

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

(51) Int Cl.7: G07F 9/02

18.04.2001

Bulletin 2001/16

(21) Application number: 00308778.0

(22) Date of filing: 05.10.2000

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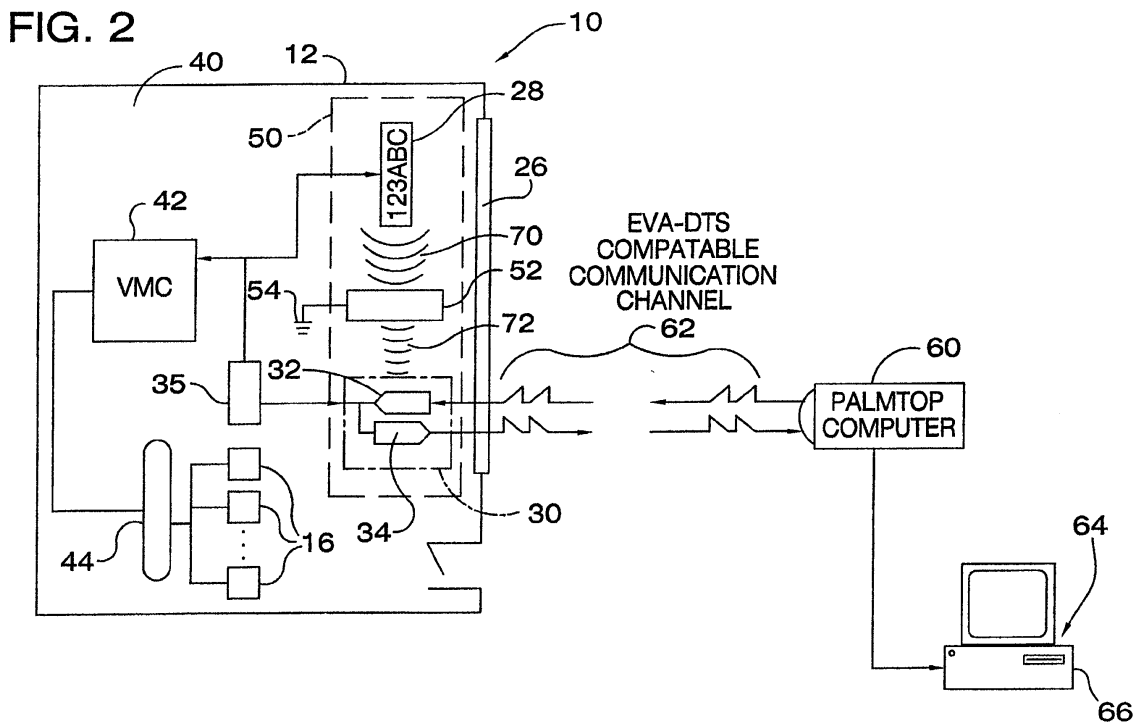
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Vending machine communication interference shield

(57)

An apparatus and module for use with a vending machine (10) using an optical communication data exchange standard. An optical transceiver (32, 34), such as an IrDA® compatible transceiver, is mounted on a printed circuit board (50) adjacent to a customer

display (28). An isolator (52) is mounted between the IR transceiver (32, 34) and the customer display (28) such that the IR transceiver's (32, 34) performance is not degraded as a result of noise emissions originating from the customer display (28).



EP 1 093 093 A2

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates generally to improvements regarding vending machine communications system, and particularly to an interference inhibiting shield for use in a vending machine having an optical/wireless communication interface mounted near a vending machine display that emits a noise signal.

[0002] Over the years, vending machines have evolved from purely mechanical devices into complicated, electronically controlled machines. Modern vending machines often employ microprocessors or similar devices that control machine operations. The addition of electronic controllers has facilitated the ability to automatically record and store various types of sales data associated with a given machine. For example, vending machines can store information relating to the sales patterns associated with particular vendable products. Such information allows, among other things, vending machine operators to optimize the products they stock in their machines, and to maximize the sales associated with a particular machine and/or with a particular location.

[0003] Electronic controllers also allow vending machine operators including service technicians and stock personnel to tailor various configuration parameters associated with their vending machines. For example, vending machine operators can set parameters related to price data, temperature settings, brewing times, product type, and product location within the machine. In some situations, vending machine operators must update the configuration data quite often. If, for example, the product type or price varies on a regular basis, vending machine service personnel may need to update the configuration data each time the machine is stocked.

[0004] With the addition of relatively sophisticated electronics in many vending machines, at least one trade association has developed a common standard for exchanging data between vending machines and other electronic devices. The European Vending Association (EVA), for instance, has developed an electronic data transfer standard (EVA-DTS) that allows vending machine operators to use common equipment to upload and download sales and/or configuration data regardless of which manufacturer made the vending machine. In other words, if a vending machine is EVA-DTS compatible, the vending machine operator is assured that he can communicate with the machine via a standard interface-without the need to purchase different upload and download devices for machines made by different manufacturers.

