WIRELESS DEVICES WITH FLEXIBLE MONITORS AND KEYBOARDS

Background of the Invention

[0001] This invention relates to improved portable devices. More particularly, this invention relates to portable devices with enlarged, and improved, display and input components.

[0002] Current portable devices are deficient. As portable devices are fabricated in smaller dimensions, input components (e.g., keyboards) and output components (e.g., display components) are taking up a larger portion of the device's surface area. Traditionally, the size of such input and display components are limited by the dimensions of the portable device. It is therefore desirable for improved portable devices (e.g., wireless devices) with larger input and output components.

[0003] Numerous entities have fabricated flexible displays (i.e., displays that can bend).

Summary of the Invention

[0004] It is an object of the invention to include flexible display screens in portable devices.

[0005] It is also an object of the present invention to include flexible input components (e.g., keyboards) into portable devices.

[0006] An improved portable device is provided that includes both a flexible display screen and a flexible keyboard. Such flexible components may be, for example, rolled, folded, or flexed into a portion of the housing of the portable device. In this manner, such flexible components may be extendable from, and retract back into, a device's housing. In some embodiments a device's housing includes two or more housings that are coupled together (e.g., coupled together by a flexible input or output component).

[0007] Support structures are also provided that provide structural support to flexible components when those structural components are extended (or partially extended).

[0008] For head-mounted devices with flexible output devices (e.g., display screens), an input glove is provided. Such an input glove allows for a wide number of inputs that can equal, and in some cases surpass, the number of inputs on a keyboard. In this manner, a user may pull a small device from his/her pocket, extend the display monitor, detach an input glove from the device, put on the input glove, extend a display screen and mount the device/screen to his/her head, and utilize the device while, for example, walking.

Brief Description of the Drawings

[0009] The above and other objects and advantages of the present invention will be apparent upon consideration of the following detailed description,

taken in conjunction with accompanying drawings, in which like reference characters refer to like parts throughout, and in which:

[0010] FIG. 1 is an illustration of a portable device with a flexible display component and a flexible input component constructed in accordance with the principles of the present invention;

[0011] FIG. 2 is an illustration showing the interior of a portable device constructed in accordance with the principles of the present invention;

[0012] FIG. 3 is an illustration of a flexible input component, and related components, constructed in accordance with the principles of the present invention;

[0013] FIG. 4 are illustrations of portable device housing configurations constructed in accordance with the principles of the present invention;

[0014] FIG. 5 is an illustration of a portable device in an expanded configuration constructed in accordance with the principles of the present invention;

[0015] FIG. 6 is an illustration of another portable device in an expanded configuration constructed in accordance with the principles of the present invention;

[0016] FIG. 7 is an illustration of a portable device in another expanded configuration constructed in accordance with the principles of the present invention;

[0017] FIG. 8 is an illustration of a portable device in a partially expanded configuration constructed in accordance with the principles of the present invention;

[0018] FIG. 9 is an illustration of a portable device configured as a headset in an expanded configuration constructed in accordance with the principles of the present invention;

[0019] FIG. 10 is an illustration of an expanding process constructed in accordance with the principles of the present invention;

[0020] FIG. 11 is an illustration of a foldable portable device in an expanded configuration constructed in accordance with the principles of the present invention; and

[0021] FIG. 12 is an illustration of a glove-based input device constructed in accordance with the principles of the present invention.

Detailed Description of the Invention

[0022] FIG. 1 shows portable device 100. Portable device 100 may be, for example, any wireless or handheld devices. Such wireless devices may include, for example, wireless telephones (e.g., CDMA, TDMA, cellular, GSM, or PCS wireless telephones), wireless Personal Digital Assitances (PDAs), and laptops. Such handheld devices may include, for example, wireless telephones, PDAs, digital music players (e.g., MP3 players).

[0023] Persons skilled in the art will appreciate that components of portable device 100 may be non-portable, or integrated into a non-portable device. For example, the flexible display and keyboard combinations of the present invention may be integrated into, and extendable from, a car ceiling or dashboard.

[0024] Portable device 100 includes flexible display 140 and flexible keyboard 160 that may extend from housing 120. Housing 120 may include memory and processing circuitry utilized by flexible keyboard 160 and flexible display 140 (and the other components of portable device 100).

