

SENSOR-DISPENSING INSTRUMENT AND METHOD OF USING THE SAME

FIELD OF THE INVENTION

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

BACKGROUND OF THE INVENTION

[002] 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.

[003] 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 resulting in 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. The sensors may be packaged individually in tear-away packages such as, for example, blister-type packaging methods.

[004] It would be desirable to have a device that turns on electronically with the same motion that assists in the testing using the one of the sensors.

SUMMARY OF THE INVENTION

[005] According to one embodiment, a sensor-dispensing instrument is adapted to handle a sensor pack containing a plurality of sensors. The sensor-dispensing instrument is further adapted to perform a test using one of the plurality of sensors. The sensor-dispensing instrument comprises a handle, a circuit board

assembly, a cover mechanism, and a pusher assembly. The handle includes a standby position, testing position, and an extended position. The circuit board assembly includes a plurality of contacts on a bottom surface thereof. The cover mechanism includes a plurality of fingers. Each of the plurality of fingers is adapted to contact at least one of the plurality of bottom surface contacts of the circuit board assembly. The pusher assembly includes a plurality of ramp contacts. The movement of the handle to the extended position causes at least one of the plurality of ramp contacts to move at least one of the plurality of fingers into contact with at least one of the plurality of bottom surface contacts. The movement of the handle to the extended position electronically turns the sensor-dispensing instrument to an ON state.

[006] According to another embodiment, a sensor-dispensing instrument is adapted to handle a sensor pack containing a plurality of sensors. The sensor-dispensing instrument is further adapted to perform a test using one of the plurality of sensors. The sensor-dispensing instrument comprises a circuit board assembly, a cover mechanism, a pusher assembly, and a motor. The circuit board assembly includes a plurality of contacts on a bottom surface thereof. The cover mechanism includes a plurality of fingers. Each of the plurality of fingers is adapted to contact at least one of the plurality of bottom surface contacts of the circuit board assembly. The pusher assembly includes a plurality of ramp contacts. The motor is adapted to cause the movement of at least one of the plurality of ramp contacts. The 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.

[007] According to one method, a sensor-dispensing instrument is adapted to handle a sensor pack containing a plurality of sensors. The sensor-dispensing instrument is further adapted to perform a test using one of the plurality of sensors. The sensor-dispensing instrument is provided that comprises a handle, a circuit board assembly, a cover mechanism, and a pusher assembly. The handle includes a standby position, testing position, and an extended position. The circuit board assembly includes a plurality of contacts on a bottom surface thereof. The cover mechanism includes a plurality of fingers. The pusher assembly includes a plurality of ramp

contacts. The handle is adapted to move to the extended position 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. The movement of the handle to the extended position electronically turns the sensor-dispensing instrument to an ON state.

[008] According to another method, a sensor-dispensing instrument is adapted to handle a sensor pack containing a plurality of sensors. The sensor-dispensing instrument is further adapted to perform a test using one of the plurality of sensors. The sensor-dispensing instrument is provided that comprises a motor, a circuit board assembly, a cover mechanism, and a pusher assembly. The circuit board assembly includes a plurality of contacts on a bottom surface thereof. The cover mechanism includes a plurality of fingers. The pusher assembly includes a plurality of ramp contacts. The motor is activated 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.

BRIEF DESCRIPTION OF THE DRAWINGS

[009] FIG. 1 is a top perspective view of a blood glucose sensor-dispensing instrument;

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

[011] 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;

[012] 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;

[013] 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;

[014] FIG. 6 is a top perspective view of the blood glucose sensor-dispensing instrument of FIG. 1 with the disk-drive pusher in the extended position;

[015] 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;

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

[017] 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;

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

[019] FIG. 11 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;

[020] 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;

[021] 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;

[022] FIG. 14 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;

[023] 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;

[024] 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;

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

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

[027] FIG. 18b is an enlarged view of bottom surface contacts in FIG. 18a.

[028] FIG. 19a is a top perspective view of a cover mechanism according to one embodiment;

[029] FIG. 19b is an enlarged view of the area 19b in FIG. 19a.

