a backlight channel **132**A, **132**B may extend between the display layers **126**A, **126**B and the illumination devices **130**A, **130**B of the side assemblies **104**. The backlight channels **132** may be fluidly connected to the front and/or rear channels **128**, **136** and form part of the closed loop airflow pathway, though such is not required. A cooling channel **148**A, **148**B may be provided at each of the side assemblies **104**A, **104**B between the illumination devices **130**A, **130**B and the second layers **124**A, **124**B. The cooling channels **148** may be fluidly connected to one of the intakes **106**A, **106**C and may be configured to accept ambient air and form part of an open loop airflow pathway at each to the side assemblies **104**.

(64) Each of the side assemblies **104**A, **104**B may comprise one or more fan assemblies **148**A, **148**B, **123**A, **123**B. Each of the fan assemblies **148**, **123** may comprise one or more fans, which may be axial type fans, centrifugal type fans, combinations thereof, or the like. One or more fan assemblies **148** may be placed within the closed loop airflow pathway of the respective one of the side assemblies **104** for moving circulating gas through the respective closed loop airflow pathway when operated. One or more fan assemblies **123** may be placed within the open loop airflow pathway of the respective one of the side assemblies **104** for moving ambient air through the respective one of the open loop airflow pathways, when operated.

(65) A central airflow pathway may extend within the mounting structure **102**, such as between the side assemblies **104** in exemplary embodiments, without limitation. The central airflow pathway may comprise the intake area **106**B, the upper cavity **114**, the lower cavity **115**, and/or the exhaust areas **108**C and/or **108**D. The exhaust areas **108**C, **108**D may be common or separate, such as on each side of the mounting structure **102**. In this fashion, the central airflow pathway may extend through a middle portion of the display assembly **100**. This may provide dedicated cooling to the electronic components **112**, in exemplary embodiments. As a great number and/or more power intensive electronic equipment **112** is utilized, increased cooling may be required to optimize component performance and/or longevity. This may also raise the display portions of the side assemblies **104**, such as to a more ergonomic viewing height.

(66) The side assemblies **104**A, **104**B may comprise additional electronic components **142**A, **142**B, such as for operating various components of the display assembly **100** and/or side assemblies **104**A, **104**B. The additional electronic components may be located within the rear channels **136**. The additional electronic components **142** may comprise, for example without limitation, power modules, transformers, video players, network connectivity equipment (e.g., wireless transmitters/receivers, routers, radios, antennae, combinations thereof, or the like), sensors (e.g., air quality, pressure, temperature, humidity, accelerometer, magnetometers, combinations thereof, or the like), cameras, microphones, location tracking devices, position measurement systems, communications equipment, electronic storage devices, processors, controllers, edge computing devices, combinations thereof, or the like.

(67) The side assemblies **104**A, **104**B may comprise heat exchangers **134**A, **134**B. The heat exchangers **134** may comprise multiple layers, such as but not limited to, for accommodating ambient air as part of the open loop airflow pathways and circulating gas as part of the closed loop airflow pathways in an alternating, cross-flow arrangement. However, any type or kind of heat exchangers **134** may be utilized. The open loop portions of the heat exchangers **134** may be in fluid communication with the intakes area **106** and exhaust areas **108**, and the closed loop portions of the heat exchangers **134** may be in fluid communication with the front, rear, and/or backlight channels **128**, **132**, and/or **136**. The open loop portions of the heat exchangers **134** may be fluidly connected with the cooling channels **148** or separate therefrom.

(68) The closed loop airflow pathways of the various side assemblies **104** may be separated from

one another and/or open loop airflow pathways of the assembly **100**, such as by partitions, dividers, walls, panels, gaskets, heat exchangers, seals, combinations thereof, or the like. A complete (e.g., gas impermeable) separation or seal is not necessarily required. In exemplary embodiments, the separation may be sufficient to prevent solid and/or liquid particulate from passing therethrough and/or solid and/or liquid particulate above a given size from passing therethrough. For example, without limitation, such separation may be sufficient to meet certain ingress protection code (IPC) standards, such as but not limited to, IP65, IP66, IP67, or the like.

