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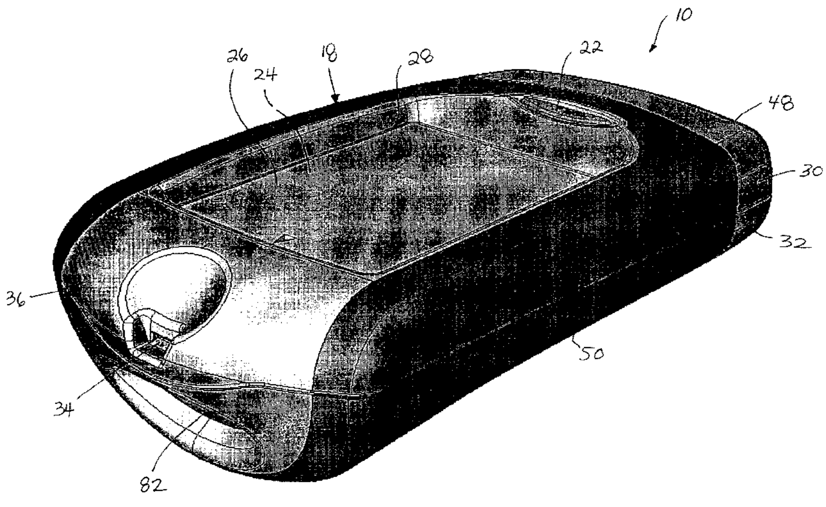
(54) Title: PORTABLE MEDICAL DIAGNOSTIC APPARATUS



(57) Abstract: A medical diagnostic apparatus including a housing, a sensor assembly located within the housing and including a temperature sensing element, and at least one thermal seal compressed between the sensor assembly and the housing and separating the temperature sensing element from heat-generating internal components of the apparatus. A rigid printed circuit board (PCB) and a rigid frame are also positioned within the housing and secured together with the housing to provide the apparatus with improved stiffness and torsional rigidity. A docking station for use with the apparatus defines a pocket having a convex projection that mates with a concave depression of the apparatus during docking, and the medical diagnostic apparatus includes at least one electrically conductive contact that contacts an electrically conductive contact of the docking station during docking.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

PORTABLE MEDICAL DIAGNOSTIC APPARATUS

Cross-Reference to Related Applications

(001) The present application claims priority from co-pending provisional U.S. Patent Application Serial No. 60/475,352, filed June 3, 2003 (Attorney docket number BYRK-28PR), which is incorporated herein by reference in its entirety.

Field of the Disclosure

(002) The present disclosure relates to a medical diagnostic apparatus and, more particularly, to a portable medical diagnostic apparatus. Even more particularly, the present disclosure relates to a portable glucose meter having improved rigidity, improved heat insulating properties, and an improved docking station.

Background of the Disclosure

(003) Blood glucose meters are medical diagnostic instruments used to measure the level of glucose in a patient's blood. Some meters include sensor assemblies that determine glucose levels by measuring the amount of electricity that can pass through a sample of blood, and other meters include sensor assemblies that measure how much light reflects from the sample. A computer processor of the meter then uses the measured light or electricity from the sensor assembly to compute the glucose level and displays the glucose level as a number.

(004) Generally, to operate a blood glucose meter, a patient or caregiver, such as a nurse or doctor, deposits a drop of the patient's blood onto a disposable cartridge or pad. The disposable cartridge along with the drop of blood is then inserted into a slot or port located on the blood glucose meter, whereupon the sensor assembly of the blood glucose meter tests the blood located on the disposable cartridge in order to determine the level of glucose in the blood. Upon determining the level of glucose in the blood, the blood glucose meter displays this information along with other information on a screen located on the blood glucose meter. Many glucose meters also include switches for allowing a user to input information or queries into the meter. Preferably, glucose meters are small enough and light-weight enough to be portable and conveniently carried by a user.

(005) Since it is important that a glucose meter is small and light-weight enough to be easily carried (e.g., about the size of a personal digital assistant or a cellular telephone), it is also important that the glucose meter is strong enough and rugged enough (e.g., "ruggedized") to withstand being accidentally dropped and continue to function properly. For example, it is desirable for a portable glucose meter to withstand being accidentally dropped from a height of at least about five feet, and not be damaged and be able to continue to function properly.

(006) It is also important that a glucose meter have good heat insulating properties to ensure accurate glucose measurements. The sensor assemblies of glucose meters often include one or more temperature sensing elements (e.g., a thermistor, thermometer, or thermocouple device) which monitor the ambient temperature to enable temperature correction of sensor signals. As with any chemical sensing method, transient changes in temperature during or between measurement cycles can alter background signal, reaction constants and/or diffusion coefficients. Accordingly, a temperature sensor is used to monitor changes in temperature over time. A maximum temperature change over time threshold value can then be used in a data screen to invalidate a measurement. Absolute temperature threshold criteria can also be employed, wherein detection of high and/or low temperature extremes can be used in a data screen to invalidate a measurement. The microprocessor of the glucose sensor can make a determination as to whether the temperature of the testing environment is within predetermined thresholds, and prohibit a user from running a test if accuracy would be negatively affected. It is important, therefore, that any temperature sensing elements of the glucose meter not be affected by heat generated within the glucose meter (e.g., by an liquid crystal display of the meter having heat-generating back lighting). The temperature sensing elements of the glucose meter should also have access to the ambient temperature surrounding the meter.

(007) Preferably, a portable glucose meter is provided with a docking station (or cradle) for receiving the glucose meter and for providing electrical connections between the docking station and the glucose meter. The electrical connections can be used for recharging the portable glucose meter and for transferring data between the portable glucose meter and another device, such as a personal computer or modem. The docking station should easily receive the portable glucose meter and provide a reliable electrical connection. Like the portable glucose meter, the docking station should also be ruggedized and be able to withstand being accidentally dropped yet continue to function properly. For example, it is desirable for a docking station to withstand being accidentally dropped from a height of at least about five feet, and not be damaged and be able to continue to function properly. In addition, the electrical connectors of the docking station and the portable glucose meter should be able to withstand thousands (e.g., 9,000 to 18,000) of docking cycles and still provide a reliable electrical connection.

(008) What is still desired, therefore, is a new and improved medical diagnostic apparatus, such as a glucose meter. Preferably, the new and improved glucose meter will be small enough and light-weight enough to be portable and conveniently carried by a user. In addition, the new and improved glucose meter will preferably be designed to withstand being accidentally dropped by a user and continue to function properly. Preferably, the new and improved glucose meter will also have good heat insulating properties to ensure accurate glucose measurements. The new and improved portable glucose meter will preferably include a docketing station that is itself ruggedized and provides an easy and reliable electrical docking connection with the glucose meter.

Summary of the Disclosure

(009) The present disclosure is directed to exemplary embodiments of a new and improved portable medical diagnostic apparatus, such as a glucose meter, and a docking station for use with the glucose meter.

(010) One exemplary embodiment of the medical diagnostic apparatus includes a housing, a sensor assembly located within the housing and including at least one temperature sensing element mounted on an auxiliary printed circuit board (PCB), and at least one thermal seal compressed between the auxiliary PCB of the sensor assembly and the housing and separating the temperature sensing element from heat-generating internal components of the medical diagnostic apparatus. In addition, the auxiliary PCB of the sensor assembly is pressed against the housing to provide a substantially direct thermal coupling between the exterior of the medical diagnostic apparatus and the temperature sensing element.

(011) Another exemplary embodiment of the medical diagnostic apparatus includes a housing, and a primary printed circuit board (PCB) positioned within the housing. The PCB is rigid, flat and has a length extending between opposing ends and a width extending between opposing sides. The apparatus also includes a liquid crystal display (LCD) positioned within the housing adjacent a window of the housing, wherein the LCD includes a length and a width that approximates the length and the width of the primary PCB, and a rigid frame supporting the LCD and having a length and a width that approximates the length and the width of the primary PCB. The rigid frame is secured to the primary PCB and at least one of the frame and the primary PCB are secured to the housing.

(012) One exemplary embodiment of the docking station includes an external housing defining a pocket for receiving the medical diagnostic apparatus. The pocket includes a wall extending upwardly from a bottom end of the pocket for slidingly receiving the wall of the medical diagnostic apparatus when the apparatus is received in the pocket, and wherein the wall of the pocket includes at least one opening spaced from the bottom end of the pocket and a convex projection extending from the bottom end of the pocket to the opening in the wall of the pocket. The convex projection of the docking station is sized and shaped to mate with a concave depression of the apparatus when the apparatus is received in the pocket. The docking station also includes at least one electrically conductive contact extending through the opening of the housing of the docking station so that, when the apparatus is received in the pocket, the contact extending out of the docking station contacts a contact extending out of the medical diagnostic apparatus.

(013) Among other aspects, benefits and advantages of the present disclosure, the new and improved glucose meter is small enough and light-weight enough to be portable and conveniently carried by a user. In addition, the new and improved glucose meter is designed to withstand being accidentally dropped by a user yet continue to function properly. The new and improved glucose meter also has good heat insulating properties to ensure accurate glucose measurements. Furthermore, the new and improved docketing station is itself ruggedized and provides an easy and reliable electrical docking connection with the glucose meter.

