



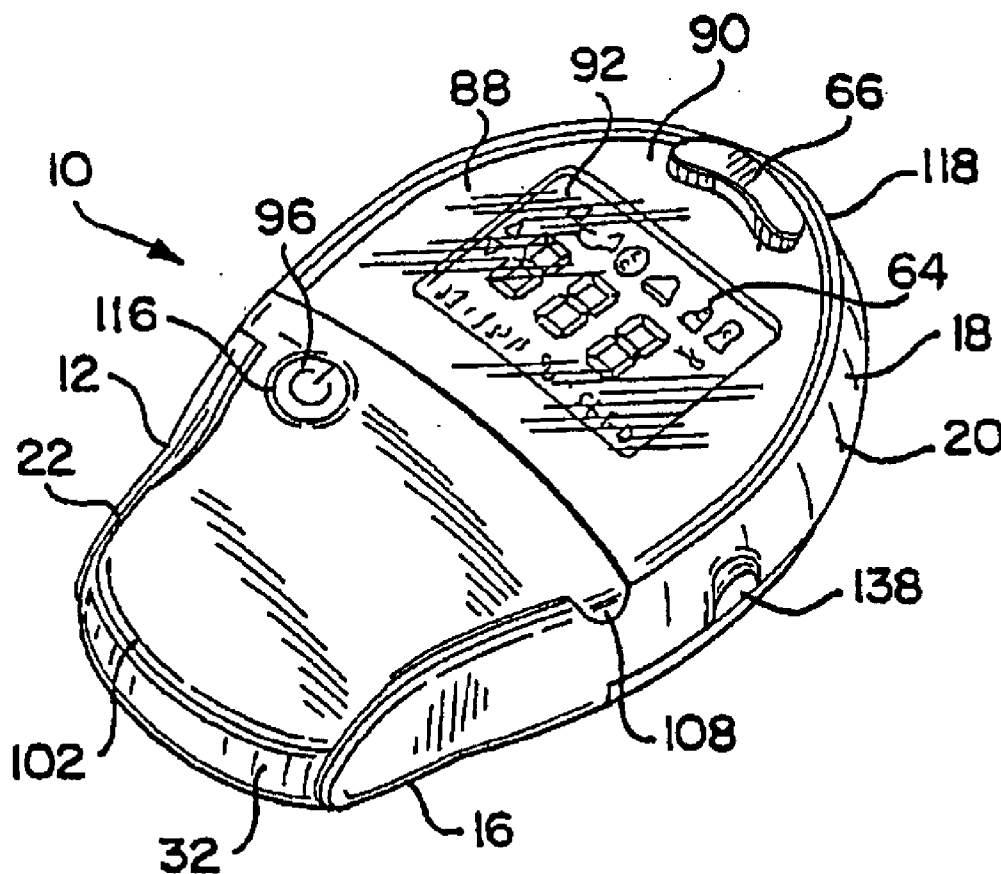
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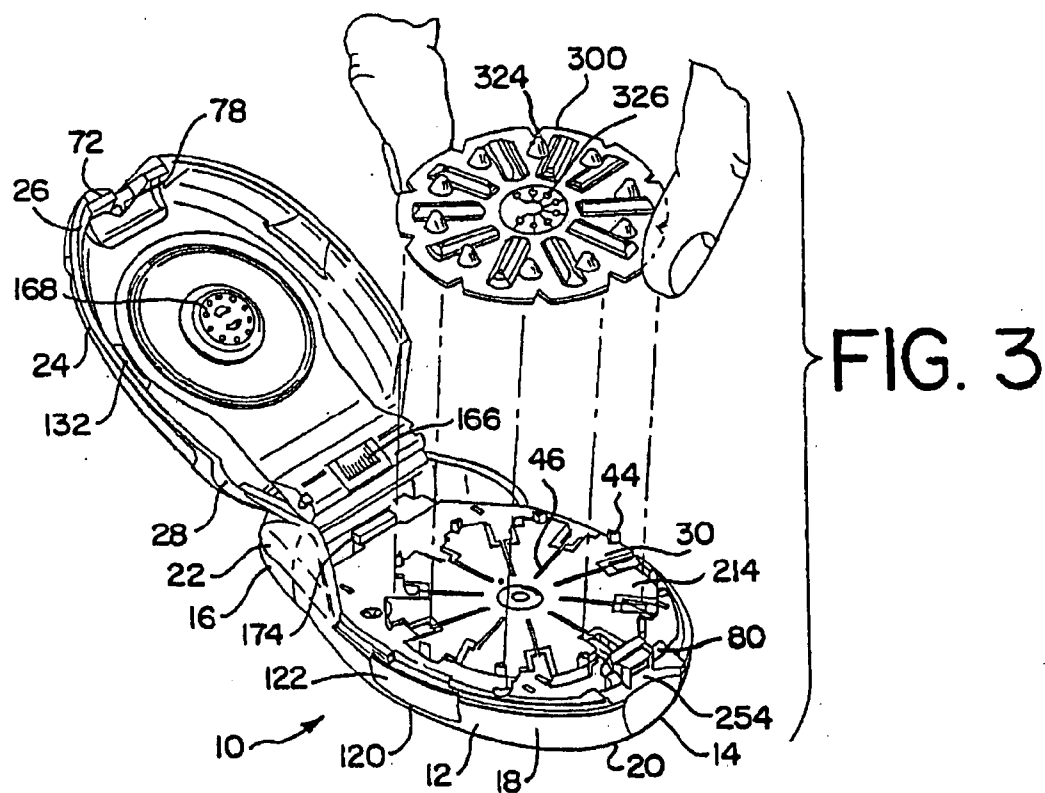
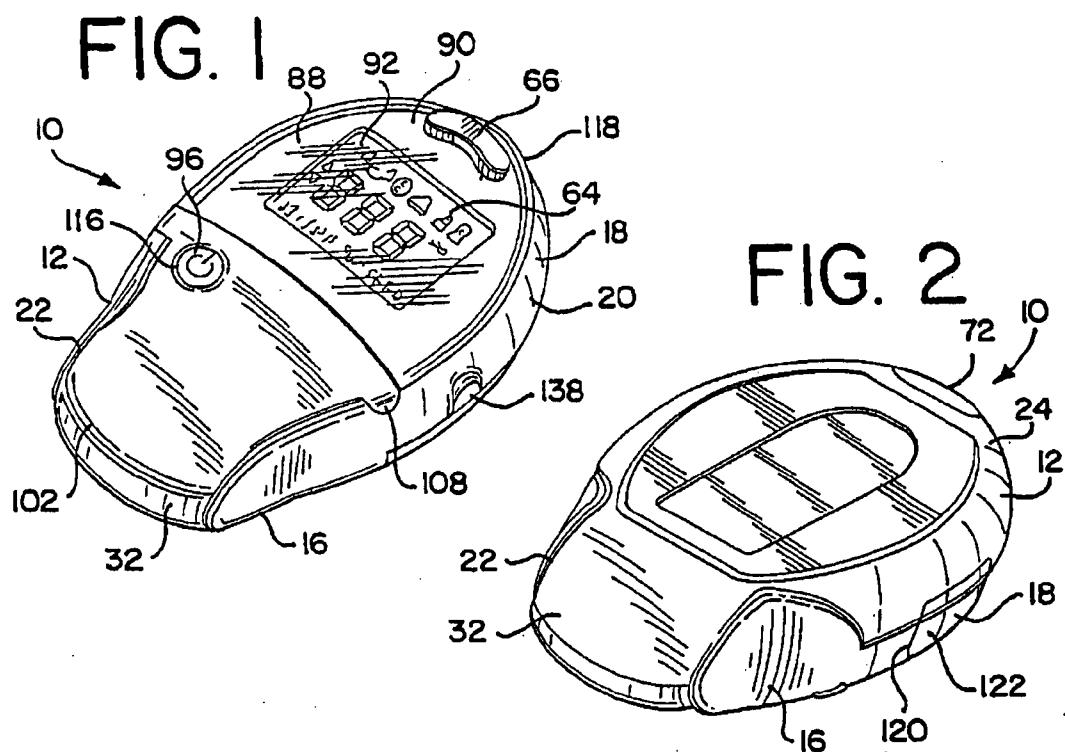
(19) **United States**(12) **Patent Application Publication**
Kirchhevel et al.(10) **Pub. No.: US 2008/0118401 A1**(43) **Pub. Date: May 22, 2008**(54) **BUTTON LAYOUT FOR A TESTING
INSTRUMENT**(60) Provisional application No. 60/311,759, filed on Aug.
13, 2001.(76) Inventors: **G. Lamar Kirchhevel**, Laguna Niguel,
CA (US); **Russell J. Micinski**, South
Bend, IN (US)**Publication Classification**(51) **Int. Cl.****B01J 19/00** (2006.01)**B65H 79/00** (2006.01)**B65H 26/00** (2006.01)(52) **U.S. Cl.** **422/68.1; 221/258; 221/2**Correspondence Address:
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48TH FLOOR
CHICAGO, IL 60601 (US)(21) Appl. No.: **11/985,376**(22) Filed: **Nov. 15, 2007****Related U.S. Application Data**(63) Continuation of application No. 10/237,995, filed on
Sep. 10, 2002, now Pat. No. 7,323,141, which is a
continuation-in-part of application No. 10/207,758,
filed on Jul. 30, 2002.

(57)

ABSTRACT

A sensor dispensing instrument adapted to handle a sensor pack containing a plurality of sensors and to perform a test using one of the sensors. The sensor dispensing instrument includes an outer housing and display disposed on the outer housing for showing items. The sensor dispensing instrument further comprises a power button for turning the sensor dispensing instrument on and off, a scroll button for scroll through the items, and a select button for selecting an item.