(69) While EV charging equipment **110** is discussed in some places, any type or kind of equipment **112** may be provided at the display assembly **100**, such as but not limited to, within the lower portion **105**. Such equipment **112** may comprise, for example without limitation, power transformers, traffic control devices, parking meters, street lighting equipment, and/or other civil or government and/or privately owned equipment, combinations thereof, or the like. Alternatively, or additionally, the mounting structure **102** may be modified to accommodate such equipment **112** and/or other structures, including but not limited to, walls or other surfaces. The side assemblies **104** may be utilized independent of the mounting structure **102**, such as for direct mounting to walls, buildings, or other structures.

(70) As illustrated with particular regard to at least FIG. **10**E, the side assemblies **104** may comprise one or more mounting devices **117**. The mounting devices **117** may comprise holes, pins, hooks, bars, protrusions, combinations thereof, or the like. The mounting devices **117**A, **117**B of the side assemblies **104**A, **104**B may be configured to mate with one or more mounting devices **119**A, **119**B of the mounting structure **102**. The mounting devices **119** of the mounting structure **102** may comprise holes, pins, hooks, bars, protrusions, combinations thereof, or the like. The mounting devices **117** and/or **119** may be configured to permit hanging or other mounting of the side assemblies **104** at the mounting structure **102** and/or another surface. Securing devices **121**A, **121**B may be provided at lower portions of the side assemblies **104**A, **104**B and/or mounting structure **102** for securing the side assemblies **104** to the mounting structure **102** or other surface, such as when the side assemblies **104** are in a closed position. The securing devices **121** may comprise one or more pins, locks, tabs, latches, fasteners, tie downs, combinations thereof, or the like. In exemplary embodiments, the mounting devices **117**, **119** comprise complementary hooks which are configured to selectively mate such that the side assemblies **104** may be removably and/or movably mounted to the mounting structure **102**. This may permit ease of mounting.

(71) FIG. **12**A through FIG. **12**C illustrate an exemplary embodiment whereby one of the side assemblies **104** is mounted to a surface **103**, such as but not limited to a wall by way of the mounting devices **117**, **119**. The surface **103** may be another object, such as but not limited to the mounting structure **102**, in other exemplary embodiments. The surface **103** and/or other object may serve as a mounting point for the side assemblies **104** by way of the mounting device(s) **119** secured to the surface **103** and/or other object and the mounting devices **117** provided at the side assemblies **104**. The mounting devices **117**, **119** for accomplishing such mounting are further illustrated in at least FIG. **13**A through FIG. **13**B.

(72) In exemplary embodiments, without limitation, one or more of the mounting devices **119** may be secured to the surface **103** or object. For example, without limitation, fasteners may be passed through portions of the mounting device **119**, such as at holes, slots, and/or otherwise solid, fastener permeable material in a laterally extending bracketing portion **113**. Alternatively, or additionally, adhesive, welding, or other bonding techniques may be utilized to secure the mounting device **119** to the surface **103** or object. The mounting device **119** may comprise one or more hooked portions **135**. The hooked portions **135** may be provided at laterally extending portions **113** of the mounting device **119** in exemplary embodiments. The hooked portions **135** may be provided at either end of the laterally extending portion **113** and/or spaced apart along the same. Preferably, the laterally extending portions **113** are sized to substantially match (e.g., within about 80%-120%) of the lateral width of the cover layer **120** for the side assembly **104**. In other exemplary

embodiments, each of the hooked portions **135** may form part of a separate mounting device **119**. In yet other exemplary embodiments, multiple mounting devices **119**, each with one or more hooked portions **135** are utilized with each side assembly **104**.

