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Steed et al.

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(54) **INTEGRATED WINDOW DISPLAY**

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(52) **U.S. Cl.** **345/7**; 345/8; 345/31; 340/815.4; 340/815.49; 340/461

(58) **Field of Classification Search** 340/995, 340/815.49, 815.4, 815.83, 815.86, 461, 340/980; 455/347–348; 348/837; 345/7, 345/9, 31; 52/204.62; 359/630, 669
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,766,540	A *	10/1956	Brown et al.	40/574
4,293,859	A *	10/1981	Sergent	343/702
4,367,467	A *	1/1983	Emile, Jr.	349/57
4,391,053	A *	7/1983	Anthony	40/735
4,446,451	A *	5/1984	Boulanger	337/380
4,625,210	A *	11/1986	Sagl	342/20
4,749,832	A *	6/1988	Schlosser	200/314
5,013,135	A *	5/1991	Yamamura	359/630
5,028,912	A *	7/1991	Iino	345/7
5,221,068	A *	6/1993	Varner et al.	248/231.41
5,678,793	A *	10/1997	Hill	248/206.3
6,049,288	A *	4/2000	Kawasaki	340/815.4
6,805,455	B1 *	10/2004	Nielsen et al.	359/877

* cited by examiner

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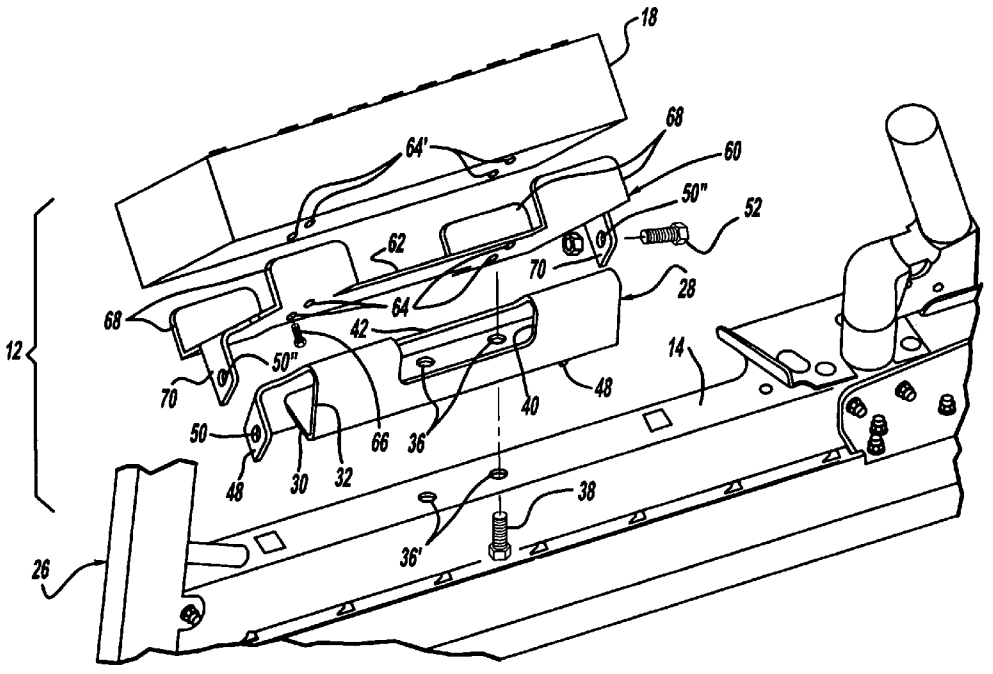
(57) **ABSTRACT**

A display system (**12**) for attachment to a sill (**14**) of a window structure (**26**) has been provided. The display system (**12**) includes a mounting device (**28**) for attaching the display system (**12**) to the sill (**14**) of the window structure (**26**) and a display device (**18**) for attachment to the mounting device (**26**). The display device (**18**) is intended to communicate various information to the viewer of the display device and preserve or create more available space surrounding the window structure (**26**).

