(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
12 June 2008 (12.06.2008)

PCT

(10) International Publication Number
WO 2008/070634 A1

(51) International Patent Classification:
G06K 7/10 (2006.01)

(21) International Application Number:
PCT/US2007/086309

(22) International Filing Date:
3 December 2007 (03.12.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/868,338 3 December 2006 (03.12.2006) US

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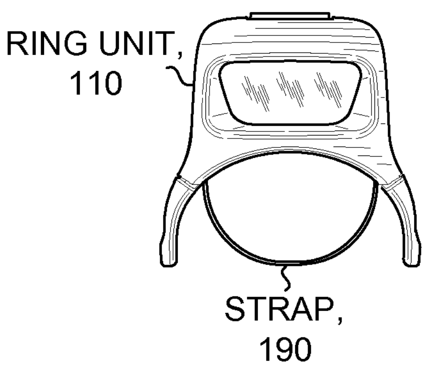
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:
— *of inventorship (Rule 4.17(iv))*

Published:
— *with international search report*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(54) **Title:** MULTI-MODE RING SCANNER



(57) Abstract: A multi-mode ring scanner (MMRS) has a ring unit for wearing on a finger. The MMRS optionally has a wrist unit coupled to the ring unit, such as via a cable. The MMRS optionally communicates wirelessly with a computing device. The ring unit has one or more scanners (such as an optical scanner or an RFID tag reader). The ring unit optionally has two paddle switches for activation by inward pressure from fingers adjacent to the finger. The two switches enable specifying operation of the MMRS in a plurality of modes and/or to communicate a plurality of information codes to the computing device. The computing device is optionally enabled to assign a function to each combination of activation of the two switches. A scanning system including the MMRS optionally provides feedback to a user based on feedback from a host processor.

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MULTI-MODE RING SCANNER

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] Priority benefit claims for this application are made in the accompanying Application Data Sheet (if any). To the extent permitted by the type of the instant application, this application incorporates by reference for all purposes the following application(s), which are all owned by the owner of the instant application:

U.S. Provisional Application Serial No. 60/554,080 (Docket No. SC.2003.23), filed Mar. 17, 2004, first named inventor Leonard Ott, and entitled **CORDLESS HAND SCANNER WITH IMPROVED USER FEEDBACK**;

U.S. Non-Provisional Application Serial No. 11/082,190 (Docket No. SC.2004.23), filed Mar. 16, 2005, first named inventor Leonard Ott, and entitled **CORDLESS HAND SCANNER WITH IMPROVED USER FEEDBACK**; and

U.S. Provisional Application Serial No. 60/868,338 (Docket No. SC.2005.16), filed Dec. 3, 2006, first named inventor Robert J. Miller, and entitled **MULTI-MODE RING SCANNER**.

BACKGROUND

[0002] Field: Advancements in scanning devices are needed to provide improvements in performance, efficiency, and utility of use.

[0003] Related Art: Unless expressly identified as being publicly or well known, mention herein of techniques and concepts, including for context, definitions, or comparison purposes, should not be construed as an admission that such techniques and concepts are previously publicly known or otherwise part of the prior art. All references cited herein (if any), including patents, patent applications, and publications, are hereby incorporated by reference in their entireties, whether specifically incorporated or not, for all purposes. Nothing herein is to be construed as an admission that any of the references are pertinent prior art, nor does it constitute any admission as to the contents or date of actual publication of these documents.

SUMMARY

[0004] The invention may be implemented in numerous ways, including as a process, an article of manufacture, an apparatus, a system, a composition of matter, and a computer readable medium such as a computer readable storage medium or a computer network wherein program instructions are sent over optical or electronic communication links. In this specification, these implementations, or any other form that the invention may take, may be referred to as techniques. In general, the order of the steps of disclosed processes may be altered within the scope of the invention. The Detailed Description provides an exposition of one or more embodiments of the invention that enable improvements in performance, efficiency, and utility of use in the field identified above. The Detailed Description includes an Introduction to facilitate the more rapid understanding of the remainder of the Detailed Description. The Introduction includes Example Embodiments that tersely summarize illustrative systems and methods in accordance with the concepts taught herein. As is discussed in more detail in the Conclusions, the invention encompasses all possible modifications and variations within the scope of the issued claims.

Brief Description of Drawings

[0005] Fig. 1 illustrates selected details of an embodiment of a ring unit of a multi-mode ring scanner, showing a three-dimensional view of the top, the front, and the left side.

[0006] Figs. 2 to 7 illustrate selected details of an embodiment of a ring unit of a multi-mode ring scanner, showing differing views.

[0007] Fig. 8A illustrates selected details of an embodiment of a ring unit of a multi-mode ring scanner, showing a cross-sectional view of a vertical slice as seen from the front.

[0008] Fig. 8B illustrates selected details of an embodiment of a ring unit of a multi-mode ring scanner, showing an enlargement of a portion of Fig. 8A.

[0009] Figs. 9A and 9B illustrate selected details of an embodiment of a ring unit of a multi-mode ring scanner, showing a cut-away view from the top.

[0010] Fig. 10 illustrates selected details of an example of deployment of a multi-mode ring scanner, showing the multi-mode ring scanner worn by a user.

[0011] Figs. 11A and 11C illustrate selected details of other examples of deployments of a multi-mode ring scanner, showing from a top view selected details of embodiments of a stretch cable used to couple a ring unit and a wrist unit. Figs. 11B and 11D illustrate, respectively, selected details of the stretch cables of Figs. 11A and 11C from a side view.

[0012] Fig. 12 illustrates a system context of an illustrative embodiment of a wireless scanner with improved user feedback.

[0013] Fig. 13 is a flow diagram illustrating an embodiment of improved user feedback in a wireless scanner.

DETAILED DESCRIPTION

[0014] A detailed description of one or more embodiments of the invention is provided below along with accompanying figures that illustrate the principles of the invention. The invention is described in connection with the embodiments. It is well established that it is neither necessary, practical, or possible to exhaustively describe every embodiment of the invention. Thus the embodiments herein are understood to be merely illustrative, the invention is expressly not limited to or by any or all of the embodiments herein, and the invention encompasses numerous alternatives, modifications and equivalents. The existence of an embodiment in some way distinct from other embodiments may be described by such adjectives as “notable”, “particular”, “some”, or equivalents thereof. All such similar characterizations should be considered to be interchangeable, being variously used to avoid monotony in the exposition and should not be construed as limiting the invention in any way or that the embodiments so labeled should be treated any differently than the other embodiments, as every embodiment described herein can be so characterized. Wherever multiple embodiments serve to illustrate variations in process, method, and/or program instruction features, other implementations are contemplated that in accordance with a predetermined or a dynamically determined criterion perform static and/or dynamic selection of one of a plurality of modes of operation corresponding respectively to a plurality of the multiple embodiments. Numerous specific details are set forth in the following description to provide a thorough understanding of the invention. The details are provided as examples and the invention may be practiced according to the claims without some or all of the details. For clarity, technical material that is known in the technical fields related to the invention has not been described in detail so that the invention is not unnecessarily obscured.

INTRODUCTION

[0015] This introduction is included only to facilitate the more rapid understanding of the Detailed Description. The invention is not limited to the concepts presented in the introduction, as the paragraphs of any introduction are necessarily an abridged view of the entire subject and are not meant to be an exhaustive or restrictive description. For example, the introduction that follows provides overview information limited by space and organization to only certain embodiments. There are in fact many other embodiments, including those to which claims will ultimately be drawn, which are discussed throughout the balance of the specification.

[0016] Multiple types of scanners/readers are in use today, including optical scanners and RFID tag readers. Optical scanning devices have been implemented in a variety of form factors, including some wearable forms. Current optical scanners are generally single function and/or lack flexible ways of providing dynamic user input. Further, cordless (wireless) hand-held scanners promise users greatly improved convenience, flexibility, and efficiency over previous corded scanners. The scan engines within such hand-held scanners function quite reliably. The wireless links, in and of themselves, also are reliable and generally have robust error correction. Nevertheless, the overall path between the scan engine and the host processor (which receives the scan data) relies upon a number of more or less independent components and may use a variety of links, with varying degrees of reliability and error detection. Furthermore, the host processor may be busy or otherwise not available. Thus, a successful scan by the scan engine does not in itself assure a successful scan received by the host processor. If the user has grown accustomed to a corded scanner, user confidence (and thereby user acceptance) in using a cordless scanner may also be lacking simply due to unfamiliarity. Increased user confidence and acceptance for cordless hand-held scanners and increased system performance and reliability may be obtained through improved user feedback in accordance with the teachings herein. In an illustrative embodiment, the state of one or more indicators on the cordless scanner is changed as a result of feedback from a coupled host processor. This is in contrast to previous scanners where scan confirmation indicators were based simply on whether the scan engine alone performed a successful scan. Obtaining timely confirmation that the host processor has received the scan successfully (or not) leads to increased confidence in, and acceptance of, the cordless hand-held scanner and more adept use thereof.

[0017] A multi-mode ring scanner (MMRS) has a ring unit for wearing on a finger. The MMRS optionally has a wrist unit coupled to the ring unit, such as via a cable. The MMRS optionally communicates wirelessly with a computing device. The ring unit has one or more scanners (such as an optical scanner or an RFID tag reader). The ring unit optionally has two paddle switches for activation by inward pressure from fingers adjacent to the finger. The two switches enable specifying operation of the MMRS in a plurality of modes and optionally enable the MMRS to communicate a plurality of information codes to the computing device. The computing device is optionally enabled to assign a function to each combination of activation of the two switches. A scanning system including the MMRS optionally provides feedback to a user based on feedback from a host processor.

Acronyms

[0018] Elsewhere herein various shorthand abbreviations, or acronyms, are used. The descriptions of at least some of the acronyms follow.

Acronym	Description
ASCII	American Standard Code for Information Interchange
CCD	Charge Coupled Device
CTS	Clear To Send
ESE	Extended SSI Engine
LAN	Local Area Network
LED	Light Emitting Diode
MMRS	Multi-Mode Ring Scanner
PAN	Personal Area Network
PC	Personal Computer
PCB	Printed Circuit Board
PCI	Peripheral Component Interconnect
PDA	Personal Digital Assistant
RF	Radio Frequency
RFID	Radio Frequency IDentification
RTS	Request To Send
S2H	Scanner-to-Host
SD	Secure Digital
SSI	Simple Serial Interface
UFL	User Feedback Logic
USB	Universal Serial Bus
UWB	Ultra Wide Band
WAN	Wide Area Network
WLAN	Wireless Local Area Network
WM	Wireless Module
WPAN	Wireless Personal Area Network

EXAMPLE EMBODIMENTS

[0019] This introduction concludes with a collection of paragraphs that tersely summarize illustrative systems and methods in accordance with the concepts taught herein. Each of the paragraphs highlights various combinations of features. These compressed descriptions are not meant to be mutually exclusive, exhaustive, or restrictive, and the invention is not limited to these highlighted combinations. As is discussed in more detail in the Conclusion section, the invention encompasses all possible modifications and variations within the scope of the issued claims.

[0020] In some embodiments, an MMRS has a wrist unit and a ring unit coupled by a cable. In various embodiments, the cable is a flat cable, a ribbon cable, a coaxial cable, or a coiled cable or a bundle of wires, optionally enclosed in a sheath. In various embodiments, the cable is permanently fixed to the wrist unit and is detachable from the ring unit, or alternatively the cable is permanently fixed to the ring unit and is detachable from the wrist unit. In some embodiments, the cable is adapted to reduce slack between the wrist unit and the ring unit, such as via implementing the cable as a stretchable cable, a z-fold cable, a serpentine cable, or a coiled cable. In some embodiments, the cable is detachable from either or both of the wrist unit and the ring unit. In some embodiments, the ring unit is worn on a finger of a user. In some embodiments, the wrist unit is worn on a wrist (or forearm) of a user. In some embodiments, the wrist unit is adapted to be worn on a belt, or attached to a waist or another part of a body of a user.

[0021] In some embodiments, an MMRS has a wrist unit and a ring unit connected by a detachable cable. In other embodiments, an MMRS has a wrist unit and a ring unit coupled via wireless transceivers, such as Bluetooth transceivers. In some embodiments, the wrist unit has a communications mechanism for communicating with a network and/or a computing device. In various embodiments, the communications mechanism is one or more of a Bluetooth transceiver, an 802.11 wireless transceiver, a ZigBee transceiver, a UWB transceiver, a WLAN or WPAN transceiver, or an infrared transceiver.