(73) One or more of the mounting devices **117** may be provided at the side assemblies **104**. The mounting devices **117**, **119** may be complementary, such as to permit removable mounting of the side assembly **104** to the surface **103**. The mounting device(s) **117** may comprise one or more hooked portions **133**. Preferably, the hooked portions **133** of the mounting devices **117** associated with the side assemblies **104** face and/or are open in a primarily downward direction while the hooked portions **135** of the mounting devices **119** associated with the surface **103** face and/or are open in a primarily upward facing direction. In this fashion, the hooked portions **133** of the mounting devices **117** associated with the side assemblies **104** may be raised above the hooked portions **135** of the mounting devices **119** associated with, and preferably already mounted to, the surface **103** or other object and slid downward to connect, mount, and secure the side assembly **104** to the surface **103** or another object.

(74) The side assemblies **104**, in this fashion, may be capable of rotational movement away from the surface **103** or other object, such as to permit access to a rear portion thereof. Alternatively, or additionally, the side assemblies **104** may be removed by upward movement of the side assemblies **104**, such as to disengage the mounting devices **117**, **119** from one another. Preferably, eye hooks may be provided (permanently or removably, such as by way of threaded apertures) at upper portions of the side assemblies to permit upward movement by attached crane or another device. The side assemblies **104** may be moved laterally outward to clear the mounting devices **117**, **119** from each other, then lowered or otherwise moved to another location as desired.

(75) The hooked portions **133** of the mounting devices **117** associated with the side assemblies **104** may be provided at laterally extending portions **111**. The hooked portions **133** may be provided at either end of the laterally extending portion **111** and/or spaced apart along the same. Preferably, the laterally extending portions **111** are sized to substantially match (e.g., within about 80%-120%) of the lateral width of the cover layer **120** for the side assembly **104**. The mounting devices **117** of the side assemblies **104** may be removably or permanently attached to the side assemblies **104** and/or integrally formed therewith.

(76) One or both of the laterally extending portions **111**, **113** may comprise apertures, such as for reduced weight, airflow, and/or accepting fasteners for securing the mounting devices **111**, **113** to the surface **103** and/or other portion of the side assembly **104**.

(77) FIG. **14**A through FIG. **14**C illustrate another exemplary embodiment whereby other exemplary mounting devices **117′**, **119′** are used to mount other exemplary side assemblies **104′** to the same or other surfaces **103** or other object(s). Same or similar components may be numbered similarly but with the addition of a prime (′) (e.g., **117** to **117′**). These mounting devices **117′**, **119′** may be, for example without limitation, preferably used with relatively smaller size side assemblies **104′** with relatively smaller size displays. These side assemblies **104′** may be relatively lighter and thus reduced size mounting devices **117′**, **119′** may be utilized in some embodiments.

(78) In exemplary embodiments, without limitation, the mounting devices **117′** associated with the side assemblies **104′** may comprise one or more apertures **131**, which may be formed as slots. The apertures **131** may be configured to accept hooked portions **135′** of the mounting device **119′** associated with the surface **103** or other structure. The hooked portions **135′** may be provided at either end of a laterally extending portion **113′**. The mounting devices **117′** associated with the side assembly **104** may be provided at either side of the side assembly **104** to receive the hooked portions **135′** in the apertures **131**. Two mounting devices **117′**, in exemplary embodiments, may be provided at each side assembly **104** with a single mounting device **119′** associated with the surface **103**. The hooked portions **135′** may extend laterally and/or depth wise to engage the apertures **131** which may be open in a lateral direction by way of non-limiting example.

(79) Any size, shape, number, and/or kind mounting device **117**, **119**, **117′**, **119′** with any size,

shape, number, and/or kind of components may be provided in any arrangement, preferably in a complementary fashion to permit removable mounting of the side assemblies **104**, **104′** to surfaces **103**. After mounting, the side assemblies **104**, **104′** may be connected to external power supply and/or communication as need for operation. However, as the side assemblies **104**, **104′** may be otherwise independent (e.g., self-contained from an airflow perspective), the mounting devices **117**, **119**, **117′**, **119′** may provide easy of mounting and removal.