(014) Additional aspects, benefits and advantages of the present disclosure will become readily apparent to those skilled in this art from the following detailed description, wherein only exemplary embodiments of the present disclosure are shown and described, simply by way of illustration of the best mode contemplated for carrying out the present disclosure. As will be realized, the present disclosure is capable of other and different embodiments, and its several details are capable of modifications in various obvious respects, all without departing from the disclosure. Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

Brief Description of the Drawings

(015) Reference is made to the attached drawings, wherein elements having the same reference character designations represent like elements throughout, and wherein:

(016) **FIG. 1** is a perspective front and end view of an exemplary embodiment of a handheld glucose meter constructed in accordance with the present disclosure;

(017) **FIG. 2** is a perspective front and end view, in section, of the handheld glucose meter of **FIG. 1**;

(018) **FIG. 3** is an exploded perspective front and end view of the handheld glucose meter of **FIG. 1**, wherein an internal frame and a primary printed circuit board of the meter are shown;

(019) **FIG. 4** is a perspective front view of the internal frame and the primary printed circuit board of the handheld glucose meter of **FIG. 1**;

(020) **FIG. 5** is a perspective front and end view of the internal frame and the primary printed circuit board of the handheld glucose meter of **FIG. 1**;

(021) **FIG. 6** is an enlarged view of the portion of the handheld glucose meter contained in circle "FIG. 6" of **FIG. 1**, wherein thermal seals of the glucose meter are shown surrounding a sensor assembly of the meter;

(022) **FIG. 7** is a further enlarged view of the portion of the handheld glucose meter contained in circle "FIG. 6" of **FIG. 1**;

(023) **FIGS. 8** through **10** are perspective front and side views of the handheld glucose meter of **FIG. 1** shown being received in a docking station constructed in accordance with the present disclosure;

(024) **FIG. 11** is a side elevation view, partially cut-away, of the handheld glucose meter of **FIG. 1** shown received in the docking station of **FIGS. 8** through **10**; and

(025) **FIG. 12** is an enlarged view of the portion of the handheld glucose meter and the docking station contained in circle "FIG. 12" of **FIG. 11**.

<u>Detailed Description of Exemplary Embodiments</u>

(026) The present disclosure is directed to a new and improved portable medical diagnostic apparatus and a new and improved docking station (cradle) for use with the portable medical diagnostic apparatus. An exemplary embodiment **10** of a portable medical diagnostic apparatus, or parts thereof, constructed in accordance with the present disclosure is shown in **FIGS. 1** through **12** of the attached drawings. Among other aspects, benefits and advantages of the present disclosure, the new and improved portable medical diagnostic apparatus **10** is designed to withstand being accidentally dropped by a user and continue to function properly. The medical diagnostic apparatus **10** can withstand being accidentally dropped because a primary printed circuit board (PCB) **12** of the apparatus is directly secured to an internal frame **14** of the apparatus, as shown best in **FIGS. 2** through **5**, to provide the apparatus with improved stiffness and torsional rigidity. The new and improved portable medical diagnostic apparatus **10** also has good heat insulating properties to ensure accurate operation. The heat insulating properties are provided by seals **16, 17** compressed between an external housing **18** and an internal sensor assembly **20** of the apparatus **10**, as shown best in **FIGS. 2, 3, 6** and **7**. Furthermore, the new and improved docking station, an exemplary embodiment **100** of which is shown in **FIGS. 8** through **12**, is itself ruggedized and provides an easy and reliable electrical docking connection with the portable medical diagnostic apparatus **10**.

(027) Referring first to **FIGS. 1** through **3**, the exemplary embodiment of a portable medical diagnostic apparatus constructed in accordance with the present disclosure comprises a blood glucose meter **10**. However, it should be understood that aspects of the present disclosure are applicable to portable medical diagnostic apparatuses other than blood glucose meters.

(028) The glucose meter **10** generally includes the housing **18**, which contains an on/off power switch **22**, a display screen **24**, and a user input device **26**. In the exemplary embodiment shown, the display screen comprises a backlit liquid crystal display (LCD) **24** and the user input device comprises a touch screen **26** layered over the LCD. The housing **18** includes a window **28** for displaying and providing access to the LCD **24** and the touch screen **26**.

(029) The housing **18** is made of a rigid, durable and light-weight material such as, but not limited to: metals such as iron, steel, aluminum, titanium, and brass; plastics such as ethylene-vinyl acetate; acrylics such as acrylonitrile-butadiene-styrene and acrylic-styrene-acrylonitrile; polymers such as polycarbonate, polyurethane, polythylene, polybutylene, polyvinyl chloride, polyphenylene oxide, chlorinated polyvinyl chloride, polyamides, and polybutylene terephthalate; carbon fiber; graphite; and any other rigid, durable and light-weight material known to those skilled in the art. The housing **18** may be formed in one of many ways known to those skilled in the art, such as die-casting, machine forming, traditional molding, and blow-molding. The housing **18** acts as a means for storing any electronics located within the glucose meter and acts as a means for mounting items such as the LCD **24**, the touch screen **26** and the power button **22**. In the exemplary embodiment shown in **FIGS. 1** through **3**, the housing **18** includes a first, or front, portion **30** and a second, or rear, portion **32** assembled together to house the LCD **24**, the touch screen **26** and other components of the glucose meter **10**. The front portion **30** includes the window **28** for the LCD **24** and the touchscreen **26**.

(030) As shown in **FIGS. 1** through **3**, the glucose meter **10** further includes a port **34** in the housing **18** for receiving a fluid sample. In the exemplary embodiment shown, the port **34** is formed in the front portion **30** of the housing **18** at a top end **36** of the meter **10**. The fluid sample (not shown) may comprise, for example, a drop of blood placed on disposable test strip, such as the Ascensia ELITE® Blood Glucose Test Strips. As shown best in **FIGS. 2** and **3**, the sensor assembly **20** is positioned within the housing **18** and adjacent to the port **34**. The sensor assembly **20** includes an electrochemical sensor **38** mounted on an auxiliary printed circuit board (PCB) **40**. The electrochemical sensor **38** is adapted to receive a test strip inserted into the port **34** and measure a glucose concentration of a blood sample placed on the test strip. An example of an electrochemical sensor **38** is a sensor that may be used is an amperometric monitoring system. Examples of an electrochemical sensor that can be used to measure glucose concentrations are those used in Bayer Corporation's Ascensia ENTRUST™, CONTOUR™, DEX® and ELITE® systems.

(031) As shown in **FIGS. 2, 3, 6** and **7**, the sensor **38** also includes at least one temperature sensing element (e.g., a thermistor, thermometer, or thermocouple device) **39** mounted on a lower surface of the auxiliary PCB **40** and which is used to measure the ambient temperature of the glucose meter **10**. As with any chemical sensing method, transient changes in temperature during or between measurement cycles can alter background signal, reaction constants and/or diffusion coefficients. Accordingly, the temperature sensing element **39** is used to monitor changes in temperature over time. A maximum temperature change over time threshold value can be used to invalidate a measurement. Such a threshold value can, of course, be set at any objective level, which in turn can be empirically determined depending upon the particular extraction/sensing device used, how the temperature measurement is obtained, and the analyte being detected. Absolute temperature threshold criteria can also be employed, wherein detection of high and/or low temperature extremes can be used in a data screen to invalidate a measurement. The temperature sensing element **39**, for example, may provide a voltage proportional to the temperature to an A/D converter of a microprocessor of the glucose meter, which can then make a determination as to whether the temperature of the testing environment is within predetermined thresholds, and prohibit a user from running a test if accuracy would be negatively affected.

(032) Still referring to **FIGS. 2, 3, 6** and **7**, the glucose meter **10** is also provided with seals **16, 17** that enclose the port **34** and provide a fluid-tight seal between the port **34** and the internal components of the glucose meter **10** other than the sensor **38** and the temperature sensing element **39**. The seals also thermally insulate the sensor **38** and the temperature sensing element **39** from any of the heat-generating internal components of the glucose meter **10** and, in particular, the backlighting of the LCD **24**. The seals **16, 17** are made of thermally insulating and electrically insulating elastomeric materials. The seals **16, 17** provide electrical isolation, thermal isolation and a fluid-tight seal and are compressed between the auxiliary PCB **40** and the housing **18** when the glucose meter **10** is assembled.

(033) As shown best in **FIGS. 6** and **7**, the auxiliary PCB **40** of the sensor assembly **20** is positioned in the glucose meter **10** so that a portion of a front surface of the auxiliary PCB **40** of the sensor assembly **20** is pressed against the housing **18** so that the temperature sensing element **39** mounted on the opposite back surface of the auxiliary PCB **40** can more accurately measure the ambient (i.e., outside) temperature of the glucose meter **10**. In addition to providing a thermal insulator for the temperature sensing element **39**, the seal **16** is compressed between the rear portion **32** of the housing **18** and the auxiliary PCB **40** and acts to press the auxiliary PCB **40** against the front portion **30** of the housing **18** so that the temperature sensing element **39** has direct thermal contact with the outside of the glucose meter **10** and can more accurately measure the ambient temperature of the glucose meter **10**. Heat sink grease is also provided between the auxiliary PCB **40** and the housing **18** to reduce any thermal resistance between the auxiliary PCB **40** and the housing **18**.

(034) The glucose meter **10** also includes the primary printed circuit board (PCB) **12**, which is shown best in **FIGS. 2** and **3**. Although not viewable, the primary PCB **12** supports much of the electronic components of the glucose meter **10** including a computer processing unit (CPU). The CPU is connected, for example, to the LCD **24**, the touch screen **26**, the power button **22** and the glucose sensor **38** and is programmed to operate all of the components of the glucose meter **10**.

(035) The primary PCB **12**, which is also shown in **FIGS. 4** and **5**, is rigid and flat and generally rectangular, having a length extending between opposing ends **42** and a width extending between opposing sides **44**. As shown best in **FIG. 2**, the opposing ends **42** of the primary PCB **12** extend from the top end **36** of the housing **18** to a bulkhead **46** of the housing **18**, which is located near a bottom end **48** of the housing **18**. The opposing sides **44** of the primary PCB **12** extend between sides **50** of the housing **18**.

(036) In general, a rigid PCB comprises a thin plate on which chips and other electronic components are fixed by solder. A rigid PCB is normally made of continuous woven glass cloth impregnated with epoxy resin, and a layer of metal (usually copper) printed circuit is applied to at least one side of the PCB. A PCB, for example, may comprise a 1/32 inch laminate with 1 ounce copper per square foot. The simplest kind of PCB has components and wires on one side and interconnections (the printed circuit) on the other. The connections are metal strips (usually copper). The pattern of connections is often produced using photo-resist and acid etching. Component leads and integrated circuit pins may pass through holes ("vias") in the board or they may be surface mounted, in which case no holes are required (though they may still be used to connect different layers). PCBs may also have components mounted on both sides and may have many internal layers, allowing more connections to fit in the same board area. Boards with internal conductor layers usually have "plated-through holes" to improve the electrical connection to the internal layers.