[0022] In some embodiments, an MMRS has a ring unit, the ring unit having a communications mechanism for communicating with a network and/or a computing device. In various embodiments, the communications mechanism is one or more of a Bluetooth transceiver, an 802.11 wireless transceiver, or an infrared transceiver.

[0023] In various embodiments, a ring unit of an MMRS has one or more of an optical scanner, an RFID tag reader, a magnetic strip (e.g. credit card) reader, and a biometric reader/scanner (e.g. a fingerprint reader or a retina scanner). In some embodiments, an optical scanner is optimized to scan bar codes. In some embodiments, an optical scanner is enabled to scan printed text.

[0024] In some embodiments, an MMRS has a computing device enabled to communicate via a network, and adapted to communicate wirelessly with another unit of the MMRS, such as a wrist unit or a ring unit,. In various embodiments, the communication in a wireless fashion is via a radio communication protocol, such as 802.11 or Bluetooth. In some embodiments, the communication in a wireless fashion is via infrared signaling. In various embodiments, software running on the computing device is enabled to process input from other units of the MMRS. For example, in some embodiments, the computing device is enabled to process user input applied at a unit of the MMRS, such as manual operation of switches on a ring unit. In another example, in various embodiments, the computing device is enabled to process input gathered by a unit of the MMRS, such as a data stream of an optical scan performed by an optical scanner of a ring unit, or a tag value obtained by an RFID tag reader of a ring unit. In yet another example, in some embodiments, the computing device is enabled to provide information for improved user feedback (e.g. "scan information successfully entered into database") to the MMRS.

[0025] In some embodiments, an MMRS has one or more processors. In some embodiments, one of the one or more processors is included in a wrist unit of the MMRS. In some embodiments, one of the one or more processors is included in a ring unit of the MMRS. In various embodiments, a processor in a ring unit of an MMRS enables local control of scanning and/or reading devices, such as an optical scanner or an RFID tag reader. In some embodiments, local control of scanning and/or reading devices includes interpreting results of scanning and/or reading to produce processed results, and communicating the processed results to a computing device, such as a host PC. In various embodiments, a processor in a ring unit of an MMRS enables local processing of user input, such as operation of switches of the ring unit. In some embodiments, local processing of input of switches includes debouncing of the switches. In some embodiments, local processing of user input includes interpreting the user input, and communicating the user input to a computing device, such as a host server or PC.

[0026] In some embodiments, an MMRS has a plurality of user-operable switches. In various embodiments, one or more switches are on a wrist unit. In various embodiments, one or more switches are on a ring unit. In some embodiments, a pair of user-operable switches is provided on a ring unit, such as one on each side of the ring unit. In some embodiments, each switch of the pair of switches operates independently. In some embodiments, each switch of the pair of switches is separately enabled to signal an event, such as by closing (or opening) a contact, when pressure is applied to (or removed from) the respective switch.

[0027] In some embodiments, a pair of user-operable switches is provided, one on each side of a ring unit, the pair arranged so that each of the user-operable switches is activated by pressure, such as squeezing, from fingers adjacent to a finger the ring unit is worn on. For example, in some usage scenarios where the ring unit is on a right index finger, a left user-operable switch is activated by pressure of an adjacent thumb, and a right user-operable switch is activated by pressure of an adjacent middle finger. In some usage scenarios, providing a pair of user-operable switches enables the ring unit to be used equally by both left-handed and right-handed users, without a need to physically alter, modify, or reconfigure the ring unit.

[0028] In some embodiments, a ring unit of an MMRS has a pair of user-operable switches, one on each side of the ring unit, and arranged so that the user-operable switches are activated by pressure, such as squeezing, from fingers adjacent to a finger the ring unit is worn on. In some embodiments, the ring unit is a single piece assembly with no ability for a user to mechanically re-arrange or re-configure a physical form factor of the ring unit. For example, because the switches are arranged symmetrically, one on each side of the ring unit, the ring unit is enabled for left- or right-handed use without mechanical rearrangement, reconfiguration, or alteration.

[0029] In some embodiments, a ring unit of an MMRS has a pair of user-operable switches, one on each side of the ring unit, with the switches formed as paddles. Each paddle acts as one side of a respective L-shaped rocker bar mechanism, with the respective paddle having a respective nominal (sans pressure) position, wherein pressure on the respective paddle pivots the respective rocker bar around a central point. The pivoting causes another side of the respective rocker bar to contact and to depress a respective membrane switch mounted on a flexible PCB, and further causes the respective membrane switch to register a respective transition. In some embodiments, releasing pressure on one of the paddles causes the respective membrane switch to return to a non-depressed state. The return of the respective membrane switch exerts a restorative force on the respective L-shaped rocker bar that returns the one of the paddles to the respective nominal position. In some embodiments, the paddle is affixed to the L-shaped rocker bar mechanism. In other embodiments, the paddle forms one side of the L-shaped rocker bar mechanism.

[0030] In some embodiments, a ring unit of an MMRS has a pair of user-operable switches, and the switches specify a two-bit, binary code. Each bit of the code is determined from an on-off (active/inactive) state of a respective one of the pair of switches. The code specifies up to four distinct operating modes of the ring unit. For example, if neither switch is depressed, a first mode is indicated; if only a left switch is depressed, a second mode is indicated; if only a right switch is depressed, a third mode is indicated; and if both switches are depressed, a fourth mode is indicated. In some usage scenarios, the modes correspond to operating modes of the ring unit, such as off (no scanning/reading active), optical scan active, RFID tag read active, and both optical scan and RFID tag read active. In some embodiments, information about mode selection is communicated from the MMRS to a computing device via a wireless communications mechanism. For example, in some usage scenarios, the modes correspond to ways of using information obtained via the ring unit, such as off (no scanning active), scan/read to verify inventory, scan/read to add inventory, and scan/read to delete inventory. For another example, in some usage scenarios, the modes correspond to operation in a scanning system with optional improved user feedback (via interaction with a host processor), such as scan with improved user feedback and scan without improved user feedback.

[0031] In some embodiments, a ring unit of an MMRS has a pair of user-operable switches, and the switches specify a plurality of codes. In some usage scenarios, depending upon a sequence and a simultaneity of depressing the switches, different codes are signaled. For example: if neither switch is depressed, a first code is indicated; if only a left switch is depressed, a second code is indicated; if only a right switch is depressed, a third code is indicated; if both switches are simultaneously depressed, a fourth code is indicated; if the right switch is depressed followed by the left switch, a fifth code is indicated; and if the left switch is depressed followed by the right switch, a sixth code is indicated. In various embodiments, other ways of using the switches, such as tapping the switches, or holding the switches for long or for short durations, or other combinations and sequences, specify different codes.

[0032] In some embodiments, a code specified by the user-operable switches is used, at least in part, to determine an operating mode of the MMRS. In some embodiments, a code specified by the user-operable switches is communicated wirelessly to a computing device, such as a host PC, for further processing and/or interpretation.

[0033] In some embodiments, at least some of the codes are directly processed by control circuitry in the ring unit. In some embodiments, at least some of the codes are communicated from the ring unit to a wrist unit and are processed at the wrist unit. In some embodiments, at least some of the codes are communicated from the MMRS to a computing device via a wireless communications mechanism, and are processed at the computing device. In some embodiments, where or how a code is processed is dependent on a value of the code. For example, if the code is a first value, then the code is directly processed by control circuitry in the ring unit. If the code is a second value, then the code is communicated from the ring unit to a wrist unit and processed at the wrist unit. If the code is a third value, then the code is communicated from the MMRS to a computing device via a wireless communications mechanism, and processed at the computing device.

[0034] In various embodiments, functions are associated with at least some of the codes, and the associations between the functions and the at least some of the codes are changeable by a computing device coupled to the MMRS via a wireless communications mechanism. For example, initially a first function is performed when a left switch is depressed, and a second function is performed when a right switch is depressed. Upon application of a change by a computing device coupled to the MMRS via a wireless communications mechanism, the second function is performed when the left switch is depressed, and the first function is performed when the right switch is depressed. In some embodiments, the computing device assigns, reassigns, or modifies one or more functions associated with or specified by the switches based on user input at the computing device (e.g. via a keyboard, mouse, or other user interface mechanism). In some embodiments, the computing device changes which of one or more functions are performed when the switches are activated, and the changes are based on the codes communicated by the scanner to the computing device. In some embodiments, the changes are dynamically made during otherwise normal operation. In some embodiments, the changes are restricted to occur only during operation in one or more configuration contexts.

[0035] In some embodiments, an MMRS has a user-output mechanism. In various embodiments, all or any portion of the user-output mechanism is on a ring unit, a wrist unit, or both. In various embodiments, the user-output mechanism is a display unit adapted for wearing, such as in the form of a pair of glasses. In various embodiments, the user-output mechanism has any combination of one or more LEDs or lights, a speaker (e.g. for generating audio output), an LCD display, and a projection display. In some usage scenarios, the user-output mechanism signals information to a user of the MMRS in response to operation of the MMRS. For example, in some embodiments, a current operating mode (or change thereof) of the MMRS is signaled via the user-output mechanism. In some embodiments, a successful scan is signaled via the user-output mechanism. In some embodiments, a computing device coupled to the MMRS via a wireless communications mechanism is enabled, at least in part, to signal via the user-output mechanism.

[0036] In some embodiments, one or more interactions between the user, the scanner, and a computing device, are managed via a scanning system that includes an MMRS embodied, for example, as a cordless scanner device, according to any of the foregoing embodiments. A first embodiment of a cordless scanner device for use in conjunction with at least one wireless enabled host processor, the first embodiment including: a scan engine, a wireless interface for coupling the scan engine to the wireless enabled host processor; at least one scan status indicator; user feedback logic coupled to the wireless interface and the at least one scan status indicator; a housing at least partially containing the scan engine, the wireless interface, the at least one scan state indicator, and the user feedback logic; and wherein the user feedback logic selectively changes the state of the at least one scan status indicator based upon scan confirmation status sent by the host processor. The preceding embodiment, wherein the scan confirmation status indicates whether or not the host processor successfully received scan data from the scan engine.

[0037] A second embodiment, including all of the aspects of the first embodiment, wherein the scan confirmation status is sent embedded in a command stream sent from the host processor to the scan engine. The second embodiment, wherein the scan confirmation status is sent as an extended SSI command. The second embodiment, wherein the user feedback logic captures the embedded scan confirmation status and implements the change in the at least one scan status indicator in accordance with the captured scan confirmation status. The preceding embodiment, wherein the at least one scan status indicator includes a green light. The preceding embodiment, wherein the green light does not illuminate until the host processor indicates that it has successfully received a scan. The preceding embodiment, wherein the green light is implemented using LED technology.

[0038] A third embodiment, including all of the aspects of either the first or the second embodiments, wherein the scan engine uses optics based scanning. The third embodiment, wherein the scan engine is for scanning bar codes. The third embodiment, wherein the scan engine includes a laser scanner. The third embodiment, wherein the scan engine includes a 1D CCD array. The third embodiment, wherein the scan engine includes a 2D CCD imager.

[0039] A fourth embodiment, including all of the aspects of either the first or the second embodiments, wherein the scan engine uses RF based scanning. The fourth embodiment, wherein the scan engine is for scanning RFID tags. The fourth embodiment, wherein the scan engine uses inductive coupling techniques. The fourth embodiment, wherein the scan engine uses perturbated reflected RF energy techniques. The fourth embodiment, wherein the scan engine uses microwave backscatter techniques. The fourth embodiment, wherein the scan engine is enabled to read a magnetic stripe. The foregoing embodiment, wherein the magnetic stripe is part of a credit card.

[0040] A fifth embodiment, including all of the aspects of any of the first through the fourth embodiments, wherein the wireless interface of the wireless scanner is compatible with an industry standard for personal area wireless networking. The forgoing embodiment wherein the industry standard is compatible with the Bluetooth standard. A sixth embodiment, including all of the aspects of any of the first through the fourth embodiments, wherein the wireless interface of the wireless scanner is compatible with an industry standard for local area wireless networking. The forgoing embodiment wherein the industry standard is compatible with the WiFi standard. A seventh embodiment, including all of the aspects of any of the first through the fourth embodiments, wherein the wireless interface of the wireless scanner is infrared.