[030] FIG. 19c is a top perspective view of a plurality of fingers according to one embodiment;

[031] FIG. 20 is a top perspective view of a pusher assembly according to one embodiment;

[032] FIG. 21 is a top perspective view of a blood glucose sensor-dispensing instrument according to another embodiment;

[033] FIG. 22 is a bottom perspective view of the blood glucose sensor-dispensing instrument of FIG. 21;

[034] FIG. 23 is a perspective view of the blood glucose sensor-dispensing instrument of FIG. 21 in the opened position showing the insertion of a sensor pack;

[035] FIG. 24 is a perspective view of the blood glucose sensor-dispensing instrument of FIG. 21 in the opened position showing a sensor pack loaded onto the indexing disk;

[036] FIG. 25 is a top perspective view of the blood glucose sensor-dispensing instrument of FIG. 21 shown with the button door in the open position;

[037] FIG. 26 is a top perspective view of the blood glucose sensor-dispensing instrument of FIG. 21 with the disk-drive pusher in the extended position;

[038] FIG. 27 is a top perspective view of the blood glucose sensor-dispensing instrument of FIG. 21 with the disk-drive pusher in the testing position with a sensor projecting from the sensor opening;

[039] FIG. 28 is an exploded perspective view of the component subassemblies of blood glucose sensor-dispensing instrument of FIG. 21;

[040] FIG. 29 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. 21;

[041] FIG. 30A 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. 21;

[042] FIG. 30B is a perspective view of the component parts of the disk-drive mechanism of the blood glucose sensor-dispensing instrument of FIG. 21 according to another embodiment; and

[043] FIG. 30C is a perspective view of the component parts of the disk-drive mechanism of the blood glucose sensor-dispensing instrument of FIG. 21 according to another embodiment.

[044] While the invention is susceptible to various modifications and alternative forms, specific embodiments are shown by way of example in the drawings and are described in detail herein. It should be understood, however, that the invention is not intended to be limited to the particular forms disclosed. Rather, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[045] Referring to the drawings, a blood glucose sensor-dispensing instrument generally designated by the reference numeral 10 is shown. 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 puller handle 32 extending from a rear end 22 of the upper case 18 of the housing 12 can be moved to activate 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).

[046] It should be noted that the sensor-dispensing instrument 10 incorporates some 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 this patent are hereby incorporated by reference to avoid the unnecessary duplication of the description of these similar components.

[047] 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.

[048] As shown 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 (*e.g.*, 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.

[049] As shown 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.

[050] 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 to insure that the sensor cavities 304 are maintained at an appropriate humidity level to preserve the reagent material in the sensor 302.

[051] 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.

[052] 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.

[053] To operate the sensor-dispensing instrument 10, the puller handle 32 is first manually pulled from a standby position (FIG. 1) adjacent the rear end 16 of the housing 12 to an extended position (FIG. 6) away from the rear end 16 of the housing 12. The outward movement of the puller handle 32 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 outward movement of the puller handle 32 also causes the sensor-dispensing instrument 10 to turn ON (*i.e.*, the electronic circuitry on the circuit board assembly 42 is activated).

[054] As will be described in greater detail below, the disk-drive mechanism 34 includes a pusher assembly such as a disk-drive pusher 48 on which an indexing-disk-drive arm 50 is mounted (see FIGs. 13 and 14). 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 puller handle 32 is manually pulled from a standby position adjacent the rear end 16 of the housing 12 to an extended position away from the rear end 16 of the housing 12, the disk-drive pusher 48 is pulled 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.

[055] The puller handle 32 is then manually pushed inwardly from the extended position (FIG. 6) back past the standby position (FIG. 1) and into a testing position (FIG. 7). The inward movement of the puller handle 32 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.

[056] 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 14). As the puller handle 32 is manually pushed from the extended position to the testing position, the disk-drive pusher 48 is 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.

[057] While the disk-drive pusher 48 is being pushed 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 pulled 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.