(037) As shown best in **FIGS. 2** and **3**, the touch screen **26** and the LCD **24** are held together with an elastomeric gasket **52** that runs along a periphery of the touch screen and the LCD and forms a fluid tight seal between the touch screen **26** and the LCD **24** and the window **28** of the front portion **30** of the housing **18**. The elastomeric gasket **52** also acts to insulate the touch screen **26** and the LCD **24** from potentially damaging shock and vibration. The touch screen **26** and the LCD **24** are rectangular and, together with the gasket **52**, approximate the length and width dimensions of the primary PCB **12**.

(038) The glucose meter **10** also includes the internal frame **14**, which supports and receives the touch screen **26**, the LCD **24** and the gasket **52**. The frame **14** is made from a strong and rigid material, such as, but not limited to, metals such as aluminum, plastics such as ethylene-vinyl acetate, acrylics such as acrylonitrile-butadiene-styrene and acrylic-styrene-acrylonitrile, polymers such as polycarbonate, polyurethane, polythylene, polybutylene, polyvinyl chloride, polyphenylene oxide, chlorinated polyvinyl chloride, polyamides, and polybutylene terephthalate, carbon fiber, graphite, and any other suitably strong and rigid material known to those skilled in the art.

(039) The frame **14**, which is also shown in **FIGS. 4** and **5**, is rectangular and includes opposing end walls **54** and opposing side walls **56** and approximates the length and width dimensions of the primary PCB **12**. The frame **14** also includes a base wall **58** extending between the end walls **54** and the side walls **56**. Much of the base wall **58** is removed (or simply not formed) during the fabrication of the frame **14** in order to reduce the weight of the frame **14** without significantly reducing the strength or the torsional rigidity of the frame **14**. Ribs **60** are located on a lower surface of the base wall **58** to provide additional strength and rigidity.

(040) As shown best in **FIGS. 3** through **5**, the frame **14** includes holes **62** for receiving screws or other suitable fasteners (not shown) passing through holes **64** in the auxiliary PCB **40** of the sensor assembly **20** and securing the auxiliary PCB to the frame **14**. The frame **14** also includes bosses **66** extending from the lower surface of the base wall **58** and holes **68** extending through the base wall **58** and the bosses **66** for receiving screws **70** or other suitable fasteners securing the primary PCB **12** to the frame **14**. Some of the same screws **70** that secure the primary PCB **12** and the frame **14** together also pass through the housing **18** and secure the front and the rear portions **30**, **32** of the housing **18** together upon assembly of the glucose meter **10**. The touch screen **26**, the LCD **24** and the gasket **52** are secured between the frame **14** and the front portion **30** of the housing **18** upon assembly of the glucose meter **10**. The frame **14** further includes holes **72** for receiving screws **74** securing the housing **18** together and to the frame **14**. Additional screws **76** secure the bottom end **48** of the housing **18** together.

(041) As shown best in **FIG. 3**, the primary PCB **12** includes holes **78** which receive the screws **70** securing the primary PCB **12** to the frame **14** and the housing **18**. Connecting the primary PCB **12** to the frame **14** increases the stiffness and the torsional rigidity of the glucose meter **10** and, therefore, helps to protect the touch screen **26** and the LCD **24** upon the glucose meter **10** being accidentally dropped. Securing the primary PCB **12** to the frame **14** has been found to substantially improve the ruggedization of the glucose meter **10** and allow the glucose meter **10** to survive an accidental drop from a height of about five feet onto a hard surface without damage and continue to function properly.

(042) As shown best in **FIGS. 2** and **3**, the exemplary embodiment of the glucose meter **10** includes a barcode scanner **80** for scanning barcodes off disposable test strips used with the glucose meter **10**. As also shown in **FIG. 1**, the housing **18** includes a window **82** for the barcode scanner **80**. In the exemplary embodiment shown, the barcode scanner **80** is secured to the primary PCB **12** with suitable fasteners, such as screws **84**. The PCB is provided with holes **85** for receiving the barcode scanner **80**.

(043) **FIGS. 8** through **10** show the glucose meter **10** of **FIG. 1** being received in the docking station **100**, and **FIGS. 11** and **12** are side elevation views, partially cut-away, of the handheld glucose meter **10** received in the docking station **100**. The glucose meter **10** and the docking station **100** of the present disclosure are both ruggedized and durable. In addition, the glucose meter **10** and the docking station **100** include novel features that allow the glucose meter **10** to be easily received in the docking station **100**, yet reduce wear create by the docking process such that the docking station **100** and the glucose meter **10** can withstand thousands of docking cycles (e.g., 9,000 to 18,000 cycles) and continue to function properly. The glucose meter **10** and the docking station **100** together comprise a system.

(044) As shown best in **FIG. 2**, the housing **18** of the glucose meter **10** includes a wall **86** extending upwardly from the bottom end **48** of the housing **18**, and an opening **88** in the wall **86** spaced from the bottom end **48**. The wall **86** defines a concave depression **90** extending between the bottom end **48** and the opening **88**. The glucose meter **10** also includes at least one electrically conductive contact **92** in contact with the primary PCB **12** and extending through the opening **18** of the housing **18**. The contact **92** of the glucose meter **10** provides a data connection to the CPU of the glucose meter **10** and also provides a electrical connection to a rechargeable battery **94** (shown in **FIGS. 2** and **3**) of the glucose meter **10**.

(045) The docking station **100** includes an external housing **102** defining a pocket **104** for receiving the medical diagnostic apparatus **10**. The pocket **104** includes a wall **106** extending upwardly from a bottom end **108** of the pocket **104** for slidingly receiving the wall **86** of the glucose meter **10** when the bottom end **48** of the meter **10** is received in the pocket **104**. As shown best in **FIG. 8**, the wall **106** of the pocket **104** includes at least one opening **110** spaced from the bottom end **108** of the pocket **104** and a convex projection **112** extending from the bottom end **108** of the pocket **104** to the opening **110** in the wall **106** of the pocket **104**. The convex projection **112** of the docking station **100** is sized and shaped to mate with the concave depression **90** of the glucose meter **10** when the bottom end **48** of the meter **10** is received in the pocket **104**

of the docking station **100**, as shown best in **FIGS. 11** and **12**. Still referring to **FIGS. 11** and **12**, the docking station **100** also includes at least one electrically conductive contact **114** mounted within the housing **102** of the docking station **100** and extending through the opening **110** of the housing of the docking station **100** so that, when the glucose meter **10** is received in the pocket **104**, the contact **114** extending out of the docking station **100** touches the contact **92** extending out of the glucose meter **10** to provide an electrical connection between the docking station **100** and the glucose meter **10**.

(046) The convex projection **112** of the docking station **100** and the concave depression **90** of the glucose meter **10** have at least two functions. First, the projection **112** and the depression **90** mate and ensure that the glucose meter **10** is correctly positioned in the docking station **100** when the meter is deposited into the pocket **104** of the docking station **100**, such that the contact **114** of the docking station **100** is in contact with the contact **92** of the glucose meter **10**. In addition, the concave depression **90** of the glucose meter **10** prevents the contact **114** of the docking station **100** from rubbing against the wall **86** of the housing **18** of the glucose meter **10** when the bottom end **48** of the glucose meter **10** is deposited into the pocket **104** of the docking station **100**, thereby preventing unnecessary wear and damage to the contact **114** of the docking station **100** and the housing **18** of the glucose meter **10**.

(047) The glucose meter **10** includes a plurality of the contacts **92** extending through the opening **88** of the meter, and the docking station **100** includes a plurality of the openings **110** and a plurality of the contacts **114** extending through the openings of the docking station **100**. In the exemplary embodiment show, the docking station **100** and the glucose meter **10** each include twelve contacts **92, 114**. The contacts **92** of the glucose meter **10** are fixed in place and substantially immovable. As shown best in **FIGS. 11** and **12**, the contacts **92** of the glucose meter **10** each comprise a metal strip bent into a U-shape and having a first free end **96** in contact with the primary PCB **12** of the meter **10** and a second fixed end **98** for contact with the contacts **114** of the docking station **100**. The primary PCB **12** of the glucose meter **10** is not attached to the contacts

92 of the glucose meter **10**, but instead has leads that are in electrical contact with the free ends **96** of the contacts **92** of the glucose meter **10** so that, if the glucose meter **10** is dropped for example, the PCB **12** can move without breaking a connection between the PCB **12** and the contacts **92**. In addition, the second fixed ends **98** of the contacts **92** can easily be cleaned, yet prevent fluid ingress into the housing **18** of the glucose meter **10**.

(048) The contacts **114** of the docking station **100** include a free end **116** that is movable and biased out of the docking station **100**. The contacts **114** of the docking station **100** each comprise an elongated metal strip having a fixed end **118** secured to a PCB **120** of the docking station **100** and the free end **116** extending out of the opening **110** of the housing **102** of the docking station **100**. The free end **116** of each of the metal strips **114** is twisted so that a thin edge of the strip faces out of the docking station **100** through its respective opening **110**. According to one exemplary embodiment, the elongate strips **114** of the docking station **100** are each about 30 millimeters long and each provide a spring force of about 0.15 N to about 0.4 N against the strips **92** of the glucose meter **10**.