[0025] At least a portion of flexible display 140 may be extendible from, and retractable back into, housing 120. Grip 180 may be utilizes to pull flexible display 140 from housing 120. Grip 180 may also be used as a stop so when flexible display 140 cannot be retracted past stop 180. Flexible display 140 may be automatically retracted via, for example, a switch (not shown), or manually retracted (e.g., manually wound over an axle or manually folded/placed into housing 120).

[0026] Display 125 may be included in device 100 as stationary/non-flexible display that is visible from the exterior of housing 120. In this manner, portable device 100 may be utilized without the need to extract flexible display 140. Alternatively, display 125 may be an aperture in housing 120 such that at least a portion of a retracted flexible display 140 is visible via the aperture. For example, flexible display 140 may be rolled around an axle located in housing 100. In this manner, flexible display 140 may be configured to have the side facing housing 100 displayable. Persons skilled in the art will appreciate that only a portion of a retracted flexible display may desired to be ON to fill an amount of an aperture defined by display 125. In this manner, to save power, only a portion of flexible display 140 may be operable to be

turned ON (or selected to turn ON) when flexible display 140 is retracted into housing 120.

[0027] Flexible input 160 may be utilized as, for example, a computer display/monitor. In this manner, a user may, for example, interact with the various input devices on portable device 100 to change the images displayed on flexible display 140. Portable device 140 may include any number of hardware and software devices. For example, antenna 199 may be included such that portable device 100 is provided with a wireless communications capability. In this manner, flexible display screen may, for example, display video from a telephonic video conference or web browser 142. Similarly, portable device 100 may have a computing capability. In such instances where computing is desired, a user may utilize computing tools 141.

[0028] At least a portion of flexible input 160 may be extended from, retracted back into, housing 120. Flexible input 160 may be coupled to grip 180 in order to facilitate, for example, the removal of flexible input 160 from housing 160.

[0029] Stationary inputs 122 may be provided as stationary inputs and may be utilized from the external surface of housing 120 when, for example, flexible input 160 is retracted into housing 120. Like for flexible display 140, input 122 may be an aperture in which at least a portion of flexible input 160 may be utilized when at least a portion of flexible input 160 resides in housing 120. Persons skilled in the art will appreciate that a portion of flexible input 160 may reside in housing 120 even when flexible input 160 is fully extended. In this manner, flexible input 160

may be utilized both through an aperture defined by input 122 and outside of housing 120 simultaneously.

[0030] Flexible input 160 may, for example, include keyboard 161. Keyboard 161 may be modeled after a standard keyboard. Alternatively, only portions of a standard keyboard may be provided as flexible input 160. A keyboard is generally a set of manually controls. In this manner, any type of control may be embodied as flexible keyboard 161. For example, a telephonic keypad (similar to the one illustrated in display 122) or another keyboard (similar to controls 121) may be embodied as keyboard 161.

[0031] Controls 121 may be provided as external controls for device 100 or as flexible controls on flexible input 160. Controls 121 may include, for example, device specific controls. For example, controls 121 may include phone controls such as TALK and CLEAR. Controls 121 may also control directional controls and ON/OFF controls. Furthermore, program specific controls (which may also be device specific controls) may be included. In this manner, a LOCATE FRIENDS control or an ACTUALITY control may be included. For example, if a user desires to play an location-based game, the ACTUALITY button may be utilized.

[0032] Flexible display 140 and flexible input 160 may be coupled together. For example, flexible display 140 and flexible input 160 may be coupled to the same grip 180 and or attached via structure 190. Structure 190 may be, for example, a tape. Alternatively structure 190 may be a polymer glued on at least a portion of a surface of flexible input 160 and flexible display 140. Alternatively, flexible input 160 and

flexible display 140 may not be coupled together. For example, flexible input 160 and flexible display 140 may have separate grips. Persons skilled in the art will appreciate that grips only facilitate particular functions and need not be included in portable device 100. Persons skilled in the art will appreciate also that portable device 100 may be provided without a flexible input (or a flexible display).