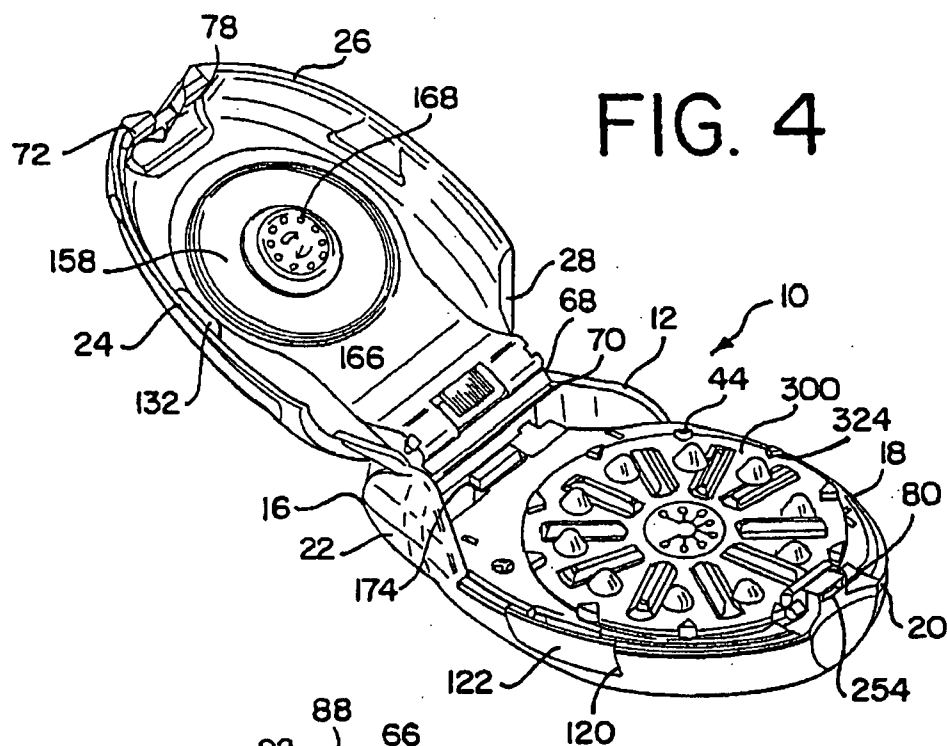


FIG. 4

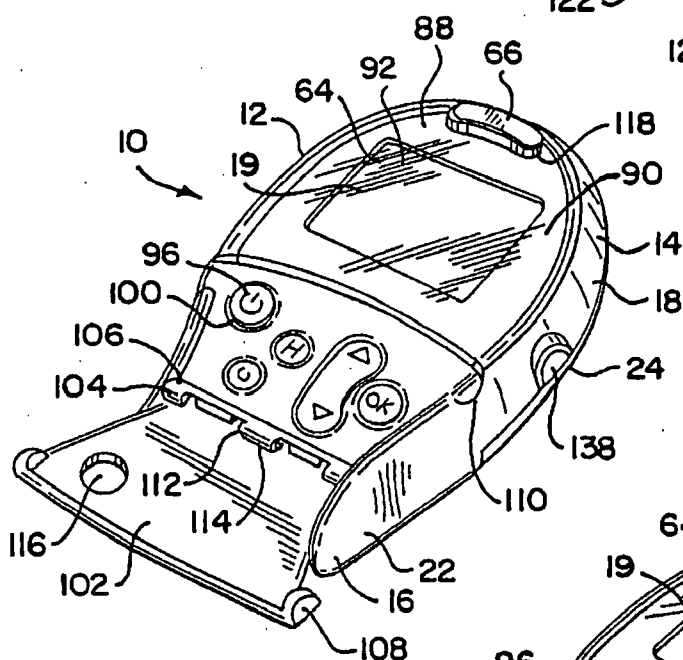
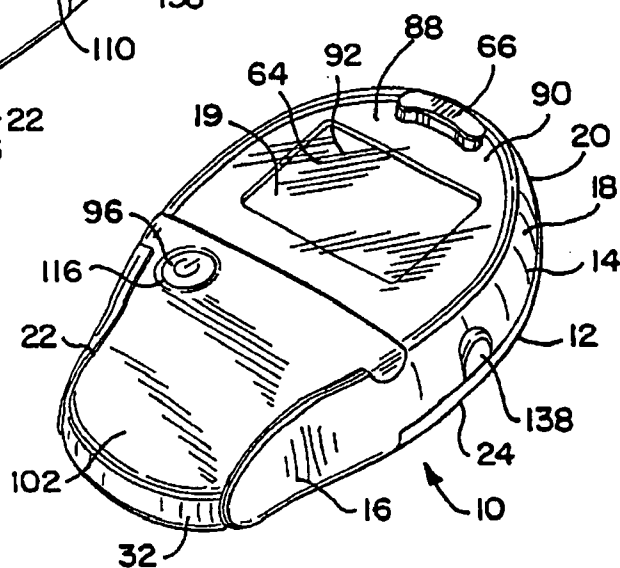
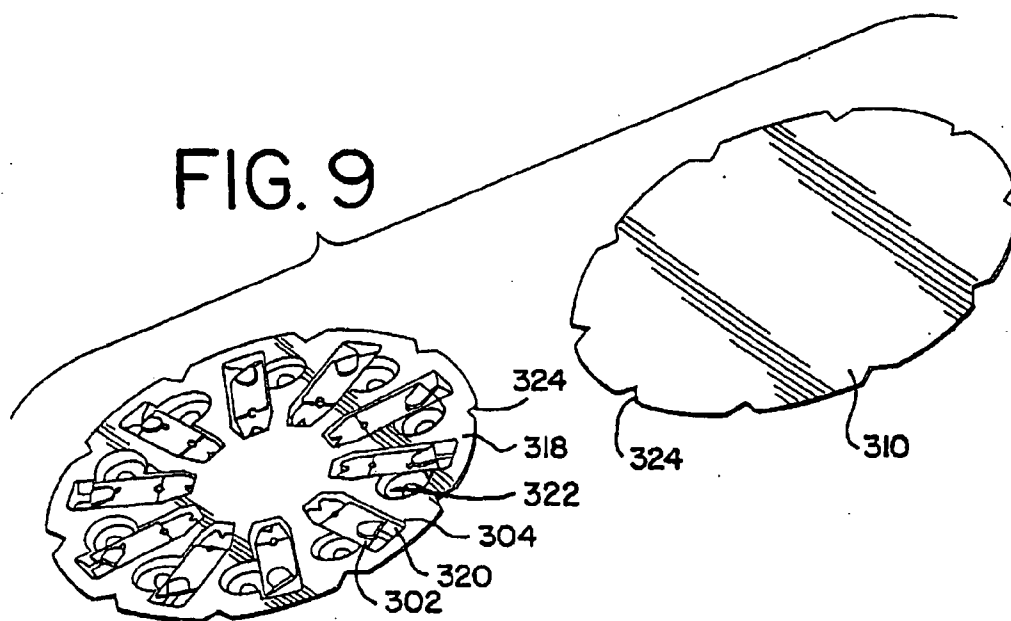
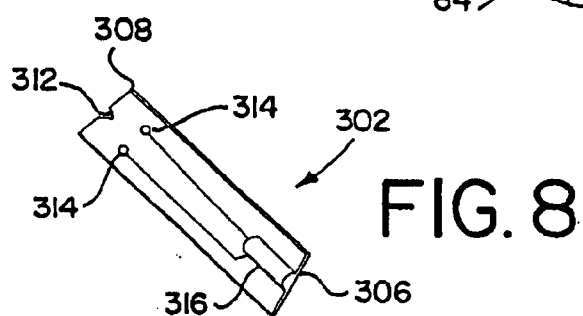
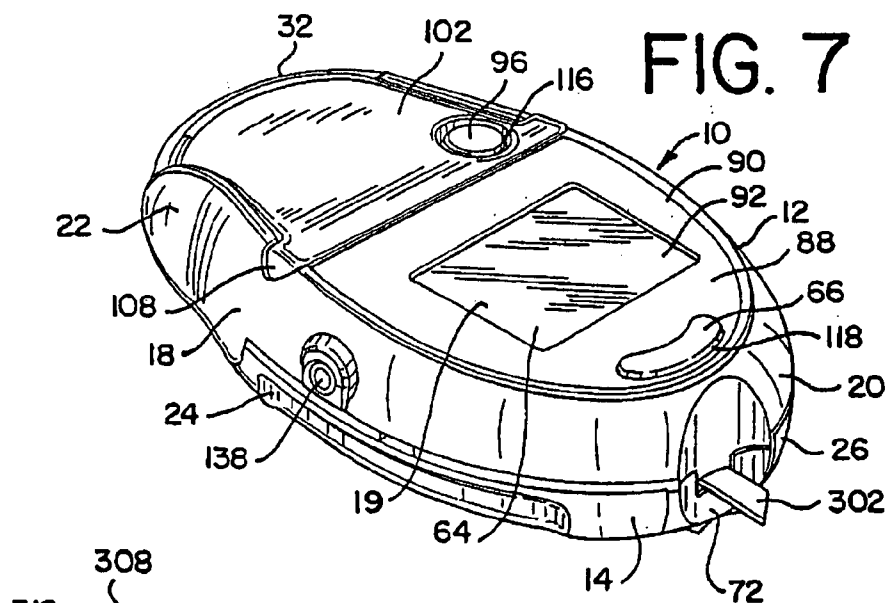
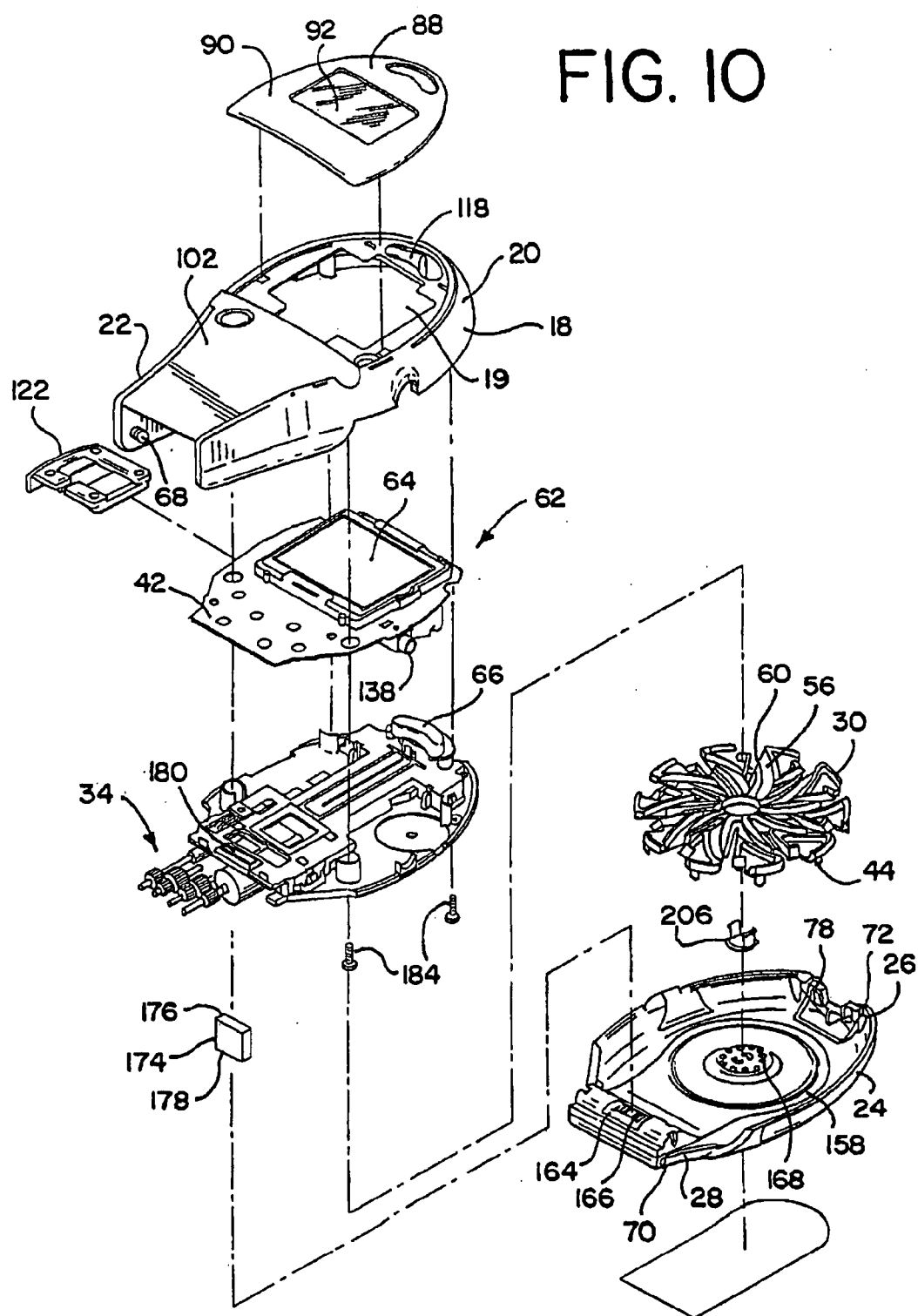


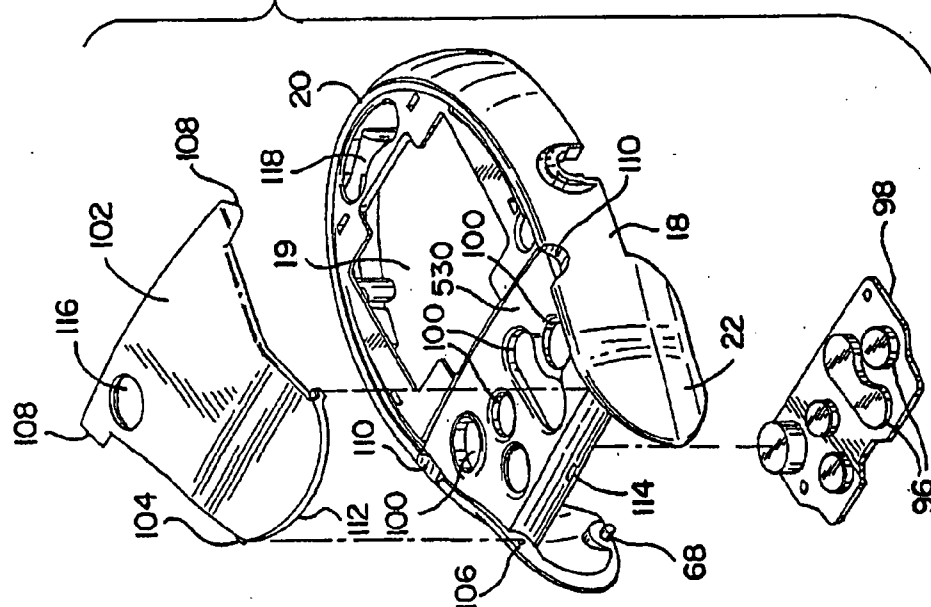
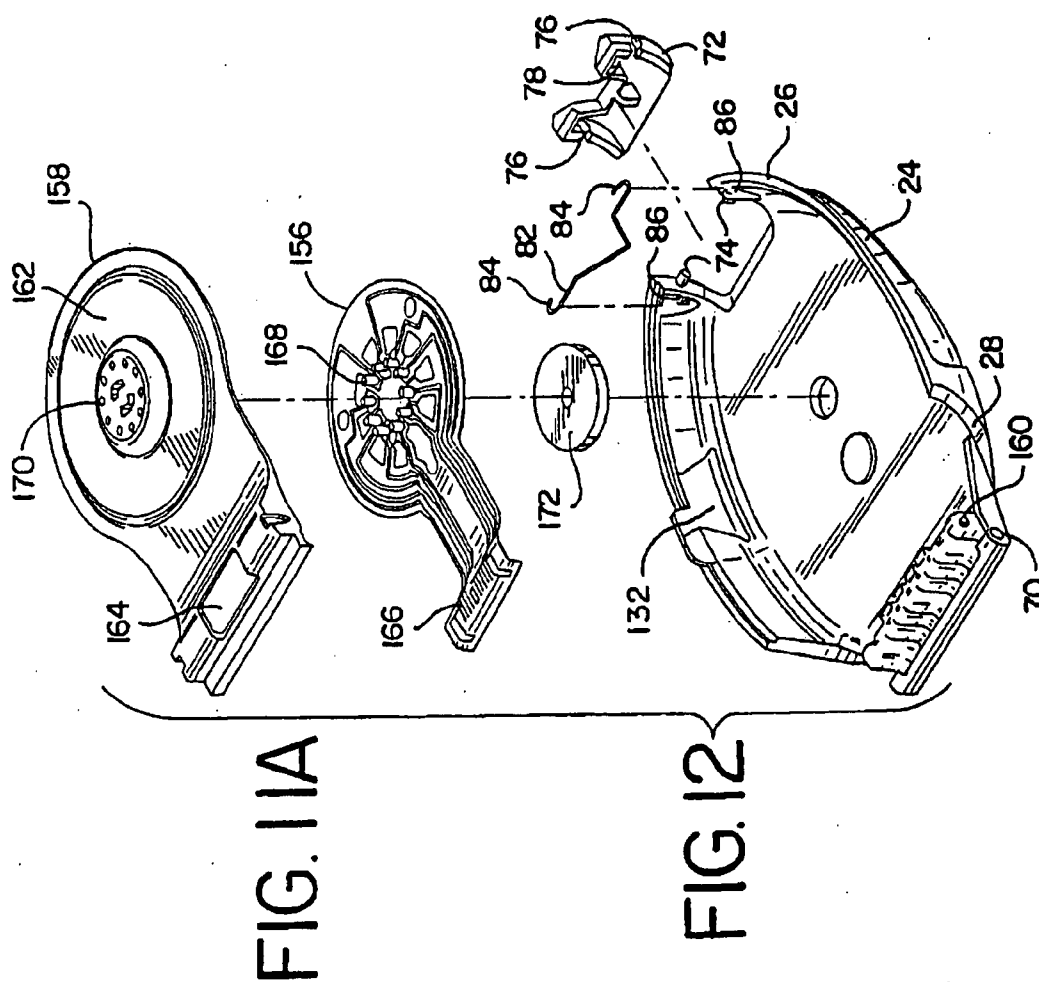
FIG. 5