15 Claims, 7 Drawing Sheets



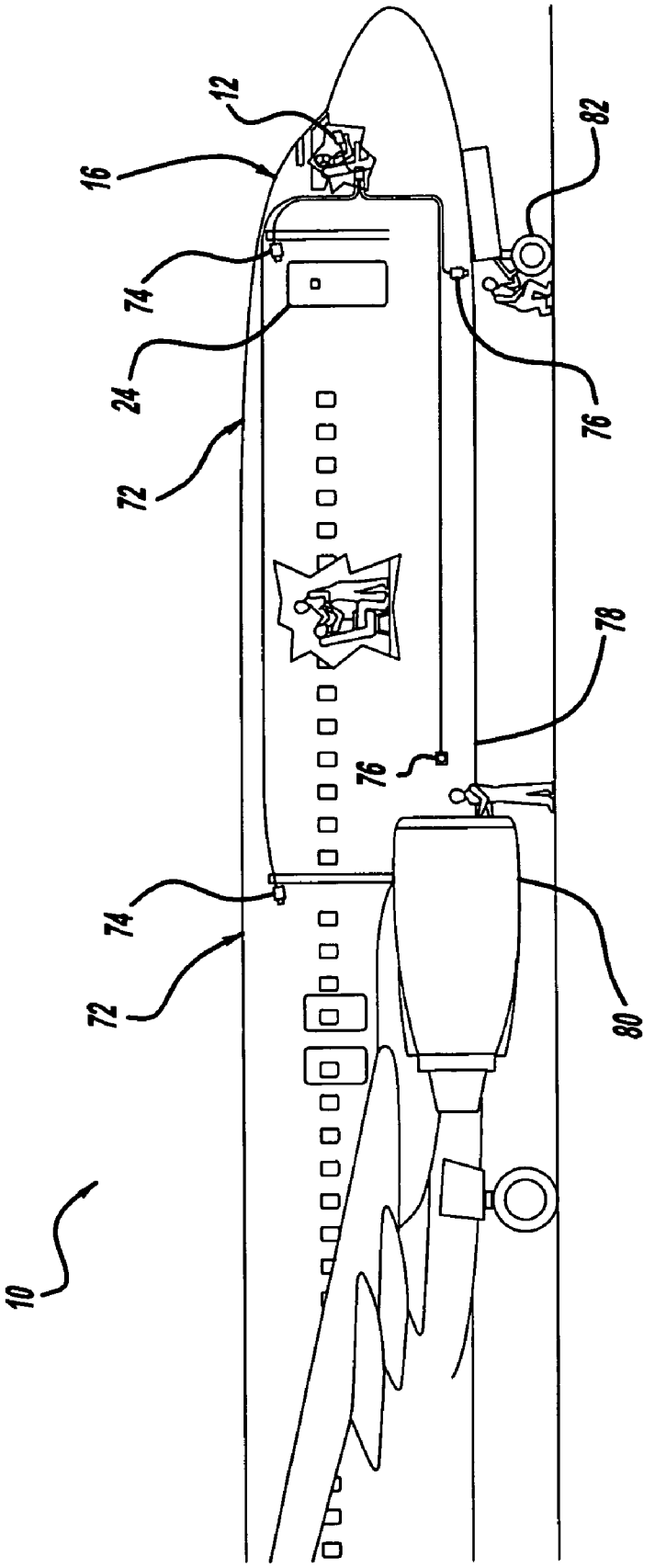


FIG - 1

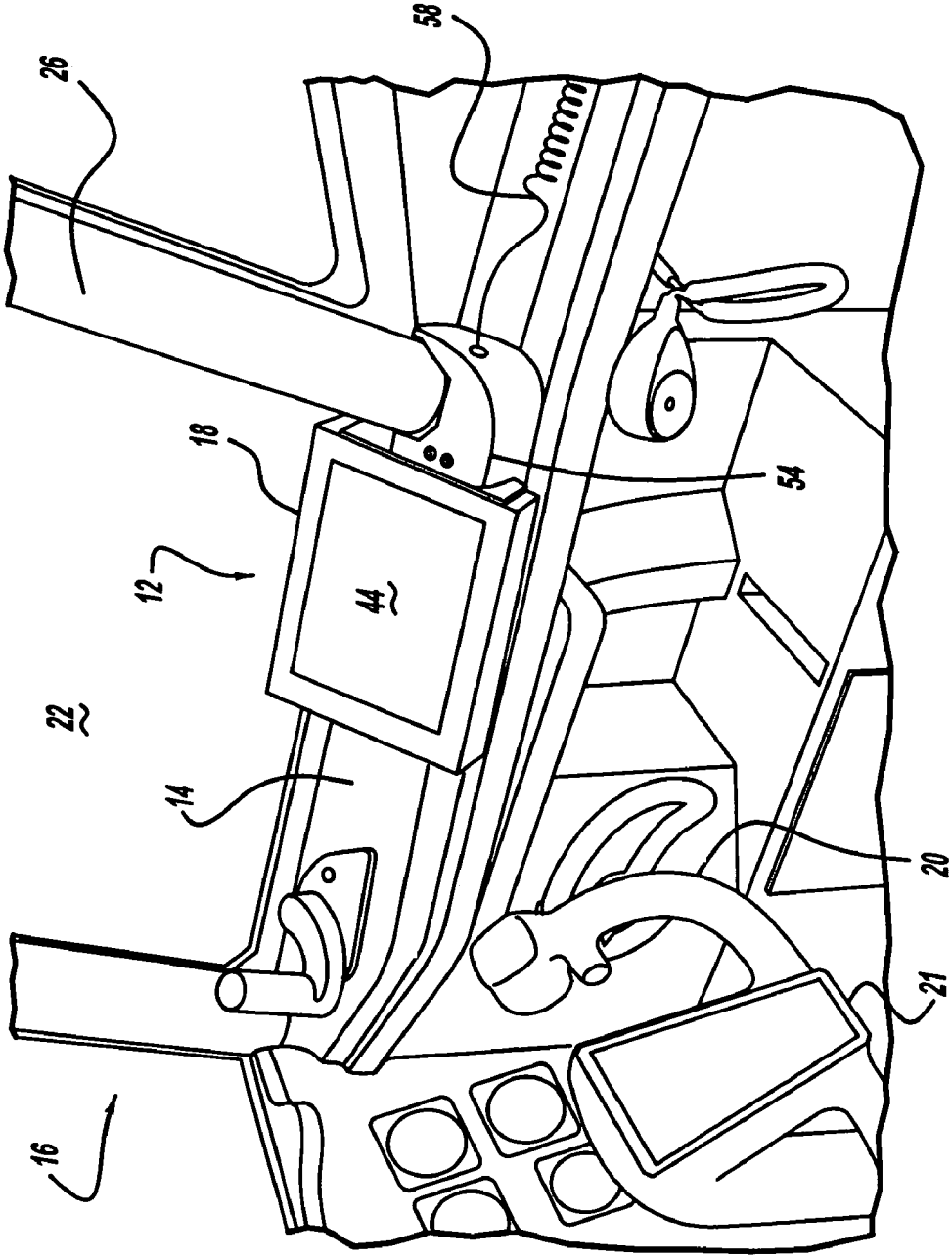


FIG - 2A

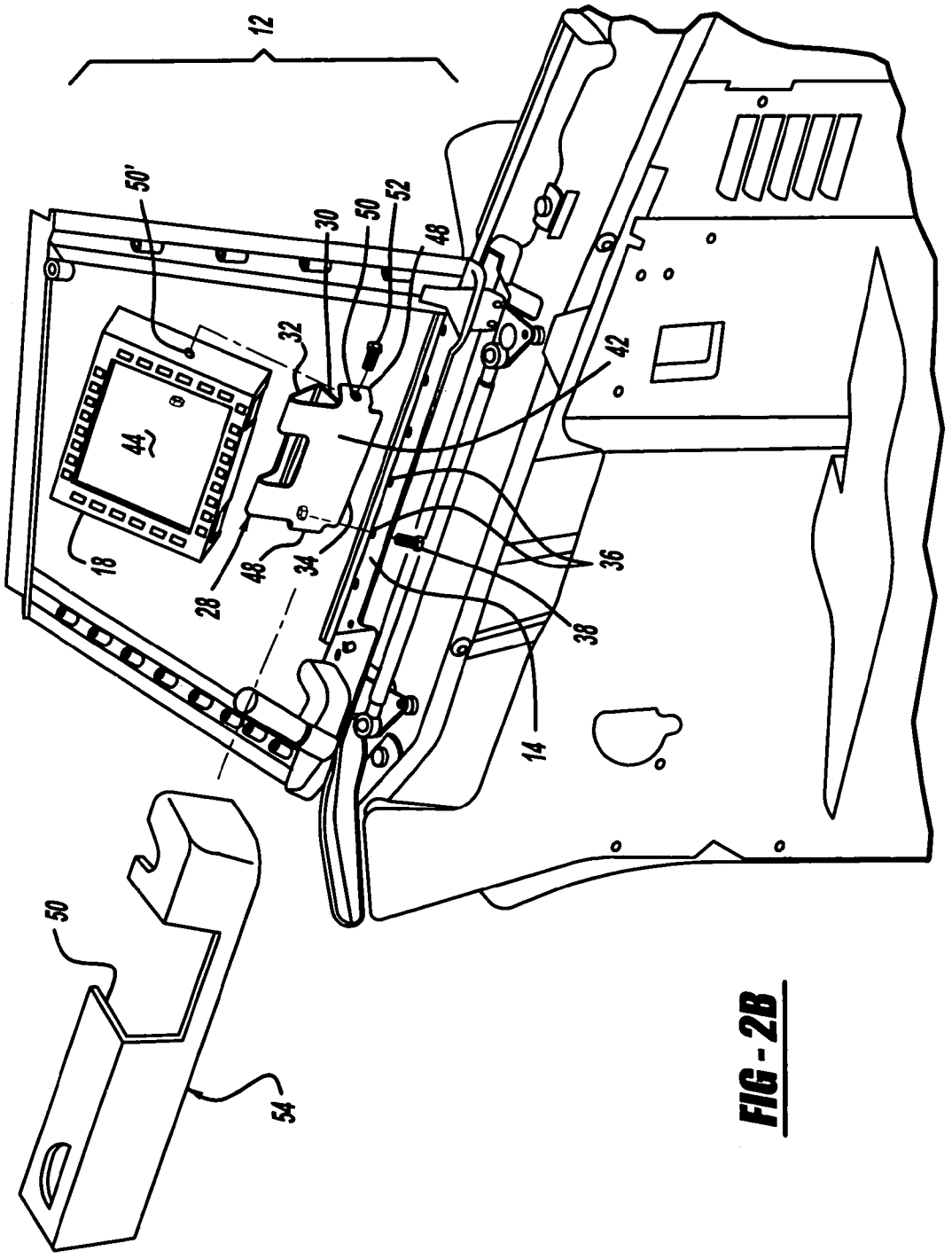


FIG - 2B

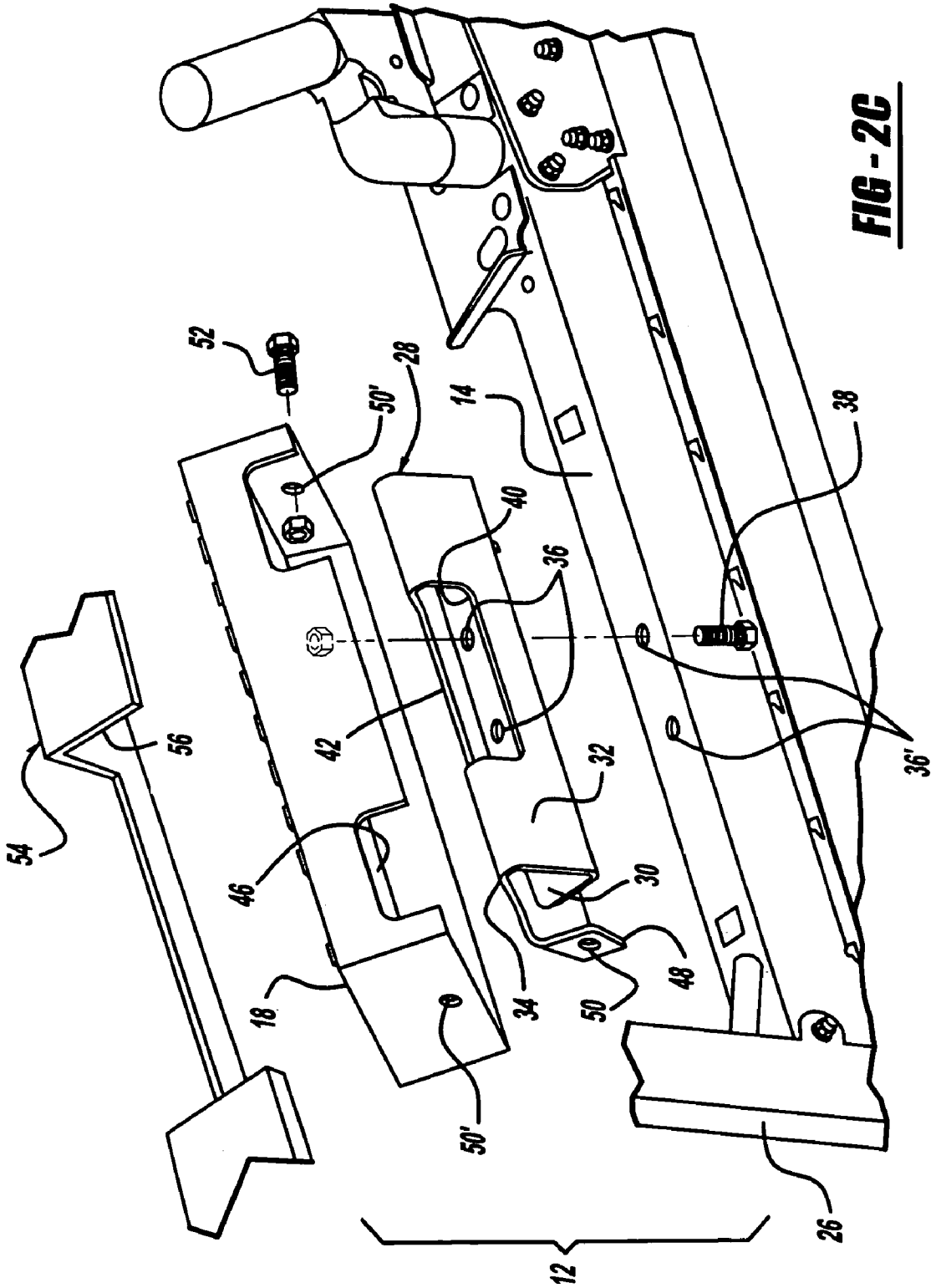


FIG - 2C

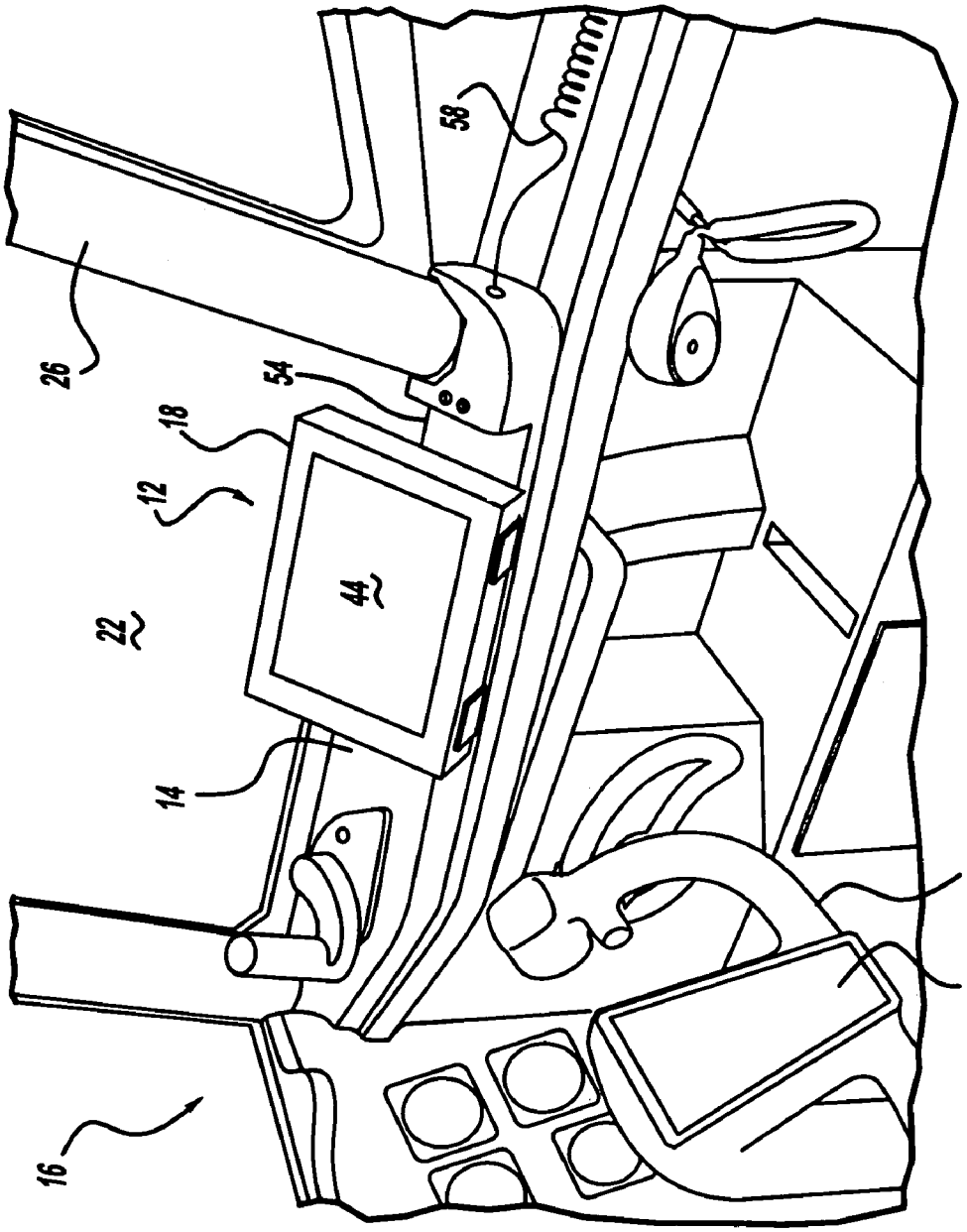