[058] 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 puller handle 32 is pushed past the standby position and into the testing position. 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.

[059] 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 puller handle 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 to automatically turn OFF pursuant a timer on the electronics assembly 62.

[060] 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.

[061] As seen in FIGs. 1, 5-7, and 10-11, the upper case 18 includes a rectangular opening 30 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. As shown in FIG. 11, 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.

[062] As shown in FIGs. 1, 5 and 11, 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.*, an On/Off button) 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.

[063] 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.

[064] 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. 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.

[065] An electronics assembly 62 is affixed to the upper inside surface of the upper case 18. As shown 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 may 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.

[066] 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.

[067] 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.

[068] 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 that 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.

[069] 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 of the cover mechanism 188, which in turn are configured to be engaged by a pair of ramp contacts 141 on the pusher assembly or disk-drive pusher 48 (see FIGs. 6 and 13). Movement of the puller handle 32 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 puller handle 32 to the electronics assembly 62. In particular, movement of the puller handle 32 from the standby or testing

positions to the extended position will turn the sensor-dispensing instrument ON. In addition, if the housing 12 is opened while the puller handle 32 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. For example, a buzzer may sound when the housing 12 is opened while the puller handle 32 is in the extended position.

[070] The puller handle 32 includes a standby position (FIG. 1), testing position (FIG. 7), and an extended position (FIG. 6). The sensor-dispensing instrument 10 is electronically turned to the ON state during the backward pull of the puller handle 32 from the standby position to the extended position. When the puller handle 32 is pushed inwardly from the extended position to the testing position, the sensor-dispensing instrument 10 is placed into testing mode. This is accomplished in one embodiment by using the cover mechanism 188, the circuit board assembly 42, and the pusher assembly 48, which may be referred together as a pull-push switch.

[071] The cover mechanism 188 includes the plurality of fingers 143. As shown in FIGs. 13 and 19a-c, the plurality of fingers 143 includes a first finger 143a, a second finger 143b and a third finger 143c, in which the second finger 143b is located between the first and third fingers 143a,c. It is contemplated that the plurality of fingers may include less than or more than the shown three fingers in FIGs. 19a-c. As shown in FIGs. 19b,c, each of the plurality of fingers 143 desirably has a raised convex section 137. It is contemplated, however, that the plurality of fingers may be shaped differently than shown in FIGs. 13 and 19a-c.

[072] The plurality of fingers 143 is desirably made of metal such as, for example, nickel-plated phosphor bronze or stainless steel. It is contemplated, however, that other metals may be used in forming the plurality of fingers. One such metal that may be used in forming the plurality of fingers is plated beryllium copper. The plurality of fingers 143 may be formed by stamping. The remainder of the cover mechanism 188 may be made of polymeric material such as polycarbonate. The plurality of fingers 143 may be insert molded into the remainder of the cover mechanism 188. It is advantageous to use a plurality of fingers because it minimizes the thickness of the sensor-dispensing instrument and is also cost effective, while still performing the desired functions. For example, it is desirable to reduce the total

thickness of the circuit board assembly 42 and the cover mechanism 188 to less than about 50 mils and, more desirably, to less than about 40 or about 35 mils.

[073] Each of the plurality of fingers 143 is adapted to contact at least one of the plurality of bottom surface contacts 139 of the circuit board assembly 42, which is shown in FIGs. 16 and 18. The plurality of bottom surface contacts 139 may be gold plated pads, such as gold over electroless nickel. As shown in FIG. 18b, the circuit board assembly 42 includes a first bottom surface contact 139a, a second bottom surface contact 139b, and a third bottom surface contact 139c. Thus, in such an embodiment, each of the plurality of fingers 143a-c is adapted to contact a respective one of the plurality of bottom surface contacts 139a-c of the circuit board assembly 42. It is contemplated that the number of plurality of fingers 143 and the number of bottom circuit contacts 139 may be different instead of the equal number shown in FIGs. 18a,b, and FIGs. 13 and 19a-c.