(80) The mounting devices **119**, **119′** may be mounted to one a wall, building, item of street furniture (e.g., a bus shelter, junction box, telephone booth, lamp pole, etc.), or other surface. In this fashion, the side assembly **104** may be so mounted to various locations. In exemplary embodiments, without limitation, the mounting devices **119**, **119′** may be connected to and/or integrally formed with, laterally support members for such walls, buildings, items of street furniture, or the like. For example, without limitation, the laterally extending portions **113**, **113′** of the mounting devices **119**, **119′** may comprise laterally extending support members of a bus shelter.

(81) FIG. **16**A through FIG. **16**F illustrate an exemplary embodiment whereby a display unit **204** is mounted to an existing bus shelter **202**. While a bus shelter **202** is discussed, other structures may be utilized, such as but not limited to, various items of street furniture. The display unit **204** may comprise some or all of the components of the side assemblies **104**, **104′** and/or display assembly **100**. Furthermore, while an approach for retrofitting existing bus shelters **202** is sometimes shown and/or discussed, the components, systems, apparatus, methods, and/or the like may be used for new structures.

(82) Bus shelters **202** and/or other structures sometimes comprise areas **203** for mounting advertising or other signage, such as static poster holders. As illustrated with particular regard to at least FIG. **16**B, the areas **203** may comprise upper and/or lower rails **206**A, **206**B for mounting static poster holders and related components. As illustrated with particular regard to at least FIG. **16**C, a retrofitting process may comprise removing such rails **206**A, **206**B and related components. As illustrated with particular regard to at least FIGS. **16**D-**16**E, the retrofitting process may comprise installing an upper panel **208**, a lower panel **210**, and/or one or more side panels **212** to the area **203**. As illustrated with particular regard to at least FIG. **16**F, the display unit **204** may be installed to the area **203**.

(83) FIG. **17**A through FIG. **17**F illustrate the mounted display unit **204** in further detail. As illustrated with particular regard to at least FIGS. **17**A and **17**C, side brackets **214**A may be provided which attach the upper panel **208** to the existing structure **202**. A corresponding side bracket **214**A may be provided on each side (right and left) of the display unit **204** in exemplary embodiments, without limitation. A mounting device **219** may be attached to the existing structure **202**, the side panel **214**A, and/or the front panel **208**. The mounting device **219** may comprise a preferably upward facing hook portion configured to interact with a mounting device **217** within the display unit **204**, which preferably faces downward. Other orientations, including the reverse, may be utilized.

(84) The mounting device **219**, **217** may facilitate hanging the display unit **204** from the structure **202**. The mounting device **219** may be secured to one or more of side members and/or an upper member of the structure **202**. The side brackets **214** may be secured to the side members of the structure **202**. The upper panel **208** may be provided, at least in part, to ensure that most or all ambient air is drawn from a space above the structure **202**, for example because the air within the area **203** may be relatively warm. The upper panel **208** may be adapted to draw air from various areas, such as with other structures **202**. A gasket may be provided at the upper panel **208** to enhance sealing and/or separation of airflows.

(85) As illustrated with particular regard to at least FIGS. **17**D-**17**F, side brackets **214**B may be provided at a lower portion of the structure **202**, such as to secure the lower panel **210**. The lower panel **210** and/or side brackets **214**B may serve as a mounting point for a lower portion of the display unit **204**, which may be secured by one or more bolts or other fasteners through the lower