[0041] An eighth embodiment, including all of the aspects of the first embodiment, wherein the scan status indicators transition between states that include: standby for host confirmation and good scan at host. The preceding embodiment, wherein the states further include: waiting on user, and bad scan at host.

[0042] A ninth embodiment, including all of the aspects of the first embodiment, wherein the scan engine performs a scan only when the wireless link between the scan engine and the host processor is working.

MULTI-MODE RING SCANNER

[0043] Fig. 1 illustrates selected details of an embodiment of a ring unit of an MMRS, showing a three-dimensional view of the top, the front, and the left side. Fig. 1 illustrates ring unit **110**. In some embodiments, ring unit **110** includes a coupling for cable **122**, enabling ring unit **110** to couple with a wrist unit, such as wrist unit **130**, as shown in Fig. 10. In other embodiments, ring unit **110** operates without cable **122** and connects wirelessly to a wrist unit, or connects wirelessly directly to a network and/or to a computing device. The wireless connectivity is provided, for example, via inclusion of one or more of a Bluetooth transceiver, an 802.11 wireless transceiver, a ZigBee transceiver, a UWB transceiver, a WLAN or WPAN transceiver, or an infrared transceiver.

[0044] Figs. 2 to 7 illustrate selected details of an embodiment of a ring unit of an MMRS, showing differing views. Figs. 2 and 6 are side views. Fig. 3 is a back view. Fig. 4 is a top view. Fig. 5 is a front view. Fig. 7 is a bottom view.

[0045] Figs. 3 and 5 also illustrate strap **190**. Strap **190** provides a way to secure ring unit **110** to a finger of a user, such as user **199**, as shown in Fig. 10. In some embodiments, strap **190** is an adjustable strap. In some embodiments, strap **190** is fabric hook-and-loop fastener (such as a Velcro strap).

EXAMPLE OF DEPLOYMENTS

[0046] Fig. 10 illustrates selected details of an example of deployment of an MMRS, showing the MMRS worn by a user. In some embodiments, ring unit **110** and wrist unit **130** are coupled via cable **122**. As shown in the example of Fig. 10, both ring unit **110** and wrist unit **130** are deployed on a finger and on a wrist, respectively, of user **199**. In some embodiments, not shown in Fig. 10, functionality of the wrist unit is subsumed into the ring unit, and the wrist unit and the cable are not present.

[0047] In some embodiments, cable **122** is a stretchable cable. The stretchable cable is adapted to permit a full range of movement of the hand and wrist. At the same time, the stretchable cable is adapted to minimize or eliminate the “loop” (the gap between the hand and the cable) that would otherwise be formed with a non-stretchable cable, by reducing excess cable length when the hand and wrist are in some configurations. In various usage scenarios, minimizing or eliminating the loop (or reducing the slack in the cable) improves visual appeal, reduces chances of catching the loop on (or by) adjacent objects, or both. In various embodiments, the stretch cable is a flat, a ribbon cable, or a coiled cable. The stretch cable length is such that a slight tension is maintained between the wrist unit and the ring unit when the wrist unit and the ring unit are in closest proximity to each other during use.

[0048] Fig. 11A illustrates selected details of another example of deployment of an MMRS, showing from a top view the use of a stretch ribbon cable to couple ring unit **110** and wrist unit **130**. As shown, the stretch cable has an outer stretch harness **122H** holding an inner cable **122C**. In various embodiments, the inner cable **122C** is arranged in a serpentine, z-fold (illustrated), or other configuration. In some embodiments, the inner cable is captured between two layers of stretch material (such as elastic fabric). In various embodiments, the layers are held together by glue, epoxy, stitching, or other fastening. Fig. 11B illustrates selected details of stretch ribbon cable **122C** of Fig. 11A from a side view. The stretch ribbon cable includes plug **122P-1** for mating with wrist unit **130** and plug **122P-2** for mating with ring unit **110**. The inner cable **122C** is held between a top stretch layer **122T** and a bottom stretch layer **122B**. Fig. 11C illustrates selected details of another example of deployment of an MMRS, showing from a top view the use of a stretch coiled cable **122D** coupling ring unit **110** and wrist unit **130**. Fig. 11D illustrates selected details of stretch coiled cable **122D** of Fig. 11C from a side view. The stretch coiled cable includes plug **122P-3** for mating with wrist unit **130** and plug **122P-4** for mating with ring unit **110**.

MULTIPLE INPUT DEVICES

[0049] Figs. 8A illustrates selected details of an embodiment of a ring unit of an MMRS, showing a cross-sectional view of a vertical slice as seen from the front. Ring unit **110**, as shown in Fig. 8A, has circuitry **850** and flexible PCB **840** enclosed by outer casing **833**. In some embodiments, flexible PCB **840** is wrapped around shelf **842**, providing mechanical support for both a top portion and a bottom portion of the flexible PCB. Circuitry **850** includes, in various embodiments, scanning and/or reading devices (such as optical scanners, RFID tag readers, magnetic strip readers, and biometric readers/scanners). In some embodiments, circuitry **850** has one or more communications mechanisms, such as an interface to cable **122** or a Bluetooth transceiver. In some embodiments, circuitry **850** further has control circuitry, such as a local processor. In some embodiments, the local processor has associated memories, such as flash memory and/or static random access memory. In some embodiments, a portion of circuitry **850** is mounted on flexible PCB **840**. In some embodiments, a portion of circuitry **850** is mounted on shelf **842**.

[0050] Ring unit **110** further has rocker arms **810** and **811**. The rocker arms are designed so that inward pressure (towards a central axis of the ring unit), applied by a wearer of the ring unit, causes the rocker arms to pivot and an end of the rocker arms to contact a switch on flexible PCB **840**. This is shown in more detail in Fig. 8B.

[0051] Figs. 8B illustrates selected details of an embodiment of a ring unit of an MMRS, showing an enlargement of a portion of Fig. 8A. Fig. 8B illustrates rocker arm **810**, showing how the rocker arm is enabled to activate a switch. Rocker arm **810** has a nominal position (when no inward pressure is applied to the rocker arm). Inward pressure on paddle end **814** pivots the rocker arm around pivot point **818**, causing switch end **816** to elevate and to depress switch **820** mounted on flexible PCB **840**. In some embodiments, switch **820** is a membrane switch. In some embodiments, removal of pressure on paddle end **814** causes membrane switch **820** to exert pressure on switch end **816**, returning rocker arm **810** to the nominal (no inward pressure) position. In some embodiments, flexible PCB **840** is wrapped around shelf **842**, providing mechanical support for both a top portion and a bottom portion of the flexible PCB, the bottom portion having switch **820**.

ATTACHMENT OF INPUT DEVICES

[0052] Figs. 9A and 9B illustrate selected details of an embodiment of a ring unit of an MMRS, showing a cut-away view from the top. In Figs. 9A and 9B, the upper portion of the ring unit (circuitry **850**, flexible PCB **840**, shelf **842**, and outer casing **833** as shown in Fig. 8A) are not illustrated to show a view of rocker arms **810** and **811**, and a manner of attachment and operation.

[0053] As illustrated by Figs. 9A and 9B, rocker arms **810** and **811** have a paddle end, such as paddle end **814** of rocker arm **810**, and a switch end, such as switch end **816** of rocker arm **810**. The rocker arms have one or more pivot points, such as pivot point **818** of rocker arm **810**, enabling the rocker arm to rotate so that in response to inward pressure on the paddle end, the switch end elevates, causing the switch end to contact a switch, such as a membrane switch, on a flexible PCB (not shown in Figs. 9A and 9B).

[0054] As shown in Figs. 9A and 9B, rocker arms **810** and **811** are independent, and operate freely and without interfering with each other. This permits user operation of the paddles, and thereby the switches they depress, to occur in a wide range of combinations and sequences.

MULTI-MODE OPERATION

[0055] One or more processors included in a wrist unit, a ring unit, or both of an MMRS, enable local processing functions, such as local control of scanning and/or reading devices, interpretation and implementation of actions relating to switches of the ring unit, and communication of information between the units of the MMRS or between a host server or PC. Activations (and deactivations) of the switches are optionally processed to change an operating mode (from among a plurality of operating modes) of the MMRS, to signal an event, or to specify a code to communicate to the host.

[0056] For example, an embodiment of an MMRS includes a pair of switches, and a first mode is entered when a first one of the two switches is activated, a second mode is entered when a second one of the two switches is activated, a third mode is entered when both of the two switches are activated, and a fourth mode is entered when neither of the two switches are activated. Exemplary modes include no scanning/reading active, optical scan active, RFID tag read active, and both optical scan and RFID tag read active. Further exemplary modes relate to ways of using information from the MMRS, such as off (no scanning active), scan/read to verify inventory, scan/read to add inventory, and scan/read to delete inventory. The modes relating to ways of using the information are optionally communicated to the host. Further exemplary modes correspond to operation with and without improved user feedback (such as from the host). For another example, any of four distinct events or codes is signaled by activation/deactivation of the pair of switches (first on and second off, first off and second on, first and second on, and both off).

[0057] The processing of the activations (and the deactivations) is, in various embodiments, performed on any combination of the processors included in the MMRS and the processing resources of the host. In some embodiments, processing relating to various activations/deactivations is performed selectively dependent on the particular activation/deactivation. As an example, activation of a first switch specifies turning on a scanner of the ring unit, and activation of a second switch specifies toggling between inventory add and inventory deletion operation. Activation of the first switch is processed by the processors included in the MMRS and activation of the second switch is processed by the processing resources of the host.

[0058] Operation of the MMRS is alterable, in some embodiments, by the host. For example, initially, first and second modes are entered, respectively, when respective ones of the switches are pressed. Subsequently, the host directs the MMRS to operate such that third and fourth modes are entered, respectively, when respective ones of the switches are pressed.

[0059] Modes, events, and/or codes are specified, in various embodiments, according to “static” and “dynamic” activation/deactivation of the switches of the MMRS. An example of static activation (deactivation) is turning a switch on (or leaving a switch off) for a relatively long period of time. Examples of dynamic activation (deactivation) are tapping a single switch, or tapping different switches in sequence.

WIRELESS SCANNER SYSTEM

[0060] Fig. 12 shows an illustrative embodiment of a wireless scanner **1100** with improved user feedback in the context of system **1000**. In system **1000**, scan target **1101** is scanned by scanner **1100** via scan process **1110**. Scan process **1110** may take a variety of forms, such as passive and active optical and RF techniques for scanning printed codes and RFID tags.

[0061] Scanner **1100** includes scan engine **1150** (including scan transducer **1151** and audible indicator **1152**) coupled via **1120** to Scanner-to-Host (S2H) interface module **1160**, control **1161**, visual indicator group **1164** (including amber light **1162** and green light **1163**). According to various embodiments, visual scan indicator group **1164** includes one or more lights (such as a green LED of an MMRS). Scanner-to-Host (S2H) interface module **1160** includes wireless module (WM) **1165**, User Feedback Logic (UFL) **1166** and Extended SSI Engine (ESE) **1167**. In an illustrative embodiment, coupling **1120** is logically compatible with an RS-232 link. According to various embodiments, all or any portions of scanner **1100** are included in any combination of a wrist unit, a cable, and a ring unit (such as wrist unit **130**, cable **122**, and ring unit **110** of Fig. 10).

[0062] Scanner **1100** communicates scan data to host **1200** via wireless connection **1130**. Wireless connection **1130** may take a variety of forms, such as PAN technology (e.g., Bluetooth or ZigBee), LAN technology (e.g., WiFi), or optical technology (e.g., infrared). In illustrative embodiments, for some applications where host **1200** is a PDA, tablet PC, or phone (e.g. mobile or cell), Bluetooth class 2 is used, having a range of roughly 10 meters. For some applications where host **1200** is a desktop, Bluetooth class 1 is used, having a range of roughly 100 meters.

[0063] Host **1200** may take a variety of forms, such as point-of-sale terminals; desktop, laptop, and tablet PCs; PDAs; and mobile/cell phones. Host **1200** includes host processor **1210** coupled via link **1215** to wireless module **1220** and optionally via interconnect **1225** to optional LAN/WAN interface **1230**. In an illustrative embodiment, link **1215** is connected to a standard com (serial communications) port of the host processor. Host **1200** includes an operating system (such as Symbian, Palm, Microsoft, Linux, or embedded variations of the foregoing, depending on the platform) and device drivers for scanner **1100**.