FIG. 6









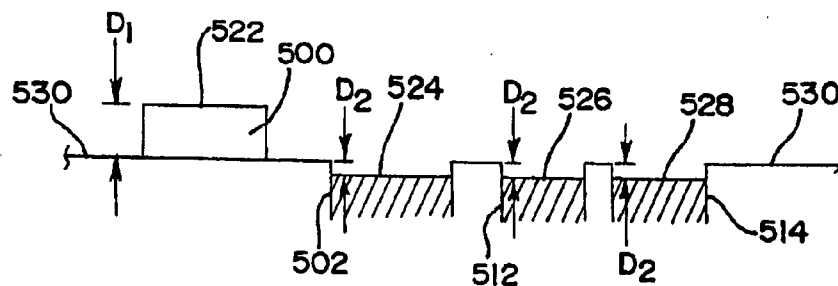
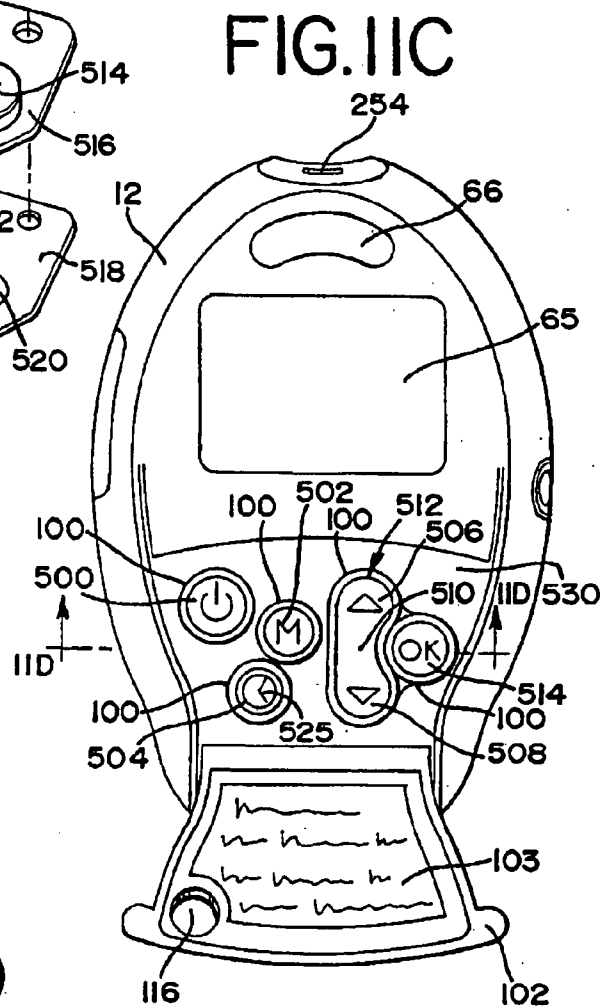
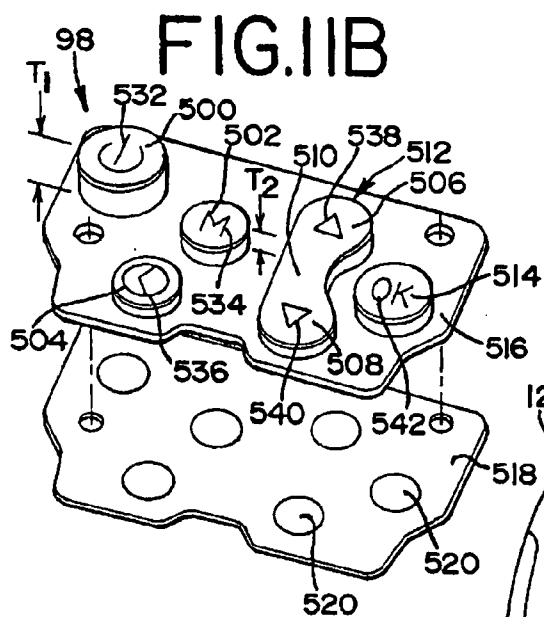


FIG. 13

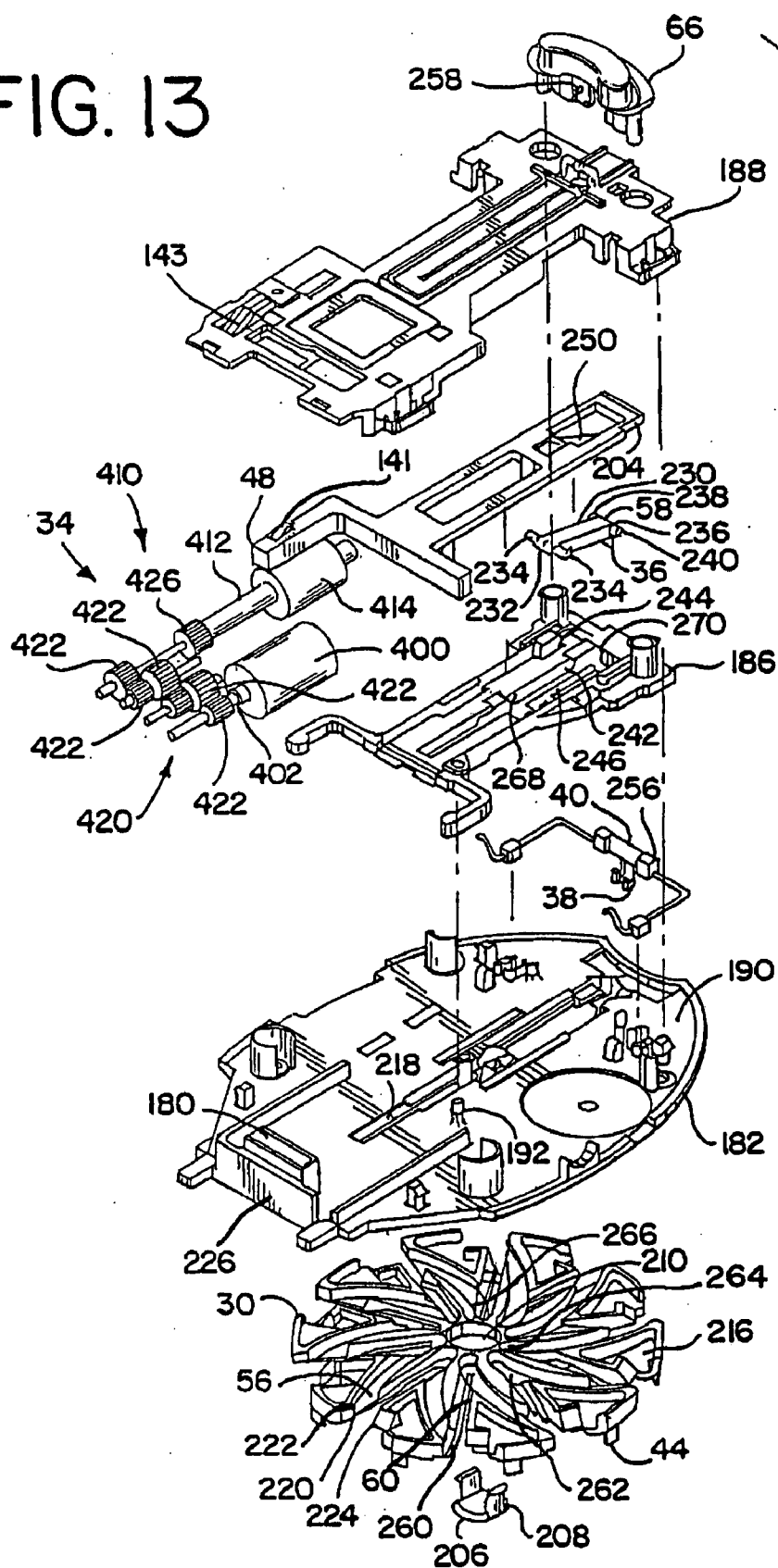


FIG. 14B

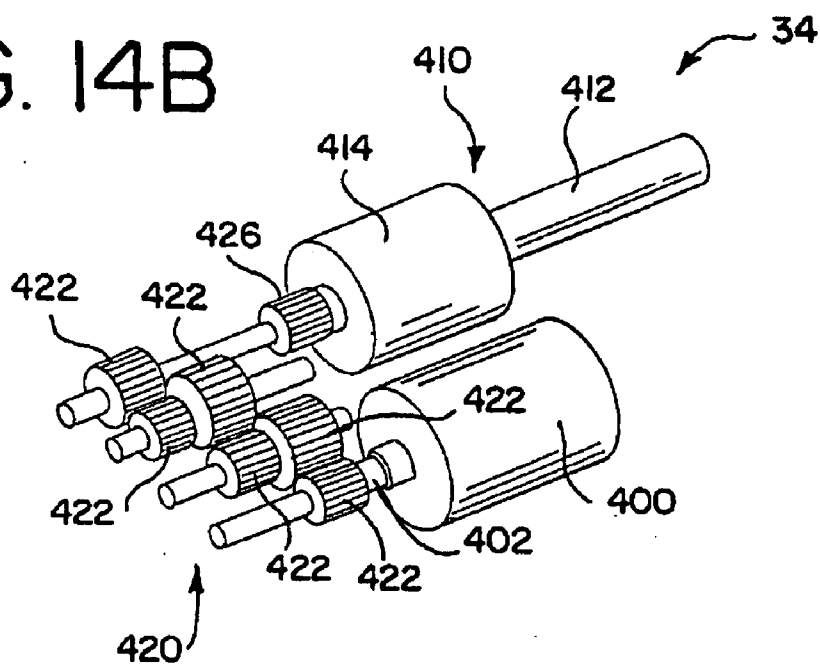


FIG. 14C

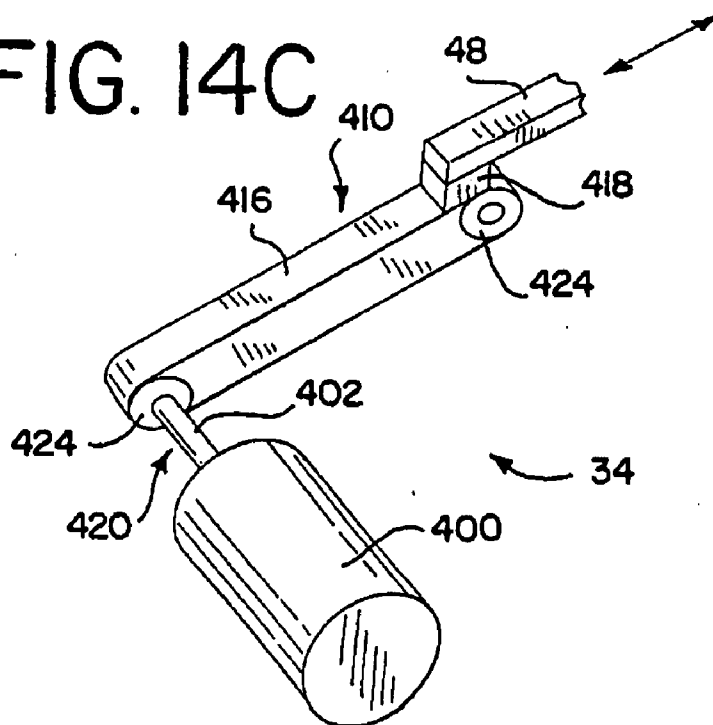


FIG. 17

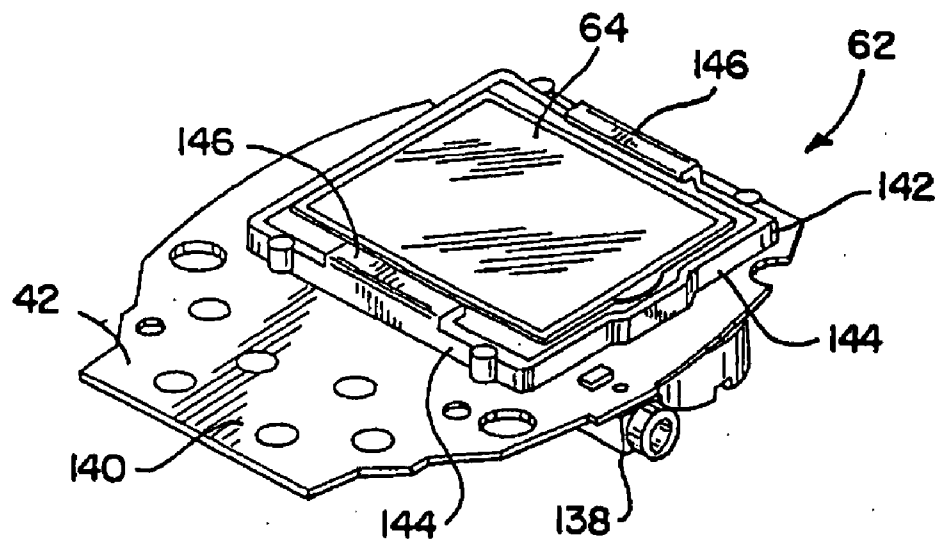
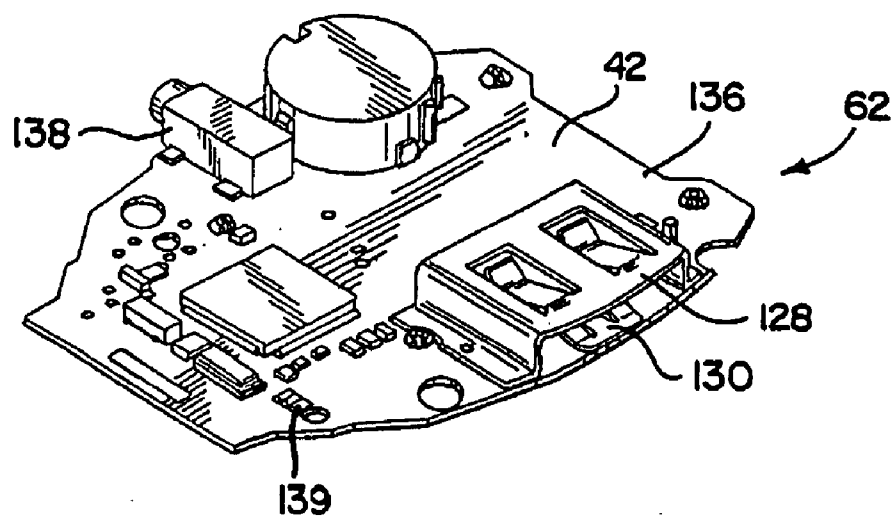


FIG. 18



BUTTON LAYOUT FOR A TESTING INSTRUMENT

[0001] This application is a continuation-in-part application of provisional application No. 60/311,759, entitled "Mechanical Mechanism For A Blood Glucose Sensor Dispensing Instrument," MSE#2642, filed on Aug. 13, 2001.