(049) Faces of the second fixed ends **98** of the metal strip contacts **92** of the glucose meter **10** face out of the glucose meter **10** and contact the thin edges of the free ends **116** of the contacts **114** of the docking station **100** when the glucose meter **10** is received in the docking station **100**. Because the thinner edges of the contacts **114** of the docking station **100** contact the wider faces of the contacts **92** of the glucose meter **10**, there is a large positional tolerance between the contacts **92, 114** and the contacts will remain in contact and provide a reliable electrical connection even if the glucose meter **10** fits slightly loosely in the docking station **100** during docking. In one exemplary embodiment, the thin edge of the contacts **114** of the docking station **100** each have a width of about 0.4 mm and the faces of the contacts **92** of the glucose meter **10** each have a width of about 2 mm, so that there is a 0.75 mm tolerance between the contacts **92, 114**.

(050) The present disclosure, therefore, provides a new and improved portable medical diagnostic apparatus that can withstand being accidentally dropped by a user and continue to function properly, and has good heat insulating properties to ensure accurate operation. The present disclosure also provides a new and improved docketing station that is itself ruggedized and provides an easy and reliable electrical docking connection with the portable medical diagnostic apparatus.

(051) Numerous further modifications and alternative embodiments of the disclosure will be apparent to those skilled in the art in view of the foregoing description. This description is to be construed as illustrative only, and is for the purpose of teaching those skilled in the art the best mode of carrying out the disclosure. The details of the apparatus and method may be varied substantially without departing from the spirit of the disclosure, and the exclusive use of all modifications which come within the scope of the appended claims is reserved.

What is claimed is:

1. A medical diagnostic apparatus comprising:

a housing;

a sensor assembly located within the housing and including a temperature sensing element mounted on a printed circuit board (PCB); and

at least one thermal seal compressed between the PCB of the sensor assembly and the housing and separating the temperature sensing element from any heat-generating components contained in the housing.

2. An apparatus according to claim 1, wherein the thermal seal is made of thermally insulating elastomeric material.

3. An apparatus according to claim 2, wherein the thermal seal is made of electrically insulating material.

4. An apparatus according to claim 3, wherein the thermal seal provides a fluid-tight seal between the temperature sensing element and the heat-generating components contained in the housing.

5. An apparatus according to claim 1, wherein the housing includes a port adjacent the sensor assembly and the thermal seal is arranged and adapted to provide a fluid-tight seal between other components contained in the housing and the port and the sensor assembly.

6. An apparatus according to claim 1, wherein the housing comprises a first portion and a second portion secured together and the PCB is secured between the first and the second portions of the housing, and wherein the thermal seal is compressed between the second portion of the housing and the PCB and biases the PCB against the first portion of the housing.

7. An apparatus according to claim 6, further comprising heat sink grease provided between the PCB and the housing.

8. An apparatus according to claim 6, wherein the temperature sensing element is positioned on the PCB between the second portion of the housing and the PCB, and between the seal and the housing.

9. An apparatus according to claim 1, wherein the housing includes a port adjacent the sensor for allowing a test strip to be inserted into the housing and into the sensor, and the thermal seal surrounds the sensor and the port.

10. An apparatus according to claim 1, the PCB is in direct contact with the housing and heat sink grease is provided between the PCB and the housing.

11. An apparatus according to claim 1, wherein the sensor assembly comprises a glucose sensor.

12. An apparatus according to claim 1, further comprising:

a primary printed circuit board (PCB) positioned within the housing, wherein the PCB is rigid, flat and generally rectangular and has a length extending between opposing ends and a width extending between opposing sides, and wherein the PCB of the sensor assembly comprises an auxiliary PCB;

a liquid crystal display (LCD) positioned within the housing adjacent a window of the housing, wherein the LCD includes a length and a width that approximates the length and the width of the primary PCB; and

a rigid frame supporting the LCD and having a length and a width that approximates the length and the width of the primary PCB, wherein the rigid frame is secured to the primary PCB and at least one of the frame and the primary PCB are secured to the housing.

13. A medical diagnostic system including an apparatus according to claim 1, and further comprising:

a docking station having a housing defining a pocket sized and shaped for receiving the medical diagnostic apparatus, and wherein the pocket includes a bottom end and at least one opening spaced from the bottom end of the pocket and a convex projection extending from the bottom end of the pocket to the opening in the pocket, and the docking station also includes at least one electrically conductive contact extending through the opening of the pocket; and

wherein the housing of medical diagnostic apparatus further includes a bottom end, at least one opening spaced from the bottom end of the medical diagnostic apparatus, and a concave depression extending between the bottom end and the opening, and wherein the concave depression of the apparatus is sized and shaped to mate with the convex projection of the docking station when the apparatus is received in the pocket, and the medical diagnostic apparatus also includes at least one electrically conductive contact extending through the opening of the housing of the apparatus so that, when the apparatus is received in the pocket of the docking station, the contact extending out of the docking station contacts the contact extending out of the apparatus.

14. A medical diagnostic apparatus comprising:

a housing;

a primary printed circuit board (PCB) positioned within the housing, wherein the PCB is rigid, flat and has a length extending between opposing ends and a width extending between opposing sides;

a liquid crystal display (LCD) positioned within the housing adjacent a window of the housing, wherein the LCD includes a length and a width that approximates the length and the width of the primary PCB; and a rigid frame supporting the LCD and having a length and a width that approximates the length and the width of the primary PCB, wherein the rigid frame is secured to the primary PCB and at least one of the frame and the primary PCB are secured to the housing.

15. An apparatus according to claim 14, wherein the primary PCB is substantially rectangular.

16. An apparatus according to claim 14, wherein the length and the width of the primary PCB approximates an internal length and width of the housing.

17. An apparatus according to claim 14, wherein the housing comprises a first portion and a second portion secured together and the primary PCB, the frame and the LCD are secured between the first and the second portions of the housing.

18. An apparatus according to claim 14, wherein the primary PCB is secured to the frame and the housing with screws.

19. An apparatus according to claim 14, wherein the frame is rectangular and includes opposing end walls and opposing side walls, a base wall extending between the end walls and the side walls, and ribs located on the base wall.

20. A medical diagnostic system including an apparatus according to claim 14, and further comprising:

a docking station having a housing defining a pocket sized and shaped for receiving the medical diagnostic apparatus, and wherein the pocket includes a bottom end and at least one opening spaced from the bottom end of the pocket and a convex projection extending from the bottom end of the pocket to the opening in the wall of the pocket, and the docking station also includes at least one electrically conductive contact extending through the opening of the pocket; and

wherein the housing of medical diagnostic apparatus further includes a bottom end, at least one opening spaced from the bottom end of the medical diagnostic apparatus, and a concave depression extending between the bottom end and the opening, and wherein the concave depression of the apparatus is sized and shaped to mate with the convex projection of the docking station when the apparatus is received in the pocket, and the medical diagnostic apparatus also includes at least one electrically conductive contact extending through the opening of the housing of the apparatus so that, when the apparatus is received in the pocket of the docking station, the contact extending out of the docking station contacts the contact extending out of the apparatus.

21. An apparatus according to claim 14, further comprising a sensor assembly positioned within the housing and wherein the housing includes a port adjacent the sensor assembly for allowing a test strip to be inserted into the housing and into a sensor of the sensor assembly.

22. An apparatus according to claim 21, wherein the sensor comprises a glucose sensor.

23. An apparatus according to claim 21, wherein the sensor assembly is secured directly to the frame.

24. An apparatus according to claim 21, further comprising a thermal seal compressed between the sensor assembly and the housing.

25. A medical diagnostic system comprising:

a medical diagnostic apparatus having,

an external housing having a bottom end, a wall extending upwardly from the bottom end, and at least one opening in the wall spaced from the bottom end, and wherein the wall defines a concave depression extending between the bottom end and the opening,

a board located within the housing, and

at least one electrically conductive contact in contact with the board and extending through the opening of the housing; and

a docking station having,

an external housing defining a pocket sized and shaped for receiving the medical diagnostic apparatus, and wherein the pocket includes a wall extending upwardly from a bottom end of the pocket for slidingly receiving the wall of the medical diagnostic apparatus when the apparatus is received in the pocket, and wherein the wall of the pocket includes at least one opening spaced from the bottom end of the pocket and a convex projection extending from the bottom end of the pocket to the opening in the wall of the pocket, and wherein the convex projection of the docking station is sized and shaped to mate with the concave depression of the apparatus when the apparatus is received in the pocket, and

at least one electrically conductive contact mounted within the housing of the docking station and extending through the opening of the housing of the docking station so that, when the apparatus is received in the pocket, the contact extending out of the docking station contacts the contact extending out of the apparatus.

26. A system according to claim 25, wherein the medical diagnostic apparatus includes a plurality of the contacts extending through the opening in the wall of the apparatus, and the docking station includes a plurality of the openings and a plurality of the contacts extending through the openings in the wall of the docking station.

27. A system according to claim 25, wherein the contact of the medical diagnostic apparatus is substantially immovable.

28. A system according to claim 25, wherein the contact of the docking station is movable and biased out of the docking station.

29. A system according to claim 25, wherein the board within the medical diagnostic apparatus comprises a printed circuit board electrically connected to the

contacts of the medical diagnostic apparatus, and the docking station includes a printed circuit board contained within the housing of the docking station and electrically connected to the contacts of the docking station.

30. A system according to claim 29, wherein the medical diagnostic apparatus includes a rechargeable battery electrically connected to the contacts of the medical diagnostic apparatus.

31. A system according to claim 25, wherein the medical diagnostic apparatus comprises a glucose meter.

32. A system according to claim 25, wherein the contact of the docking station comprises an elongated metal strip having a fixed end secured to the board of the docking station and a free end extending out of the opening in the housing of the docking station and wherein the free end of the metal strip is twisted so that a thin edge of the strip faces out of the docking station.

33. A system according to claim 32, wherein the contact of the medical diagnostic apparatus comprises a metal strip and wherein a face of the metal strip faces out of the apparatus and contacts the thin edge of the strip of the docking station when the medical diagnostic apparatus is received in the docking station.

34. A system according to claim 33, wherein the thin edge of the strip of the docking station has a width of about 0.4 mm and the face of the metal strip of the medical diagnostic apparatus has a width of about 2 mm.