[074] The plurality of fingers 143 is adapted to contact at least one of the plurality of bottom surface contacts 139 of the circuit board assembly 42 via the pusher assembly 48. As shown in FIGs. 13 and 20, the pusher assembly 48 includes the plurality of ramp contacts 141. Specifically, the pusher assembly 48 includes exactly two ramps 141a, 141b. It is contemplated that the ramp contacts may be shaped differently than shown in FIG. 20. For example, the plurality of ramp contacts may be semi-circular.

[075] When the puller handle 32 is pulled backwards from the standby position to the extended position, one of the plurality of ramp contacts 141a, contacts the first and second fingers 143a,b and causes the first and second fingers 143a,b to move upward. During this upward movement, the first and second fingers 143a,b contact the respective first and second bottom circuit contacts 139a,b. On contact between the first and second fingers 143a,b and respective first and second bottom second circuit contacts 139a,b, the sensor-dispensing instrument 10 is turned ON electronically. When the meter is turned on electronically, all of the segments of the sensor-dispensing instrument 10 display may be turned ON.

[076] As discussed above, the display may be liquid crystal display 64. Some of the information that may be displayed when the sensor-dispensing instrument 10 is turned ON include the following: a battery indication, a numerical

display, an indication of the number of sensors remaining, an indication to load the sensor pack or blister, apply blood indication, a temperature indication, or various combinations thereof. Thus, the sensor-dispensing instrument 10 is turned ON electronically with the same motion by the user that places the sensor 302 into a testing position on the front end 14 of the housing (*see* FIG. 7).

[077] When the puller handle 32 is pushed forward from the extended position to the testing position, it passes through the standby position. The display desirably remains fully lit during this movement. When the puller handle 32 is pushed forward from the extended position to the testing position, the first and second fingers 143a,b are lowered after contacting the ramp contact 141a, which results in the first and second fingers 143a,b becoming disengaged from respective first and second bottom circuit contacts 139a,b. As the puller handle 32 continues to be pushed forward from the extended position to the testing position, a second one of the ramp contacts 141b contacts and pushes up the second and third fingers 143b,c. This causes the second and third fingers 143b,c to be pushed upward and contact the respective second and third bottom circuit contacts 139b,c. When the second and third fingers 143b,c contact respective second and third bottom circuit contacts 139b,c, the display of the sensor-dispensing instrument 10 shows a blood drop, which indicates to the user that the meter is ready to perform testing such as blood glucose testing. More specifically, the display may have a blinking or flashing blood drop that indicates to the user that the blood should be added to the sensor 302. Additionally, the display may have a symbol to indicate that the sensor pack 300 needs to be loaded in the sensor-dispensing instrument 10.

[078] According to another embodiment, the second finger 143b may be permanently located in the upward position. In such an embodiment, it would no longer be necessary for the ramps contacts 141a,b to push up the second finger 143b so as to contact the second bottom circuit contact 139b. In this embodiment, the second finger 143b would be permanently located such that during the movement from the standby position to the extended position and from the extended position to the testing position the second finger 143b contacts the second bottom circuit contact 139b.

[079] Referring back to the electronics assembly, 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.

[080] As mentioned above, the sensor-dispensing instrument 10 includes calibration circuitry for determining calibration and production information about the sensor pack 300. As shown 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.

[081] The flex circuit 156 comprises a plurality of probes 168 that extends 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.

[082] As shown 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.

[083] 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.

[084] The disk-drive mechanism 34 is affixed to the upper inside surface of the upper case 18. As shown 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.

[085] Although the disk-drive mechanism 34 will be described in greater detail below, it should be noted that 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, the disk-drive mechanism 34 has a modular design that can be tested prior to final assembly of the sensor-dispensing instrument 10.