BACKGROUND OF THE INVENTION**[0002] 1. Field of the Invention**

[0003] The present invention generally relates to a fluid monitoring system, and, more particularly, to a new and improved button layout for a testing instrument for handling sensors that are used in analyzing blood glucose or other analytes contained therein.

[0004] 2. Description of the Prior Art

[0005] People suffering from various forms of diabetes routinely need to test their blood to determine the level of blood glucose. The results of such tests can be used to determine what, if any, insulin or other medication needs to be administered. In one type of blood glucose testing system, sensors are used to test a sample of blood.

[0006] Such a sensor may have a generally flat, rectangular shape with a front or testing end and a rear or contact end. The sensor contains biosensing or reagent material that will react with blood glucose. The testing end of the sensor is adapted to be placed into the fluid being tested, for example, blood that has accumulated on a person's finger after the finger has been pricked. The fluid is drawn into a capillary channel that extends in the sensor from the testing end to the reagent material by capillary action so that a sufficient amount of fluid to be tested is drawn into the sensor. The fluid then chemically reacts with the reagent material in the sensor with the result that an electrical signal indicative of the blood glucose level in the blood being tested is supplied to contact areas located near the rear or contact end of the sensor.

[0007] In order to couple the electrical signals produced at the sensor contacts to monitoring equipment, the sensors need to be inserted into sensor holders prior to the sensor end being placed into the fluid being tested. The holders have corresponding mating contact areas that become coupled to the contacts on the sensor when the sensor is inserted into the holder. Consequently, the holders act as an interface between the sensor and monitoring equipment that accumulates and/or analyzes the test results.

[0008] Prior to being used, the sensors need to be maintained at an appropriate humidity level so as to insure the integrity of the reagent materials in the sensor. Sensors can be packaged individually in tear-away packages so that they can be maintained at the proper humidity level. For instance, blister type packaging methods could be used. In this configuration, the packages can include desiccant material to maintain the proper humidity in the package. In order for a person to use an individual sensor for testing blood glucose, the package must be opened by tearing the seal. Alternatively, some packages require the user to exert force against one side of the package resulting in the sensor bursting or rupturing the foil on the other side. As can be appreciated, the opening of these packages can be difficult. Moreover, once the package is opened, the user needs to be sure that the sensor is not damaged or contaminated as it is being placed into the sensor holder and used to test the blood sample.

[0009] U.S. Pat. No. 5,630,986, issued on May 20, 1997, and entitled Dispensing Instrument For Fluid Monitoring Sensors (referred to hereinafter as "the '986 patent"), discloses a type of sensor pack with multiple sensors and a testing blood glucose and dispensing instrument for handling the sensors contained in such a sensor pack. In particular, the sensor dispensing instrument disclosed in the '986 patent is adapted to receive a sensor pack containing a plurality of blood glucose sensors. The sensor pack includes a circular base having a plurality of sensor retaining cavities, each of which hold an individual sensor. Each of the sensors has a generally flat, rectangular shape with a front testing end through which fluid is drawn so as to react with a reagent material in the sensor and an opposite rear, contact end.

[0010] The sensor instrument disclosed in the '986 patent includes an outer housing having an upper and a lower case that are pivotable with respect to each other so that the sensor pack can be positioned in the housing on an indexing disk disposed in the housing. With the sensor pack loaded in the housing, a slide latch on a slide actuator disposed on the upper case of the housing controls whether the movement of the slide actuator places the instrument in a display mode or in a testing mode. The instrument is placed into its display mode when the slide latch is moved laterally and the slide actuator is pushed away from its standby position. When in the display mode, a person using the instrument can view data displayed on a display unit in the upper case and/or input data into the instrument.

[0011] The instrument is in its testing mode when the slide latch is in its normal position and the slide actuator is pushed towards its testing position. As the slide actuator is moved towards its actuated position, the driver with the knife blade thereon moves toward the testing position of the feed mechanism and the disk drive arm travels in a straight, radially extending groove in the indexing disk such that the disk is not rotated as the feeding mechanism is moving towards its testing position. The knife blade is moved towards one of the sensor cavities in the sensor pack and pierces the foil covering the sensor cavity so as to engage the sensor disposed in the cavity. As the slide actuator and the driver are pushed toward the actuated position of the actuator, the knife blade ejects the sensor out from the sensor cavity and into a testing position near the testing end of the sensor housing.

[0012] Once the blood analyzing test is completed, the slide actuator is moved in the opposite direction towards its standby position so that the sensor can be removed from the dispensing instrument. The continued retraction of the driver causes the indexing disk drive arm to travel along a curvilinearly extending groove in the indexing disk, resulting in the rotation of the indexing disk. The rotation of the indexing disk results in the sensor pack being rotated so that the next sensor is positioned in alignment with the knife blade for the next blood glucose test that is to be performed.

[0013] Although the sensor instrument disclosed in the '986 patent overcomes many of the problems discussed above in connection with the use of individual sensors, the sensor instrument disclosed in the '986 uses only two buttons labeled "A" and "B" to control all the functions of the sensor instrument, such as: entering a set-up mode to adjust the time and date, to program numbers for reagent calibration, and to set-up audio volume; and entering a memory mode for viewing the most recent results. Since there are only two buttons, and

since they are labeled "A" and "B," there is no intuitive indication of what should happen once a button is pressed. Accordingly, it is desirable to have a sensor dispensing instrument utilizing an improved button layout that can be more easily learned and manipulated by users.

BRIEF SUMMARY OF THE INVENTION

[0014] Accordingly, an object of the present invention is to provide a new and improved sensor dispensing instrument for handling the sensors contained in a sensor pack of multiple sensors, each of the sensors disposed in a sensor cavity on said sensor pack and enclosed by a protective covering. The sensor dispensing instrument is further adapted to perform a test using one of said plurality of sensors. The sensor dispensing instrument includes a display for showing items. The sensor dispensing instrument also includes a power button for turning the sensor dispensing instrument on and off, a scroll button for scrolling through items shown on the display, and a select button for selecting an item.

[0015] In accordance with another aspect of the present invention, the present invention is embodied in a glucose meter adapted to perform a test using a sensor. The glucose meter comprises a display for showing items. The glucose meter also comprises a power button for turning the glucose meter on and off, a scroll button for scroll through the items, and a select button for selecting an item.

[0016] In accordance with another aspect of the present invention, the present invention is embodied in a method of operating a testing instrument adapted to perform a test using at least one sensor, said testing instrument comprising an outer housing having a sensor slot through which one of said sensors is disposed to conduct the test, and said testing instrument further comprising a display disposed on the outer housing for showing items, a power button, a scroll button, and a select button. The method comprises pressing the power button to activate the display and turn the testing instrument on, pressing the scroll button to scroll through the items, and pressing the select button to select an item.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

[0017] The present invention, together with the above and other objects and advantages, can best be understood from the following detailed description of the embodiment of the invention illustrated in the drawing, wherein:

[0018] FIG. 1 is a top perspective view of a blood glucose sensor dispensing instrument embodying the present invention;

[0019] FIG. 2 is a bottom perspective view of the blood glucose sensor dispensing instrument of FIG. 1;

[0020] FIG. 3 is a perspective view of the blood glucose sensor dispensing instrument of FIG. 1 in the opened position showing the insertion of a sensor pack;

[0021] FIG. 4 is a perspective view of the blood glucose sensor dispensing instrument of FIG. 1 in the opened position showing a sensor pack loaded onto the indexing disk;

[0022] FIG. 5 is a top perspective view of the blood glucose sensor dispensing instrument of FIG. 1 shown with the button door in the open position;

[0023] FIG. 6 is a top perspective view of the blood glucose sensor dispensing instrument of FIG. 1 with the button door in the closed position;

[0024] FIG. 7 is a top perspective view of the blood glucose sensor dispensing instrument of FIG. 1 with the disk drive pusher in the testing position with a sensor projecting from the sensor opening;

[0025] FIG. 8 is a top perspective view of a sensor for use with blood glucose sensor dispensing instrument of FIG. 1;

[0026] FIG. 9 is an exploded perspective view of a sensor pack for use with blood glucose sensor dispensing instrument of FIG. 1 showing the protective foil separated from the base portion of the sensor pack;

[0027] FIG. 10 is an exploded perspective view of the component sub-assemblies of blood glucose sensor dispensing instrument of FIG. 1;

[0028] FIG. 11A is an exploded perspective view of the component parts of the upper case sub-assembly of the blood glucose sensor dispensing instrument of FIG. 1;

[0029] FIG. 11B is an exploded perspective view of the component parts of the buttons of the blood glucose sensor dispensing instrument of FIG. 1;

[0030] FIG. 11C is a top view of the blood glucose sensor dispensing instrument of FIG. 1 shown with the button door in the open position;

[0031] FIG. 11D is a partial cross-sectional view of the blood glucose sensor dispensing instrument of FIG. 11C taken along line 11D;

[0032] FIG. 12 is an exploded perspective view of the component parts of the lower case sub-assembly of the blood glucose sensor dispensing instrument of FIG. 1;

[0033] FIG. 13 is an exploded top perspective view of the component parts of the disk drive mechanism and indexing disk sub-assembly of the blood glucose sensor dispensing instrument of FIG. 1;

[0034] FIG. 14A is an exploded bottom perspective view of the component parts of the disk drive mechanism and indexing disk sub-assembly of the blood glucose sensor dispensing instrument of FIG. 1;

[0035] FIG. 14B is a perspective view of the component parts of the disk drive mechanism of the blood glucose sensor dispensing instrument of FIG. 1, according to one embodiment;

[0036] FIG. 14C is a perspective view of the component parts of the disk drive mechanism of the blood glucose sensor dispensing instrument of FIG. 1, according to one embodiment;

[0037] FIG. 15 is an exploded perspective view of the component parts of the battery tray sub-assembly of the blood glucose sensor dispensing instrument of FIG. 1;

[0038] FIG. 16 is an exploded perspective view of the component parts of the electronics assembly of the blood glucose sensor dispensing instrument of FIG. 1;

[0039] FIG. 17 is a top perspective view of the electronics sub-assembly of the blood glucose sensor dispensing instrument of FIG. 1; and

[0040] FIG. 18 is a bottom perspective view of the electronics sub-assembly of the blood glucose sensor dispensing instrument of FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

[0041] Referring now more specifically to the drawings, therein is disclosed a blood glucose sensor dispensing instrument generally designated by the reference numeral 10 and embodying the present invention. The sensor dispensing instrument 10 includes an outer housing 12 having an upper case 18 and a lower case 24, the lower case 24 pivoting on the upper case 18. The upper case 18 is pivotable with respect to the lower case 24 in a clamshell fashion so that a sensor pack 300 (see FIGS. 3 and 4) can be positioned on an indexing disk 30 within the housing 12. With the sensor pack 300 so loaded in the housing 12, a button 32 can be pressed to cause a disk drive mechanism, generally designated by the numeral 34 (see FIG. 10), to load a sensor 302 into a testing position on the front end 14 of the housing 12 (see FIG. 3). The sensor dispensing instrument also includes a motor 400, a linear drive system 410, and a power transfer system 420, which cause the disk drive mechanism 34 to load a sensor 302 into a testing position on the front end 14 of the housing once the button 32 is pressed, as described below.

[0042] It should be noted that the sensor dispensing instrument 10 of the present invention incorporates components that are similar in design and/or function as those described in U.S. Pat. No. 5,630,986, issued May 20, 1997, and entitled Dispensing Instrument For Fluid Monitoring Sensors. The contents of these patents are hereby incorporated by reference to avoid the unnecessary duplication of the description of these similar components.

[0043] The sensor pack 300 utilized by the sensor dispensing instrument 10 is of the type described in U.S. Pat. No. 5,575,403, issued Nov. 19, 1996, and entitled Dispensing Instrument For Fluid Monitoring Sensors, the contents of which are hereby incorporated by reference. In general, and as shown in FIGS. 8 and 9, the sensor pack 300 is adapted to house ten sensors 302, with one of the ten sensors 302 in each of ten separate sensor cavities 304. Each of the sensors 302 has a generally flat, rectangular shape extending from a front or testing end 306 to a back end 308. The front end 306 is angled so that it will puncture an unsevered portion of the protective foil 310 overlying the sensor cavity 304 as the sensor 302 is being forced out of the sensor cavity 304 by a knife blade 36 (to be described below). The front end 306 is also adapted to be placed into blood that is being analyzed. The back end 308 of the sensor 302 includes a small notch 312 that is engaged by the knife blade 36 as the knife blade 36 ejects the sensor 302 from the sensor cavity 304. Contacts 314 near the back end 308 of the sensor 302 are adapted to mate with metal contacts 38 on a sensor actuator 40 (to be described below) when the sensor 302 is in the testing position illustrated in FIG. 7. As a result, the sensor 302 is coupled to the electronic circuitry on the circuit board assembly 42 so that information generated in the sensor 302 during testing can be stored, analyzed and/or displayed.

[0044] As best seen in FIG. 8, each sensor 302 is provided with a capillary channel 316 that extends from the front or testing end 306 of the sensor 302 to biosensing or reagent material disposed in the sensor 302. When the testing end 306 of the sensor 302 is placed into fluid (for example, blood that

is accumulated on a person's finger after the finger has been pricked), a portion of the fluid is drawn into the capillary channel 316 by capillary action. The fluid then chemically reacts with the reagent material in the sensor 302 so that an electrical signal indicative of the blood glucose level in the blood being tested is supplied to the contacts 314, and subsequently transmitted through the sensor actuator 40 to the circuit board assembly 42.