[0033] FIG. 2 shows portable device 200 that includes one or more flexible components 230 attached to one or more grip 220. Flexible components 230 may be extended from housing 210 by pulling grip 220. For example, flexible components 230 may be wound around axle 201 when in a retracted, or partially retracted, position. Grip 220 may be utilized to aid in extending flexible components 230 from housing 210 (e.g., may provide a better grip then the flexible components). Grip 220 may also, for example, act as a stop such that 230 can only retract into housing 210 to a particular degree.

[0034] Axle 201 may be coupled to, for example, a spiral spring grounded to housing 210(not shown) such that when flexible components 230 are at least partially retracted, a retracting force is applied against the extended portion of flexible components 230. In this manner, flexible components 230 may be provided with an autonomous retracting functionality. A mechanical stop (not shown) may be provided such that a user may mechanically put a force against axle 201, or flexible components 230, to fight the retracting force (while the stop is activated). In this manner, flexible components 230 may be extended a particular distance and then stopped, via a mechanical stop. The

user may then let go of device 100 entirely and not worry about flexible components 230 retracting. Such a stop may be de-activated such that retracting may occur. Further, axle 201 may be wound manually by, for example, a lever (not shown).

[0035] Grip 220 may alternatively act as supplemental housing. For example, grip 220 may be large enough to house a second axle that flexible components 230 (or other flexible components) may extend and retract from.

[0036] Persons skilled in the art will appreciate that axle 201 need not be included in housing 210. Rather a portion of housing 210 may open up such that flexible components may be folded or stuffed into housing 210. For example, grip 220 may act as a door that is hinged on housing 210 and the aperture in housing 210, and grip 220, may be enlarged.

[0037] FIG. 3 shows one embodiment of a flexible input component. Particularly, FIG. 3 shows flexible input 300 that may contain any number of flexible controls 320 coupled to processor 310. Flexible control 320 may include conductive layers 325 and 326 separated by non-conductive components 324 and 323. Conductive layers 325 and 326 may be fabricated from a flexible conductive materials or may be non-flexible.

[0038] Furthermore, flexible non-conductive components 324 and 323 may be a single component such as, for example, a non-conductive washer-shaped cushion. In this manner, non-conductive components 324 and 323 may form a ring such that when, for example, a downward force is applied to conductive layer 325 the ring may compress and conductive layer 325 may electrically couple layer 326. In this manner, an

electromechanical switch may be provided. For example, an electrical signal may be provided by processor 310 (e.g., power process 311 via node 311) to conductive layer 325 such that when conductive layer 325 electrically coupled conductive layer 326, processor 310 may sense the provided electrical signal (e.g., sense process 312 via node 322).

[0039] Multiple such electromechanical switched may be provided and coupled together by one or more flexible layers 328 and 329 such that a flexible keyboard is provided. Portions of particular components may be fixed (e.g., glued) to particular portions of flexible layers 328 and 329 such that the electromechanical switches remain in the same position (with respect to layers 328 and 329) when electromechanical switch is in an extended or retracted position.

[0040] Persons skilled in the art will appreciate that a flexible input device may take multiple forms. For example, conductive layer 326 may be included as two separate and isolated layers. When conductive layer 326 electrically contacts these two separate and isolated layers, conductive layer 326 may electrically couple these two separate layers together. In this manner, conductive layer 325 may be provided as a relay between the two separated portions of layers 326. An electrical signal may be provided to a particular one of these two separated portions, and sensed by the other separate portion, when the relay is ON such that a manual input is realized. Processor 310 may associate a particular action to a particular flexible electromechanical switch (e.g., via software stored in memory or hard-coded into circuitry) such that a

variety of controls may be provided. For example, electromechanical switch 320 may be associated to the letter "S."

[0041] Persons skilled in the art will appreciate that numerous types flexible input devices may be provided in accordance with the principles of the present invention so long as they are flexible (i.e., can bend).

[0042] Air holes (not shown) may also be included in order to aid in the autonomous decompression of a flexible cushion (if utilized) when a force is not applied compressing the cushion.

[0043] FIG. 4 show a variety of possible housings. Particularly, FIG. 4 shows housings 410, 420, 430, and 440.