FIG - 3A

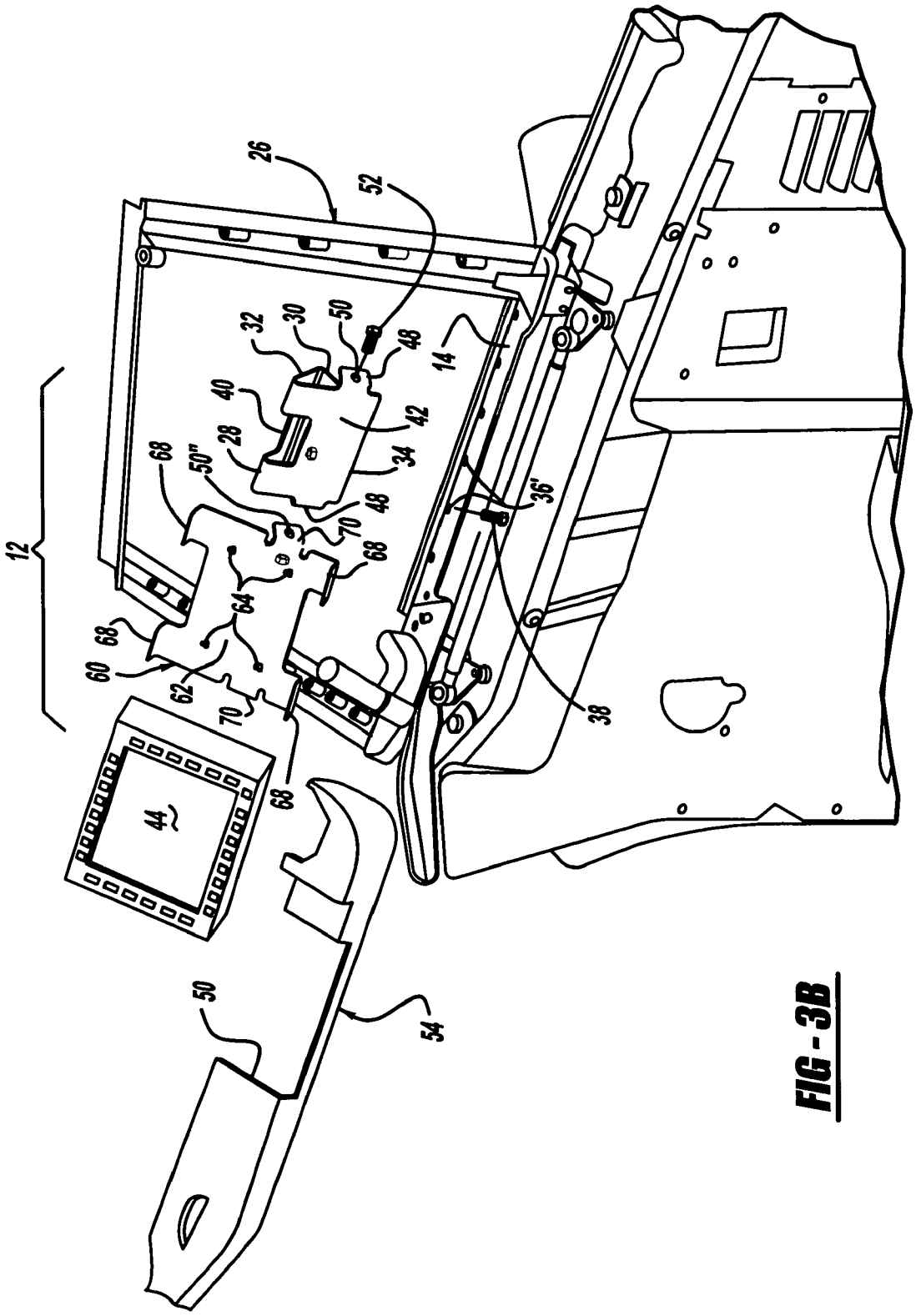

26
52
32
30
50
48
14
40
42
28
34
68
50"
36'
48
70
68
12
64
68
60
62
70
68
38
44
50
54

FIG - 3B

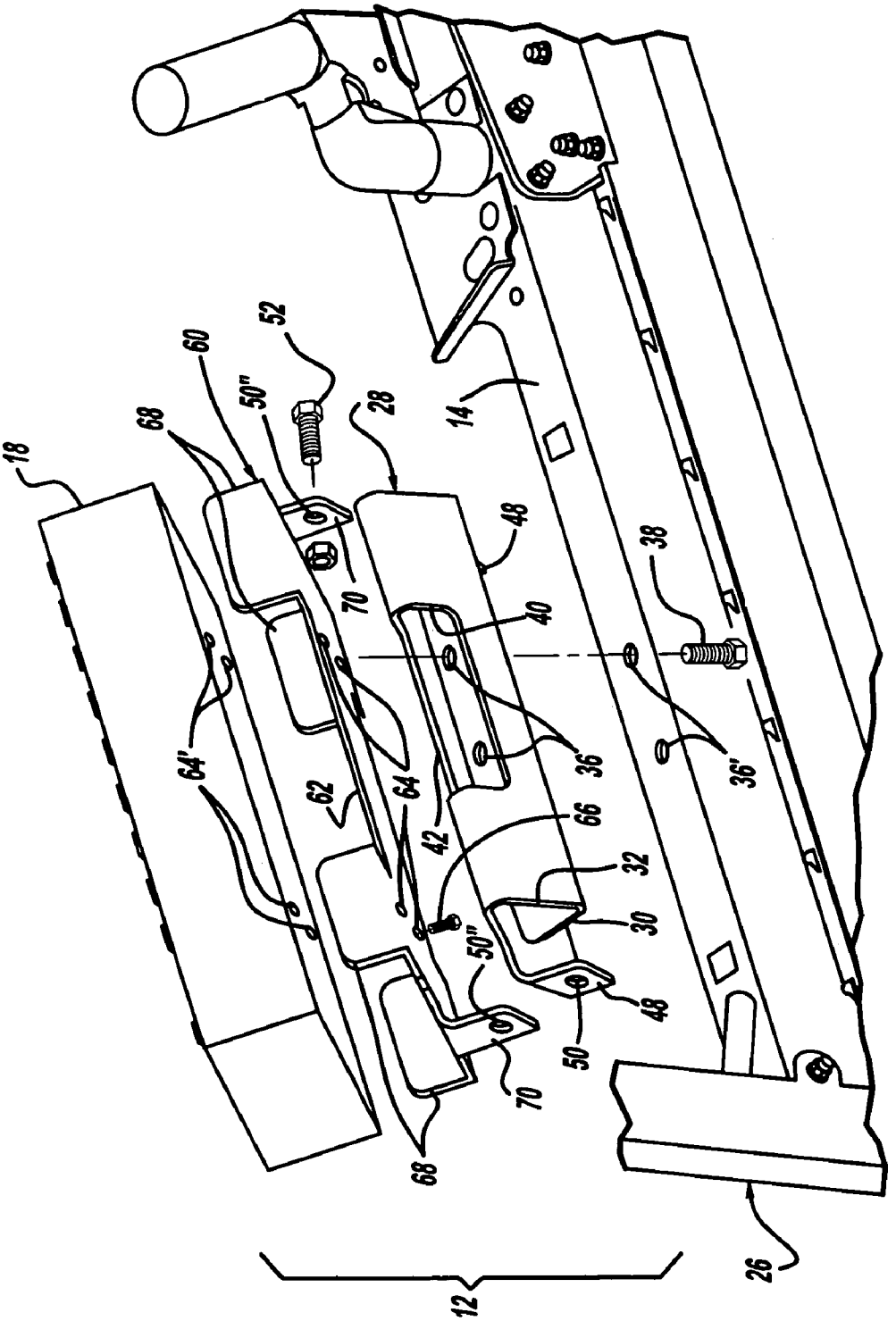

18
68
60
52
50"
28
14
48
38
70
40
36
36'
64'
62
64
42
66
32
30
50"
48
50
70
68
26
12

FIG - 3C

INTEGRATED WINDOW DISPLAY

TECHNICAL FIELD

The present invention relates generally to a display system, and more particularly to a display system that is integrated within a sill of a window structure, such as a window structure of an aircraft.

BACKGROUND OF THE INVENTION

Display systems are widely utilized for communicating various kinds of information in a variety of environments, e.g. a vehicle and a building. These display systems typically are positioned within locations that allow for efficient use of the surrounding area.