[0045] As best seen in FIG. 9, the sensor pack 300 comprises a circularly shaped base portion 318 covered by a sheet of protective foil 310. The sensor cavities 304 are formed as depressions in the base portion 318, with each of the sensor cavities 304 adapted to house an individual sensor 302. Each of the sensor cavities 304 has an inclined or sloped support wall 320 to guide the sensor 302 as the sensor 302 is ejected through the foil 310 and out of the sensor cavity 304.

[0046] Each of the sensor cavities 304 is in fluid communication with a desiccant cavity 322 formed by a small depression in the base portion 318. Desiccant material is disposed in each of the desiccant cavities 322 in order to insure that the sensor cavities 304 are maintained at an appropriate humidity level to preserve the reagent material in the sensor 302.

[0047] Notches 324 are formed along the outer peripheral edge of the base portion 318. The notches 324 are configured to engage pins 44 on the indexing disk 30 so that the sensor cavities 304 are in proper alignment with the indexing disk 30 when the sensor pack 300 is loaded into the sensor dispensing instrument 10. As will be explained in greater detail below, the sensor cavities 304 must be aligned with the knife slots 46 in the indexing disk 30 to permit the knife blade 36 to engage, eject and push one of the sensors 302 into a testing position on the front end 14 of the housing 12.

[0048] The sensor pack 300 further comprises a conductive label 326 on the central portion of the base portion 318. As will be explained below, the conductive label 326 provides calibration and production information about the sensor pack 300 that can be sensed by calibration circuitry in the sensor dispensing instrument 10.

[0049] To operate the sensor dispensing instrument 10, the button 32 is pressed causing an electrical connection (not shown) between the button 32 and a motor 400 (FIG. 14B) to be made, and therefore causing the motor 400 to be activated. Upon activation, the motor 400 moves a linear drive system 410 (FIG. 14B) which causes the disk drive mechanism 34 to rotate the sensor pack 300 and place the next sensor 302 in a standby position prior to being loaded into a testing position. The pressing of the button 32 also causes the sensor dispensing instrument 10 to turn ON (i.e., the electronic circuitry on the circuit board assembly 42 is activated).

[0050] As will be described in greater detail below, the disk drive mechanism 34 includes a disk drive pusher 48 on which an indexing disk drive arm 50 is mounted (see FIG. 14A). The indexing disk drive arm 50 comprises a cam button 52 disposed at the end of a plate spring 54. The cam button 52 is configured to travel in one of a plurality of curvilinearly extending grooves 56 on the upper surface of the indexing disk 30. As the button 32 is pressed, the motor 400 is activated, causing the linear drive system 410 to move the disk drive pusher 48 laterally towards the rear end 22 of the upper case 18. This causes the cam button 52 on the indexing disk

drive arm 50 to travel along one of the curvilinearly extending grooves 56 so as to rotate the indexing disk 30. The rotation of the indexing disk 30 causes the sensor pack 300 to be rotated so that the next one of the sensor cavities 304 is placed in a standby position.

[0051] The linear drive system 410 then moves the disk drive pusher 48 laterally towards the front end 20 of the upper case 18 and causes the disk drive mechanism 34 to remove a sensor 302 from the sensor pack 300 and place the sensor 302 into a testing position on the front end 14 of the housing 12.

[0052] As will be described in greater detail below, the disk drive mechanism 34 includes a knife blade assembly 58 that is pivotally mounted to the disk drive pusher 48 (see FIGS. 13 and 14A). After the disk drive pusher 48 is moved laterally towards the rear end 22 of the upper case 18, the disk drive pusher 48 is then pushed laterally towards the testing or front end 20 of the upper case 18. This causes the knife blade assembly 58 to pivot downwardly so that a knife blade 36 on the end of the knife blade assembly 58 pierces a portion of the protective foil 310 covering one of the sensor cavities 304 and engages the sensor 302 in the sensor cavity 304. As the disk drive pusher 48 continues to move towards the front end 20 of the upper case 18, the knife blade assembly 58 forces the sensor 302 out of the sensor cavity 304 and into a testing position at the front end 14 of the housing 12.

[0053] While the disk drive pusher 48 is being moved from the extended position to the testing position, the cam button 52 on the indexing disk drive arm 50 travels along one of the radially extending grooves 60 to prevent the indexing disk 30 from rotating. Similarly, while the disk drive pusher 48 is being moved from the standby position to the extended position, the knife blade assembly 58 is in a retracted position so as to not interfere with the rotation of the indexing disk 30.

[0054] After the sensor 302 has been completely ejected from the sensor cavity 304 and pushed into a testing position projecting out from the front end 14 of the housing 12, the disk drive pusher 48 engages and forces a sensor actuator 40 against the sensor 302 to thereby maintain the sensor 302 in the testing position. The sensor actuator 40 engages the sensor 302 when the button 32 is pressed. The sensor actuator 40 couples the sensor 302 to an electronics assembly 62 disposed in the upper case 18. The electronics assembly 62 includes a microprocessor or the like for processing and/or storing data generated during the blood glucose test procedure, and displaying the data on a liquid crystal display 64 in the sensor dispensing instrument 10.

[0055] Once the blood analyzing test is completed, a button release 66 on the upper case 18 is depressed so as to disengage the sensor actuator 40 and release the sensor 302. Depressing the button release 66 causes the disk drive pusher 48 and the button 32 to move from the testing position back to the standby position. At this point, the user can turn the sensor dispensing instrument 10 OFF by depressing the button 96 on the upper case 18, or by allowing the sensor dispensing instrument 10 automatically turn OFF pursuant a timer on the electronics assembly 62.

[0056] As seen in FIGS. 1-7 and 10-12, the upper case 18 and the lower case 24 of the sensor dispensing housing 12 are complementary, generally oval shaped hollow containers that are adapted to be pivoted with respect to each other about pivot pins 68 extending outwardly in the rear end 22 of the

upper case 18 into pivot holes 70 in a rear section 28 of the lower case 24. The upper case 18 and the lower case 24 are maintained in their closed configuration by a latch 72 that is pivotally mounted in a front section 26 of the lower case 24 by pins 74 that extend inwardly into pivot holes 76 in the latch 72 (see FIG. 12). The latch 72 has recesses 78 that are configured to mate with hooks 80 on the upper case 18 to secure the upper case 18 and the lower case 24 in their closed configuration. The latch 72 is biased in a vertical or closed position by a latch spring 82. The ends 84 of the latch spring 82 are secured in slots 86 on the inside of the lower case 24. When the latch 72 is pivoted against the biasing force of the latch spring 82, the hooks 80 on the upper case 18 disengage from the recesses 78 to permit the upper case 18 and the lower case 24 to open.

[0057] As seen in FIGS. 1, 5-7 and 10-11A, the upper case 18 includes a rectangular opening 19 through which a liquid crystal display 64 is visible below. The liquid crystal display 64 is visible through a display lens 88 that is affixed to upper surface of the upper case 18. In the preferred embodiment shown, the display lens 88 has an opaque portion 90 and a transparent portion 92, the transparent portion 92 being coincident with the display area of liquid crystal display 64. The liquid crystal display 64 is a component of the electronics assembly 62, and is coupled to the circuit board assembly 42 via elastomeric connectors 94 (see FIG. 16). The liquid crystal display 64 displays information from the testing procedure and/or in response to signals input by the buttons 96 on the upper case 18. For example, the buttons 96 can be depressed to recall and view the results of prior testing procedures on the liquid crystal display 64. While a liquid crystal display 64 is described above, any type of display 65 which can display information or items can be used, such as, but not limited to, a cathode ray tube, a plasma screen, and a series of light-emitting diodes. The display 65 may display items such as, but not limited to, letters, numbers, symbols, graphical representations, and the like.

[0058] As best seen in FIG. 11A, the buttons 96 are part of a button set 98 that is attached to the upper case 18 from below so that the individual buttons 96 project upwardly through button openings 100 in the upper case 18. When pressed, the buttons 96 are electrically connected to the circuit board assembly 42. In one embodiment, the sensor dispensing instrument 10, and more specifically, the button set 98, includes a power button 500, a memory button 502, a set-up button 504, a scroll button 512, and a select button 514, as illustrated in FIGS. 11A, 11B, 11C, and 11D. The buttons 500, 502, 504, 512, and 514 are all mounted through openings 100 in the outer housing 12, and more specifically, the upper case 18, as illustrated in FIGS. 11A and 11C. The buttons 500, 502, 504, 512, and 514 each have a respective contact surface 522, 524, 525, 526, and 528. In order to engage one of the buttons 500, 502, 504, 512, and 514, a user must press down upon the respective contact surface 522, 524, 525, 526, and 528, thus causing a respective buttons 500, 502, 504, 512, and 514 to become depressed. The outer housing 12 forms a top surface 530 which defines the openings 100, as illustrated in FIGS. 11A, 11C, and 11D.

[0059] The power button 500 turns the sensor dispensing instrument 10 on and off when engaged. In particular, the power button 500 powers on and off the electronic circuitry on the circuit board assembly 42. The power button 500 is located in the upper left corner of the button set 98, when viewed from the top of the sensor dispensing instrument 10,

as illustrated in FIG. 11C. The power button 500 comprises a power symbol 532 imprinted on the contact surface 522 of the power button 500, as illustrated in FIG. 11B. Preferably, the color of the power symbol 532 contrasts with the color of the power button 500. Preferably, the power symbol 532 comprises a semi-circle and a line, as illustrated in FIGS. 11B and 11C or a complete circle with a vertical line contained therein (not shown).

[0060] The memory button 502 causes the sensor dispensing instrument 10 to enter a memory mode when engaged. The memory mode allows the most recent test results to be immediately viewed on the display 65 by the user. By engaging the scroll button 512 when in the memory mode, the user can then scroll up or down through the test results stored in memory to view a particular test result. The memory button 502 is located between the power button 500 and the scroll button 512. The memory button 502 comprises a memory symbol 534 imprinted on the contact surface 524 of the memory button 502, as illustrated in FIG. 11B. Preferably, the color of the memory symbol 534 contrasts with the color of the memory button 502. Preferably, the memory symbol 534 comprises the letter “M,” as illustrated in FIGS. 11B and 11C.

[0061] The set-up button 504 causes the sensor dispensing instrument 10 to enter a set-up mode when engaged. The set-up mode allows the user to adjust the time and date, to program numbers for calibration, to adjust the audio volume, and to perform other such tasks which would be required to set-up the sensor dispensing instrument 10. By engaging the scroll button 512 when in the set-up mode, the user can then scroll up or down through the items shown within the set-up mode. The set-up button 504 is adjacent the memory button 502. Preferably, the set-up button is located below and between the memory button 502 and the power button 500, as illustrated in FIG. 11C. The set-up button 504 comprises a set-up symbol 536 imprinted on the contact surface 525 of the set-up button 504, as illustrated in FIG. 11B. Preferably, the color of the set-up symbol 536 contrasts with the color of the set-up button 504. Preferably, the set-up symbol 534 comprises an illustration of a clock, as illustrated in FIGS. 11B and 11C.

[0062] When engaged, the scroll button 512 allows the user to scroll through items displayed upon the display 65 or stored in memory within the sensor dispensing instrument 10. The scroll button 512 allows a user to bi-directionally scroll through a list of items or a series of test results stored in the memory. For example, if the desired option or test result is missed, the user may scroll back until the missed item or test result is found rather than viewing a complete cycle of the list of items or test results. In order to accomplish the bi-directional scrolling, the scroll button 512 includes a scroll up button 506 and a scroll down button 508. The scroll up button 506 allows the user to scroll through the list of items or series of test results in a first direction. The scroll down button 508 allows the user to scroll through the list of items or series of test results in a second direction opposed to the first direction. By using the scroll up button 506 in conjunction with the scroll down button 508, a user can quickly scroll through a list of items or series of test results. Preferably, the scroll up button 506 is connected to the scroll down button 508 through a rocker 510 in order to simplify the appearance of the scroll button 512, as illustrated in FIGS. 11B and 11C. The scroll button 512 adds the ability for a user to bi-directionally scroll through any of the functions programmed within the sensor

dispensing instrument 10, such as, setting the time, setting the date, programming numbers for calibration, reviewing memory results, and editing memory results. The scroll button 512 comprises a scroll up symbol 538 and a scroll down symbol 540 imprinted on the contact surface 526 of the scroll button 512, as illustrated in FIG. 11B. Preferably, the color of the scroll up symbol 538 and the scroll down symbol 540 contrasts with the color of the scroll button 512. Preferably, the scroll up symbol 538 comprises an arrow pointing up and the scroll down symbol 540 comprises an arrow pointing down, as illustrated in FIGS. 11B and 11C.

[0063] The select button 514 allows a user to select an item displayed upon the display 65 when engaged. The select button 514 may be used to accept a setting, such as the time or date, and then revert back up to a previous user interface level. The select button 514 is adjacent the scroll button 512, as illustrated in FIG. 11C. The select button 514 comprises a select symbol 542 imprinted on the contact surface 528 of the select button 514, as illustrated in FIG. 11B. Preferably, the color of the select symbol 542 contrasts with the color of the select button 514. Preferably, the select symbol 542 comprises the letters “OK,” as illustrated in FIGS. 11B and 11C.

[0064] The sensor dispensing instrument 10 comprises a button door 102 pivotally connected to the outer housing 12, as illustrated in FIGS. 5 and 11C. The button door 102 is movable between a closed position, as illustrated in FIG. 6, and an open position, as illustrated in FIG. 5. In one embodiment, the button door 102 covers all the buttons 500, 502, 504, 512, and 514 when in the closed position. In another embodiment, the button door 102 covers buttons 502, 504, 512, and 514, but not the power button 500, when in the closed position, as illustrated in FIG. 6. In this embodiment, the button door 102 forms an opening 116, and the power button 500 extends into the opening 116 when the button door 102 is in the closed position. The button door 102 allows access to all the buttons 500, 502, 504, 512, and 514 when in the open position.