[0064] Link **1215** is, in various embodiments, compatible with USB, PCI, SD, and ExpressCard bus signaling and/or protocols. Link **1215** uses, in various embodiments, a protocol that is compatible with transport provided by link **1130**. For example, in some embodiments where the host is a PDA or phone, link **1215** uses a protocol compatible with the industry standard H4 serial protocol to communicate the SSI data between the host processor and the scanner. For another example, in some embodiments where the host is a desktop, laptop, or tablet PC, a protocol compatible with the industry standard USB protocol is used.

[0065] Host **1200** optionally communicates over network LAN/WAN **1300** to client/server **1400** (via host-to-network link **1250** and client/server-to-network link **1350**). LAN/WAN **1300** may take a variety of forms such as a LAN, a larger departmental network, an intranet, and the Internet. Links **1250** and **1350** may take a variety of forms such as Ethernet, WiFi, RS-232, dial-up modem, and mobile/cell phone technologies. Wireless links employ antennas, perhaps embedded within their associated devices, perhaps at least partially external, none of which are explicitly shown, but are understood to be present to those of ordinary skill in the art.

[0066] Client/server **1400** generally has an associated database **1500** that may be queried or updated in response to the scan of scan target **1101**. Alternatively, such a database may in whole or in part reside on host **1200** and be queried or updated locally, and the LAN/WAN connection may be established periodically to synchronize the local and remote copies of the database.

[0067] The scan data is transferred over the links using various degrees of encoding and encapsulation. Scan engine **1150** communicates using the industry SSI protocol, that encapsulates ASCII data corresponding to scanned code. Example off-the-shelf SSI modules suitable for use as scan engine **1150** are the SE4400, 923, 824, and Positron modules, all by Symbol Technologies. Other modules are suitable for use as the scan engine, such as the Intermec EA15. In some embodiments, ESE **1167** and host processor **1210** communicate using an extension of the SSI protocol, described below. The extended SSI protocol is bridged onto wireless link **1130**. The device drivers within host **1200** (for use with scanner **1100),** and the firmware within ESE **1167**, are enabled to use the extended SSI protocol.

[0068] In an illustrative embodiment, data received by ESE **1167** from host processor **1210** over wireless link **1130** is generally resent over RS-232 link **1120** as a command to scan engine **1150** using an RTS/CTS control handshake. Data received by ESE **1167** from scan engine **1150** over RS-232 link **1120** is generally resent to host processor **1210** using the flow control protocol of wireless link **1130**.

[0069] To enable host processor **1210** to send messages to scanner **1100** over wireless link **1130**, a current SSI command from the "HOST" to the scan engine has been lengthened. In an illustrative embodiment, the command selected is the SSI command CMD_NAK, which has the Opcode 0xD1 and a minimum length of 6 bytes.

[0070] As illustrated in the following table, an SSI Sub Command of CMD_NAK is defined with a payload that includes an indication that the host processor did (ACK), or did not (FAIL), receive a good scan. How these indications are used is detailed in conjunction with examination of Fig. 13, discussed next. Other embodiments use other techniques for extending the SSI command set, or use a custom command set, to equivalently provide the scanner with the host scan confirmation.

Table 1. Host Scan Confirmation Status (Extended SSI Command)			
Field Name	**Format**	**Size**	**Description**
Length	0x07	1 Byte	Length of packet (excludes CS)
Opcode	0xD1	1 Byte	SSI Opcode (always 0xD1)
Message Source	0x04 (Host)	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Sub Command	0x0008	2 Bytes	Host Scan Confirmation Status
Payload		1 Byte	Scan Confirmation Status: 0x00 = bad scan (FAIL) 0x01 = scan received OK (ACK)
Checksum		2 Bytes	Checksum of message.

WIRELESS SCANNER USER FEEDBACK

[0071] Fig. 13 is a flow diagram conceptually illustrating improved user feedback in a wireless scanner. Multiple embodiments are illustrated by the figure, corresponding to dashed paths **2010** and **2020**.

[0072] Flow begins conceptually at operation **500**, corresponding to waiting for a new scan to be user initiated. Button-event, operation **501**, corresponds to the user initiating a scan by pressing scan button **1161**. The button-event is then noted by User-Feedback Logic (UFL) **1166** in operation **502**. According to various embodiments, scan button **1161** corresponds to either of two switches, such as activated by rocker arms **810** or **811** of Fig. 8A, e.g. by squeezing or pressing respective paddles. In various embodiments, an activation of scan button **1161** corresponds to specification of one or more of a plurality of codes via operation of the paddles or a sequence of operations of the paddles. In one example, activation of the scan button corresponds to squeezing a left (or right) paddle that depresses a left (or right) switch. In another example, activation of the scan button corresponds to squeezing the left paddle followed by squeezing the right paddle, thus depressing the left switch followed by depressing the right switch.

[0073] From operation **502**, flow continues down one of path **2010** or **2020**. In a first embodiment, corresponding to path **2020**, host processor **1210** receives notice of the button-event from UFL **1166** in operation **503**. UFL **1166** subsequently receives a scan initiation command from host processor **1210** in operation **504**. In a second embodiment, flow follows path **2010**, bypassing operations **503** and **504** (these operations are not implemented if path **2010** is followed). In both embodiments, flow continues to operation **505**.

[0074] Scan engine **1150** receives the scan initiation command from UFL **1166** in operation **505**, and initiates a scan. The scan engine returns scan data and status to UFL **1166** in operation **506A.**

[0075] Whether to use path **2010** or **2020** is an implementation dependent choice. In some usage scenarios, path **2020** is preferable if the additional operations do not introduce a significant delay in initiating the scan. When flow includes path **2020**, UFL **1166** will not proceed to operation **505** until it receives a scan command from host processor **1210**. If the scan command is not received within a timeout interval, the flow returns to operation **500**, without the scan engine being activated. This abnormal timeout path is not explicitly illustrated in Fig. 13. In some usage scenarios, not activating the scan engine when the wireless link is down is a benefit of using the embodiment of path **2020**. Activating the scan engine (which generates scanning behavior that the user generally perceives) when the wireless link is down may confuse the user.

[0076] Reduced path delay frequently is in tension with reduced power consumption. E.g., if a Bluetooth wireless link is used for link **1130**, the sleep configuration of the Bluetooth radios adjusts how often the radios are enabled within their allocated time slots, which directly impacts both battery life and latency. If the overall path latency prior to initiating the scan is too much, and reducing the latency by increasing power consumption is not an option, then in some usage scenarios, path **2010** is used.

[0077] The state of visual indicators **1164** is changed to "standby" (amber light **1162** is lit) in operation **506B**, corresponding to the first opportunity that UFL **1166** has to receive scan data from the scanner. The standby indication gives visual feedback that the scan action has been completed locally and that the scanner is waiting for host confirmation (i.e. host confirmation is pending). The location of the operation setting the pending indication is not critical, although the exact definition of the standby indication necessarily may change as a result of its placement in the control flow.

[0078] In operation **507**, UFL **1166** forwards the scan data and status to host processor **1210**. Once host processor **1210** has determined that the scan was successful, the host processor communicates success state back to UFL **1166** (via the ACK), in operation **508**. If host processor **1210** determines that the scan was not successful (based on the scan status, invalid data, or an elapsed time-out interval), then host processor **1210** optionally communicates failure state back to UFL **1166** (via the FAIL).

[0079] In operation **509**, the state of visual indicators **1164** is updated as function of the host feedback. In the event of success, UFL **1166** changes the pending indication to a successful completion indication (amber light **1162** is extinguished and green light **1163** is lit). In the event of failure (either due to an explicit FAIL from the host, or due to a timeout without ACK), UFL **1166** changes the pending indication to a failure indication (e.g., by extinguishing amber light **1162** and keeping green light **1163** dark, flashing amber light **1162**, or by an additional red light indicator, not explicitly shown). Optionally in operation **509**, UFL **1166** also sends a command to scan engine **1150** to sound audible indicator **1152** to provide positive or negative audible feedback (e.g., a short pleasant tone for a successful scan, a long discordant buzz for a failed scan). After operation **509**, the process conceptually returns to operation **500**, corresponding to waiting for a new scan to be user initiated.

[0080] Thus UFL **1166** indicates transitions among four states via corresponding transitions of the lights and tones. The states (and associated example visual and audible indications) are Waiting on User (no lights), Standby for Host Confirmation (amber light), Good Scan at Host (green light, positive tone), and Bad Scan at Host (red light, negative tone).

CONCLUSION

[0081] Although the foregoing embodiments have been described in some detail for purposes of clarity of understanding, the invention is not limited to the details provided. There are many ways of implementing the invention. The disclosed embodiments are illustrative and not restrictive.

[0082] It will be understood that many variations in construction, arrangement and use are possible consistent with the teachings and within the scope of the claims of the issued patent. For example, interconnect and function-unit bit-widths, clock speeds, and the type of technology used may generally be varied in each component block. The names given to interconnect and logic are merely illustrative, and should not be construed as limiting the concepts taught. The order and arrangement of flowchart and flow diagram process, action, and function elements may generally be varied. Also, unless specifically stated to the contrary, the value ranges specified, the maximum and minimum values used, or other particular specifications (such as a type, a size, a configuration, or a pinout of a connector; a type or a size of a cable; a form factor or physical dimensions of a card; types of radio circuitry or frequencies of radio transmission or reception; a type of processor or a nature of control circuitry; a manner of wearing or attaching a ring unit to a finger; a manner of wearing or attaching a wrist unit; and the number of entries or stages in registers and buffers), are merely those of the illustrative embodiments, may be expected to track improvements and changes in implementation technology, and should not be construed as limitations.

[0083] Functionally equivalent techniques known to those of ordinary skill in the art may be employed instead of those illustrated to implement various components, sub-systems, functions, operations, routines, and sub-routines. It is also understood that many design functional aspects may be carried out in either hardware (i.e., generally dedicated circuitry) or software (i.e., via some manner of programmed controller or processor), as a function of implementation dependent design constraints and the technology trends of faster processing (which facilitates migration of functions previously in hardware into software) and higher integration density (which facilitates migration of functions previously in software into hardware). Specific variations may include, but are not limited to: differences in partitioning; different form factors and configurations; use of different operating systems and other system software; use of different interface standards, network protocols, or communication links; and other variations to be expected when implementing the concepts taught herein in accordance with the unique engineering and business constraints of a particular application.

[0084] The embodiments have been illustrated with detail and environmental context well beyond that required for a minimal implementation of many of aspects of the concepts taught. Those of ordinary skill in the art will recognize that variations may omit disclosed components or features without altering the basic cooperation among the remaining elements. It is thus understood that much of the details disclosed are not required to implement various aspects of the concepts taught. To the extent that the remaining elements are distinguishable from the prior art, components and features that may be so omitted are not limiting on the concepts taught herein.

[0085] All such variations in design comprise insubstantial changes over the teachings conveyed by the illustrative embodiments. It is also understood that the concepts taught herein have broad applicability to other computing and networking applications, and are not limited to the particular application or industry of the illustrated embodiments. The invention is thus to be construed as including all possible modifications and variations encompassed within the scope of the claims of the issued patent.

WHAT IS CLAIMED IS:

1. A multi-mode ring scanner comprising:
a ring unit comprising at least two respective switches that are settable in a plurality of states at least in part via respective digits of a hand;
means for determining the respective states of the respective switches; and
means for determining, based at least in part on the respective states of the respective switches, a selected one of a plurality of modes to operate the multi-mode ring scanner in.

2. The multi-mode ring scanner of claim 1, further comprising means for optically scanning when the selected mode is an optical scanning mode, and means for reading a Radio Frequency IDentification (RFID) tag when the selected mode is a read RFID tag mode.

3. The multi-mode ring scanner of claim 1, further comprising means for configuring the multi-mode ring scanner to perform optical scans when the selected mode transitions to an optical scanning mode.

4. The multi-mode ring scanner of claim 1, further comprising means for configuring the multi-mode ring scanner to perform Radio Frequency IDentification (RFID) tag reads when the selected mode transitions to a read RFID tag mode.