panel **210** and/or side brackets **214**B.
(86) Any embodiment of the present invention may include any of the features of the other embodiments of the present invention. The exemplary embodiments herein disclosed are not intended to be exhaustive or to unnecessarily limit the scope of the invention. The exemplary embodiments were chosen and described in order to explain the principles of the present invention so that others skilled in the art may practice the invention. Having shown and described exemplary embodiments of the present invention, those skilled in the art will realize that many variations and modifications may be made to the described invention. Many of those variations and modifications will provide the same result and fall within the spirit of the claimed invention.
(87) Certain operations described herein may be performed by one or more electronic devices. Each electronic device may comprise one or more processors, electronic storage devices, executable software instructions, combinations thereof, and the like configured to perform the operations described herein. The electronic devices may be general purpose computers or specialized computing devices. The electronic devices may comprise personal computers, smartphone, tablets, databases, servers, or the like. The electronic connections and transmissions described herein may be accomplished by wired or wireless means. The computerized hardware, software, components, systems, steps, methods, and/or processes described herein may serve to improve the speed of the computerized hardware, software, systems, steps, methods, and/or processes described herein.

Claims

1. A system for mounting display assemblies, said system comprising: a first mounting device comprising a laterally extending portion and hooked portions facing, at least primarily, in a first direction; and a side assembly comprising a display layer and a backlight, and a second mounting device located, at least in part, rearward of at least a viewing surface of the display layer, said second mounting device comprising a laterally extending portion and hooked portions facing, at least primarily, in a second direction; wherein the first mounting device is configured to receive the side assembly by raising the side assembly relative to, and independently from, the first mounting device such that said hooked portions of said second mounting device are positioned to clear the hooked portions of the first mounting device, moving the side assembly laterally rearward such that the hooked portions of the second mounting device at least partially overlap at least a subset of the hooked portions of the first mounting device, and lowering the side assembly to engage at least the subset of the hooked portions of the first mounting device with the hooked portions of the second mounting device.
2. The system of claim 1 wherein: the first direction is a downward facing direction; and the second direction is an upward facing direction.
3. The system of claim 1 wherein: the laterally extending portion comprises holes for receiving fasteners for connecting the first mounting device to a wall or other surface.
4. The system of claim 1 further comprising: a structural framework, wherein the first mounting device is provided at, connected to, or forms part of, the structural framework.
5. The system of claim 4 further comprising: a second side assembly comprising a second display layer, a second backlight, and a third mounting device located, at least in part, rearward of at least a viewing surface of the second display layer, said third mounting device comprising a laterally extending portion and hooked portions facing, at least primarily, in the second direction, wherein the first mounting device is configured to receive the second side assembly at a different side of said structural framework from said side assembly by raising the second side assembly relative to the first mounting device such that said hooked portions of said third mounting device are positioned to clear at least a further subset of the hooked portions of the first mounting device unoccupied by the side assembly, moving the second side assembly laterally rearward such that the