[0065] In one embodiment, the power button 500 is taller than the other buttons 502, 504, 512, and 514. Preferably, the power button 500 is tall enough so that the power button 500 can extend at least partially through the opening 116 in the button door 102, thus allowing the user to turn on the sensor dispensing instrument, perform a test, and then turn off the sensor dispensing instrument without opening the button door 102. In one embodiment, the power button 500 is the only button to extend at least partially through the button door 102 when the button door 102 is in the closed position.

[0066] In one embodiment, the distance D1 from the top surface 530 to the contact surface 522 of the power button 500 is greater than the distance D2 from the top surface 530 to the contact surface 526 of the scroll button 512, or to the contact surface 528 of the select button 514. In one embodiment, the distance D1 from the top surface 530 to the contact surface 522 of the power button 500 is greater than the distance D2 from the top surface 530 to the contact surface 524 of the memory button 502, or to the contact surface 525 of the set-up button 504. In one embodiment, the contact surfaces 524, 525, 526, and 528 of the buttons 502, 504, 512, and 514 are flush with or recessed below the top surface 530, as illustrated in FIG. 11D.

[0067] Preferably, the power button 500, the scroll button 512, and the select button 514 comprise a first color and the

memory button **502** and the set-up button **504** comprise a second color. More preferably, the top surface **530** comprises a third color, wherein the third color contrasts with the first color and the second color. Preferably, the level of contrast between the first color and the third color is greater than the level of contrast between the second color and the third color.

[0068] In one embodiment, the buttons **500**, **502**, **504**, **512**, and **514** are all manufactured as a single, unitary, flexible membrane **516** as illustrated in FIG. **11b**. Flexible membrane **516** can comprise any type of flexible material such as, but not limited to, silicone, rubber, latex, plastic or any other type of flexible material that may be used. The flexible membrane **516** is then fitted atop a contact member **518**. Contact member **518** includes a series of contacts **520** which are positioned underneath the buttons **500**, **502**, **504**, **512**, and **514** which are formed on the flexible membrane in **516**. By exerting a pressure upon one of the contacts **520**, an electrical connection can be made. So, for example, by locating the buttons **500**, **502**, **504**, **512**, and **514** over the contacts **520** of the contact member **518**, a button **500**, **502**, **504**, **512**, and **514** can be engaged by applying pressure on the contact surface **522**, **524**, **525**, **526**, **528** of the button **500**, **502**, **504**, **512**, and **514**, thus causing the button **500**, **502**, **504**, **512**, and **514** to move downwards and exert pressure on the contact **520**. Once pressure is exerted on the contact **520**, the contact **520** causes an electrical connection to be made and the button **500**, **502**, **504**, **512**, and **514** to be engaged. While the above-described buttons **500**, **502**, **504**, **512**, and **514** use a flexible membrane **516** and a contact member **518**, the button **500**, **502**, **504**, **512**, and **514** can be manufactured in any one of a number of ways.

[0069] In one embodiment, a label **103** is placed onto or connected with the button door **102**. The label **103** describes the function of each of the buttons **500**, **502**, **504**, **512**, and **514** and contains information explaining each button's **500**, **502**, **504**, **512**, and **514** functions in the user's language. Preferably, the label **103** would be selected and applied by the user from a sheet (not shown) containing multiple labels **103**, each printed in a single language.

[0070] While the above-described buttons **500**, **502**, **504**, **512**, and **514** are arranged in a certain fashion, the buttons may be arranged in any fashion. Additionally, while the above-described invention pertains to a sensor dispensing instrument **10** that dispenses multiple sensors **302**, the invention could also be applied to a testing instrument that does not dispense sensor **302**, but rather is designed to only receive sensors **302**.

[0071] As best seen in FIGS. **1**, **5** and **11A**, a button door **102** is pivotally connected to the upper case **18** by a pair of pins **104** projecting outwardly from either side of the button door **102** that engage holes **106** on the side walls of the upper case **18**. The button door **102** also comprises a pair of ears **108** that fit into recesses **110** in the side walls of the upper case **18** when the button door **102** is closed. The ears **108** extend slightly beyond the side walls of the upper case **18** so that they can be grasped by the user to open the button door **102**. A pivot edge **112** of the button door **102** engages a tab **114** on the upper surface of the upper case **18**. The tab **114** rubs against the pivot edge **112** in such a manner so as to bias the button door **102** in either a closed or fully open position. In the preferred embodiment shown, the button door **102** has an opening **116** that permits one of the buttons **96** (e.g., the power button **500**) to be accessed when the button door **102** is

closed (see FIG. **1**). This permits dedicated, but seldom or lesser used buttons **96** to be concealed underneath the button door **102**, thereby simplifying the learning curve and daily operation of the sensor dispensing instrument **10** for the user.

[0072] The upper case **18** also contains an opening **118** for the button release **66**, which projects upwardly through the upper case **18**. As will be described in more detail below, the button release **66** is depressed to disengage the sensor actuator **40** and release a sensor **302** from the testing position.

[0073] The upper case **18** also contains an opening **120** for a battery tray assembly **122**. The battery tray assembly **122** includes a battery tray **124** in which a battery **126** is disposed. The battery tray assembly **122** is inserted into the opening **120** in the side of the upper case **18**. When so inserted, the battery **126** engages battery contacts **128** and **130** on the circuit board assembly **42** so as to provide power for the electronics within the instrument **10**, including the circuitry on the circuit board assembly **42** and the liquid crystal display **64**, and the power for the motor **400**. A tab **132** on the lower case **24** is configured to engage a slot **134** in the battery tray assembly **122** so as to prevent the battery tray assembly **122** from being removed from the sensor dispensing instrument **10** when the upper case **18** and the lower case **24** are in the closed configuration.

[0074] An electronics assembly **62** is affixed to the upper inside surface of the upper case **18**. As best seen in FIGS. **16-18**, the electronics assembly **62** comprises a circuit board assembly **42** on which various electronics and electrical components are attached. A positive battery contact **128** and a negative battery contact **130** are disposed on the bottom surface **136** (which is the upwardly facing surface as viewed in FIGS. **16** and **18**) of the circuit board assembly **42**. The battery contacts **128** and **130** are configured to electrically connect with the battery **126** when the battery tray assembly **122** is inserted into the side of the upper case **18**. The bottom surface **136** of the circuit board assembly **42** also includes a communication interface **138**. The communication interface **138** permits the transfer of testing or calibration information between the sensor dispensing instrument **10** and another device, such as a personal computer, through standard cable connectors (not shown). In the preferred embodiment shown, the communication interface **138** is a standard serial connector. However, the communication interface **138** could alternatively be an infra-red emitter/detector port, a telephone jack, or radio frequency transmitter/receiver port. Other electronics and electrical devices, such as memory chips for storing glucose test results or ROM chips for carrying out programs, are likewise included on the bottom surface **136** and the upper surface **140** of the circuit board assembly **42**.

[0075] A liquid crystal display **64** is affixed to the upper surface **140** (upwardly facing surface in FIG. **17**) of the circuit board assembly **42**. The liquid crystal display **64** is held by a snap-in display frame **142**. The snap-in display frame **142** includes side walls **144** that surround and position the liquid crystal display **64**. An overhang **146** on two of the side walls **144** holds the liquid crystal display **64** in the snap-in display frame **142**. The snap-in display frame **142** includes a plurality of snap fasteners **148** that are configured to engage mating holes **150** on the circuit board assembly **42**. The liquid crystal display **64** is electrically connected to the electronics on the circuit board assembly **42** by a pair of elastomeric connectors **94** disposed in slots **152** in the snap-in display holder **142**. The elastomeric connectors **94** generally comprise alternating

layers of flexible conductive and insulating materials so as to create a somewhat flexible electrical connector. In the preferred embodiment shown, the slots **152** contain a plurality of slot bumps **154** that engage the sides of the elastomeric connectors **94** to prevent them from falling out of the slots **152** during assembly.

[0076] As set forth in detail in U.S. Provisional Patent Application No. 60/311,944 filed on Aug. 13, 2001, and entitled "Snap-in Display Frame," MSE#2639, which is hereby incorporated by reference herein, the snap-in display frame **142** eliminates the screw-type fasteners and metal compression frames that are typically used to assemble and attach a liquid crystal display **64** to an electronic device. In addition, the snap-in display frame **142** also permits the liquid crystal display **64** to be tested prior to assembling the liquid crystal display **64** to the circuit board assembly **42**, and testing of the electronics module **62** prior to assembly into instrument **10**.

[0077] The button set **98** also mates to the upper surface **140** of the circuit board assembly **42**. As mentioned above, the button set **98** comprises several individual buttons **96** that are depressed to operate the electronics of the sensor dispensing instrument **10**. For example, the buttons **96** can be depressed to activate the testing procedure of the sensor dispensing instrument **10**. The buttons **96** can also be depressed to recall and have displayed on the liquid crystal display **64** the results of prior testing procedures. The buttons **96** can also be used to set and display date and time information, and to activate reminder alarms which remind the user to conduct a blood glucose test according to a predetermined schedule. The buttons **96** can also be used to activate certain calibration procedures for the sensor dispensing instrument **10**.

[0078] The electronics assembly **62** further comprises a pair of surface contacts **139** on the bottom surface **136** of the circuit board assembly **42** (see FIGS. **16** and **18**). The surface contacts **139** are configured so as to be contacted by one or more fingers **143** on the cover mechanism **188**, which in turn are configured to be engaged by one or more ramp contacts **141** on the disk drive pusher **48** (see FIG. **13**). Movement of the disk drive pusher **48** causes the ramp contacts **141** to push the fingers **143** into contact with one or both of the surface contacts **139** so as to communicate the position of the pusher **48** to the electronics assembly **62**. In particular, movement of the pusher **48** from a stand-by or testing positions to an extended position will turn the sensor dispensing instrument ON. In addition, if the housing **12** is opened while the pusher **48** is in the extended position, an alarm will be activated to warn the user that the knife blade **36** may be in the extended position.

[0079] It should be noted that the design and configuration of the electronics assembly **62** permits the assembly and testing of the electronics and electrical components prior to assembly of the electronics assembly **62** to the upper case **18** of the sensor dispensing instrument **10**. In particular, the liquid crystal display **64**, the button set **98**, the battery contacts **128** and **130**, and the other electronics and electrical components can each be assembled to the circuit board assembly **42** and tested to verify that these components, and the electrical connections to these components, are working properly. Any problem or malfunction identified by the testing can then be corrected, or the malfunctioning component can be discarded, prior to assembling the electronics assembly **62** to the upper case **18** of the sensor dispensing instrument **10**.

[0080] As mentioned above, the sensor dispensing instrument **10** includes calibration circuitry for determining calibration and production information about the sensor pack **300**. As best seen in FIG. **12**, the calibration circuitry comprises a flex circuit **156** located in the lower case **24**. The flex circuit **156** is held in position in the lower case **24** by an autocal disk **158** that is connected to the rear section **28** of the lower case **24** by a pair of pins **160**. The autocal disk **158** has a raised central portion **162** configured to engage the sensor cavities **304** on the sensor pack **300** so as to hold the sensor pack **300** against the indexing disk **30**. The autocal disk **158** also has an open area **164** located between the pins **160** to expose contacts **166** on the flex circuit **156**.

[0081] The flex circuit **156** comprises a plurality of probes **168** that extend upwardly from the flex circuit **156** through holes **170** in the inner region of the autocal disk **158**. These probes **168** are connected to the contacts **166** on the end of the flex circuit **156**. When the sensor dispensing instrument **10** is closed with the lower case **24** latched to the upper case **18**, the probes **168** make contact with a conductive label **326** on the sensor pack **300** being used in the sensor dispensing instrument **10**. A foam pad **172** is positioned below the flex circuit **156** to provide a biasing force to assure that the probes **168** press against the conductive label **326** with a force sufficient to make an electrical connection. The foam pad **172** also provides a cushioning force so that the probes **168** can move independently with respect to each other as the sensor pack **300** is being rotated by the indexing disk **30**. As a result, information, such as calibration and production data, contained on the conductive label **326** can be transmitted via the probes **168** to the flex circuit **156**, which in turn couples the data to the electronic circuitry on the circuit board assembly **42** via an elastomeric connector **174**. This information can then be used by the electronics assembly **62** to calibrate the sensor dispensing instrument **10**, or can be displayed on the liquid crystal display **64**.

[0082] As best seen in FIG. **10**, the elastomeric connector **174** is made of layers of silicon rubber extending from a top edge **176** to a bottom edge **178** with alternate layers having conductive materials dispersed therein to connect contacts on the top edge **176** to contacts on the bottom edge **178**. When the upper case **18** and the lower case **24** are closed, the elastomeric connector **174** is compressed in the direction between the edges **176** and **178** such that the contacts along the top edge **176** engage electronic circuitry on the circuit board assembly **42** in the upper case **18**, and the contacts along the bottom edge **178** engage the contacts **166** on the flex circuit **156** in the lower case **24**. With the elastomeric connector **174** so compressed, low voltage signals can be readily transmitted between the circuit board assembly **42** and the flex circuit **156** through the elastomeric connector **174**.

[0083] The elastomeric connector **174** is held in position by a slotted housing **180** on the guide block **182**. In the preferred embodiment shown, the slotted housing **180** has a serpentine cross-section configured to allow the connector **174** to compress when the upper case **18** and the lower case **24** are closed, while still holding the elastomeric connector **174** when the upper case **18** and the lower case **24** are open. Alternatively, the slotted housing **180** may include inwardly projecting ridges that engage the sides of the connector **174**.

[0084] The disk drive mechanism **34** is affixed to the upper inside surface of the upper case **18**. As best seen in FIG. **10**,

the disk drive mechanism 34 is attached to the upper case by a plurality of mounting screws 184 that engage posts (not shown) on the upper inside surface of the upper case 18. The mounting screws 184 also pass through and secure the electronics assembly 62, which is disposed between the disk drive mechanism 34 and the upper case 18.