[0005] As currently envisioned, the EVA-DTS uses a portable handheld electronic terminal to exchange information with a vending machine. The handheld unit can be preprogrammed using a standard PC and loaded with a complete set of configuration data that is subse-

quently transferred to a vending machine. Similarly, the handheld unit can read sales and other operational data from the vending machine. Such data can then be displayed directly on the handheld unit or stored for later use by a PC-based system and database.

[0006] In order to use a data transfer device such as the handheld unit envisioned for use with the EVA-DTS, it is necessary to specify a data transfer protocol. A data transfer protocol is a recognized set and sequence of commands that provide for structured communications between a vending machine control processor and another electronic terminal such as the handheld unit mentioned above. United States vending machine operators and manufacturers typically prefer a data exchange protocol referred to in the industry as the DEX/UCS protocol. The DEX/UCS protocol uses a ¼ inch (0.64 cm) jack/plug and an associated cable to establish a communication channel between the vending machine and the handheld unit.

[0007] The EVA-DTS, on the other hand, uses a communications system based on the so-called Enhanced Optical Protocol (EOP), defined in the EVA-DTS, Version 4, January 4, 1977. The EOP is similar to the Digital Equipment Corporation Data Communications Message Protocol (DDCMP). For additional details regarding the DDCMP, see DDCMP Specification No. AA-DS99A-TC. The EOP, also referred to as the Enhanced DDCMP, is similar to the DDCMP except that the EOP supports higher data transfer rates and uses the IrDA® optical interface. The IrDA® optical interface was developed by the Infrared Data Association and is commonly used in the palmtop and palm PC industry. It should be understood that although the EOP preferably uses a wireless optical interface, it may also be employed in a conventional jack-and-plug, physical cable configuration.

[0008] Vending machine manufacturers wishing to implement the EVA-DTS or a similar data transfer standard using optical interfaces such as the IrDA® face many difficult design challenges and considerations. For example, in forward fitting newly manufactured machines so that they are EVA-DTS compatible, the optical interface (also referred to as an I/O port, an IrDA® interface, or an IR interface) must be conveniently located and easily accessed. Retrofitting existing machines with EVA-DTS compatible interfaces such as the IrDA® presents even greater challenges including minimizing the down time required to install the upgraded device. In both the forward fit and the retrofit situations, it is necessary to select a location for the I/O port that facilitates ease of use. It is also necessary to select a location that minimizes the cost of manufacture and installation. Finally, when an EVA-DTS interface is added to new or existing vending machines, it is economically desirable that the new interface be mechanically and electronically compatible with the existing vending machine hardware and software.

[0009] Hence, there is a need for a vending machine

that implements the EVA-DTS or similar standard in which the I/O port operates satisfactorily and is mechanically and electronically compatible with other vending machine equipment. There is also a need for a module that allows for retrofitting an EVA-DTS (or similar) compatible communication device into new and existing vending machines.

SUMMARY OF THE INVENTION

[0010] The invention meets the above needs and overcomes the deficiencies of the prior art by providing an improved vending machine and vending machine subassembly (also referred to as a module) for use with an EVA-DTS compatible infrared (IR) interface. This is accomplished by locating an IR transceiver in a position that requires no new openings on the exterior of the vending machine. The IR transceiver is shielded from the effects of local interference emissions and signals by use of a shielding device thereby allowing the IR transceiver to be located in a convenient and economical location. Advantageously, the IR transceiver and shielding device may be mounted on an existing vending machine subassembly and installed into new machines, or it may also be retrofitted into existing machines. Thus, vending machine manufacturers and vending machine operators can add the IR transceiver and the shielding device to their vending machines in a practical, efficient, and economic manner.

[0011] In one form, the invention comprises an apparatus that includes a vending machine that vends a product. A vending machine controller controls an operation of the vending machine. A display window is on the vending machine. A customer display is mounted on the vending machine and is controlled by the vending machine controller. The customer display may be viewed by a customer through the display window. The customer display indicates a status of the vending machine. The display emits a noise signal that has a signal strength. An optical interface port is mounted within the vending machine, and is accessible through the display window. The optical interface port is adapted to permit a portable data carrier device to communicate with the vending machine controller via the port. An isolator is positioned between the customer display and the optical interface port. The isolator shields the optical interface port from the noise signal generated by the customer display, and thereby attenuates the signal strength of the noise signal received by the optical interface.

[0012] In another form the invention comprises a module for use with a vending machine that has a display window and a vending machine controller. The module includes a printed circuit board adapted to be installed in the vending machine. A customer display is mounted on the printed circuit board. A customer can view the customer display through the display window. The display emits a noise signal having a signal strength. An optical interface port is mounted on the

printed circuit board. The optical interface port is adapted to communicate with the vending machine controller when the printed circuit board is installed in the vending machine. An isolator is mounted on the printed circuit board at a position between the customer display and the optical interface port. The isolator shields the optical interface port from the noise signal emitted by the customer display, and thereby attenuates the signal strength of the noise signal received by the optical interface port.