hooked portions of the third mounting device at least partially overlap the further subset of the hooked portions of the first mounting device, and lowering the second side assembly to engage the further subset of the hooked portions of the first mounting device with the further subset of the hooked portions of the third mounting device.
6. The system of claim 5 wherein: the subset of the hooked portion of the first mounting device are located at a first side of the laterally extending portion and the further subset of the hooked portion of the first mounting device are located at a second side of the laterally extending portion.
7. The system of claim 6 wherein: the side assembly and the second side assembly are configured to be removably secured to opposing sides of the structural framework.
8. The system of claim 1 further comprising: eyehooks provided to the side assembly for connecting the side assembly to a crane for raising the side assembly.
9. The system of claim 1 wherein: the second mounting device is located at a rear surface of the side assembly.
10. The system of claim 1 wherein: the side assembly comprises a cover, wherein the display layer is located behind the cover; the laterally extending portion of the second mounting device has a length that is within 80%-120% of a width of the cover; and the laterally extending portion of the first mounting device has a length that is within 80%-120% of the width of the cover.
11. The system of claim 1 wherein: the side assembly comprises: an open loop airflow pathway extending within the side assembly; a closed loop airflow pathway extending within the side assembly; and one or more fans located along the closed loop airflow pathway.
12. The system of claim 1 wherein: the side assembly comprises a cover layer located forward of the display layer and at least one fan assembly; and the display layer, backlight, cover layer, and at least one fan assembly are structurally interconnected by way of at least the second mounting device.
13. The system of claim 12 wherein: the side assembly is supported by the first mounting device when connected.
14. A display assembly with integrated mounting system, said display assembly comprising: a structural framework; a first mounting device provided at, connected to, or forming part of the structural framework and comprising a laterally extending portion and hooked portions facing, at least primarily, in a first direction; and a side assembly comprising a cover layer, a display layer, located rearward of the cover layer, a backlight located rearward of the display layer, at least one fan assembly, and a second mounting device positioned rearward of at least a viewing surface of the display layer, said second mounting device comprising a laterally extending portion and hooked portions facing, at least primarily, in a second direction, wherein the cover layer, the display layer, the backlight, and at least one fan assembly are structurally interconnected by way of at least the second mounting device; wherein the first mounting device is configured to receive the side assembly by raising the side assembly relative to, and independently from, the first mounting device such that at least a subset of said hooked portions of said second mounting device are positioned to clear the hooked portions of the first mounting device, moving the side assembly laterally rearward such that said hooked portions of the second mounting device at least partially overlap at least the subset of hooked portions of the first mounting device, and lowering the side assembly to engage at least the subset of hooked portions of the first mounting device with the hooked portions of the second mounting device.
15. The display assembly of claim 14 further comprising: a second side assembly comprising a second display layer and a third mounting device positioned rearward of at least a viewing surface of the second display layer, said third mounting device comprising a laterally extending portion and hooked portions facing, at least primarily, in the second direction, wherein the first mounting device is configured to receive the second side assembly at a second, opposing side of the structural framework from the side assembly by raising the second side assembly relative to, and independently from, the first mounting device such that said hooked portions of said third

mounting device are positioned to clear a further subset the hooked portions of the first mounting device unoccupied by the side assembly, moving the second side assembly laterally rearward such that the hooked portions of the third mounting device at least partially overlap at least the further subset of the hooked portions of the first mounting device, and lowering the second side assembly to engage at least the further subset of the hooked portions of the first mounting device with the hooked portions of the third mounting device.

16. The display assembly of claim 15 wherein: the first direction is a downward facing direction; and the second direction is an upward facing direction.

17. The display assembly of claim 16 wherein: the side assembly comprises a cover, wherein the display layer is located behind the cover; the laterally extending portion of the second mounting device has a length that is within 80%-120% of a width of the cover; and the laterally extending portion of the first mounting device has a length that is within 80%-120% of the width of the cover.

18. The display assembly of claim 14 wherein: the laterally extending portion of the first mounting device comprises holes for receiving fasteners for connecting the first mounting device to a wall or other surface.

19. A display assembly with integrated mounting system, said display assembly comprising: a structural framework; a first mounting device provided at, connected to, or forming part of the structural framework and comprising a laterally extending portion and hooked portions facing, at least primarily, in a first, upward facing direction, wherein a first portion of said hooked portions is provided at a first side of the first mounting device and a second portion of said hooked portions is provided at a second side of the first mounting device; and side assemblies, each comprising a directly backlit liquid crystal electronic display behind a cover layer and an additional mounting device positioned rearward of at least a viewing surface of the electronic display, each of said additional mounting devices comprising a laterally extending portion and hooked portions facing, at least primarily, in a second, downward facing direction; wherein the first mounting device is configured to receive each of the side assemblies by raising the side assemblies relative to the first mounting device such that said hooked portions of each of said additional mounting devices are positioned to clear the hooked portions of the first mounting device, moving the side assemblies laterally rearward such that the hooked portions of the additional mounting devices at least partially overlap at least a respective subset of the hooked portions at a respective side of the first mounting device, and lowering the side assemblies to engage the respective subset of the hooked portions of the first mounting device with the hooked portions of the additional mounting devices.

20. The display assembly of claim 19 wherein: the laterally extending portion of the second mounting device has a length that is within 80%-120% of a width of the cover layer; and the laterally extending portion of the first mounting device has a length that is within 80%-120% of the width of the cover layer.