[0044] Housing 410 includes housing portions 411 and 412. One or both of housing portion 411 and 412 may include, for example, an axle that flexible components (or the same flexible component) may be retractable into. For example, a flexible display may have one end coupled to an axle in housing 411 and another end coupled to and axle in housing 422. Female and male curvatures may exist between the two devices such that more stability is provided to housing 410 when housing 411 and 412 are physically connected together.

[0045] Housing 420 may include housing portions 421 and 422. No substantial male female connection is provided through the general structure of housing 420. In this manner, housing components 421 and 422 may be more able to, for example, roll more of a flexible component around an axle.

[0046] Housing 430 is provided and includes housing portions 431 and 432.

[0047] Housing 440 is provided and include housing portions 441 and 442. Axles 451 and 452 may be provided in portions 441 and 442, respectively such that one or more flexible components 453 may be extended from, and retracted back into housing portions 441 and 442, respectively.

[0048] FIG. 5 shows a portable device 500 with an expanded flexible interactive structure 510 (e.g., a flexible display or flexible input). Support structure 520 is provided such that flexible structure 510 becomes inflexible. In this manner, structural stability may be provided throughout housing 501, flexible interactive structure 510 and housing 502. For example, flexible interactive structure 510 may be extended from one, or both, housing portions 501 and/or 502 such that a sturdy tablet PC is provided. In this manner, the present invention may combine multiple types of devices into a single ultimate electrical device -- a personal electronic device (PED). In this manner, a PED could be, for example, a cellular phone when compacted (e.g., flexible components are retracted) and a sturdy, wireless tablet PC when expanded.

[0049] FIG. 6 shows device 600 that may include support structures 611 and 621 that pivot around axles 612 and 622, respectively. Such axles may be locked, or support structures may be connected and locked together) to increase the structural stability of the expanded device. Any number of such support structures may be provided on either housing 601 or housing 602 to provide support to flexible interactive component 630 (e.g., a flexible display, flexible input, or both).

[0050] FIG. 7 shows device 700 that may include support structures 711 and 721 that may pivot about structures 712 and 722, respectively, on one or more housing portions 701 and 702, respectively, to support flexible components 730. Persons skilled in the art will appreciate that device 700 is particularly beneficial if only a single housing portion is provided. For example, suppose both structure 711 and structure 722 pivot on housing portion 701. Structures 711 and 722 may be spaced such that they do not extend outside of the boundary defined by housing portion 701 when retracted. When structures 711 and 722 are extended however, structural stability may be provided to flexible components 730. Flexible components 730 may, for example, fix directly to one or more structural components. For example, the end of an extended flexible components 730 may contain a latch for each of structural components 711 and 721 so that flexible components 730 may be temporarily attached to structural components 711 and 721.

[0051] FIG. 8 shows device 800 that may be provided with one or more housing portions 801 and 802 and one or more accordion structures 811 and 821 permanently affixed at points 812 and 822, respectively.

[0052] FIG. 9 shows portable device 900 that may act as a headset as shown in illustration 904. One or more housing portions may be utilized. For example housing portions 901 and 902 may be utilized to house flexible components 903. Such housing portions 901 and 902 may also act as ear pieces. A curved support structure may also be provided. Persons skilled in the art will appreciate that only a portion of a flexible component may desire a flexible display or a flexible input. For

example only the portions of flexible component 903 that would be in front of one eye may be desired to be a monitor. In such instances, the rest of flexible component 903 may be, for example, a transparent polymer.

[0053] FIG. 10 shows device 1000 that is foldable. In this manner device 1000 may be provided as a wireless phone or a miniature laptop with enhanced attributes. Device 1000 may be include housing portions 1010 and 1020 that may be folded into one surface area 1001. Hinge 1035 (which may include components such as electrical circuitry) may be provided to allow housing portions 1010 and 1020 to OPEN and CLOSE into surface area 1001 (shown as portions 1030 and 1040). Each housing portion may include one or more flexible components. For example, one housing component may include a flexible display (e.g., housing component 1050 on hinge 1055 may include flexible display 1051). Furthering this example, a different housing component (e.g., housing component 1060 on hinge 1055 may include flexible input device 1061). Persons skilled in the art will appreciate that support structures may also be provided to provide structural support to flexible components when those flexible components are extended from the housing portions.