[0085] Although the disk drive mechanism 34 will be described in greater detail below, it should be noted that preferably the disk drive mechanism 34 is configured so as to permit the assembly and testing of its operation prior to mounting the disk drive mechanism 34 to the upper inside surface of the upper case 18. In other words, preferably the disk drive mechanism 34 has a modular design that can be tested prior to final assembly of the sensor dispensing instrument 10.

[0086] As best seen in FIGS. 13 and 14A, the disk drive mechanism 34 comprises a guide block 182, a sensor actuator 40, a housing guide 186, a disk drive pusher 48, an indexing disk drive arm 50, a knife blade assembly 58, a cover mechanism 188, and a button release 66. The housing guide 186 is fixed to the upper surface 190 (as viewed in FIG. 13) of the guide block 182 by one or more pins 192. The disk drive pusher 48 is supported on the housing guide 186 and the guide block 182 in such a manner as to permit the disk drive pusher 48 to slide laterally relative to the housing guide 186 and the guide block 182. The knife blade assembly 58 is pivotally connected to the underside of the disk drive pusher 48, and is guided by the housing guide 186 and the guide block 182. The indexing disk drive arm 50 is also connected to the disk drive pusher 48, and is partially guided by the guide block 182. The cover mechanism 188 is affixed to the guide block 182 with the disk drive pusher 48 and the housing guide 186 disposed therebetween. The sensor actuator 40 is attached to the guide block 182 and is engaged by the front end 204 of the disk drive pusher 48 when the disk drive pusher 48 is in the testing position. The button release 66 is slidably connected to the cover mechanism 188 so as to engage the front end 204 of the disk drive pusher 48 when the disk drive pusher 48 is in the testing position.

[0087] As best seen in FIGS. 13, 14A, 14B, and 14C the motor 400, the linear drive system 410, and the power transfer system 420 allow the disk drive mechanism 34 to automatically load a sensor 302 into a testing position on the front end 14 of the housing 12 once the button 32 is pressed, as described below. Preferably, the motor 400 is an electrical motor, such as a DC motor, however, the motor 400 may be any device known to those skilled in the art which can provide either linear or rotational movement. The motor 400 is activated once the button 32 is pressed. Button 32 is electronically connected with motor 400 and may be placed anywhere on the housing 12. A control unit (not shown) controls the speed and direction of the motor 400. The motor 400 provides rotational movement by rotating a shaft 402, as illustrated in FIGS. 14B and 14C. Preferably, the control unit (not shown) controls the speed and direction of the shaft 402. The motor 400 is attached to the power transfer system 420 (as viewed in FIGS. 14B and 14C). In one embodiment the shaft 402 of the motor 400 is connected with the power transfer system 420. The power transfer system 420 is connected with the motor 400 and the linear drive system 410. The power transfer system 420 transfers the power provided by the motor to the linear drive system 410 and translates the linear or rotational movement provided by the motor 400 into linear movement for the linear drive system, as illustrated in FIGS. 14B and 14C. The linear drive system 410 is connected with the disk drive mechanism 34 and the power transfer system 420,

wherein the linear drive system 410 moves the disk drive mechanism 34 when the motor 400 is activated. Preferably, the linear drive system 410 is connected with the pusher 48 of the disk drive mechanism 34 and moves the pusher 48 when the motor 400 is activated.

[0088] In one embodiment, the power transfer system 420 includes at least one gear 422 for transferring power and translating movement from the motor 400 to the linear drive system 410, as illustrated in FIG. 14B. Preferably, a series of gears 422 are used to transfer power and translate movement from the motor 400 to the linear drive system 410, as illustrated in FIG. 148. The linear drive system 410 includes a lead screw 412 and a nut 414 threaded on the lead screw 412, wherein the nut 414 is connected with and moves the disk drive pusher 48 as the lead screw 412 is rotated. In one embodiment, the lead screw 412 is a double helix screw, which allows the lead screw and the motor to rotate in only one direction instead of two, in order to move the disk drive pusher 48 from the standby position to the extended position, and from the extended position to the testing position. The lead screw is connected to the gears 422 through a lead screw connector 426, as illustrated in FIG. 14B. Preferably, at least one gear 422 is connected with shaft 402, while a second gear 422 is connected with the lead screw connector 426, as illustrated in FIG. 14B.

[0089] In one embodiment, the power transfer system 420 includes at least one roller 424 for transferring power and translating movement from the motor 400 to the linear drive system 410, as illustrated in FIG. 14C. The roller 424 is connected with the shaft 402. The linear drive system 410 includes a belt 416 and a connecting member 418 connected to the belt. The belt 416 is wrapped around the roller 424, as illustrated in FIG. 14C. As the motor 400 is activated, the roller 424 rotates, causing the belt 416 to move. The connecting member 418 is connected with the disk drive pusher 48. Therefore, as the belt 416 moves, the disk drive pusher 48 moves as well.

[0090] An indexing disk 30 is rotatably secured to the disk drive mechanism 34 by a retainer disk 206 connected through the indexing disk 30 and into guide block 182. As best seen in FIG. 14A, the retainer disk 206 has a pair of latch arms 208 that extend through a central hole 210 in the indexing disk 30 and latch into an opening 212 in the guide block 182. As mentioned above, the indexing disk 30 includes a plurality of pins 44 protruding from the lower surface 214 thereof. These pins 44 are configured to engage notches 324 on the sensor pack 300 (see FIG. 4) so as to align and rotate the sensor pack 300 in accordance with the position of the indexing disk 30. Hence, the pins 44 and the notches 324 have the dual purpose of retaining the sensor pack 300 on the indexing disk 30 so that the sensor pack 300 will rotate with the indexing disk 30 and of positioning the sensor pack 300 in proper circumferential alignment relative to the indexing disk 30.

[0091] As previously indicated, the disk drive pusher 48 is moved towards the rear end 16 of the housing 12 (away from the testing end 14) by motor 400 when the button 32 is pressed. The disk drive pusher 48 is guided in a lateral direction by the guide block 182, the housing guide 186, and the cover mechanism 188, as the pusher 48 is moved towards the rear end 22 of the upper case 18. As the disk drive pusher 48 slides towards the rear end 22 on the upper case 18, the indexing disk drive arm 50 causes the indexing disk 30 to rotate.

[0092] The indexing disk drive arm 50 extends rearwardly from the disk drive pusher 48. The indexing disk drive arm 50

includes a plate spring 54 made of spring type material such as stainless steel so as to bias the arm 50 outwardly from the disk drive pusher 48. A cam button 52 is affixed to the distal end of the arm 50, and is configured to engage the upper surface 216 (as viewed in FIG. 13) of the indexing disk 30. In particular, the indexing disk drive arm 50 is bent so as to protrude downwardly through a slot 218 in the guide block 182 such that the cam button 52 projects outwardly from the surface thereof. The slot 218 is designed such that the indexing disk drive arm 50 and the cam button 52 can move along the slot 218 as the disk drive pusher 48 is moved back and forth during the testing procedure. The slot 218 also prevents the indexing disk drive arm 50 from moving sideways with respect to the disk drive pusher 48 (i.e., it provides lateral support to the indexing disk drive arm 50).

[0093] As best seen in FIG. 13, the upper surface 216 of the indexing disk 30 comprises a series of radially extending grooves 60 and a plurality of curvilinearly extending grooves 56. The cam button 52 is configured to ride along these grooves 56 and 60 during the movement of the disk drive pusher 48. As the disk drive pusher 48 slides towards the rear end 22 of the upper case 18, the cam button 52 moves along one of the curvilinearly extending grooves 56. This causes the indexing disk 30 to rotate. In the preferred embodiment shown, there are ten radially extending grooves 60 and ten curvilinearly extending grooves 56 equally spaced about the circumference of the indexing disk 30, with each radially extending groove 60 being disposed between a pair of curvilinearly extending grooves 56. Accordingly, the movement of the disk drive pusher 48 towards the rear end 22 on the upper case 18 results in a $\frac{1}{10}$ th rotation of the indexing disk 30. As the button 32 is pressed, and the pusher 48 is moved towards the rear end 16 of the housing 12, the cam button 52 passes over an outer step 220 that separates the outer end 222 of the curvilinearly extending groove 56 from the adjacent radially extending groove 60. The outer step 220 is formed by the difference in depth between the outer end 222 of the curvilinearly extending groove 56 and the outer end 224 of the adjacent radially extending groove 60. In particular, the outer end 224 of the radially extending groove 60 is deeper than the outer end 222 of the curvilinearly extending groove 56. Thus, when the cam button 52 moves from the curvilinearly extending groove 56 into the adjacent radially extending groove 60, the biasing force of the plate spring 54 of the indexing disk drive arm 50 causes the cam button 52 to travel downwardly past the outer step 220. The outer step 220 prevents the cam button 52 from re-entering the outer end 222 of the curvilinearly extending groove 56 when the direction of travel of the disk drive pusher 48 is reversed (as will be explained below).

[0094] Rotation of the indexing disk 30 causes the sensor pack 300 to likewise rotate so that the next available sensor cavity 304 is placed in a standby position adjacent to the testing end 14 of the housing 12. The sensor pack 300 rotates with the indexing disk 30 because of the engagement of the notches 324 on the sensor pack 300 by the pins 44 on the indexing disk 30. As explained above, each sensor cavity 304 contains a disposable sensor 302 that is used during the glucose testing procedure.

[0095] Further rearward movement of the disk drive pusher 48 is prevented by a rear wall 226 on the guide block 182. In the preferred embodiment shown, the rear wall 226 includes a slotted housing 180 for holding the elastomeric connector 174 that connects the electronics assembly 62 to the flex circuit 156 disposed in the lower case 24. An interior edge 228 of the disk drive pusher 48 engages the rear wall 226 on the guide block 182 when the disk drive pusher 48 is in the fully extended position.

[0096] Upon reaching the rear end 16 of the housing 12, the pusher 48 then changes direction and moves inwardly back past the standby position (FIG. 1) and into a testing position (FIG. 7). As previously indicated, the inward movement of the pusher 48 causes the disk drive mechanism 34 to remove a sensor 302 from the sensor pack 300 and place the sensor 302 into a testing position.

[0097] As best seen in FIGS. 13 and 14A, the disk drive mechanism 34 includes a knife blade assembly 58 that is pivotally mounted to the disk drive pusher 48. The knife blade assembly 58 comprises a swing arm 230 having a first end 232 that is pivotally connected to the disk drive pusher 48 by a pair of pivot pins 234. A knife blade 36 is connected to the second end 236 of the swing arm 230. The second end 236 of the swing arm 230 also includes a first cam follower 238 and a second cam follower 240, each in the shape of a transversely extending post. The first cam follower 238 is configured to follow a pathway formed on one side of the knife blade assembly 58 by the guide block 182, the housing guide 186, and the cover mechanism 188. In particular, this pathway is formed by a cam projection 242 on the housing guide 186 that forms an upper pathway 244 between the cam projection 242 and the cover mechanism 188 and a lower pathway 246 between the cam projection 242 and the guide block 182. When the first cam follower 238 is disposed in the upper pathway 244, the knife blade 36 is in the retracted position. On the other hand, when the first cam follower 238 is disposed in the lower pathway 246, then the knife blade 36 is in the extended position. The upper pathway 244 and the lower pathway 246 are connected together at both ends of the cam projection 242 so as to form a continuous loop about which the first cam follower 238 can travel.

[0098] The second cam follower 240 engages a cam spring 248 attached to the housing guide 186. As will be explained below, the cam spring 248 guides the knife blade assembly 58 from the lower pathway 246 to the upper pathway 244 when the disk drive pusher 48 is initially moved rearward from standby position towards the extended position. The disk drive pusher 48 also comprises a spring 250 for biasing the knife blade 36 towards the extended position when the disk drive pusher 48 is initially moved forward from the extended position towards the testing position. In the preferred embodiment shown, the spring 250 comprises a plate spring that presses against the upper side of the swing arm 230.

[0099] As the button 32 is pressed, the disk drive pusher 48 is moved laterally towards the testing or front end 14 of the housing 12. As the disk drive pusher 48 begins to move forward, the spring 250 biases the swing arm 230 downwardly towards the indexing disk 30 so that the first cam follower 238 engages a sloped surface 252 on the interior end 268 of the cam projection 242 and is forced into the lower pathway 246. This causes the knife blade 36 to assume an extended position whereby the knife blade 36 projects outwardly through a knife slot 46 in the indexing disk 30 to pierce the protective foil 310 covering one of the sensor cavities 304 and engage the notch 312 on the back end 308 of the sensor 302 contained therein. As the disk drive pusher 48 continues to move towards the front end 20 of the upper case 18, the first cam follower 238 continues along the lower pathway 246, thereby causing the knife blade 36 to remain in the extended position projecting through the knife slot 46 so that it will travel along the knife slot 46 and push the sensor 302 forward out of the sensor cavity 304 and into a testing position at the front end 14 of the housing 12. The sensor 302 is in the testing position when the front end 306 of the sensor 302 projects out of the sensor opening 254 formed on the front end of the guide

block 182. While in the testing position, the sensor 302 is prevented from being pushed back through the sensor opening 254 by the engagement of the knife blade 36 against the notch 312 on the back end 308 of the sensor 302.

[0100] As the disk drive pusher 48 reaches the testing position, the front end 204 of the disk drive pusher 48 simultaneously engages the sensor actuator 40 and the button release 66. In particular, the front end 204 of the disk drive pusher 48 engages and pushes the button release 66 outwardly so as to project upwardly from the upper surface of the upper case 18. At the same time, the front end 204 of the disk drive pusher 48 engages a contact pad 256 on the sensor actuator 40 so as to force the sensor actuator 40 downward. This downward motion causes a pair of metal contacts 38 on the sensor actuator 40 to project into the sensor opening 254 on the guide block 182 and engage the contacts 314 on the sensor 302 for the glucose testing procedure. The metal contacts 38 also apply a frictional force to the sensor 302 so that the sensor 302 does not prematurely fall out of the sensor opening 254 prior to completion of the glucose testing procedure. In the preferred embodiment shown, the metal contacts 38 are somewhat flexible and are made of stainless steel. The housing guide 186 includes support ribs 187 disposed adjacent to the metal contacts 38 so as to prevent the metal contacts 38 from bending. As explained above, the metal contacts 38 permit the transmission of electrical signals between the sensor 302 and the electronics assembly 62 during the glucose testing procedure.