[0013] Alternatively, the invention may comprise various other methods, systems, and devices.

[0014] Other objects and features will be in part apparent and in part pointed out hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Fig. 1 is a perspective view of one preferred embodiment of a vending machine having a display window through which a display is viewable and having a communication system with an optical interface adjacent the display.

[0016] Fig. 2 is a block diagram of one preferred embodiment of the communication system of Fig. 1.

[0017] Fig. 3 is a layout view of a printed circuit board having an IR transceiver, an isolation bar, and a multi-character vacuum fluorescent display according to the invention.

[0018] Figs. 4A-D are front, top, bottom, and side views, respectively, of the IR transceiver of Fig. 3.

[0019] Fig. 5 is a side view of the isolation bar of Fig. 3. Corresponding reference characters are intended to indicate corresponding parts throughout the drawings.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0020] Fig. 1 illustrates various aspects of a vending machine 10 suitable for use with the present invention. A vending machine housing 12 includes a vending machine door 14 that can be opened by a vending machine operator to stock the vending machine 10 with various vendable products that are typically stored in a product storage/display area 16. A customer panel 20, typically mounted on the front of the vending machine housing 12 or door 14, includes a display area 22, and a plurality of product selection buttons 24. The display area 22 further comprises a transparent customer display window 26, a customer display 28, and an IR interface port 30, also referred to as an optical interface or an I/O port. The customer display 28 indicates, for example, a vending machine status or other information that a vending machine customer might find useful.

[0021] As explained above, it is desirable for vending machine 10 to have an EVA-DTS compatible IR interface port 30. It is further desirable that IR interface port 30 be installed so that vending machine operators such as service technicians can access the port and ex-

change data with a portable data carrier device via the port 30 without opening vending machine door 14, and without the need to connect a physical cable to vending machine 10. Moreover, it would be advantageous to retrofit EVA-DTS compatible IR interface ports 30 into existing machines 10. One obstacle, however, is the fact that on most vending machines 10 there is very little front surface area available for mounting new devices such as IR interface port 30. Also, it is generally considered less desirable to dedicate a portion of the vending machine surface area to IR interface port 30 that could otherwise be used for optional devices, such as, for example, a card reader. It is also generally less desirable to create a new opening in the front of vending machine 10 because adding a new opening increases cost and makes retrofitting IR interface port 30 more difficult and time consuming.

[0022] Advantageously, IR interface port 30 is mounted inside machine housing 12 such that it is accessible through display area 22 or customer panel 20-vending machine operators need not open vending machine door 14 or access a special panel in order to exchange data via IR interface port 30. Further, there is no need to create new openings in the front of machine 10. When machine door 14 is closed, customer display 28 is viewable through the display window 26, and similarly, IR interface port 30 may receive and transmit EVA-DTS compatible messages through display window 26. As such, IR interface port 30 may be installed without adversely affecting the aesthetics of vending machine 10 while at the same time providing a convenient access location.

[0023] IR interface port 30 is shown as a separately visible component in Fig. 1 for illustrative purposes only and to improve the contrast between port 30 and customer display 28 in that figure. As a matter of vending machine aesthetics, IR interface port 30 preferably blends in visually with display window 26 and customer display 28, such that it does not draw the attention of customers who purchase items from vending machine 10.

[0024] Fig. 2 is a block diagram of one embodiment of vending machine 10 and associated data transfer equipment suitable for use with the present invention. Vending machine 10 includes housing 12 that defines an inner compartment 40 that encloses the products to be dispensed. A vending machine controller (VMC) 42, typically mounted in the inner compartment 40, controls the general operation of machine 10. For example, the VMC 42 may be programmable and controls the dispensing of the vendable products 16 via an electromechanical dispensing apparatus 44. VMC 42 also communicates with IR interface port 30 via an encoder/decoder 35, such as that available from Hewlett Packard (part no. HSDL-7001). Usually, customer display window 26 is positioned generally at eye level, within an exterior surface of vending machine housing 12 so that customers can view information displayed on customer display 28 through customer display window 26.

[0025] In order to use existing front panel openings, display areas, and available mounting surfaces, and in order to keep the appearance of the customer display area aesthetically pleasing, it is advantageous to mount the EVA-DTS compatible IR interface port 30 in close proximity to customer display 28. This is believed to be preferable to creating a new opening or mounting IR interface port 30 in a location that would require vending machine operators to open machine 10 to access port 30.