[086] As shown in FIGs. 13 and 14, 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 puller handle 32, 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 puller handle 32 comprises an upper puller handle 194 and a lower puller handle 196 connected to each other by snap-press fittings 198 that pass through holes 200 in the rear end 202 of the disk-drive pusher 48. In the preferred embodiment shown, the upper puller handle 194 and the lower puller handle 196 each have a concaved, textured outer surface (*i.e.*, the top and bottom surfaces of the puller handle 32) to facilitate gripping of the puller handle 32 between the thumb and finger of the user's hand. 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.

[087] In addition, 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 shown in FIG. 14, 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.

[088] As previously indicated, the disk-drive pusher 48 is pulled away from the rear end 16 of the housing 12 (away from the testing end 14) by the user manually exerting a pulling force on the puller handle 32 to move the handle 32 from the standby position to the extended position. As the puller handle 32 is pulled away from the rear end 22 of the upper case 18, 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 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.

[089] 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).

[090] As shown 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 $1/10^{\text{th}}$ rotation of the indexing disk 30.

[091] As the puller handle 32 is pulled away from the rear end 16 of the housing 12 to a fully extended position, 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).

[092] 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.

[093] 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 (see FIG. 6).

[094] From the fully extended position, the puller handle 32 is then manually pushed inwardly back past the standby position (FIG. 1) and into a testing position (FIG. 7). As previously indicated, the inward movement of the puller handle 32 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.

[095] As shown in FIGs. 13 and 14, 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.

[096] 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 pulled 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 pushed 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.

[097] As the puller handle 32 is manually pushed from the extended position to the testing position, the disk-drive pusher 48 is pushed 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.

[098] 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.

[099] 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.

[0100] 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).

[0101] 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 pulled outward towards 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.

[0102] As explained above, the disk-drive pusher 48 is pulled 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.

[0103] 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 autocal disk 158, thereby breaking the electrical connection between the autocal disk 158 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).

[0104] 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. 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.

[0105] The following is a brief description of the operation of the sensor-dispensing instrument 10. First, the puller handle 32 is manually pulled from a standby position (FIG. 1) adjacent the rear end 16 of the housing 12 to an extended position (FIG. 6) away from the rear end 16 of the housing 12. The outward movement of the puller handle 32 causes the sensor-dispensing instrument 10 to turn ON. The outward movement of the puller handle 32 also causes 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 $1/10^{\text{th}}$ 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.

[0106] Next, the puller handle 32 is manually pushed inwardly from the extended position (FIG. 6) back past the standby position (FIG. 1) and into a testing position (FIG. 7). The inward movement of the puller handle 32 causes 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 puller handle 32 continues to move back towards 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.

[0107] 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.

[0108] 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.

[0109] According to another embodiment, a blood glucose sensor-dispensing instrument 390 may be used. As shown in FIGS. 21-27, the sensor-dispensing instrument 390 includes the outer housing 12 having the upper case 18 and the 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 the sensor pack 300 (see FIGS. 23 and 24) can be positioned on the indexing disk 30 within the housing 12. With the sensor pack 300 so loaded in the housing 12, a button 392 can

be pressed to cause a disk-drive mechanism, generally designated by the numeral 394 (see FIG. 28), to load a sensor 302 into a testing position on the front end 14 of the housing 12 (see FIG. 23). The sensor-dispensing instrument 390 also includes a motor 400, a linear-drive system 410, and a power-transfer system 420, which cause the disk-drive mechanism 394 to load a sensor 302 into a testing position on the front end 14 of the, housing once the button 392 is pressed, as described below.

[0110] To operate the sensor-dispensing instrument 390, the button 392 is pressed causing an electrical connection (not shown) between the button 392 and the motor 400 (FIG. 30B) to be made, and therefore causing the motor 400 to be activated. Upon activation, the motor 400 moves the linear-drive system 410 (FIG. 30B), which causes the disk-drive mechanism 394 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 392 also causes the sensor-dispensing instrument 10 to turn ON (*i.e.*, the electronic circuitry on the circuit board assembly 42 is activated).

[0111] As will be described in greater detail below, the disk-drive mechanism 394 includes the pusher assembly such as the disk-drive pusher 48 on which the indexing-disk-drive arm 50 is mounted (see FIGS. 29 and 30A). The indexing-disk-drive arm 50 comprises the cam button 52 disposed at the end of the 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 392 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.