35. A system according to claim 33, wherein the strip of the docking station provides a spring force of about 0.15 N to about 0.4 N against the strip of the medical diagnostic apparatus.

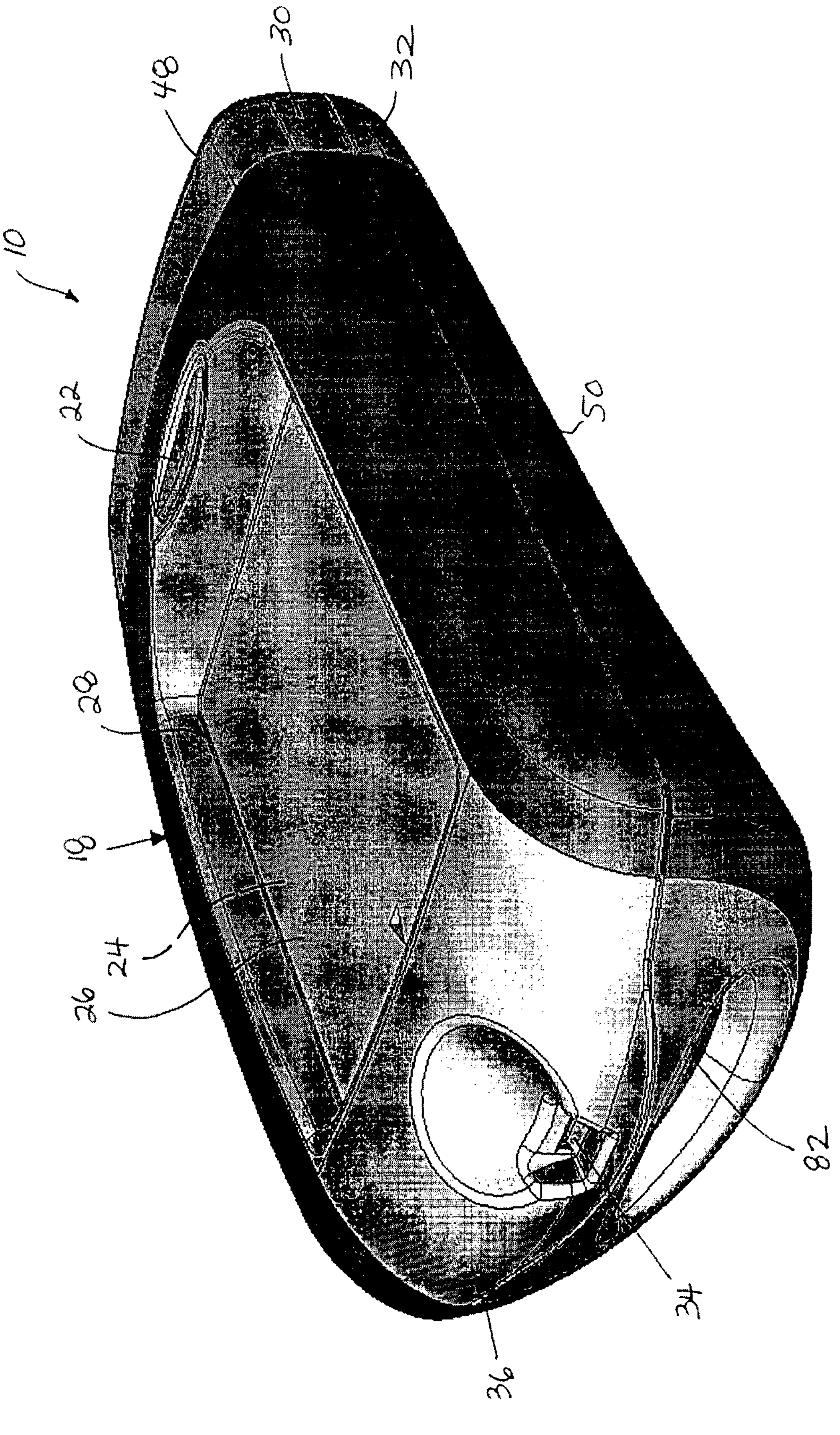

FIG. 1

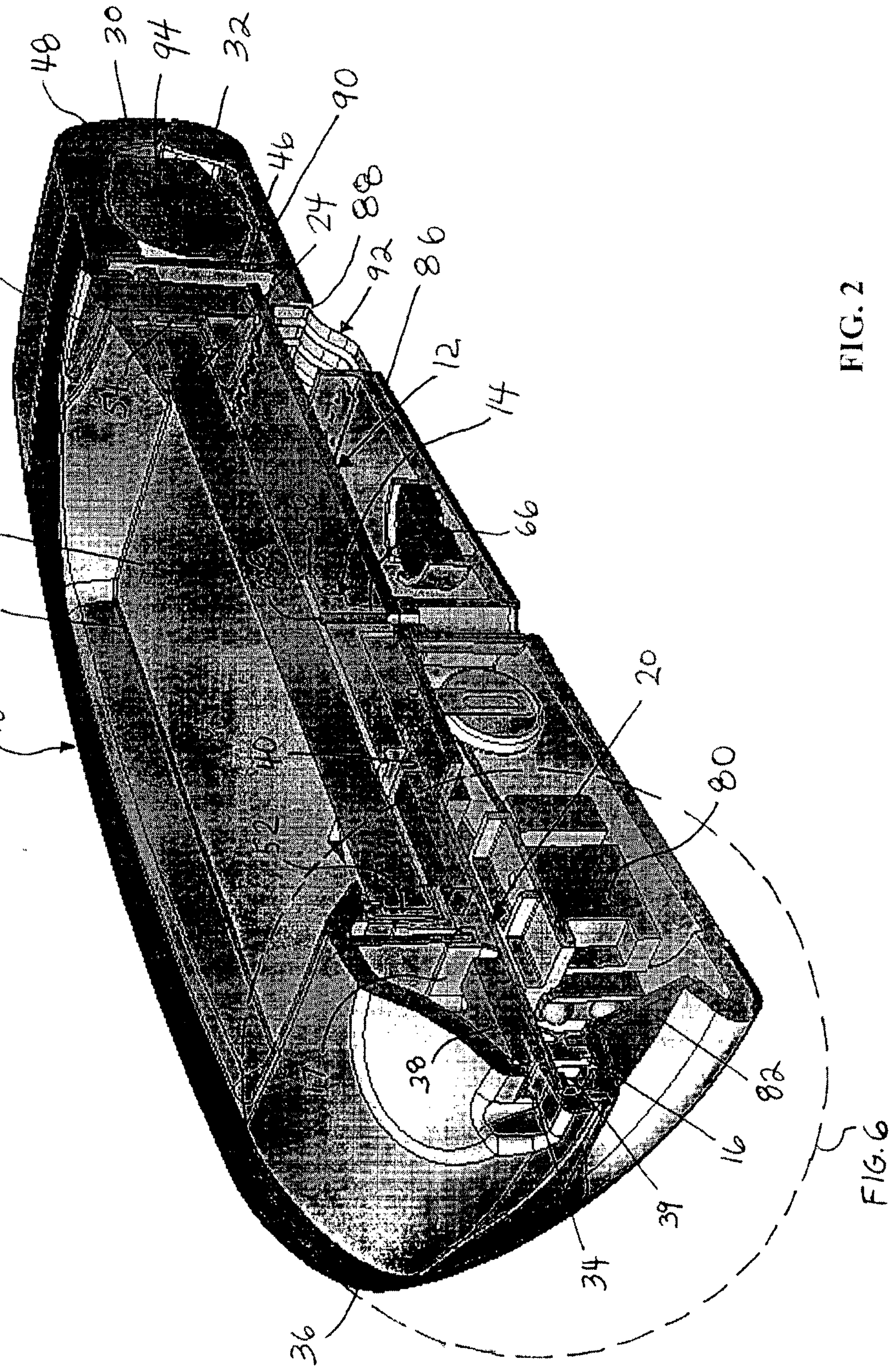
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FIG.6