[0026] Usually, customer display 28 is mounted on a printed circuit board 50 thereby allowing easy installation and removal in new and existing vending machines 10. In the embodiment depicted in Fig. 2, customer display 28 preferably comprises a vacuum fluorescent display such as that available from Noritake Co., Ltd. (part no. AH1016A). IR interface port 30 includes an IR receiver 32 and an IR transmitter 34 (collectively referred to as an IR transceiver), and is mounted adjacent to customer display 28 on the printed circuit board 50. IR interface port 30 is positioned on printed circuit board 50 such that the IR transceiver may communicate (e.g., exchange data) with a portable data carrier device (PDCD), such as an IrDA® compatible palmtop computer 60, using the WINDOWS CE® operating system.

[0027] In the embodiment shown in Fig. 2, the palmtop computer 60 is further configured to enable it to communicate with a base station 64 located remotely from vending machine 10, such as a desktop PC 66. Information such as vending machine configuration parameters and/or vending machine operating software may be entered on the PC 66 and downloaded into palmtop computer 60 for transmitting and storing the information in VMC 42 via IR interface port 30, the encoder/decoder 35, and the wireless EVA-DTS compatible protocol 62. Similarly, sales or other vending machine information (including vending machine operating software) may be uploaded to palmtop computer 60 from VMC 42, via encoder/decoder 35, IR interface port 30, and EVA-DTS interface 62, and transferred to PC 66 for subsequent use and analysis.

[0028] As explained above, in order to minimize the cost of adding IR interface 30, while at the same time providing a user friendly and aesthetically pleasing system design, it is desirable to mount IR interface port 30 behind display window 26, and in close proximity to customer display 28. The customer displays used in many vending machines (e.g., vacuum fluorescent displays) are often relatively high current or high voltage digital devices. IR transceivers, on the other hand, are typically high gain analog devices. For a number of reasons, which may include saturation of input devices, it has been found that customer displays, such as vacuum fluorescent displays, emit electrical and optical noise/interference signals having signal strengths that can interfere with other, more sensitive electronic equipment (e.g., IR transceivers) located nearby. It has been found, for example, that errors occur in the reception of data

signals when an IR receiver is located close to a vacuum fluorescent display. The number of errors has been found to increase as the distance between the IR receiver and customer display 28 decreases. Thus, in order to achieve acceptable performance characteristics from IR receiver 32, while also taking advantage of the many benefits associated with mounting IR interface port 30 adjacent to customer display 28, it is preferable to account for the interference signals generated by customer display 28. In particular, it is preferable to minimize the interference effect that those interference signals have on the performance of IR interface port 30.

[0029] Advantageously, and as shown in Fig. 2, an isolation bar 52 is mounted on printed circuit board 50 between IR interface port 30 and customer display 28. The isolation bar 52 is connected to an electrical ground 54. As will be explained in greater detail below, by positioning the grounded isolation bar 52 between IR interface port 30 and customer display 28, the noise signals generated by customer display 28 are attenuated by isolation bar 52. Stated differently, the noise signals generated by customer display 28 have an originating signal strength 70 (represented in Fig. 2 by the relatively larger emission waves) that could interfere with the performance of IR interface port 30. Despite its close proximity to customer display 28, IR interface port 30 is not exposed to the full originating signal strength 70 of the noise signals because isolation bar 52 shields IR interface port 30 such that the noise signals, as received by IR interface port 30, have a reduced signal strength 72 (represented in Fig. 2 by the relatively smaller emission waves) as compared to the originating signal strength 70. Additionally, although Fig. 2 shows isolation bar 52 mounted directly between IR interface port 30 and customer display 28, it is also possible to shield IR interface port 30 from undesirable emissions using an isolation bar 52, or similar device, positioned indirectly between IR interface port 30 and customer display 28. It is preferable that the isolator's position sufficiently shields IR interface port 30 from a substantial portion of the originating signal strength 70 of the noise signal generated by customer display 28.

[0030] Referring now to Fig. 3 which illustrates a layout view of one embodiment of printed circuit board 50, IR interface port 30 is mounted on printed circuit board 50 adjacent to a vacuum fluorescent customer display 29 having a display height DH and a display depth DD. Isolation bar 52 is mounted longitudinally between the vacuum fluorescent display 29 and IR interface port 30. Isolation bar 52 shields IR interface port 30 from noise emissions 70 (Fig. 2) emitted by vacuum fluorescent display 29. Isolation bar 52 is connected to a ground plane on the printed circuit board which is, in turn, grounded within the vending machine (see Fig. 2). Isolation bar 52 attenuates the noise signals originating from vacuum fluorescent display 29 by shunting a portion of the noise signals to the ground plane so that the full strength of the noise signals 70 does not reach IR interface port 30.

In this way, isolation bar 52 reduces the effect such noise emissions have on IR interface port 30. By locating isolation bar 52 between vacuum fluorescent display 29 and IR interface port 30, IR interface port 30 is in an electrical shadow of the noise emissions originating from vacuum fluorescent display 29, and is thus shielded from the effect of those emissions.