[0112] The linear-drive system 410 then moves the disk-drive pusher 48 laterally towards the front end 14 of the upper case 18 and causes the disk-drive mechanism 394 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.

[0113] The linear-drive system 410 then moves the disk-drive pusher 48 towards the front end 14 of the upper case 18 even more causing the sensor 302 to be pushed forward out of the sensor opening 254 so that the sensor 302 is free from the instrument 390 and can be disposed.

[0114] As will be described in greater detail below, the disk-drive mechanism 394 includes a knife-blade assembly 58 that is pivotally mounted to the disk-drive pusher 48 (see FIGS. 29 and 30A). 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 the 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.

[0115] 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.

[0116] 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 the 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 392 is pressed. The sensor actuator 40 couples the sensor 302 to the 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 the liquid crystal display 64 in the sensor-dispensing instrument 390.

[0117] Once the blood analyzing test is completed, the 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 392 to move forward pushing the sensor 302 out of the sensor opening 254 and then move back to the standby position. At this point, the user can turn the sensor-dispensing instrument 390 OFF by depressing the button 96 on the upper case 18, or by allowing the sensor-dispensing instrument 390 to automatically turn OFF pursuant a timer on the electronics assembly 62.

[0118] The cover mechanism 188 (including the plurality of fingers 143), pusher assembly 48 (including the pair of ramp contacts 141), and the plurality of surface contacts 139 function similar in the sensor-dispensing instrument 390 as described above with sensor-dispensing instrument 10. Specifically, the disclosures of the cover mechanism 188, the pusher assembly 48, and the plurality of surface contacts 141 are the same in the sensor-dispensing instrument 390 as described above in the sensor-dispensing instrument 10. One difference is the use of the puller handle 32 in the sensor-dispensing instrument 10 to move the plurality of ramp contacts 141. In the sensor-dispensing instrument 390, however, the motor 400 assists in activating the plurality of ramp contacts 141.

[0119] Specifically, when the motor 400 is activated, this causes at least one of the plurality of ramp contacts 141 to push at least one of the plurality of fingers 143 into contact with at least one of the plurality of bottom surface contacts 139. The contact between at least one of the plurality of fingers 143 with at least one of the plurality of bottom surface contacts 139 electronically turns the sensor-dispensing instrument 390 to an ON state.

[0120] The disk-drive mechanism 394 is affixed to the upper inside surface of the upper case 18. As shown in FIG. 28, the disk-drive mechanism 394 is attached to the upper case by the 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 394 and the upper case 18.

[0121] Although the disk-drive mechanism 394 will be described in greater detail below, it should be noted that preferably the disk-drive mechanism 394 is

configured so as to permit the assembly and testing of its operation prior to mounting the disk-drive mechanism 394 to the upper inside surface of the upper case 18. In other words, preferably the disk-drive mechanism 394 has a modular design that can be tested prior to final assembly of the sensor-dispensing instrument 390.

[0122] As shown in FIGS. 29 and 30, the disk-drive mechanism 394 comprises the guide block 182, the sensor actuator 40, the housing guide 186, the disk-drive pusher 48, the indexing-disk-drive arm 50, the knife-blade assembly 58, the cover mechanism 188, and the button release 66. The housing guide 186 is fixed to the upper surface 190 (as viewed in FIG. 29) 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.

[0123] As shown in FIGS. 29, 30A, 30B, and 30C, the motor 400, the linear-drive system 410, and the power-transfer system 420 allow the disk-drive mechanism 394 to automatically load a sensor 302 into a testing position on the front end 14 of the housing 12 once the button 392 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 392 is pressed. Button 392 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. 30B and 30C. 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. 30B and 30C). 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. 30B and 30C. The power-transfer system also steps the power of the motor up by slowing down the rotational speed through a series of gears. The linear-drive system 410 is connected with the disk-drive mechanism 394 and the power-transfer system 420, wherein the linear-drive system 410 moves the disk-drive mechanism 394 when the motor 400 is activated. Preferably, the linear-drive system 410 is connected with the pusher 48 of the disk-drive mechanism 394 and moves the pusher 48 when the motor 400 is activated.