FIG. 2

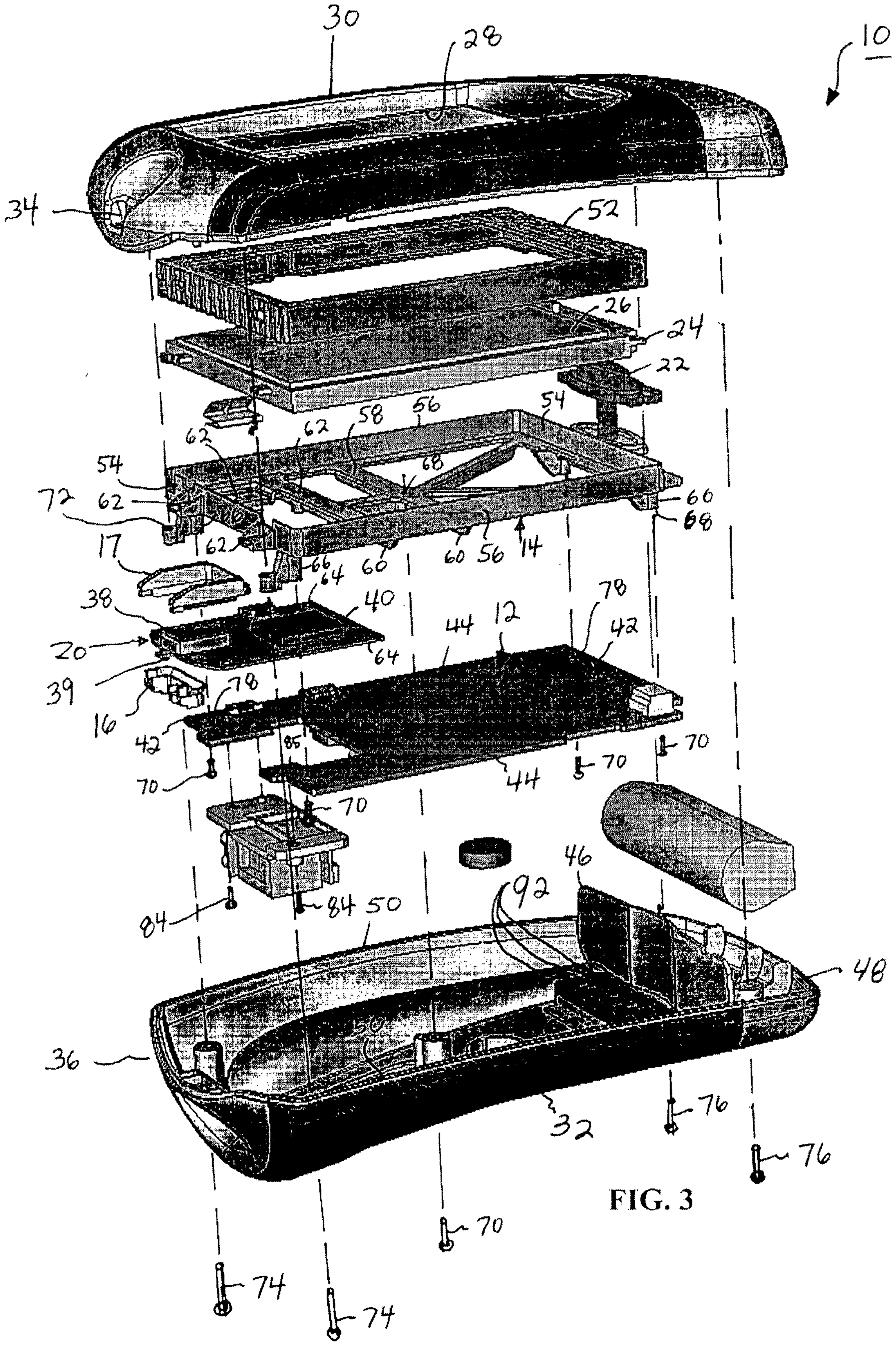
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FIG. 3

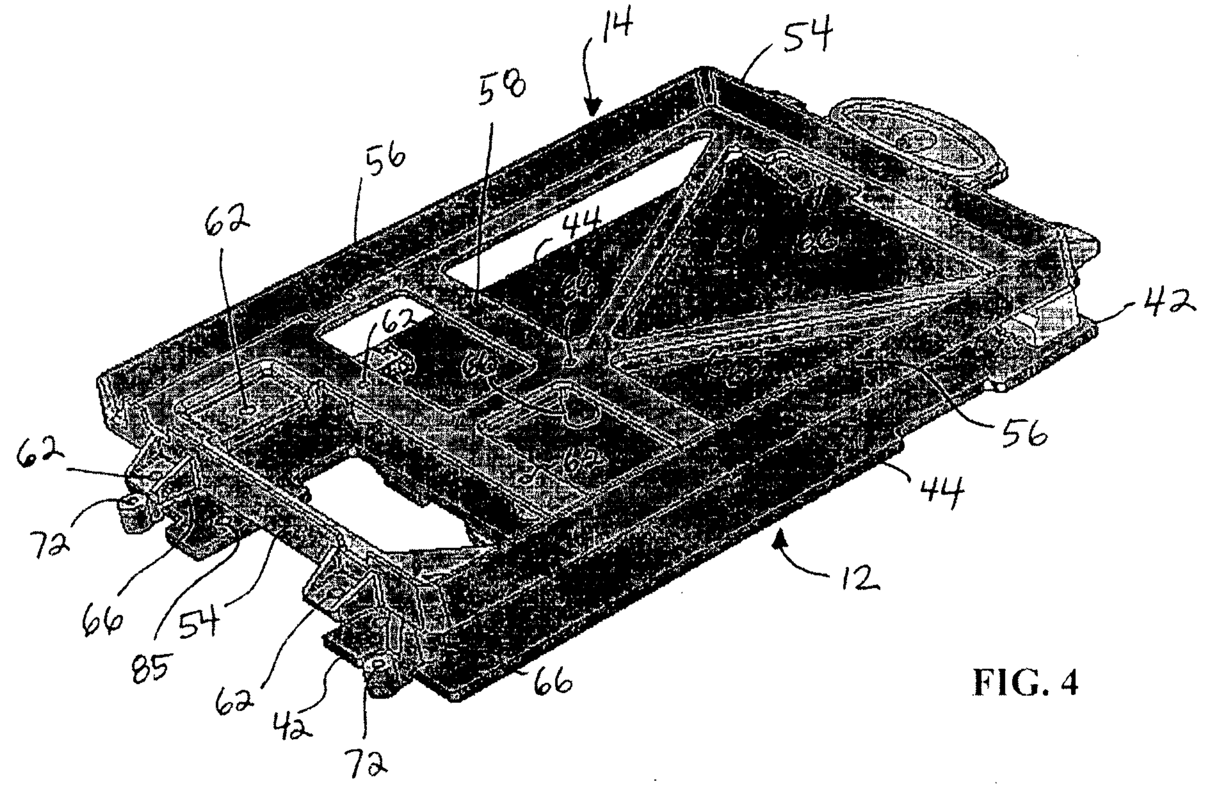
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FIG. 4

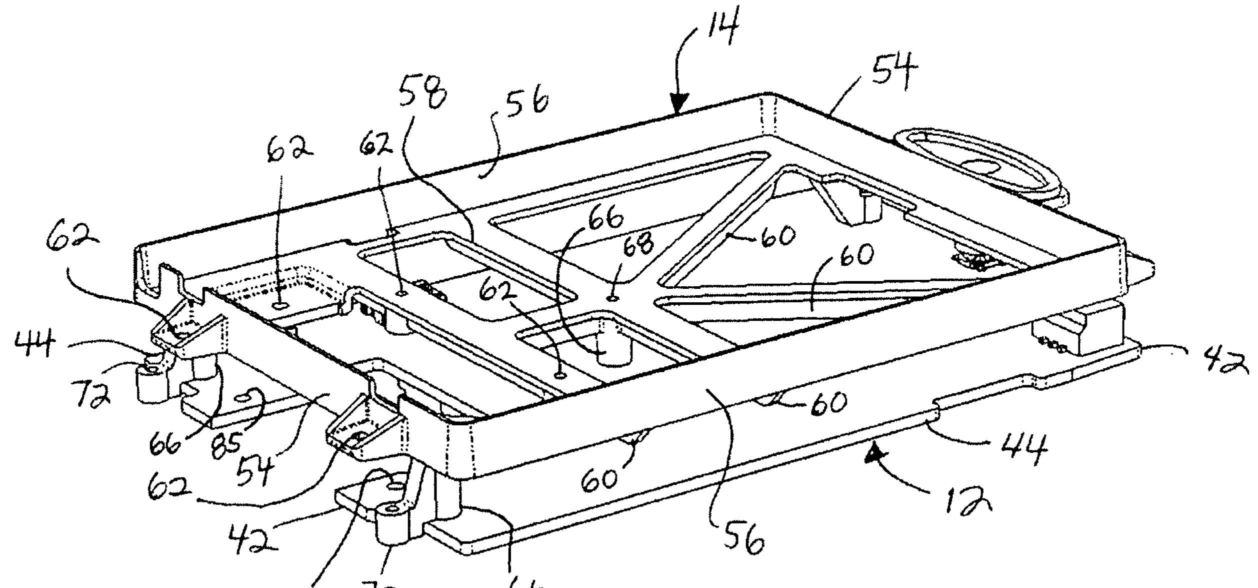
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FIG. 5