[0031] Isolation bar 52 is preferably has a bar length BL (Fig. 5) that is longer than the display height DH, and a bar height BH (Fig. 5) that is taller than the display depth DD. Other embodiments will also work to inhibit interference effects. For example, it is also possible to use an isolation bar that is as long and as tall as the transceiver length TL (Fig. 4B) and the transceiver depth TD (Fig. 4A) of IR interface port 30. It is further possible to use a combination of multiple isolation bars or similar devices. It should be noted, however, that as smaller isolation devices are used, it is expected that such devices will require more precise positioning to ensure adequate shielding. Consequently, due to the availability and low cost of isolation bars such as that shown in Fig. 5 below, it is generally considered economically desirable to use a relatively larger isolation bar rather than incur the expense of optimizing one or more smaller isolation bars.

[0032] It should also be noted that devices such as vacuum fluorescent display 29 are light emitting devices that emit optical noise/interference signals. Advantageously, isolation bar 52 is opaque and, therefore, acts to block/shield IR interface port 30 from the effects of optical noise/interference signals originating in devices such as vacuum fluorescent display 29. Thus, isolation bar 52 effectively shields IR interface port 30 from multiple forms of noise signals (electromagnetic, electro-optical, optical, and the like).

[0033] Although the embodiment shown in Fig. 3 reflects an isolation bar 52 that is separate component, it is to be understood that isolation bar 52 may also be made integral with the IR interface port 30, the vacuum fluorescent display 29, or another circuit component.

[0034] Advantageously, printed circuit board 50 is adapted to be retrofitted into existing machines, thereby providing an optical/IR communication port in such machines at a very low cost. Similarly, printed circuit board 50 may also be installed into new machines as they are manufactured. Consequently, printed circuit board 50 facilitates the use of a standard communications interface across a wide variety of new and old vending machines.

[0035] Figs. 4A-4D depict several views of an IR transceiver suitable for use with the present invention. In particular, Figs. 4A-4D show a surface mounted integrated IR transceiver 80 such as that available from Hewlett Packard (part no. HSDL-3610). In the embodiment shown in Figs. 4A-4D, the IR transceiver 80 comprises separate transmit and receive elements 82, 84. IR transceiver 80 is mounted to printed circuit board 50 using surface mount techniques that are known in the art.

[0036] Fig. 5 illustrates in greater detail an embodiment of isolation bar 52. As shown in Fig. 5, isolation bar 52 is an electro tin plated copper alloy bar such as that available from Circuit Components, Inc., (part no. B250-1-1.0). Isolation bar 52 includes a main body 53 with a length L and a height H. Isolation bar 52 further includes two mounting tabs 56. The mounting tabs 56 are used to solder or otherwise electrically and physically secure isolation bar 52 to printed circuit board 50.

[0037] Although the embodiments have been described primarily with reference to an EVA-DTS compatible infrared interface, other wireless/optical interface may also be used with the present invention. Similarly, although the handheld device has been generally described as a palmtop computer, other portable processing devices such as a laptop computer, or a custom built unit, may be used to implement a vending machine communication interface and system.

[0038] In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

[0039] As various changes could be made in the above constructions and methods without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Claims

1. A device comprising:

a printed circuit board (50) ;
 a customer display (28) mounted on the printed circuit board (50) for viewing by a customer, said display (28) emitting a noise signal having a signal strength (70) ;
 an optical interface port (30) mounted on the printed circuit board (50); and
 an isolator (52) mounted on the printed circuit board (50) at a position between the customer display (28) and the optical interface port (30) wherein said isolator (52) shields the optical interface port (30) from the noise signal (70) emitted by the customer display (28) thereby attenuating the signal strength of the noise signal (72) received by the optical interface port (30).

2. A device according to claim 1 further comprising:

a vending machine (10) vending a product;
 a vending machine controller (42) controlling an operation of the vending machine (10);
 a display window (26) on the vending machine (10);

wherein the customer display (28) is mounted

on the vending machine (10), said customer display (28) being controlled by the vending machine controller (42) for viewing by a customer through the display window (26) to indicate a status of the vending machine (10); and

wherein the optical interface port (30) is accessible through the display window (26), said optical interface port (30) being adapted to permit a portable data carrier device (60) to communicate with the vending machine controller (42) via said port (30).

3. A device according to claim 1 or claim 2, wherein the vending machine (10) further comprises a vending machine door (14) allowing access to an interior compartment (40) of the vending machine (10), the vending machine window (26) being mounted on the vending machine door (14).

4. A device according to any one of claims 1 to 3, wherein the customer display (28) comprises a vacuum fluorescent display (29) .

5. A device according to any one of claims 1 to 4, wherein the isolator (52) comprises a grounded isolation bar mounted on the printed circuit board (50) between the optical interface port (30) and the customer display (28).

6. A device according to any one of claims 1 to 5, wherein the optical interface port (30) comprises an infrared transceiver.