[0054] FIG. 11 shows device 1100 that includes housing portions 1101 and 1102 coupled to hinge 1103. Flexible component 1110 may be provided with flexible display 1111 that may extend from, and retract into, housing 1101. Alternatively, flexible component 1120 may be provided with flexible keyboard 1121 that may extend from, and retract into, housing 1102.

[0055] Flexible component 1110 and flexible component 1120 may be coupled together via flexible component 1130. Alternatively, flexible components 1110 and flexible components 1120 may be provided as the same flexible component. Component/portion 1130 may retract into a hollow portion of hinge 1103.

[0056] Persons skilled in the art will appreciate that no housing may be provided in a portable device. For example, a flexible keyboard and a flexible display may be housed in a single flexible component (e.g., a single flexible component 1110) which may be, for example, one or more pieces of a sturdy, transparent polymer. Such an portable device may then be flexed in any manner (e.g., rolled like a map) and may be utilized with a variety of external support structures (e.g., a desk) or support structures attached to the one or more flexible components (e.g., one or more long piece of hard plastic that may pivot on an end of the one or more flexible components).

[0057] FIG. 12 shows input glove 1200 that may exhibit similar functions to, for example, a standard keyboard. Generally, the glove operates as follows. Electrical contacts may be placed around the glove such that when two electrical contacts are electrically coupled together (e.g., as a result of a particular hand movement), a processor connected to the contacts executes a function associated to that action. In this manner, one glove action may result in the letter "S" being activated while another may result in the letter "U" and yet another may result in the letter "E". In this manner, a user may spell "SUE" with three simple hand actions. More particularly, the hand actions needed to provide an input do not have to be difficult

(e.g., a hand-sign), but the simple touching of two or more fingers together or one or more finger to the palm of the hand. In this manner, a simple, economical input glove may be provided. Combined with a head-monitor a user may easily perform any function that the user can perform on a keyboard on one or more gloves of the present invention.

[0058] Glove 1200 may include any number of contacts 1201-1222. Particular contacts may be SENSE contacts. Other contacts may be POWER contacts. Moreover, each contact may have both SENSE and POWER portions. For example, contact 1201 may be a POWER contact and may provide an electrical signal that is detectable by, for example contact 1202 that may be SENSE contact. In this manner, a processor or other circuitry(not shown) may denote INPUT "2" when contacts 1201 and 1202 electrically couple together. Accordingly, a processor or other circuitry (not shown) may denote INPUT "3" when contacts 1201 and 1203 electrically couple together.

[0059] Persons skilled in the art will appreciate that it may not be desirable to have electrical signals flow between contacts of a glove. Other sensing means may therefore be provided. For example, contact 1201 may be made of a particular material, or given a particular electric field such that the capacitance of contact 1202 changes when the two electrically couple (or are in the vicinity of one another). In this manner, a processor, or other circuitry, may determine the change in a capacitance, or wait for the capacitance of a contact to fall into a particular range of capacitances, to determine when an INPUT has been activated. Other electrical properties may be

sensed in a similar fashion to provide a functional glove. For example, sensing and changing the impedance of a contact may provide the function of an input glove.

[0060] Alternatively, the electromechanical switches/relays described above in connection with, for example, system 300 of FIG. 3 may be utilized as one or more contacts for a glove. Alternatively, the capacitive, or electrical property, sensing of glove 1200 may be utilized in system 300 of FIG. 3 as a flexible input device (e.g., a flexible keyboard).

[0061] Combinations of contacts touching one another may also be utilized as different inputs. For example, combinations 1223-1225 may be provided. Looking at combination 1223, contacts 1215, 1216, and 1217 may provide a particular input (e.g., INPUT 23) when all three are, for example, electrically coupled together. Particular actions may be associated to particular INPUTS. In this manner, INPUT 23 may, for example, minimize an application, or toggle between applications.

[0062] Persons skilled in the art will appreciate that glove 1200 may provide a large number of controls with very simple, easy to learn point-to-point in-hand contacts. Such point-to-point hand contacts in-hand contacts may be performed very quickly such that an experienced user may, for example, achieve a rather high words-per-minute typing average.