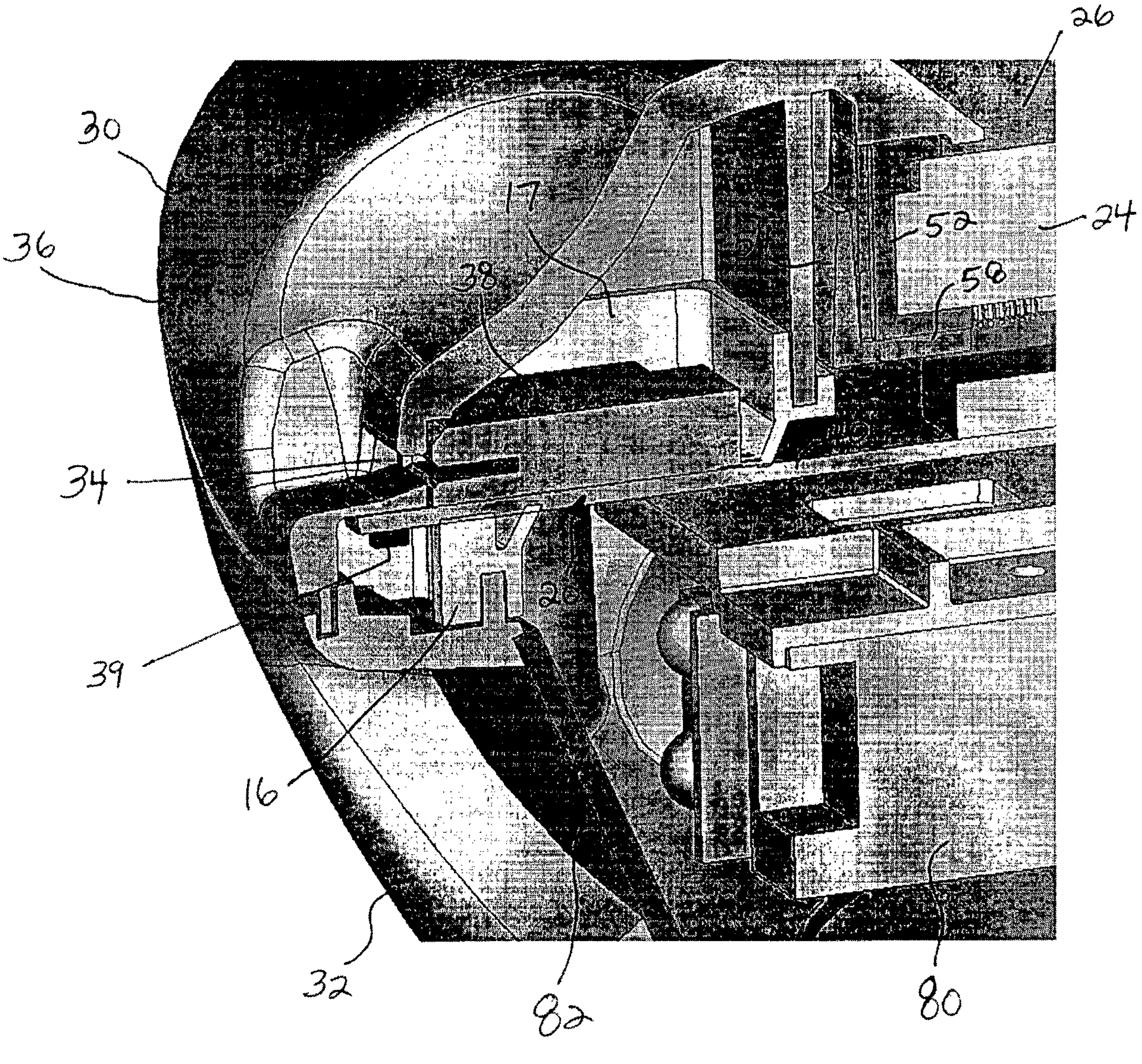

FIG. 6

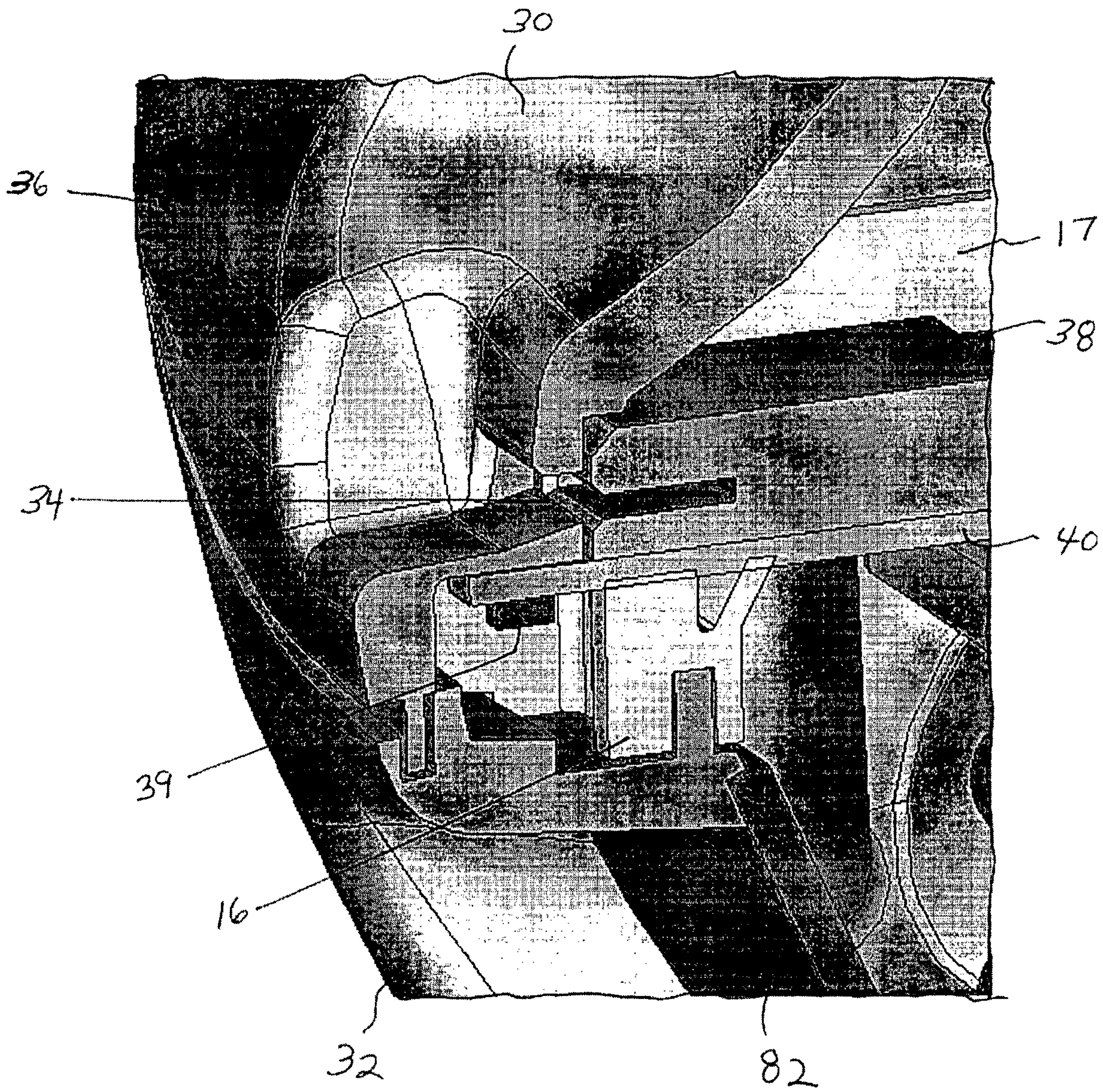

FIG. 7

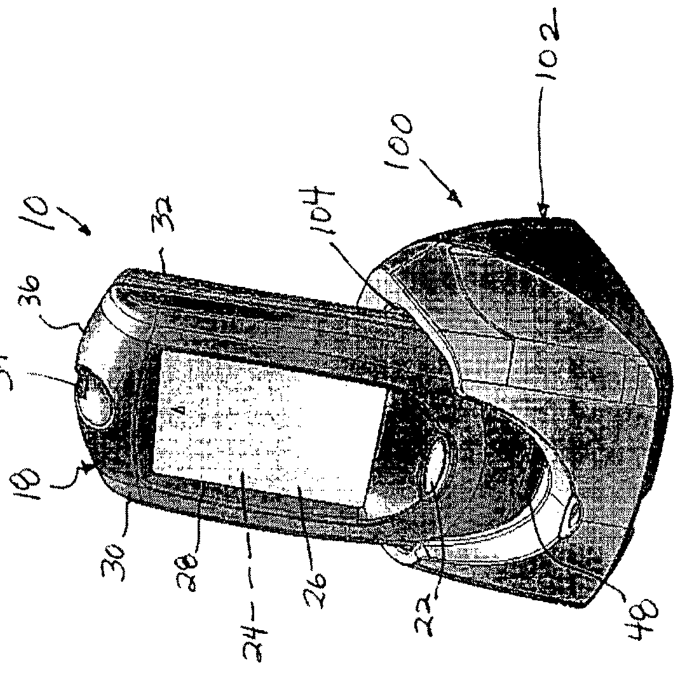

FIG. 10

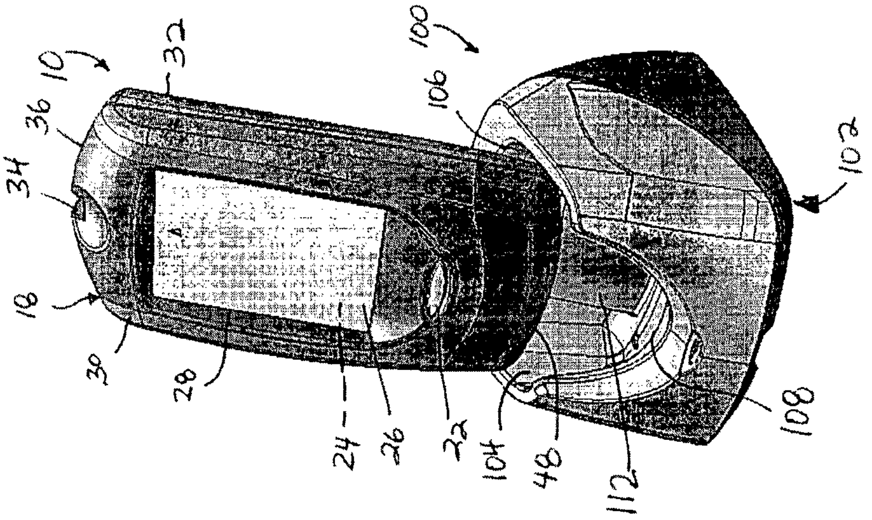

FIG. 9

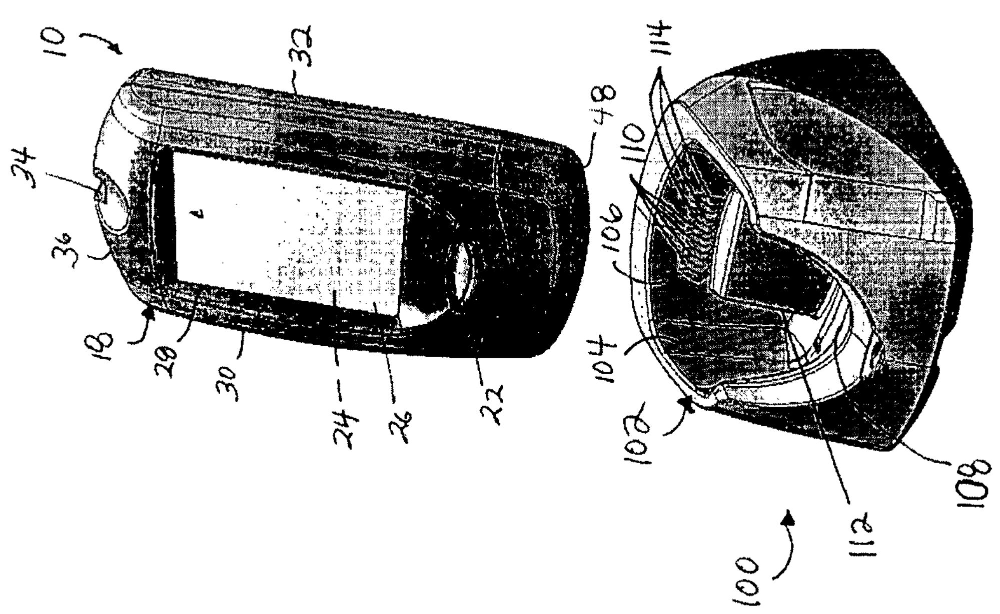

FIG. 8

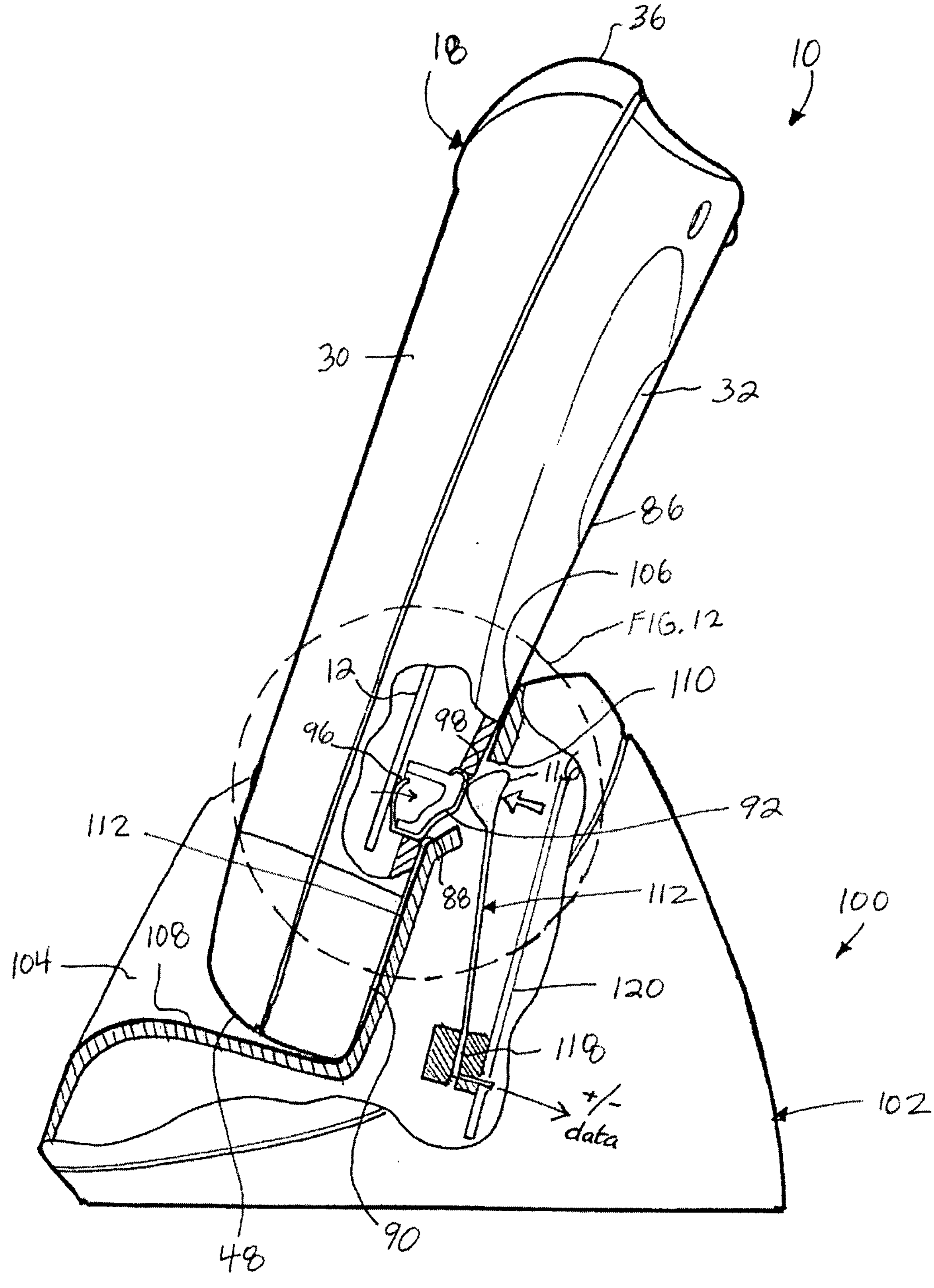
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FIG. 12
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FIG. 11

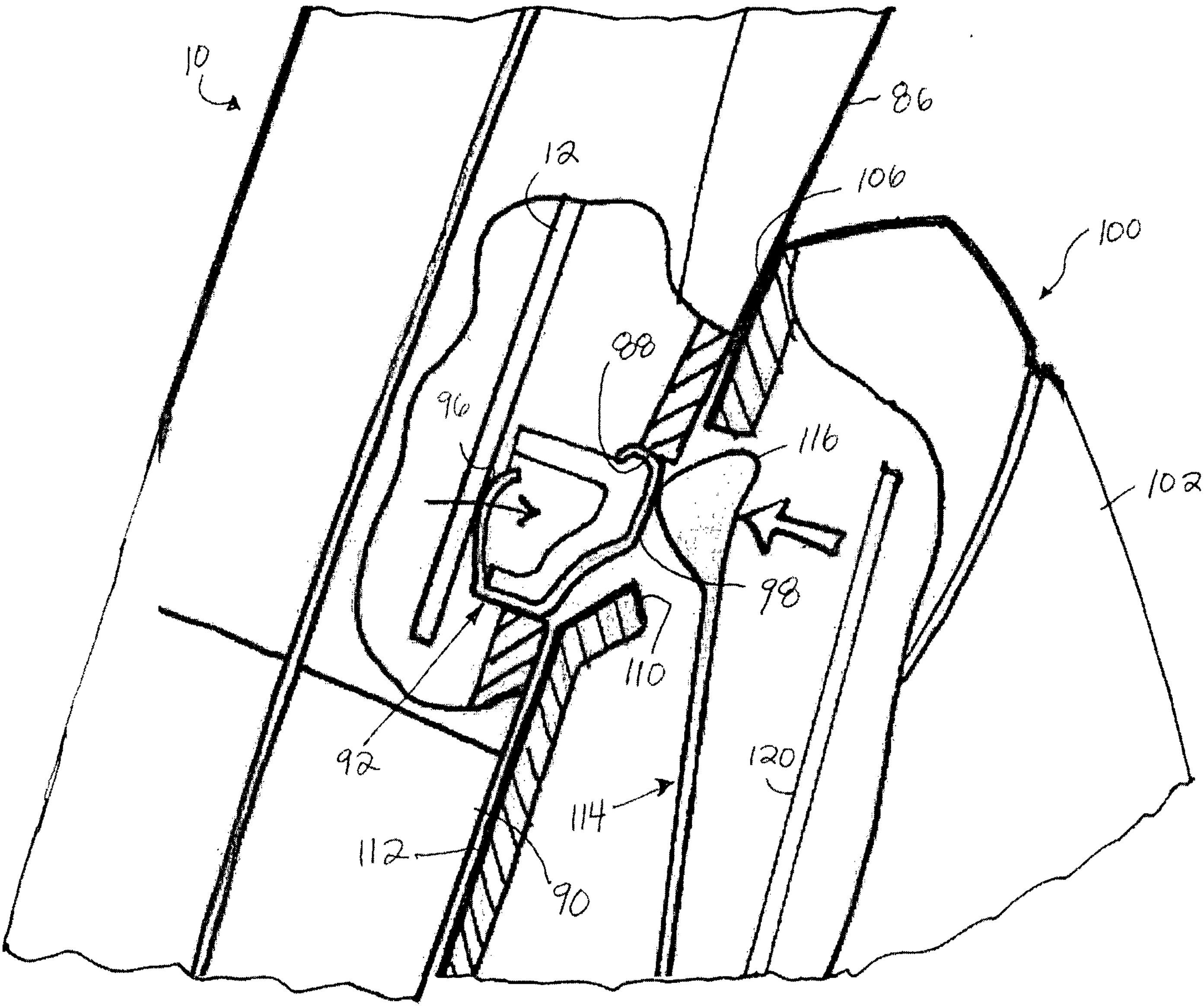

FIG. 12

patsnap

专利名称(译)	便携式医疗诊断设备		
公开(公告)号	EP1628568A2	公开(公告)日	2006-03-01
申请号	EP2004754048	申请日	2004-06-03
[标]申请(专利权)人(译)	拜尔健康护理有限责任公司		