5. The multi-mode ring scanner of claim 1, further comprising means for receiving an assignment of functions from a host computer, the assignment specifying at least first and second functions, respectively, to the respective switches.

6. The multi-mode ring scanner of claim 5, wherein the first function is to activate an optical scanner of the ring unit, and the second function is to activate a Radio Frequency IDentification (RFID) tag reader of the ring unit.

7. A multi-mode ring scanning device comprising:
a ring unit comprising
at least two independent switches each settable in a plurality of states at least in part via respective digits of a hand, and
processing circuitry;
wherein the ring unit is enabled to operate in a selected one of a plurality of modes and adapted to be worn on at least one digit of the hand; and
wherein the processing circuitry is enabled to determine the selected mode based at least in part on the states of the switches.

8. The multi-mode ring scanning device of claim 7, wherein one of the respective digits is a thumb of the hand and another one of the respective digits is a finger of the hand.

9. The multi-mode ring scanning device of claim 7, wherein a first one of the states corresponds to a contact of one of the switches being closed, and a second one of the states corresponds to the contact being open.

10. The multi-mode ring scanning device of claim 7, wherein the processing circuitry is further enabled to determine the selected mode based at least in part on previous values of the states of the switches.

11. The multi-mode ring scanning device of claim 7, wherein a first one of the modes specifies the operating of the ring unit to be actively scanning, and a second one of the modes specifies the operating of the ring unit to be not scanning.

12. The multi-mode ring scanning device of claim 7, wherein the ring unit comprises one or more of an optical scanner and a Radio Frequency IDentification (RFID) tag reader.

13. The multi-mode ring scanning device of claim 7, wherein the ring unit is further enabled to receive an assignment of functions from a host computer, the assignment specifying at least first and second functions, respectively, to the two switches.

14. The multi-mode ring scanning device of claim 13, w herein the first function is to activate an optical scanner of the ring unit, and the second function is to activate a Radio Frequency IDentification (RFID) tag reader of the ring unit.

15. The multi-mode ring scanning device of claim 7, further comprising a wrist unit coupled to the ring unit and enabled to operate in accordance with the modes.

16. The multi-mode ring scanning device of claim 7, wherein the processing circuitry is first processing circuitry and further comprising a wrist unit coupled to the ring unit and comprising second processing circuitry, and wherein the first processing circuitry is further enabled to determine the selected mode based at least in part on information determined by the second processing circuitry based at least in part on the states of the switches.

17. The multi-mode ring scanning device of claim 16, wherein the coupling is via a stretchable cable connecting the units and configured to reduce slack of the cable.

18. The multi-mode ring scanning device of claim 16, wherein the coupling is via a wireless connection.

19. The multi-mode ring scanning device of claim 7, wherein the processing circuitry comprises a programmable processor.

20. A method comprising:

determining respective states of respective switches that are settable in a plurality of states at least in part via respective digits of a hand;

determining, based at least in part on the respective states of the switches, a selected one of a plurality of modes to operate a multi-mode ring scanner in;

wherein the multi-mode ring scanner comprises a ring unit comprising the switches and adapted to be worn on at least one digit of the hand; and

wherein the ring unit further comprises processing circuitry that is enabled to perform the determining of the selected mode.

21. The method of claim 20, further comprising, via the multi-mode ring scanner, optically scanning when the selected mode is an optical scanning mode, and reading a Radio Frequency IDentification (RFID) tag when the selected mode is a read RFID tag mode.

22. The method of claim 20, further comprising configuring the multi-mode ring scanner to perform optical scans when the selected mode transitions to an optical scanning mode.

23. The method of claim 20, further comprising configuring the multi-mode ring scanner to perform Radio Frequency IDentification (RFID) tag reads when the selected mode transitions to a read RFID tag mode.

24. The method of claim 20, further comprising receiving an assignment of functions from a host computer, the assignment specifying at least first and second functions, respectively, to the respective switches.

25. The method of claim 24, wherein the first function is to activate an optical scanner of the ring unit, and the second function is to activate a Radio Frequency IDentification (RFID) tag reader of the ring unit.

26. The method of claim 20, further comprising setting the respective states of the respective switches via the respective digits of the hand.

27. A multi-mode ring scanner comprising:

a wrist unit and a ring unit comprising at least two respective switches that are settable in a plurality of states at least in part via respective digits of a hand;

means for determining the respective states of the respective switches;

means for determining, based at least in part on the respective states of the switches, a selected one of a plurality of codes;

means for communicating the selected code to a host computer; and

wherein the ring unit is adapted to be worn on at least one digit of the hand.

28. The multi-mode ring scanner of claim 27, further comprising means for receiving an identification of one of a plurality of modes from the host computer.

29. The multi-mode ring scanner of claim 28, wherein the ring unit further comprises an optical scanner and the multi-mode ring scanner further comprises a means for operating the optical scanner in accordance with an optical scan mode of the modes.

30. The multi-mode ring scanner of claim 28, wherein the ring unit further comprises a Radio Frequency IDentification (RFID) tag reader and the multi-mode ring scanner further comprises a means for operating the RFID tag reader in accordance with an RFID tag reading mode of the modes.

31. A multi-mode ring scanning device comprising:

a ring unit having at least two independent switches each settable in a plurality of states at least in part via respective digits of a hand, the ring unit adapted to be worn on at least one digit of the hand;

a wrist unit coupled to the ring unit; and

wherein the ring unit and the wrist unit are operable as a combination enabled to communicate a selected one of a plurality of codes to a host computer and further enabled to determine the selected code based at least in part on the states of the switches.

32. The multi-mode ring scanning device of claim 31, wherein one of the respective digits is a thumb of the hand and another one of the respective digits is a finger of the hand.

33. The multi-mode ring scanning device of claim 31, wherein the units comprise respective processing circuitry, and the processing circuitry is enabled to perform, at least in part, the determining.

34. The multi-mode ring scanning device of claim 31, wherein the ring unit comprises one or more of an optical scanner and a Radio Frequency IDentification (RFID) tag reader.

35. The multi-mode ring scanning device of claim 34, wherein the combination is further enabled to receive an assignment of functions from the host computer, the assignment specifying at least first and second functions, respectively, to the two switches.

36. The multi-mode ring scanning device of claim 35, w herein the first function is to activate the optical scanner, and the second function is to activate the Radio Frequency IDentification (RFID) tag reader.

37. The multi-mode ring scanning device of claim 31, wherein the coupling is via a stretchable cable connecting the units and configured to reduce slack of the cable.

38. The multi-mode ring scanning device of claim 31, wherein the coupling is via a wireless connection.

39. A method comprising:

operating a ring unit and a wrist unit in combination as a multi-mode ring scanner;

determining respective states of respective switches that are settable in a plurality of states at least in part via respective digits of a hand;

determining, via processing circuitry of the multi-mode ring scanner and based at least in part on the respective states of the switches, a selected one of a plurality of codes;

communicating the selected code to a host computer; and

wherein the ring unit comprises the switches and is adapted to be worn on at least one digit of the hand.

40. The method of claim 39, further comprising receiving an identification of one of a plurality of modes from the host computer.

41. The method of claim 40, further comprising operating an optical scanner of the ring unit when operating the multi-mode ring scanner in accordance with an optical scan mode of the modes.

42. The method of claim 40, further comprising operating an Radio Frequency IDentification (RFID) tag reader of the ring unit when operating the multi-mode ring scanner in accordance with an RFID tag reading mode of the modes.