[0063] Additional inputs may also be provided on glove 1200. For example, a small finger-controlled joystick or non-flexible touch-screen may be provided on glove 1200 to provide a mouse-type control. Such a finger joystick may be positioned anywhere on glove

1200. One particularly useful position would be substantially around the area defined by contact 1203. Contacts 1204 and 1202 (which may be electromechanical switches/relays) may then provide, for example, the functionality of mouse-buttons. Thus, a person walking could easily scroll through a webpage, and click on links, that are displayed, for example, on portable device 900 of FIG. 9

[0064] Persons skilled in the art will appreciate that more than one input glove (e.g., 2) may be utilized by a user to increase the number of inputs utilized (or the simplicity of remembering a particular associations between hand-actions and inputs).

[0065] It will also be recognized that the invention may take many forms other than those disclosed in this specification. Accordingly, it is emphasized that the invention is not limited to the disclosed methods, systems and apparatuses, but is intended to include variations to and modifications thereof which are within the spirit of the following claims.

What is Claimed is:

1. A device comprising:

a first housing;

a flexible keyboard comprising:

a first keyboard portion coupled to a first component, wherein said first component is located in the interior of said first housing;

a second keyboard portion operable to be stored in, and expanded from, said first housing;

a flexible display comprising:

a first display portion coupled to a second component, wherein said second component is located in the interior of said first housing;

a second display portion operable to be stored in, and expanded from, said first housing; and

a processor electrically coupled to said flexible keyboard and said flexible display.

2. The device of claim 1, wherein said first component is an axle and said second keyboard portion is operable to roll around said axle.

3. The device of claim 1, wherein said first component is a portion of the interior of said first housing

4. The device of claim 1, further comprising:

a second housing;

wherein said flexible keyboard further comprises:

a third keyboard portion coupled to a third component, wherein said third component is located in the interior of said second housing; and

wherein said flexible display further comprises:

a third display portion coupled to a fourth component, wherein said fourth component is located in the interior of said second housing.

5. The device of claim 4:

wherein said flexible keyboard further comprises:

a fourth keyboard portion operable to be stored in, and expanded from, said second housing; and

wherein said flexible display further comprises:

a fourth display portion operable to be stored in, and expanded from, said second housing.

6. The device of claim 1, further comprising:

a non-flexible display located on the exterior of said first housing, wherein said non-flexible display screen is electrically coupled to said processor.

7. The device of claim 1, further comprising:

a non-flexible keyboard located on the exterior of said first housing, wherein said non-flexible display screen is electrically coupled to said processor.

8. The device of claim 1, further comprising:

a support structure coupled to, and extendable from, said first housing, wherein said support structure provides structural support to at least one of said second keyboard portion or second display portion when said second keyboard or second display portion is extended from said first housing.

9. The device of claim 1, further comprising:

a fifth keyboard portion of said flexible keyboard operable to be stored in, and expanded from, said first housing, wherin said fifth keyboard portion is operable from the exterior of said first housing when said fifth keyboard portion is stored in said first housing.

10. The device of claim 9, wherein said fifth keyboard portion is operable through a gap in said housing.

11. The device of claim 1, further comprising:

a fifth display portion of said flexible display operable to be stored in, and expanded from, said first housing, wherin said fifth display portion is viewable from the exterior of said first housing when said fifth display portion is stored in said first housing.

12. The device of claim 11, wherein said fifth display portion is viewable through a gap in said housing.

13. The device of claim 12, wherein a piece of transparent material is located in said gap.

14. A wireless phone comprising:

a first housing;

a flexible keyboard, wherein at least a portion of said flexible keyboard is operable to be stored in, and expanded from, the interior of said first housing;

a flexible display, wherein at least a portion of said flexible display is operable to be stored in, and expanded from, the interior of said first housing; and

at least one processor, wherein at least one of said at least one processor is electrically coupled to said flexible keyboard and at least one of said at least one processor is electrically coupled to said flexible display.

Abstract of the Disclosure

A portable device (e.g., a wireless device such as a cell phone) is provided with a flexible keyboard and a flexible display screen. Such flexible components may be stored in the housing of the portable device when not in use. The flexible display screen and flexible keyboard may be expanded from the housing when the flexible components are utilized by a user.