For example, an aircraft can have a variety of gauges integrated within an instrument panel of the cockpit for the purpose of positioning those gauges beyond a space typically utilized for another function. Specifically, the integration of the gauges within the instrument panel can allow a pilot to freely operate the steering tiller of the aircraft without interference from the gauges. Moreover, in this position, the gauges typically do not obstruct the pilot's field of view, hinder the crew members' access to their oxygen masks, or delay the crew members in exiting the aircraft.

Unfortunately, the typical locations in which the display systems are mounted can lack sufficient space or be inadequately shaped for receiving an additional display system. As a result, the display system may be omitted from the environment thereby eliminating the information that could be otherwise provided by the display system.

Therefore, a need exists for a display system that is integrated within a windowsill of a vehicle or a building so as to provide various kinds of information and allow for efficient use of the area surrounding the window structure.

SUMMARY OF THE INVENTION

The present invention provides a display system for attachment to a sill of a window structure. The display system includes a mounting device for attaching the display system to the sill of the window structure and a display device for attachment to the mounting device. The display device is intended to communicate various information to the viewer of the display device.

One advantage of the invention is that a display system for attachment to a sill of a window structure is provided that preserves or increases the availability of space in the areas surrounding the window structure.

Other advantages of the present invention will become apparent when viewed in light of the detailed description of the preferred embodiment when taken in conjunction with the attached drawings and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of this invention, reference should now be made to the embodiments illustrated in greater detail in the accompanying drawings and described below by way of examples of the invention:

FIG. **1** is a schematic diagram of an aircraft having a display system, according to one embodiment of the present invention;

FIG. **2**A is a perspective view of a cockpit of an aircraft with a display system integrated within a windowsill of the cockpit according to one embodiment of the present invention;

FIG. **2**B is an interior rear exploded view of the display system shown in FIG. **2**A;

FIG. **2**C is an exterior rear exploded view of the display system shown in FIG. **2**A;

FIG. **3**A is a perspective view of a cockpit of an aircraft with a display system integrated within a windowsill of the cockpit according to another embodiment of the present invention;

FIG. **3**B is an interior rear exploded view of the display system shown in FIG. **3**A; and

FIG. **3**C is an exterior rear exploded view of the display system shown in FIG. **3**A.

DETAILED DESCRIPTION OF THE INVENTION

In the following figures the same reference numerals will be used to illustrate the same components in the various views. The present invention is particularly suited for a display system integrated within a windowsill of an aircraft for the purpose of providing various types of information to the crew members of the aircraft while preserving or creating more available space surrounding the windowsill. However, it is understood that the invention can also be suited for a display system integrated within a windowsill of various other vehicles, e.g. an automobile, or even within a windowsill of a building as desired. For example, the display system can be integrated within a windowsill of a residential home. In particular, this integrated display system can be integrated within a kitchen windowsill so as to preserve or create more available space within the kitchen, e.g. the countertop surface area.

Referring to FIG. **1**, there is shown an aircraft **10** having a display system **12** integrated within a windowsill **14** of the cockpit **16** of the aircraft **10**, according to one embodiment of the present invention. This display system **12** is intended to provide various information to crew members located within the cockpit **16** and to preserve or create more available space surrounding the display system **12**.

Referring now to FIG. **2**A, there is shown a perspective view of the cockpit **16** of the aircraft **10** with the display system **12** integrated within the windowsill **14** of the cockpit **16** according to one embodiment of the present invention. The attachment of the display system **12** to the windowsill **14** does not obstruct movement of the crew member within the cockpit **16** nor does it interfere with the operation of the aircraft **10**.

For instance, as best shown in FIGS. **2**A and **3**A, the display system **12** is positioned on the windowsill **14** beyond the swept envelope of a nose wheel steering tiller **20** and the swept envelope of the yoke **21**. As is known in the art, the windowsill **14** of an aircraft **10** typically is positioned at a predetermined distance from the steering tiller **20** and the yoke **21** so as to permit the tiller **20** and the yoke **21** to have all ranges of free movement without interference from the windowsill **14**. The display system **12** may extend from the windowsill **14** toward the tiller **20** and the yoke **21** at a maximum extension distance, e.g. about one inch, without encroaching the swept envelope of the tiller **20** and the yoke **21**. In this regard, the display system **12** allows a pilot to access and operate the steering tiller **20** without interference from the display system **12**.

In addition, the display system **12** is located on the windowsill **14** beyond the emergency egress path of a flight crew member. For example, the display system **12** may be inset within the windowsill **14** in a suitable position for allowing unfettered egress of the crew member through a

moveable windowpane **22** of the aircraft **10**. Also, the display system **12** can be positioned on the windowsill **14** in an acceptable location for providing an unimpeded walking path from the cockpit **16** to the nearest exit **24**.

In accordance with yet another example, the display system **12** is attached to the windowsill **14** beyond the swept path utilized by a flight crew member for strapping on his oxygen mask. In other words, the display system **12** is not positioned between the crew member and the location where oxygen mask is stored. This configuration allows the crew member to freely obtain the mask, strap the mask onto his head, and then receive a flow of oxygen within a relatively short period of time, e.g. five seconds.

Still, according to another example, the display system **12** is integrated within the windowsill **14** beyond a pilot's field of view so as to prevent the display system **12** from distracting the pilot as he operates the aircraft **10**. This feature allows the pilot to focus his concentration on safely performing his responsibilities.

Each of these examples illustrates that the integration of the display system **18** within the windowsill **14** of the cockpit **16** provides a crew member with sufficient room for operating the aircraft **10** in a safe and efficient manner. However, it is understood that the integration of the display system **12** within the windowsill **14** can provide for a variety of other advantages, as well.

Referring now to FIG. **2**B, there is shown a cutaway exploded view of the display system **12** shown in FIG. **2**A, illustrating the attachment of the display device **18** to the windowsill **14**. Specifically, the display system **12** includes a window structure **26** that is an integral part of the aircraft **10**. This window structure **26** has the windowsill **14** integrated therein. The windowsill **14** is intended to have a mounting device **28** attached thereon.