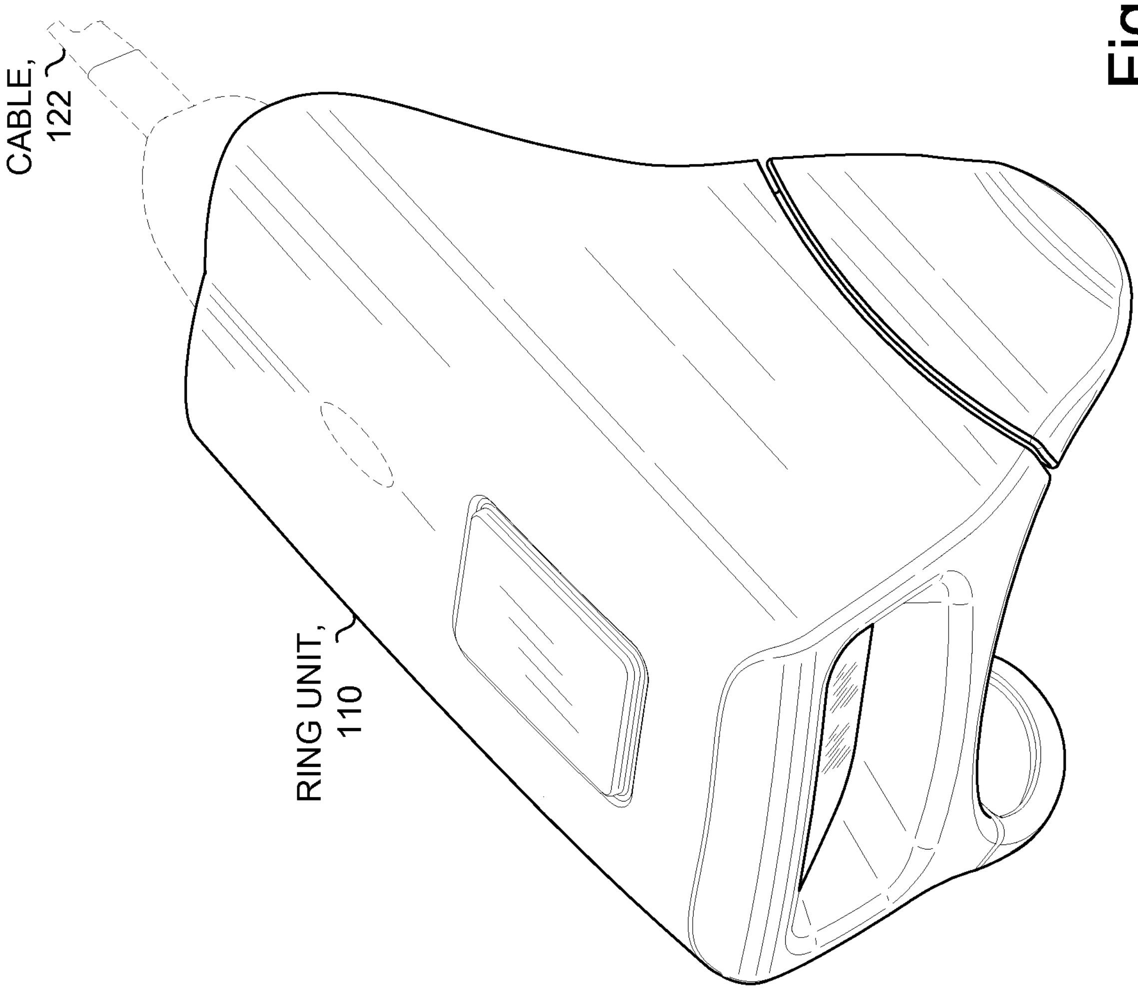

Fig. 1

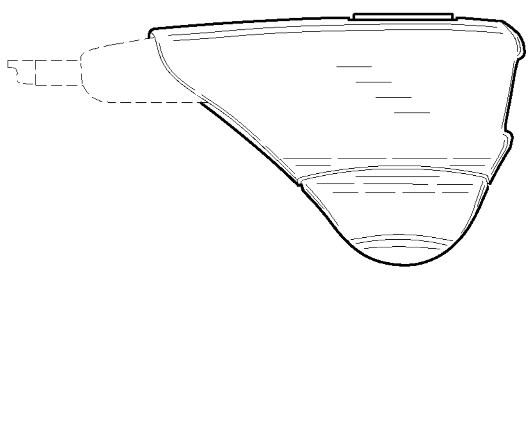

Fig. 2

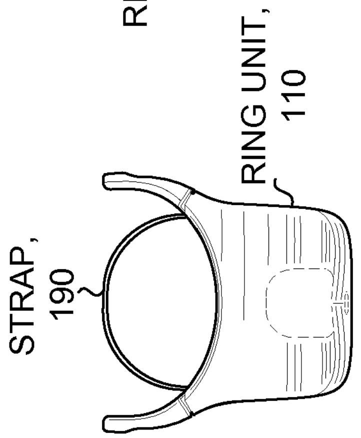

Fig. 3

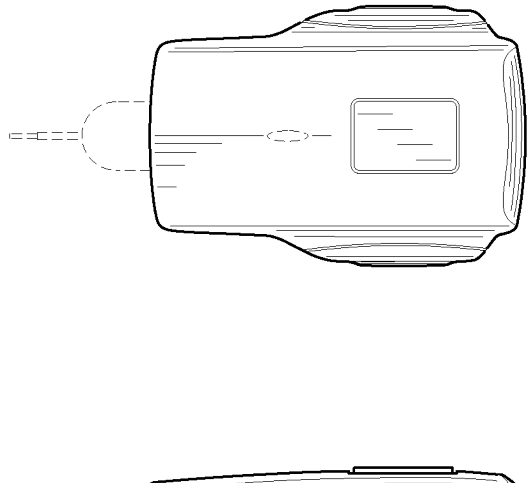

Fig. 4

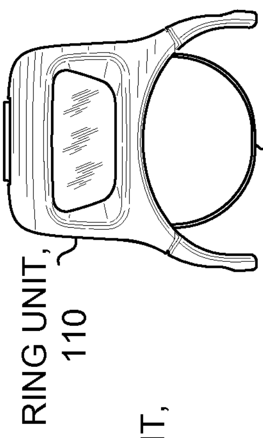

Fig. 5

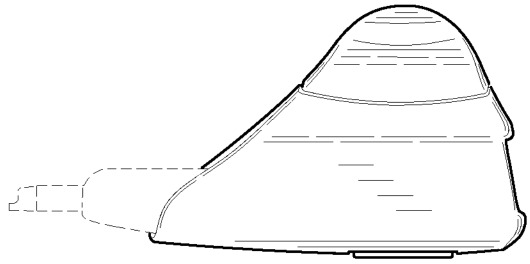

Fig. 6

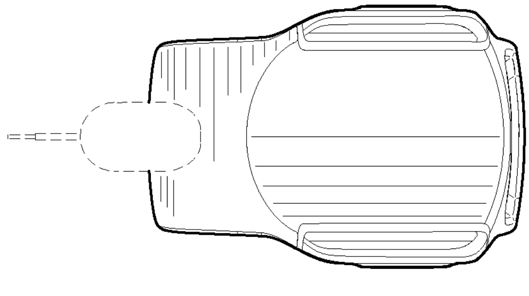

Fig. 7

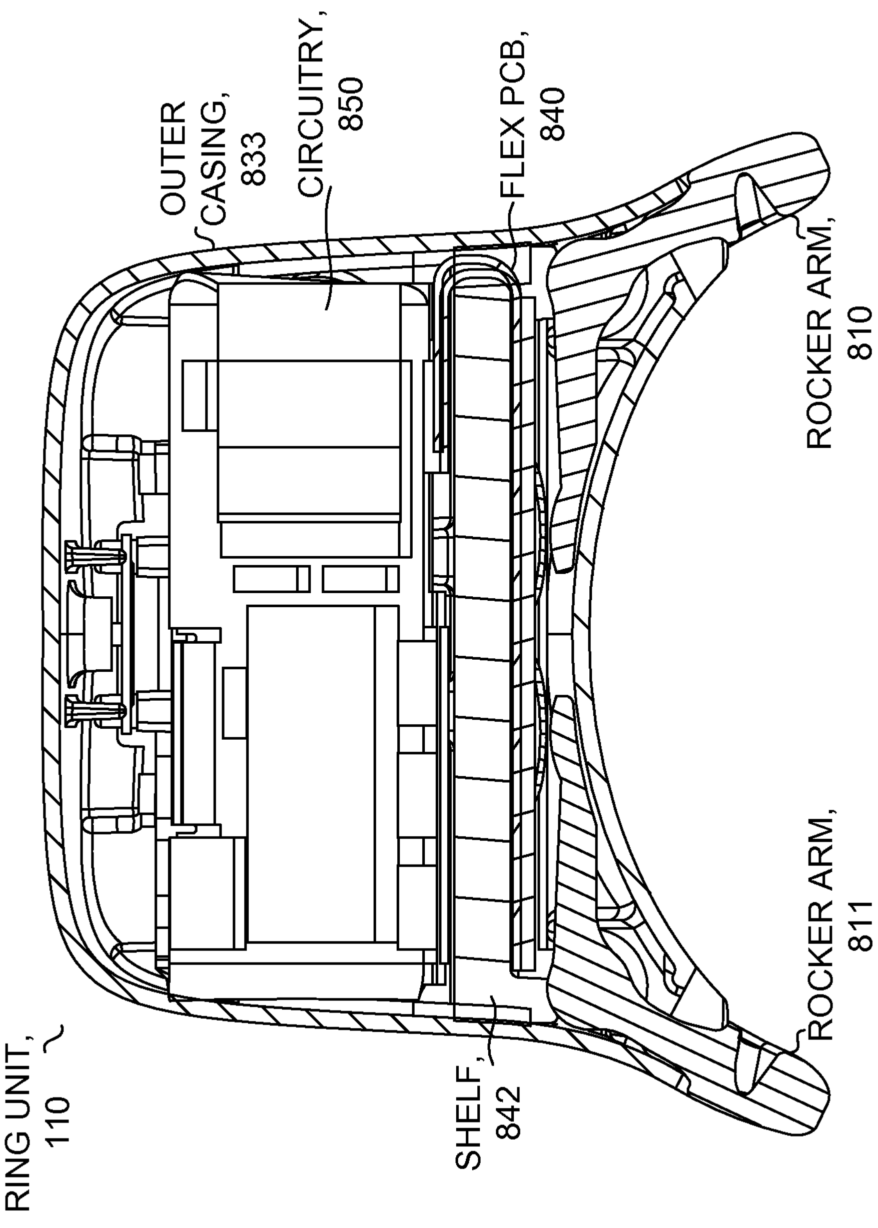
OUTER CASING, 833
CIRCUITRY, 850
FLEX PCB, 840
ROCKER ARM, 810
ROCKER ARM, 811
SHELF, 842
RING UNIT, 110

Fig. 8A

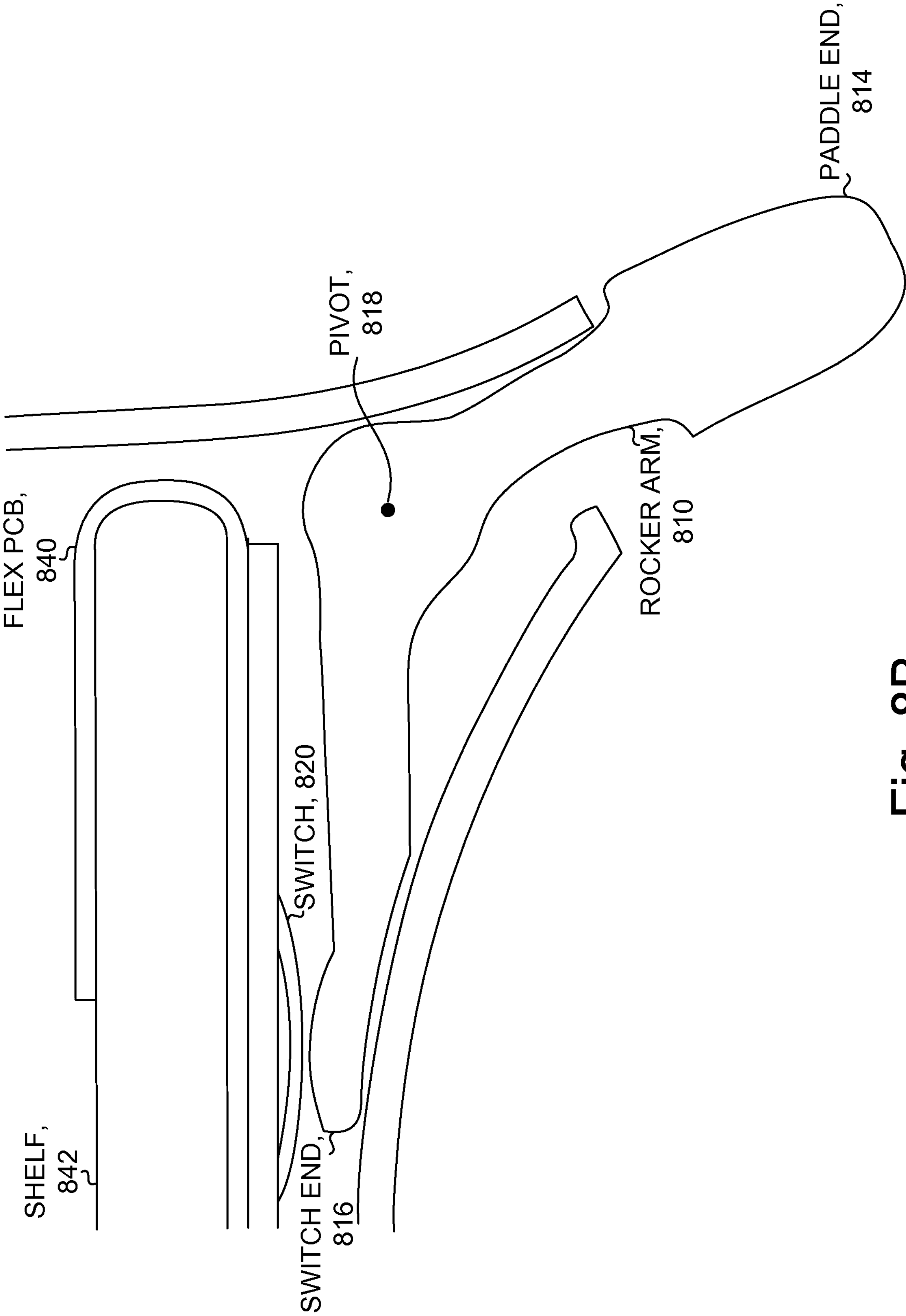
PADDLE END, 814
PIVOT, 818
ROCKER ARM, 810
FLEX PCB, 840
SWITCH, 820
SHELF, 842
SWITCH END, 816

Fig. 8B

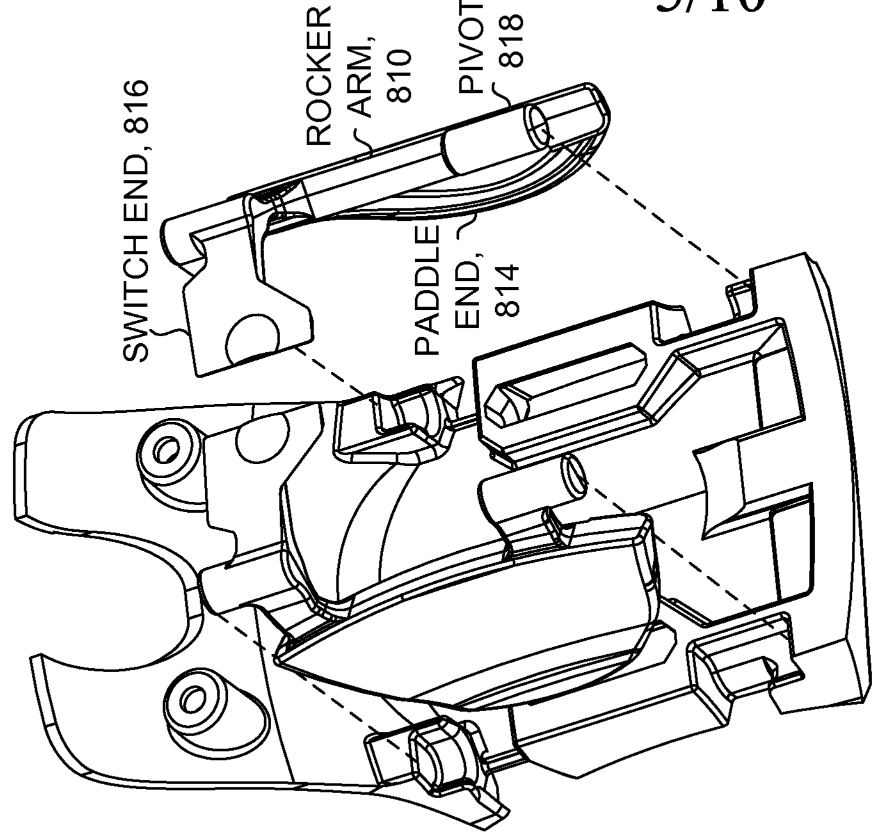
SWITCH END, 816
ROCKER ARM, 810
PIVOT, 818
PADDLE END, 814