[0101] When the glucose testing procedure is complete, the button release 66 is depressed to release the sensor 302 from the testing position. The button release 66 has a sloped contact surface 258 that engages the front end 204 of the disk drive pusher 48 at an angle. As the button release 66 is depressed, the sloped contact surface 258 slides along the front end 204 of the disk drive pusher 48, thereby causing the disk drive pusher 48 to move rearward from the testing position and into the standby position. In the preferred embodiment shown, the disk drive pusher 48 is moved laterally a distance of 0.080 inches. The movement of the disk drive pusher 48 to the standby position also causes the front end 204 of the disk drive pusher 48 to disengage from the contact pad 256 on the sensor actuator 40, thereby allowing the sensor actuator 40 to move away from and disengage the sensor 302. The sensor 302 can then be removed by tipping the front end 14 of the sensor dispensing instrument 10 downwardly.

[0102] As mentioned above, when the disk drive pusher 48 is pushed from the extended position towards the testing position, the cam button 52 on the indexing disk drive arm 50 travels along one of the radially extending grooves 60 to prevent the indexing disk 30 and the sensor pack 300 from rotating. The radially extending groove 60 includes a sloped portion 260 that changes the depth of the groove 60. In particular, the sloped portion 260 decreases the depth of the radially extending groove 60 so that the middle portion of the radially extending groove 60 is shallower than the curvilinearly extending grooves 56. The radially extending groove 60 also comprises an inner step 262 near its inner end 264 (i.e., near the center of the indexing disk 30). The inner step 262 is formed along the juncture of the inner end 264 of the radially extending groove 60 and the inner end 266 of the curvilinearly extending groove 56. As the disk drive pusher 48 is pushed from the extended position towards the testing position, the cam button 52 travels up the sloped portion 260 of the radially extending groove 60, past the inner step 262, and into the adjacent curvilinearly extending groove 56. The biasing force of the plate spring 54 of the indexing disk drive arm 50

causes the cam button 52 to travel downwardly past the inner step 262. The inner step 262 prevents the cam button 52 from re-entering the radially extending groove 60 when the direction of travel of the disk drive pusher 48 is reversed (as explained above in connection with the outward movement of the disk drive pusher 48).

[0103] As the disk drive pusher 48 reaches the testing position, the first cam follower 238 passes the exterior end 270 of the cam projection 242. At the same time, the second cam follower 240 passes over the end of the cam spring 248, which retracts upwardly and out of the way as the first cam follower 238 nears the exterior end 270 of the cam projection 242. Once the first cam follower 238 has passed the end of the cam spring 248, the cam spring 248 moves downwardly so as to engage and guide the second cam follower 240 upwardly when the direction of travel of the disk drive pusher 48 is reversed and pulled outward towards the extended position. In particular, when the disk drive pusher 48 is subsequently moved into the extended position, the cam spring 248 guides the second cam follower 240 upwardly so that the first cam follower 238 enters the upper pathway 244 and the knife blade 36 is retracted.

[0104] As explained above, the disk drive pusher 48 is moved outwardly to initiate the testing procedure. During the outward motion of the disk drive pusher 48, the cam button 52 on the indexing disk drive arm 50 travels along one of the curvilinearly extending grooves 56 so as to rotate the indexing disk 30. During this outward motion, the first cam follower 238 on the knife blade assembly 58 travels along the upper pathway 244. As a result, the knife blade 36 is retracted from the knife slot 46 on the indexing disk 30 so that the indexing disk 30 is free to rotate in response to action of the cam button 52 in the curvilinearly extending groove 56. As the disk drive pusher 48 reaches the fully extended position, the first cam follower 238 passes the interior end 268 of the cam projection 242 and is guided into the lower pathway 246 by the biasing force of the spring 250 on the swing arm 230 of the knife blade assembly 58.

[0105] Prior to operating the sensor dispensing instrument 10, a sensor pack 300 must first be loaded into the sensor dispensing instrument 10 if one has not already been so loaded, or if all of the sensors 302 in the previously loaded sensor pack 300 have been used. To load a sensor pack 300, the lower case 24 and the upper case 18 are opened by depressing the latch 72 on the lower case 24. In the preferred embodiment shown, the opening of the lower case 24 and the upper case 18 causes the elastomeric connector 174 to separate from the contacts 166 on the flex circuit 156, thereby breaking the electrical connection between the flex circuit 156 and the electronics assembly 62. This causes an electronic counter (which is part of the electronics assembly 62) that keeps count of the number of unused sensors 302 in the sensor pack 300 to re-set to zero (0).

[0106] The opened housing 12 is then turned so that the lower surface 214 of the indexing disk 30 faces upwardly as shown in FIG. 3. A sensor pack 300 is then placed on the indexing disk 30 by aligning the notches 324 along the periphery of the sensor pack 300 with the pins 44 on the indexing disk 30. The lower case 24 is then pivoted on to the upper case 18 so as to enclose the sensor pack 300 within the housing 12. Once the lower case 24 is secured to the upper case 18 by the latch 72, the sensor dispensing instrument 10 is ready for operation.

[0107] The following is a brief description of the operation of the sensor dispensing instrument 10. First, the button 32 is

pressed which causes the sensor dispensing instrument 10 to turn ON and the cam button 52 on the indexing disk drive arm 50 to travel along one of the curvilinearly extending grooves 56 on the upper surface 216 of the indexing disk 30 so as to rotate the indexing disk 30 $\frac{1}{10}$ th of a complete rotation. The rotation of the indexing disk 30 causes the sensor pack 300 to be rotated so that the next one of the sensor cavities 304 is placed in a standby position aligned with the testing end 14 of the housing 12. At the same time, the knife blade assembly 58 is retracted and moved towards the center of the indexing disk 30.

[0108] Next, the pusher 48 moves away from the rear end 16 of the housing 12 causing the knife blade assembly 58 to pivot downwardly so that a knife blade 36 pierces a portion of the protective foil 310 covering the sensor cavity 304 in the standby position and engages the sensor 302 in the sensor cavity 304. As the pusher 48 continues to move away from the rear end 16 of the housing 12, the knife blade assembly 58 forces the sensor 302 out of the sensor cavity 304 and into a testing position at the front end 14 of the housing 12. At the same time, the cam button 52 on the indexing disk drive arm 50 travels along one of the radially extending grooves 60 to prevent the indexing disk 30 from rotating.

[0109] After the sensor 302 has been completely ejected from the sensor cavity 304 and pushed into a testing position projecting out from the front end 14 of the housing 12, the sensor actuator 40 engages the sensor 302 to hold the sensor 302 in the testing position and to couple the sensor 302 to the electronics assembly 62. The front end 306 of the sensor is then inserted into a drop of blood to be tested, whereby the blood is analyzed by the electronics assembly 62. The results of the analysis are then displayed on the liquid crystal display 64 of the sensor dispensing instrument 10.

[0110] Once the analysis of the blood is complete, the button release 66 on the upper case 18 is depressed so as to disengage the sensor actuator 40 and release the sensor 302, which can be disposed of by tipping the front end 14 of the housing 12 downwardly.

[0111] While the invention has been described with reference to details of the illustrated embodiment, these details are not intended to limit the scope of the invention as defined in the appended claims. For example, the sensor dispensing instrument 10 can be used for testing fluids other than blood glucose. In fact, the sensor dispensing instrument 10 can be used in connection with the analysis of any type of chemistry fluid that can be analyzed by means of a reagent material.

1-20. (canceled)

21. A sensor-dispensing instrument adapted to handle a sensor pack containing a plurality of sensors, the sensor-dispensing instrument further adapted to perform a test using one of the plurality of sensors, the sensor-dispensing instrument comprising:

- a circuit board assembly including a plurality of contacts on a bottom surface thereof;
- a cover mechanism including a plurality of fingers, each of the plurality of fingers adapted to contact at least one of the plurality of contacts on the bottom surface of the circuit board assembly;
- a pusher assembly including a plurality of ramp contacts; and
- a motor adapted to cause the movement of at least one of the plurality of ramp contacts,

wherein movement of at least one of the plurality of ramp contacts pushes at least one of the plurality of fingers into contact with at least one of the plurality of bottom surface contacts, resulting in the sensor-dispensing instrument being electronically turned to an ON state.

22. The instrument of claim 21 wherein the motor is activated by a button.

23. The instrument of claim 21 wherein the number of the plurality of fingers and the number of the plurality of bottom surface contacts are the same.

24. The instrument of claim 21 further including an outer housing, a knife-blade, and an alarm, the knife-blade having an extended position, and wherein when the outer housing is in an open position and the handle is in an extended position, the alarm is activated to indicate the possibility that the knife-blade is in the extended position.

25. The instrument of claim 21 wherein the sensor-dispensing instrument is a blood glucose meter.

26. The instrument of claim 21 wherein at least one of the plurality of fingers is in a permanent upward position such that none of the plurality of ramp contacts moves the at least one of the plurality of fingers.

27. A method of using a sensor-dispensing instrument, the sensor-dispensing instrument adapted to handle a sensor pack containing a plurality of sensors, the sensor-dispensing instrument further adapted to perform a test using one of the plurality of sensors, the method comprising the acts of:

providing a sensor-dispensing instrument comprising a motor, a circuit board assembly, a cover mechanism and a pusher assembly, the circuit board assembly including a plurality of contacts on a bottom surface thereof, the cover mechanism including a plurality of fingers, the pusher assembly including a plurality of ramp contacts; and

activating the motor such that at least one of the plurality of ramp contacts moves at least one of the plurality of fingers into contact with at least one of the plurality of bottom surface contacts, resulting in the sensor-dispensing instrument being electronically turned to an ON state.

28. The method of claim 27 wherein the motor is activated by a button.

29. The method of claim 27 wherein each of the plurality of fingers is adapted to contact a respective one of the plurality of bottom surface contacts of the circuit board assembly.

30. The method of claim 27 wherein the sensor-dispensing instrument is a blood glucose meter.

31. The method of claim 27 wherein each of the plurality of fingers have a raised convex section.

32. The method of claim 27 wherein at least one of the plurality of fingers is in a permanent upward position such that none of the plurality of ramp contacts moves the at least one of the plurality of fingers.

33. A testing instrument comprising:

- a sensor pack containing a plurality of sensors;
- an outer housing having an opening through which at least one of the plurality of sensors is disposed to conduct a test, wherein the outer housing includes a display for displaying a plurality of items;
- an electronics assembly including a microprocessor for operating the testing instrument and storing data; and

a plurality of controllers connected through the electronics assembly and adapted to control the operation of the testing instrument, the controllers including a power control for turning the sensor dispensing instrument on and off, a display control for viewing at least one of the plurality of items on the display, a select control for selecting at least one of the plurality of items, a memory control for displaying test results, and a set-up control for performing tasks related to the operation of the testing instrument.

34. The testing instrument of claim 33, wherein the outer housing forms a plurality of openings, and wherein the power control, the display control, the select control, the memory control and the set-up control are mounted through respective ones of the plurality of openings in the outer housing.

35. The testing instrument of claim 33, further comprising a controller door pivotally connected to the outer housing, wherein the controller door is moveable between a closed position and an open position, wherein the controller door covers the power control, the select control, the display control, the memory control and the set-up control when in the closed position, and wherein the controller door allows access to the power control, the display control, the select control, the memory control and the set-up control when in the open position.

36. The testing instrument of claim 35, wherein the controller door forms an opening and wherein the power control extends in the opening when the controller door is in the closed position.

37. The testing instrument of claim 33, further comprising an indexing disk with a plurality of pins, the plurality of pins assisting in properly aligning the sensor pack.

38. The testing instrument of claim 33, wherein the power control, the select control, the display control, the memory control and the set-up control each have a contact surface, and wherein the distance from the top surface of the outer housing to the contact surface of the power control is greater than the distance from the top surface of the outer housing to the contact surfaces of the select control, the display control, the memory control and the set-up control.

39. The testing instrument of claim 33, further comprising a communication interface for transferring or receiving testing information from a second device.

40. A method of operating a testing instrument comprising:

providing the testing instrument, the testing instrument including a sensor pack containing a plurality of sensors, an electronics assembly including a microprocessor for operating the sensor dispensing instrument and storing data, an outer housing having an opening through which at least one of the plurality of sensors is disposed to conduct a test and a display for displaying a plurality of

items, and a plurality of controllers connected through the electronics assembly to control the operation of the testing instrument, the controllers including a power control, a display control, a select control, a memory control and a set-up control;

activating the power control to activate the display and turn the testing instrument on;

activating the display control to view the items on the display;

activating the select control to select at least one item;

activating the memory control to view test results; and

activating the set-up control to perform tasks relating to the operation of the testing instrument.

41. The method of claim 40, wherein activating the set-up control includes adjusting the time and date and programming numbers for reagent calibration.

42. The method of claim 40, further comprising aligning the sensor pack using an indexing disk.

43. The method of claim 40, wherein the testing instrument further comprises a controller door, the method further comprising moving the controller door between a closed position and an open position, the open position allowing a user to activate at least one of the plurality of controllers.

44. The method of claim 40, wherein activating the display control includes scrolling through a list of items or a series of test results stored in the testing device.

45. A sensor dispensing instrument adapted to perform a test using a sensor, and comprising:

a sensor pack containing a plurality of sensors;

an outer housing having an opening through which at least one of the plurality of sensors is disposed to conduct a test, wherein the outer housing includes a display for displaying a plurality of items;

an electronics assembly including a microprocessor for operating the sensor dispensing instrument and storing data; and

a plurality of controllers connected through the electronics assembly and adapted to control the operation of the sensor dispensing instrument, the controllers including a power control for turning the sensor dispensing instrument on and off, a display control for viewing at least one of the plurality of items on the display, a select control for selecting at least one of the plurality of items, a memory control for displaying test results, and a set-up control for performing tasks related to the operation of the sensor dispensing instrument.

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