7. A device according to any one of claims 1 to 6, wherein the optical interface port (30) has a port length and a port depth and wherein the isolator (52) comprises an isolation bar, said isolation bar having a bar length (BL) greater than the port length and having a bar depth (BH) greater than the port depth.

8. A device according to any one of claims 1 to 7, wherein the customer display (28) has a display depth (DD) and a display height (DH) and wherein the isolator (52) comprises an isolation bar, said isolation bar having a bar length (BL) greater than the display height (DH) and having a bar height (BH) greater than the display depth (DD).

9. A device according to claim 1, wherein the device further comprises a module for use with a vending machine (10) having a display window (26) and a vending machine controller (42), wherein:

the printed circuit board (50) is adapted to be installed in the vending machine (10);
 the customer display (28) is mounted on the printed circuit board (50) for viewing by a customer through the display window (26); and

the optical interface port (30) is adapted to communicate with the vending machine controller (42) when the printed circuit board (50) is installed in the vending machine (10).

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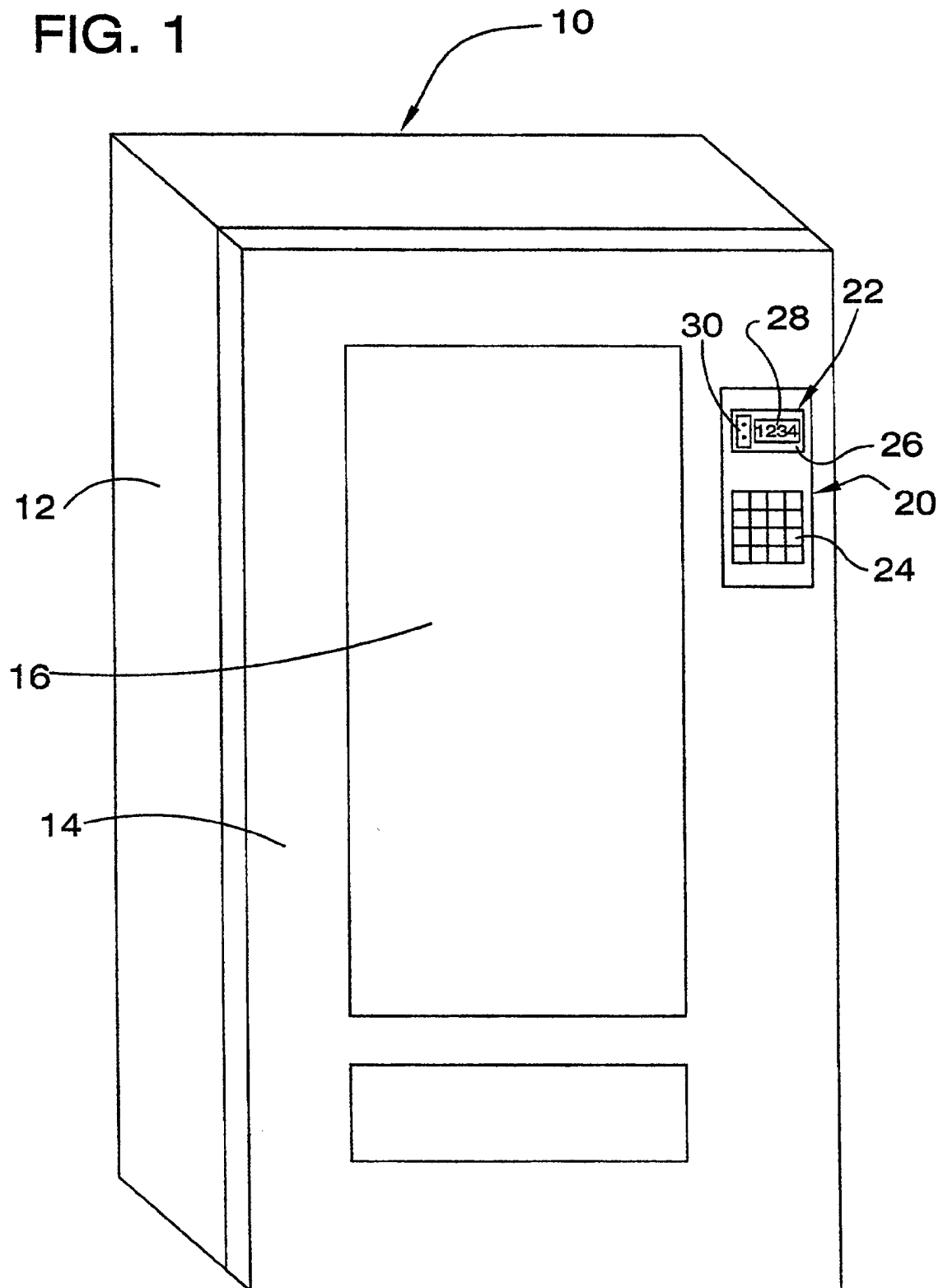
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FIG. 1