[0124] 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. 30B. 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. 30B. 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, 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. 30B. 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. 30B.

[0125] 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. 30C. 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. 30C. 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.

Referring to FIG. 26, the disk-drive pusher 48 is in the fully extended position (see FIG. 26). 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. 21) and into a testing position (FIG. 27). As previously indicated, the inward movement of the pusher 48 causes the disk-drive mechanism 394 to remove a sensor 302 from the sensor pack 300 and place the sensor 302 into a testing position.

[0126] The following is a brief description of the operation of the sensor-dispensing instrument 390. First, the button 392 is pressed which causes the sensor-dispensing instrument 390 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 $1/10^{\text{th}}$ 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.

[0127] Next, the pusher 48 moves away from the rear end 16 of the housing 12 causing the knife-blade assembly 58 is pivoted 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.

[0128] 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 390.

[0129] Once the analysis of the blood is complete, the linear-drive system 410 then moves the disk-drive pusher 48 towards the front end 14 of the upper case 18 even more causing the sensor 302 to be pushed forward out of the sensor opening 254 so that the sensor 302 is free from the instrument 390 and can be disposed. The linear-drive system 410 then returns the knife blade 36 to the standby position.

[0130] 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 or 390 can be used for testing fluids other than blood glucose. In fact, the sensor-dispensing instrument 10 or 390 can be used in connection with the analysis of any type of chemistry fluid that can be analyzed by means of a reagent material.

WHAT IS CLAIMED IS:

1. 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 handle that includes a standby position, testing position, and an extended position;
 - a circuit board assembly including a plurality of contacts on a bottom surface thereof;
 - 10 a cover mechanism including a plurality of fingers, each of the plurality of fingers being adapted to contact at least one of the plurality of bottom surface contacts of the circuit board assembly; and
 - a pusher assembly including a plurality of ramp contacts, wherein movement of the handle to the extended position causes at least one of the plurality of ramp contacts to move at least one of the plurality of fingers into contact with at least one of the plurality of bottom surface contacts, wherein movement of the handle to the extended position electronically turns the sensor-dispensing instrument to an ON state.
2. The instrument of claim 1 wherein movement of the handle from the standby position to the extended position electronically turns the sensor-dispensing instrument to an ON state.
3. The instrument of claim 1 wherein movement of the handle from the testing position to the extended position electronically turns the sensor-dispensing instrument to an ON state.
- 25 4. The instrument of claim 1 wherein the position of the handle is communicated within the sensor-dispensing instrument when at least one of the plurality of fingers contacts at least one of the bottom surface contacts of the circuit board assembly.
5. The instrument of claim 1 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

6. The instrument of claim 1 wherein the number of the plurality of fingers and the number of the plurality of bottom surface contacts are the same.

7. The instrument of claim 1 wherein the plurality of fingers is exactly three fingers and the plurality of bottom surface contacts is exactly three surface contacts.

8. The instrument of claim 7 wherein the plurality of ramp contacts is exactly two ramp contacts.

9. The instrument of claim 1 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.

10. The instrument of claim 1 wherein the sensor-dispensing instrument is a blood glucose meter.

11. The instrument of claim 1 wherein the plurality of fingers is made of metal and formed by stamping.

12. The instrument of claim 1 wherein the plurality of fingers comprises nickel plated phosphor bronze.

13. The instrument of claim 1 wherein the plurality of fingers comprises stainless steel.

14. The instrument of claim 1 wherein the plurality of fingers is made of metal and the remainder of the cover mechanism is made of polycarbonate.

15. The instrument of claim 1 wherein the plurality of fingers is insert molded into the remainder of the cover mechanism.