The mounting device **28** is a one-piece bracket with a sill attachment portion **30**, an extension portion **32** extending from the sill attachment portion **30**, and a display attachment portion **34** extending from the extension portion **30**. The sill attachment portion **30** is fixedly attached to the windowsill **14**. In this respect, the sill attachment portion **30** has one or more holes **36** for receiving a nut and bolt fastening pair **38**. Likewise, the windowsill **14** has one or more holes **36'** for receiving the nut and bolt fastening pair **38**. This nut and bolt fastening pair **38** is utilized to attach the sill attachment portion **30** of the mounting device **28** to the windowsill **14**. However, it is understood that a variety of other suitable fasteners or attachment methods may be utilized. Moreover, it is also understood that the mounting device **28** can be an integral part of the window structure **26** as desired.

The extension portion **32**, the display attachment portion **34**, or both the extension portion **32** and the display attachment portion **34** have an opening **40** integrally formed therethrough for allowing an individual to access the nut and bolt fastening pairs **38** and attach the mounting device **28** to the windowsill **14**. This opening **40** preferably is rectangular in shape and positioned above the sill attachment portion **30**. However, it is understood that the opening **40** can be otherwise sized or shaped as desired or otherwise positioned on the display attachment portion **34** in other suitable locations. Moreover, the display attachment portion **34** may not even include this opening **40** as desired.

The display attachment portion **34** includes a shelf portion **42** for supporting a bottom side of the display device **18**. This shelf portion **42** preferably is located at a predetermined position relative to the sill attachment portion **30** so as to position a display screen **44** of the display device **18** generally perpendicular to the average-sized crew member's line of sight. This configuration can provide various-sized crew members with an acceptable view of the screen.

Also, the shelf portion **42** is sufficiently sized for allowing the display attachment portion **34** to be inserted within a recess **46** formed within the bottom side of the display device **18** (as shown in FIG. **2**C). This engagement allows the display device **18** to be mounted closer to the window structure **26** and farther from the swept paths and the swept envelopes utilized for safe operation of the aircraft **10**.

In addition, the shelf portion **42** includes a pair of tabs **48** extending generally perpendicularly from opposing sides of the shelf portion **42**. Each tab **48** has one or more apertures **50** formed therethrough for receiving a nut and bolt fastening pair **52**. Similarly, the display device **18** defines one or more apertures **50'** for receiving the fastening pair **52**. This fastening pair **52** is intended to attach the display device **18** to the display attachment portion **34**. Alternatively, various other suitable fasteners, fastening methods, and constructions can be employed for attaching the display device **18** to the display attachment portion **34** of the mounting device **28**.

Furthermore, the display system **12** includes a sill panel **54** for attachment to the window structure **26** and concealment of a substantial portion of the mounting device **28** and the display device **18**. Specifically, the panel **54** defines a display device hole **56** through which a crew member can access the display device **18**. Preferably, the top surface of the display device **18** is level with the top surface of the panel **54**. Additionally, the panel **54** preferably is smooth and contoured. As best shown in FIG. **2**A, this construction is beneficial because it can prevent a crew member from having his clothes or body parts inadvertently caught on a sharp corner or edge of the display device **18** or the panel **54** itself. However, it is understood that the display device **18** may instead be positioned above or below the top surface of the panel **54** as desired. The panel **54** is attached to the window structure **26** by nut and bolt fastening pairs and alternatively other suitable fasteners or fastening methods.

In further reference to FIG. **2**A, the display system **12** also includes a bundled cord **58** through which power and data are delivered to the display device **18**. This cord **58** can also be utilized to provide power to a thermal resistor integrated within the windowpane **22**.

Referring now to FIGS. **3**A–**3**C, there is shown a display system **12** according to another embodiment of the present invention. In this embodiment, the display device **18** further comprises a mounting tray **60** for attaching the display device **18** to the mounting device **28**. This tray **60** is beneficial because it allows for the attachment of a display device **18'**, which lacks a recess formed within its bottom side.

This mounting tray **60** preferably includes a platform portion **62** with four notches **64** formed therein for permitting four fasteners **66** to pass therethrough. These fasteners **66** are intended to be inserted into respective notches (as shown in FIG. **3**C) formed within the display device **18**. As a result, the mounting tray **60** can be fixedly attached to the display device **18**. However, it is understood that the tray **60** can include more or less than four notches **64** as desired. It is also understood that various other suitable fasteners or fastening methods can be utilized as desired. Moreover, the platform portion **62** includes four perimeter ledges **68** extending therefrom for positioning the display device **18** on the platform portion **62**. However, it is understood that more or less than four ledges **68** can be employed in other embodiments of the invention.

Furthermore, the mounting tray **60** includes a pair of flaps **70** extending therefrom for engaging the pair of tabs **48**

extending from the mounting device **28**. Each flap **70** has one or more apertures **50"** formed therein for allowing the fastener **64** to pass therethrough and into the respective aperture **50** formed within the respective tab **48**. As a result, the mounting tray **60** and the display device **18** are attached to the windowsill **14**.

As exemplified in FIG. **3**C, it is understood that the sill panel **54** may still be utilized to conceal the window structure **26** yet lack the construction for covering a substantial portion of the display system **12**. As a result, the structures of the display device **18** and the mounting device **28** can be exposed to the cockpit **16** and thus be more accessible to the crew members within the cockpit **16**.

The mounting device **28** and the mounting tray **60** preferably are comprised of a metal material. However, it is understood that these components **28**, **60** can instead be comprised of a ceramic material, a laminate material, or a plastic material as desired.

Referring back to FIG. **1**, as introduced above, the display system **12** can be utilized for providing various kinds of information to a flight crew member located within the cockpit **16** of the aircraft **10**.

For example, the display system **12** can provide surveillance of a passenger cabin **72** to a crew member located within the cockpit **16**. In this regard, the display system **12** can be used in conjunction with one or more interior cameras **74** positioned in predetermined areas of one or more of the passenger cabins **16** of the aircraft **10**. These interior cameras **74** are electronically coupled to a display device **18** located within the cockpit **16**. These cameras **74** are intended to receive images of the events occurring within the passenger cabins **72**, convert those images into a video stream, and then transmit the video stream to the display device **18** within the cockpit **16**. This surveillance is beneficial because it can provide early detection of a dangerous situation, e.g. a hijacking attempt, which can arise in the passenger cabin **72**. Specifically, the display system **12** can alert the flight crew members of the dangerous situation and provide them with sufficient time to adequately prepare themselves for managing the problem.