Fig. 9B

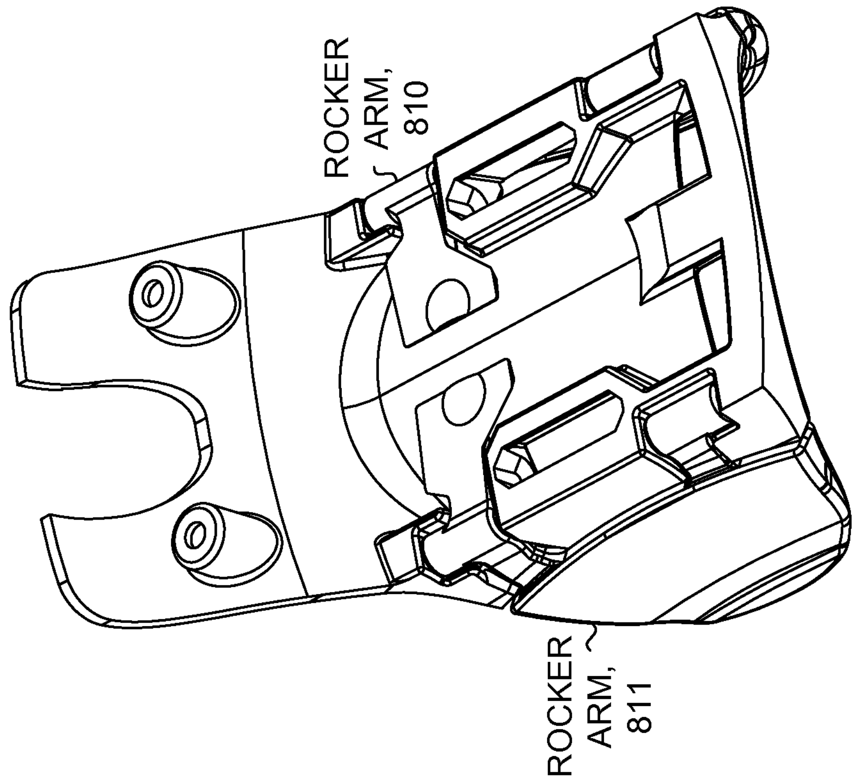
ROCKER ARM, 810
ROCKER ARM, 811

Fig. 9A

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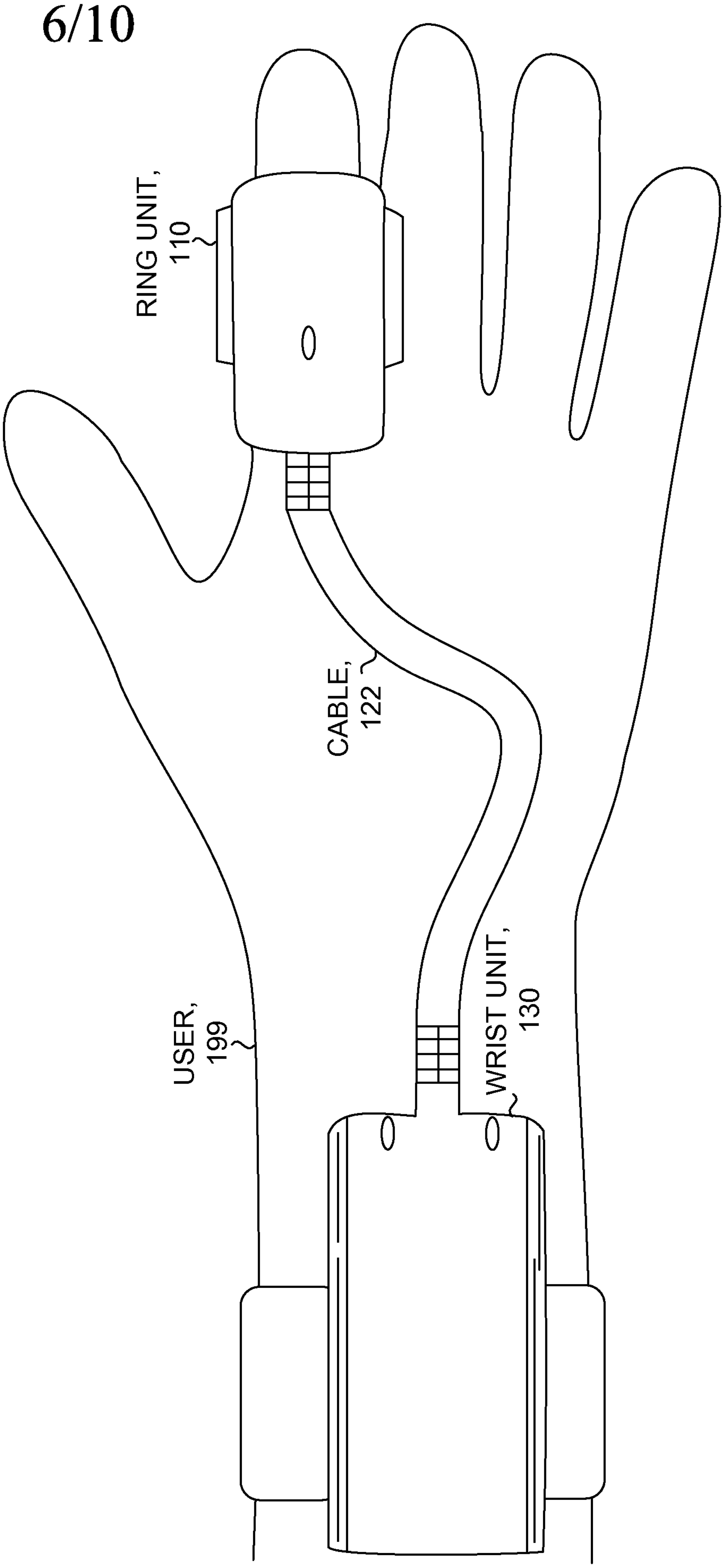