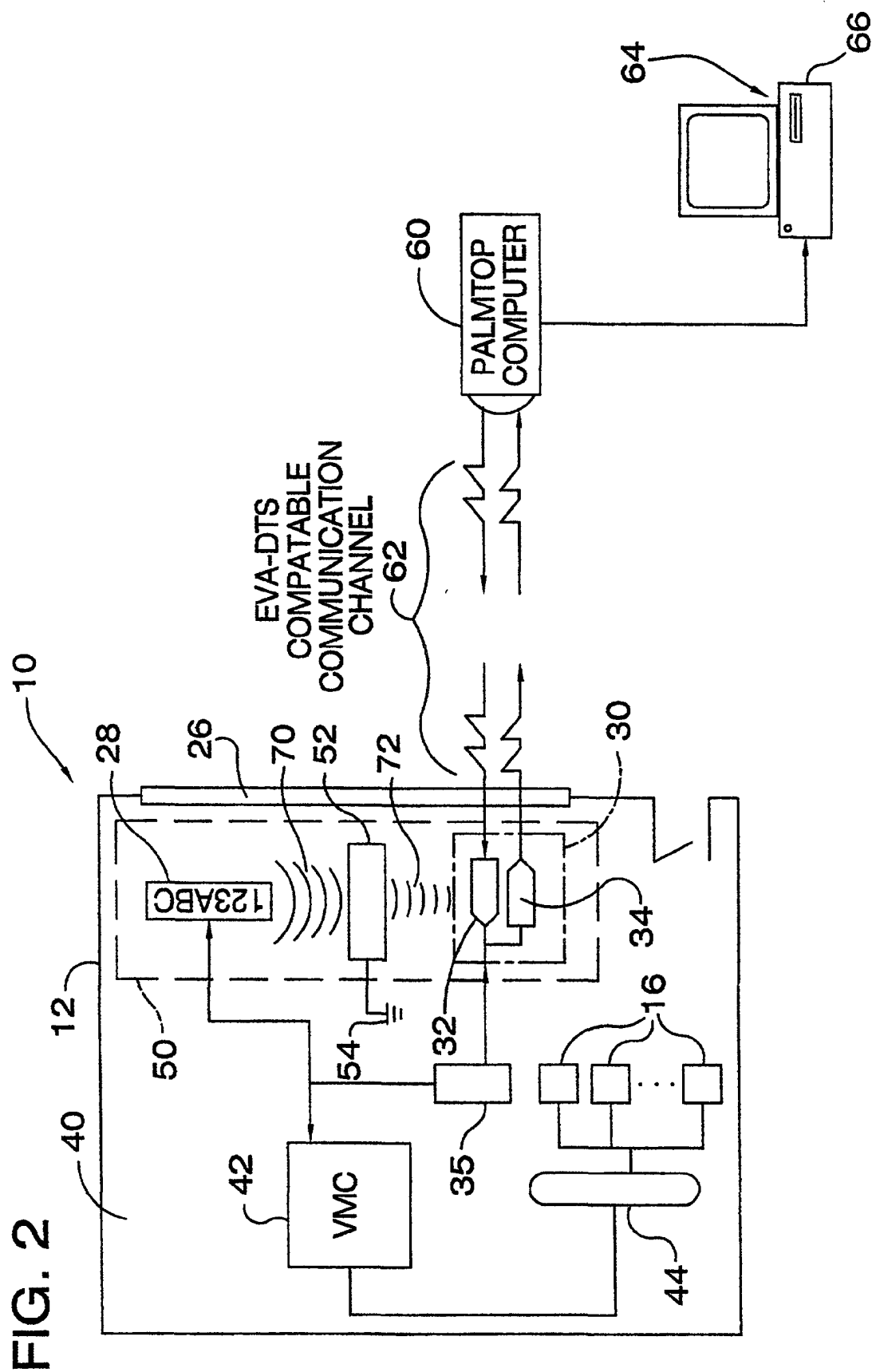


FIG. 3

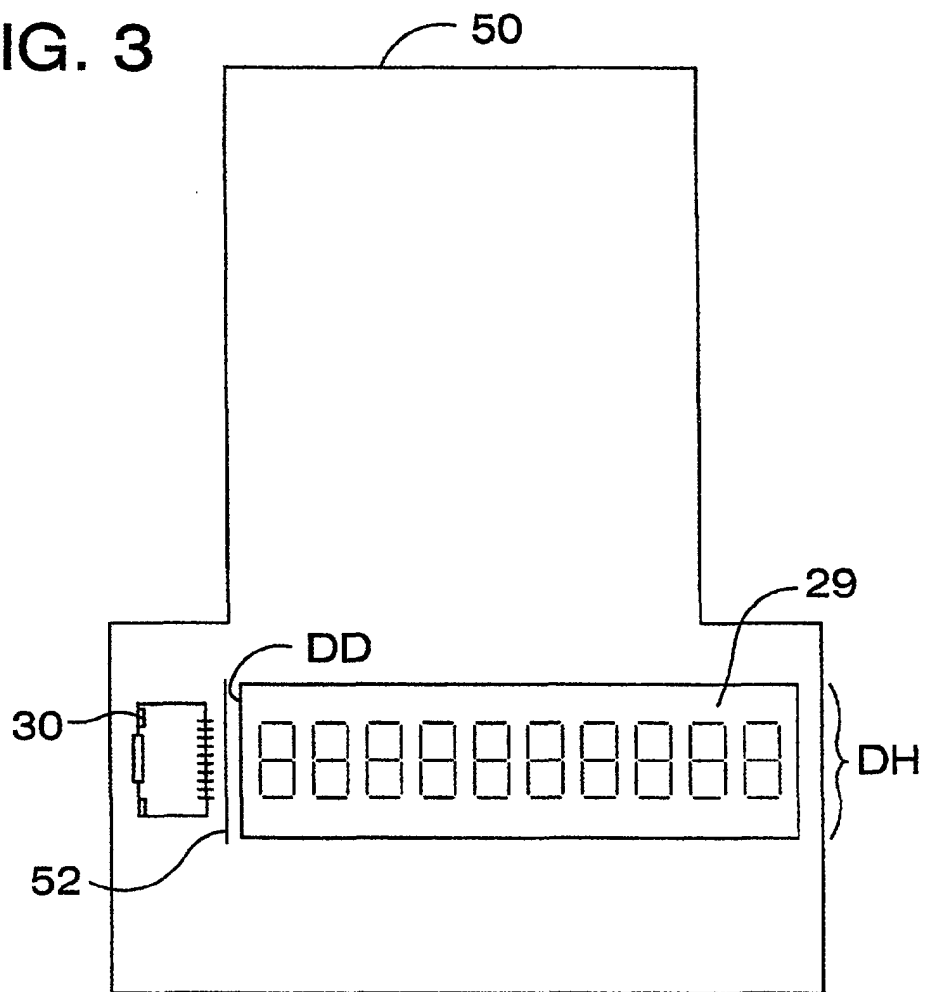


FIG. 5

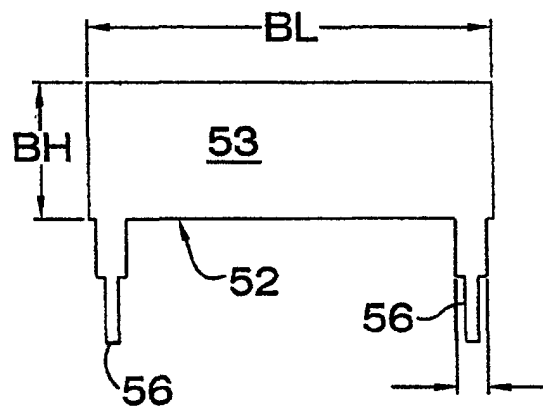


FIG. 4A