16. The instrument of claim 1 wherein each of the plurality of fingers has a raised convex section.

17. The instrument of claim 1 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.

18. 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;

5 a cover mechanism including a plurality of fingers, each of the plurality of fingers adapted to contact at least one of the plurality of bottom surface contacts of the circuit board assembly;

a pusher assembly including a plurality of ramp contacts; and

10 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.

15 19. The instrument of claim 18 wherein the motor is activated by a button.

20. The instrument of claim 18 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.

21. The instrument of claim 18 wherein the number of the plurality of
20 fingers and the number of the plurality of bottom surface contacts are the same.

22. The instrument of claim 18 wherein the plurality of fingers is exactly three fingers and the plurality of bottom surface contacts is exactly three surface contacts.

23. The instrument of claim 22 wherein the plurality of ramp contacts is
25 exactly two ramp contacts.

24. The instrument of claim 18 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
30 position.

25. The instrument of claim 18 wherein the sensor-dispensing instrument is a blood glucose meter.

26. The instrument of claim 18 wherein the plurality of fingers is made of metal and formed by stamping.

27. The instrument of claim 18 wherein the plurality of fingers comprises nickel plated phosphor bronze.

5 28. The instrument of claim 18 wherein the plurality of fingers comprises stainless steel.

29. The instrument of claim 18 wherein the plurality of fingers is made of metal and the remainder of the cover mechanism is made of polycarbonate.

10 30. The instrument of claim 18 wherein the plurality of fingers is insert molded into the remainder of the cover mechanism.

31. The instrument of claim 18 wherein each of the plurality of fingers has a raised convex section.

15 32. The instrument of claim 18 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 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:

20 providing a sensor-dispensing instrument comprising a handle, a circuit board assembly, a cover mechanism and a pusher assembly, the handle including a standby position, testing position, and an extended position, 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

25 moving the handle to the extended position 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,

30 wherein movement of the handle to the extended position electronically turns the sensor-dispensing instrument to an ON state.

34. The method of claim 33 wherein movement of the handle from the standby position to the extended position electronically turns the sensor-dispensing instrument to an ON state.

5 35. The method of claim 33 wherein movement of the handle from the testing position to the extended position electronically turns the sensor-dispensing instrument to an ON state.

36. The method of claim 33 wherein the position of the handle is communicated within the sensor-dispensing instrument when at least one of the plurality of fingers contacts at least one of the bottom surface contacts of the circuit board assembly.

37. The method of claim 33 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.

15 38. The method of claim 33 wherein the number of the plurality of fingers and the number of the plurality of bottom surface contacts are the same.

39. The method of claim 33 wherein the sensor-dispensing instrument is a blood glucose meter.

20 40. The method of claim 33 wherein the plurality of fingers is made of metal and formed by stamping.

41. The method of claim 33 wherein the plurality of fingers comprises nickel plated phosphor bronze.

42. The method of claim 33 wherein the plurality of fingers comprises stainless steel.

25 43. The method of claim 33 wherein each of the plurality of fingers has a raised convex section.

44. The method of claim 33 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.

30 45. 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:

5 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

10 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.

46. The method of claim 45 wherein the motor is activated by a button.

47. The method of claim 45 wherein each of the plurality of fingers is adapted to contact a respective one of the plurality of bottom surface contacts of the
15 circuit board assembly.

48. The method of claim 45 wherein the number of the plurality of fingers and the number of the plurality of bottom surface contacts are the same.

49. The method of claim 45 wherein the sensor-dispensing instrument is a blood glucose meter.

20 50. The method of claim 45 wherein the plurality of fingers is made of metal and formed by stamping.

51. The method of claim 45 wherein the plurality of fingers comprises nickel plated phosphor bronze.

25 52. The method of claim 45 wherein the plurality of fingers comprises stainless steel.

53. The method of claim 45 wherein each of the plurality of fingers have a raised convex section.

54. The method of claim 45 wherein at least one of the plurality of fingers is in a permanent upward position such that none of the plurality of ramp contacts
30 moves the at least one of the plurality of fingers.