Fig. 10

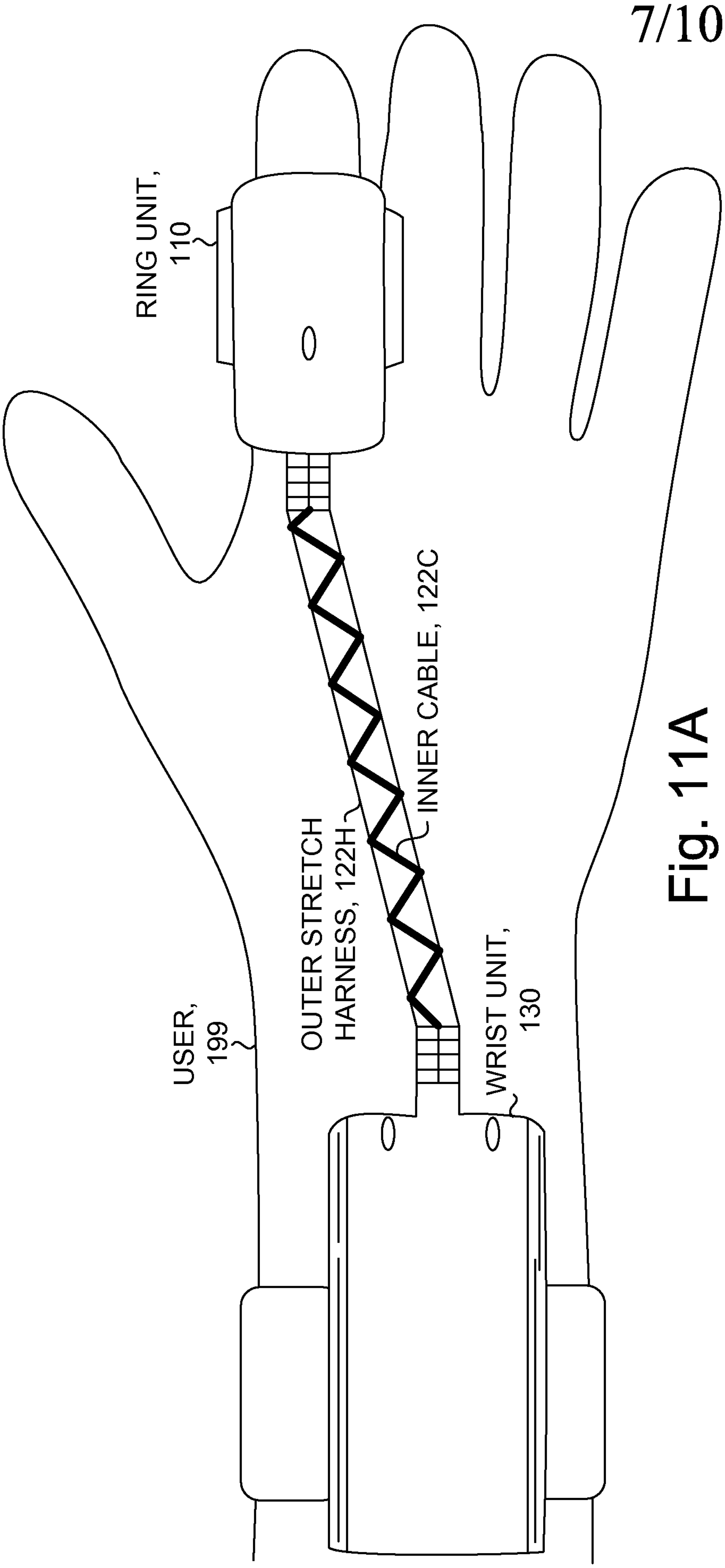

Fig. 11A

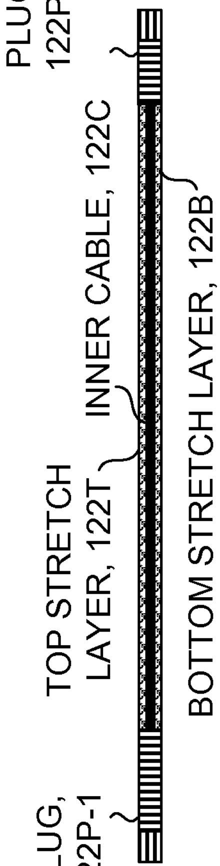

Fig. 11B

8/10

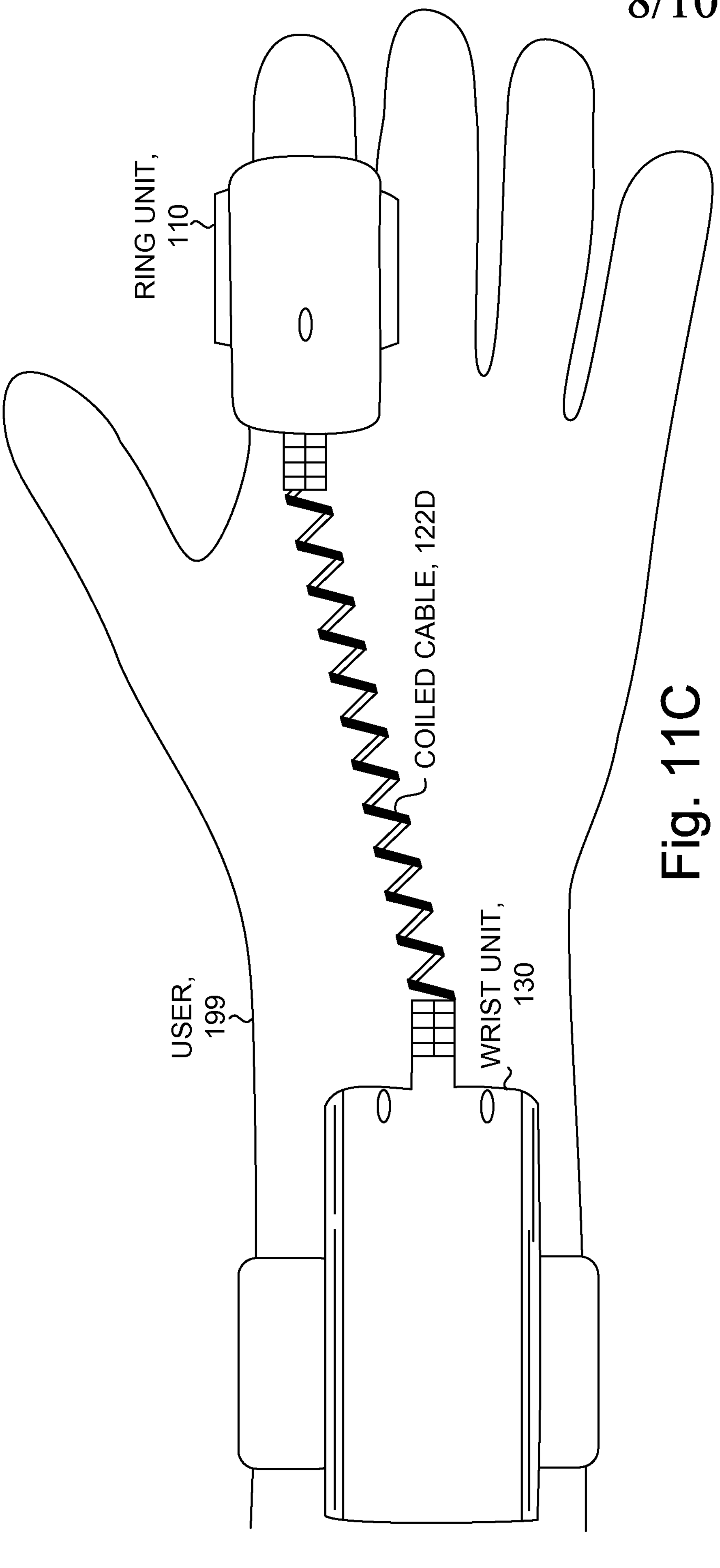

Fig. 11C

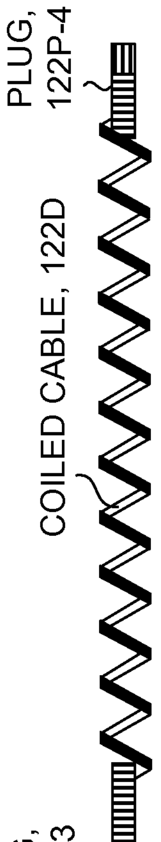

Fig. 11D

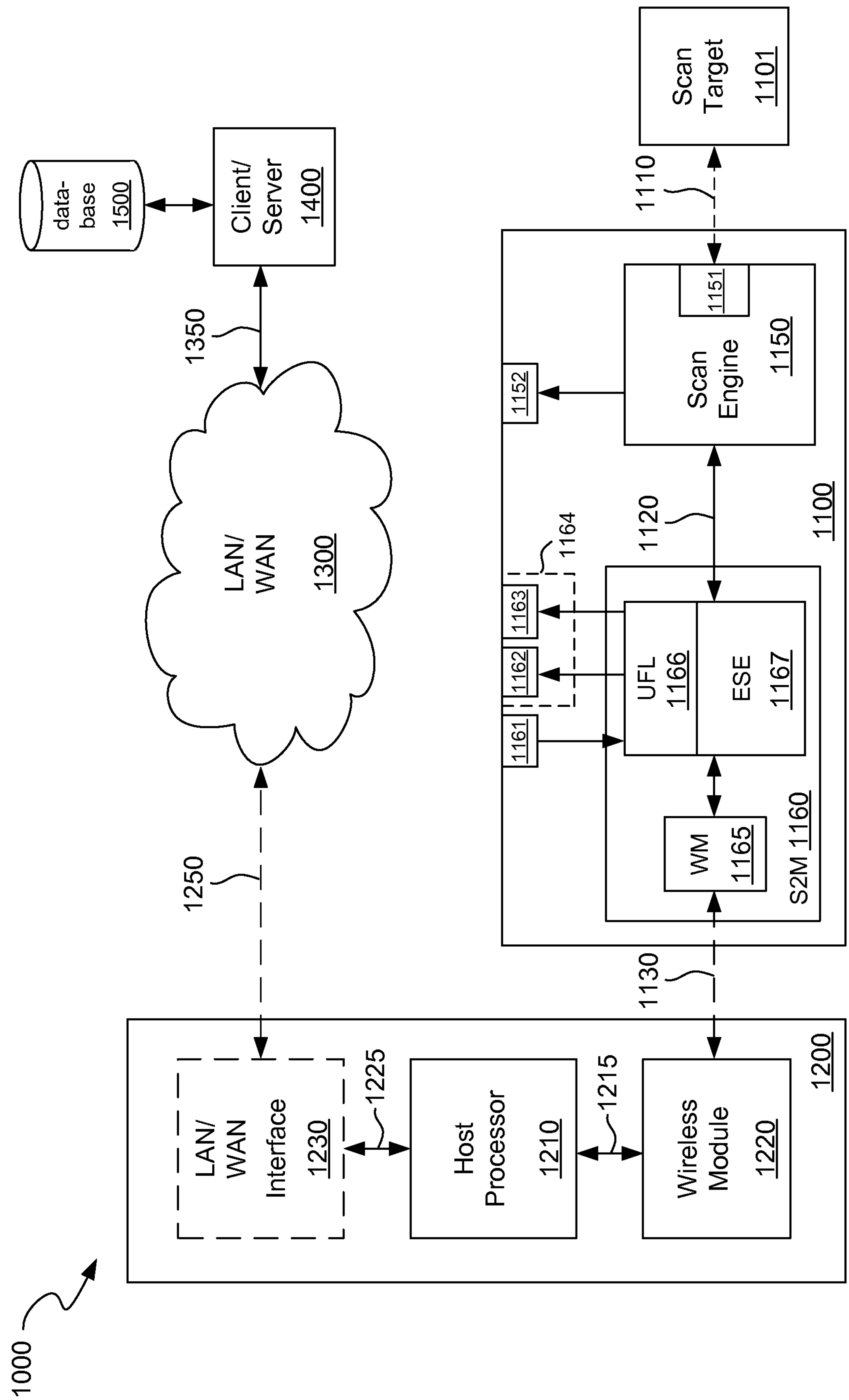
data-
base
1500
Client/
Server
1400
1350
LAN/
WAN
1300
1250
Scan
Target
1101
1110
1151
Scan
Engine
1150
1152
1120
1100
1164
1163
1162
1161
UFL
1166
ESE
1167
WM
1165
S2M 1160
1130
LAN/
WAN
Interface
1230
1225
Host
Processor
1210
1215
Wireless
Module
1220
1200
1000

Fig. 12

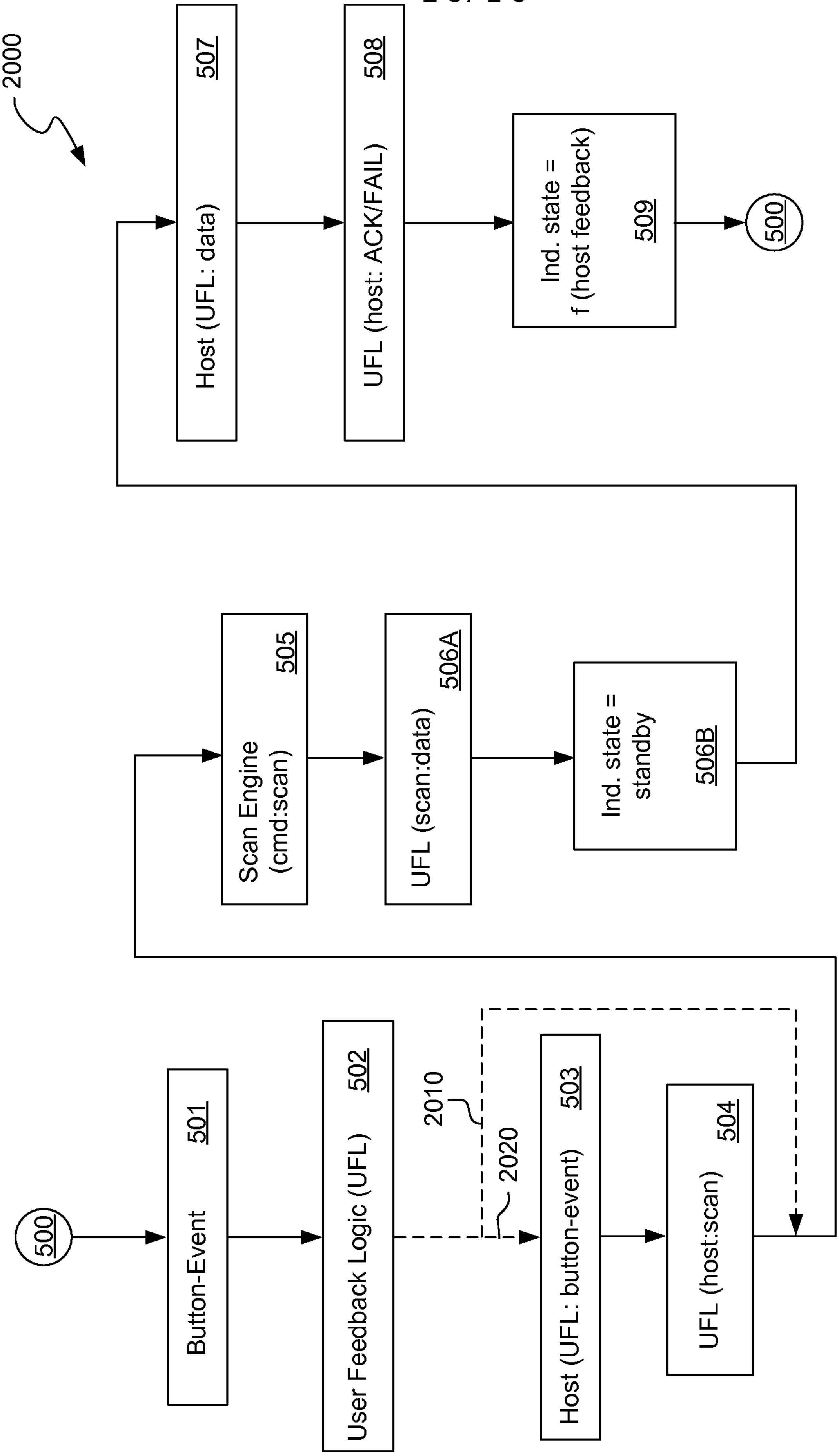
2000
500
Button-Event 501
User Feedback Logic (UFL) 502
2010
2020
Host (UFL: button-event) 503
UFL (host:scan) 504
Scan Engine (cmd:scan) 505
UFL (scan:data) 506A
Ind. state = standby 506B
Host (UFL: data) 507
UFL (host: ACK/FAIL) 508
Ind. state = f (host feedback) 509
500

Fig. 13

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2007/086309

A. CLASSIFICATION OF SUBJECT MATTER

G06K 7/10(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 8: G06K, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models since 1975
Japanese Utility models and applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKIPASS(KIPO Internal) "barcode", "tag", "RFID", "ring", "wearable", "scanner"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2006-0138232 A1 (ED HAMMERSLAG et al) 29 June 2006 See claim 1, paragraphs [0038]-[0049], figure 4	1-42
Y	US 6853293 B2 (JEROME SWARTZ et al) 8 February 2005 See claim 1, column 13, line 30 - column 14, line 29, figures 8, 16 and 17	1-42
Y	US 6607125 B1 (PAUL LEE CLOUSER et al) 19 August 2003 See claim 1, column 3, line 38 - column 4, line 22, figure 2	1-42
Y	US 7140546 B1 (JEFF TERLIZZI et al) 28 November 2006 See claims 10 and 29, column 4, lines 45-51, figure 1	1-42
Y	US 6003774 A (SIMON BARD et al) 21 December 1999 See claim 1, column 5, line 56 - column 6, line 8, figures 1A and 1B	1-42

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 APRIL 2008 (28.04.2008)	**28 APRIL 2008 (28.04.2008)**

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
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Facsimile No. 82-42-472-7140

Authorized officer
JEON, CHANG IK
Telephone No. 82-42-481-8261

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2007/086309

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006-0138232 A1	29.06.2006	US 7207488 B2	24.04.2007
US 6853293 B2	08.02.2005	US 2003-0020629 A1	30.01.2003
US 6607125 B1	19.08.2003	None	
US 7140546 B1	28.11.2006	US 2007-0057069 A1	15.03.2007
US 6003774 A	21.12.1999	None	