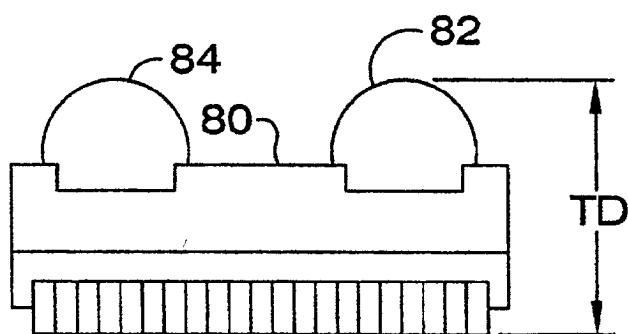


FIG. 4B

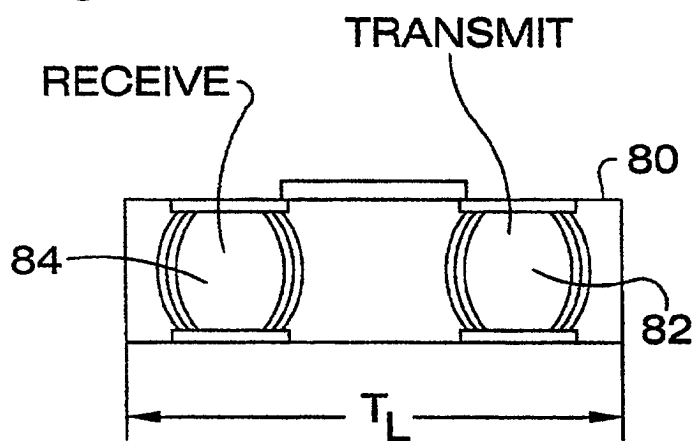


FIG. 4D

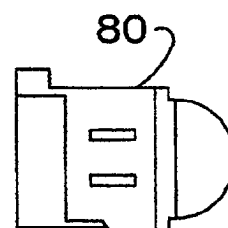


FIG. 4C