申请(专利权)人(译)	拜耳医药保健，LLC		
当前申请(专利权)人(译)	拜耳医药保健，LLC		
[标]发明人	POLLOCK NEIL STREETER ADRIAN J WEHBEH JAMIE G		
发明人	POLLOCK, NEIL STREETER, ADRIAN, J. WEHBEH, JAMIE, G.		
IPC分类号	A61B5/00 G01K1/20 A61B5/01 G02F1/133 G06F3/023 G06F3/033 G06F3/048 H02J7/00		
CPC分类号	A61B5/7475 A61B5/14532 A61B2560/0252 A61B2562/0271 G06F3/04886		
优先权	60/475352 2003-06-03 US		
外部链接	Espacenet		

摘要(译)

一种医学诊断设备，包括壳体，位于壳体内并包括温度传感元件的传感器组件，以及在传感器组件和壳体之间压缩的至少一个热密封件，并将温度传感元件与发热的内部部件分开。仪器。刚性印刷电路板（PCB）和刚性框架也定位在壳体内并与壳体固定在一起，以为装置提供改进的刚度和抗扭刚度。与所述设备一起使用的对接站限定了具有凸起突出部的口袋，所述凸出突出部在对接期间与所述设备的凹陷部配合，并且所述医学诊断设备包括至少一个导电触点，所述导电触点在对接期间接触所述对接站的导电触点。对接。