By way of another example, the display system **12** can be utilized for providing surveillance of an exterior region of the aircraft **10** which can otherwise be difficult or impossible to view from the cockpit **16**. In particular, the display system **12** can be used in conjunction with one or more exterior cameras **76** integrated within one or more predetermined sections of the outer skin **78** of the aircraft **10**. These exterior cameras **76** are electronically coupled to the display device **18** and are intended to receive images illustrating the location of nearby ground crew members, convert those images into a video stream, and then transmit the video stream to the display device **18** that is located within the cockpit **16**. This surveillance is beneficial because it can notify the pilot that a ground crew member is located in a potentially dangerous area thereby allowing the pilot to take appropriate action for averting the danger. For instance, the display system **12** may communicate to the pilot that a ground crew member is positioned adjacent to an engine **80** of the aircraft **10**. As a result, this information may allow the pilot to abort from increasing power to that engine **80** thereby preventing possible injury to the ground crew member. In addition, the exterior cameras **76** may be utilized for communicating to the pilot that a ground crew member is located in the path of a landing gear **82** of the aircraft **10**. This information can allow the pilot to abort from taxiing the aircraft **10** on the tarmac toward the ground crew member, which would otherwise result in harm to the ground crew member. However, it is understood that the exterior cameras **76** can be utilized for providing the pilot with a variety of other suitable information.

According to yet another example, the display device **18** is an I/O interface that can be electronically coupled to a computer having a database of various information. This information can comprise a database of the crew members and their respective skills and backgrounds. This information can be beneficial for enabling the pilot to delegate a particular responsibility to a crew member who is most qualified for that responsibility. Alternatively, the information can comprise a database of airport maps, which can assist a pilot in determining an appropriate direction of approach for landing the aircraft **10** and taxiing the aircraft **10** on the tarmac. However, it is understood that the information can be comprised of a variety of other suitable kinds of information as desired

While particular embodiments of the invention have been shown and described, numerous variations and alternate embodiments will occur to those skilled in the art. Accordingly, it is intended that the invention be limited only in terms of the appended claims.

What is claimed is:

1. An aircraft display system comprising:

an aircraft having a window structure with a windowsill;

a mounting device extending from said windowsill; and

a display device coupled to said mounting device;

wherein said mounting device is a on-piece bracket comprising a sill attachment portion coupled to said windowsill, a display attachment portion having at least one tab extending therefrom for coupling to said display device, wherein each of said at least one tab defines a plurality of apertures for receiving at least one fastener and coupling said display device to said tab, and an extension portion extending between said sill attachment portion and said display attachment portion;

wherein at least one of said display attachment portion and said extension portion includes an opening formed therethrough for allowing access to said sill attachment portion.

2. The aircraft display system of claim **1** wherein said sill attachment portion defines at least one hole for receiving at least one sill fastener for coupling said sill attachment portion to said windowsill.

3. The aircraft display system of claim **1** wherein said mounting device is comprised of material selected from the group consisting of a metal material, a ceramic material, a plastic material, and a composite laminate material.

4. The aircraft display system of claim **1** wherein said display system is positioned beyond a field of forward view for a pilot.

5. An aircraft display system comprising:

an aircraft having a window structure with a windowsill;

a mounting device extending from said windowsill; and

a display device coupled to said mounting device;

wherein said mounting device is a one-piece bracket comprising a sill attachment portion coupled to said windowsill, a display attachment portion having at least one tab extending therefrom for coupling to said display device, wherein each of said at least one tab defines a plurality of apertures for receiving at least one fastener and coupling said display device to said tab, and an extension portion extending between said sill attachment portion and said display attachment portion;

wherein at least one of said display attachment portion and said extension portion includes an opening formed therethrough for allowing access to said sill attachment portion;

wherein said display device is disposed beyond a swept envelope of a nose-wheel steering tiller and positioned for being in a constantly open lone of sight for a pilot seated adjacent thereto.

6. The aircraft display system of claim **5** wherein said sill attachment portion defines at least one hole for receiving at least one sill fastener and coupling said sill attachment portion to said sill.

7. The aircraft display system of claim **5** wherein said display attachment portion has at least one tab extending therefrom for coupling to said display device.

8. The aircraft display system of claim **7** wherein each of said at least one tab defines an aperture for receiving at least one display fastener and coupling said display device to said tab.

9. The aircraft display system of claim **5** wherein said mounting device is comprised of material selected from the group consisting of a metal material, a ceramic material, a plastic material, and a composite laminate material.

10. An aircraft display system comprising:

an aircraft having a window structure with a windowsill;

a mounting device extending from said windowsill; and

a display device coupled to said mounting device;

wherein said mounting device is a on-piece bracket comprising a sill attachment portion coupled to said windowsill, a display attachment portion having at least one tab extending therefrom for coupling to said display device, wherein each of said at lest one tab defines a plurality of apertures for receiving at least one fastener and coupling said display device to said tab, and an extension portion extending between said sill attachment portion and said display attachment portion;

wherein at least one of said display attachment portion and said extension portion includes an opening formed therethrough for allowing access to said sill attachment portion;

wherein said display device is disposed beyond a swept envelope of a nose-wheel steering tiller and positioned for being in a constantly open lone of sight for a pilot seated adjacent thereto;

wherein said display device is disposed beyond a swept envelope of a yoke;

wherein said display device is positioned beyond an emergency egress path through said window structure.

11. The aircraft display system of claim **10** wherein said sill attachment portion defines at least one aperture for receiving at least one sill fastener for coupling said sill attachment portion to said sill.

12. The aircraft display system of claim **10** wherein said display attachment portion has at least one tab extending therefrom for coupling to said display device.

13. The aircraft display system of claim **12** wherein each of said at least one tab defines a hole for receiving at least one display fastener and coupling said display device to said tab.

14. The aircraft display system of claim **10** wherein said mounting device is comprised of material selected from the group consisting of a metal material, a ceramic material, a plastic material, and a composite laminate material.

15. The aircraft display system of claim **10** wherein said display device is positioned beyond an oxygen mask access path utilized for accessing an oxygen mask.

* * * * *