Non-flexible display and input components may be provided on the exterior of the portable device such that the device may be used, in some form, while the flexible components are stored. In one embodiment, a portion of the flexible display (or flexible keyboard) may be utilized when the flexible display (or flexible keyboard) is stored in said first housing.

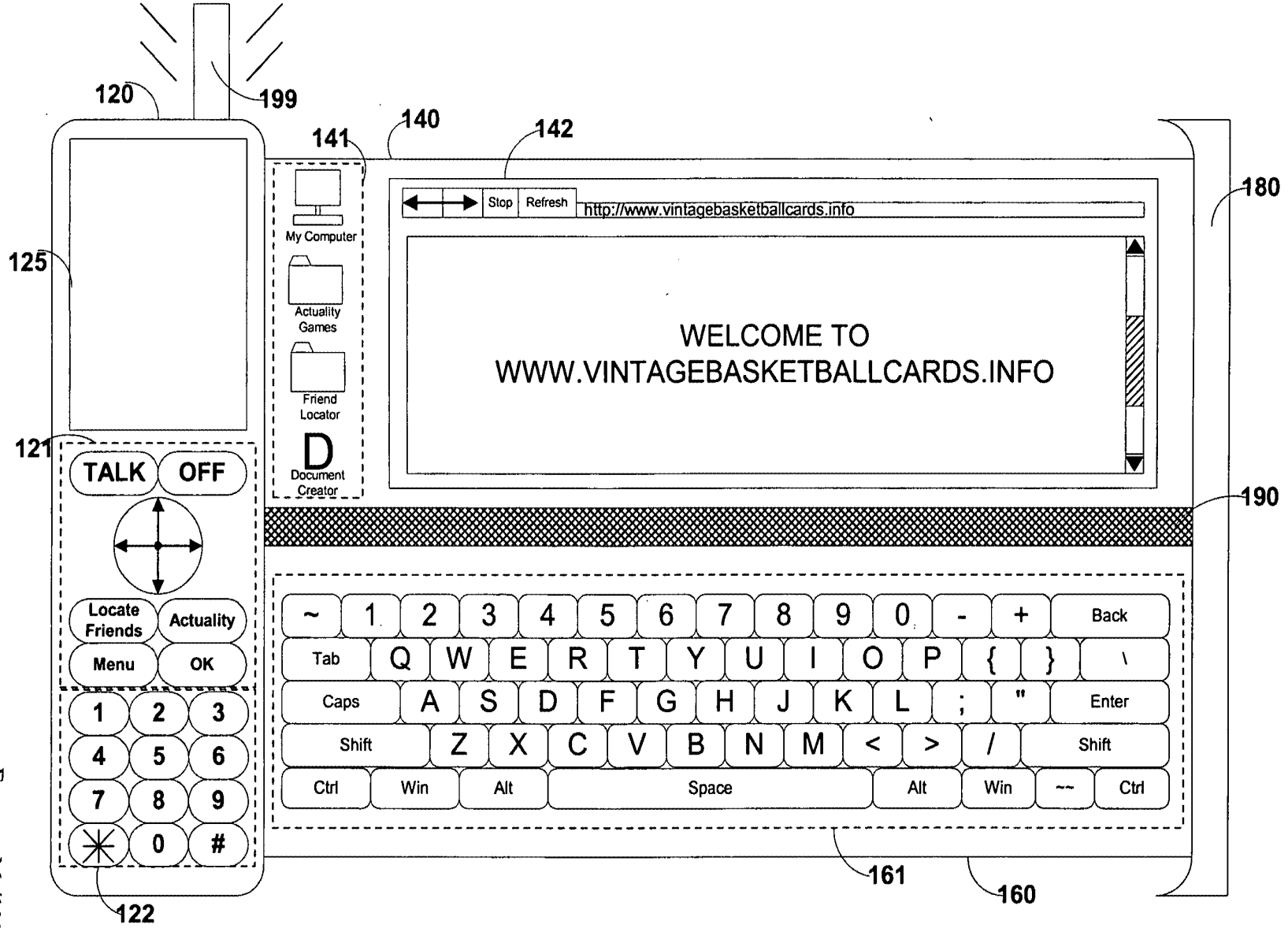

FIG. 1

200

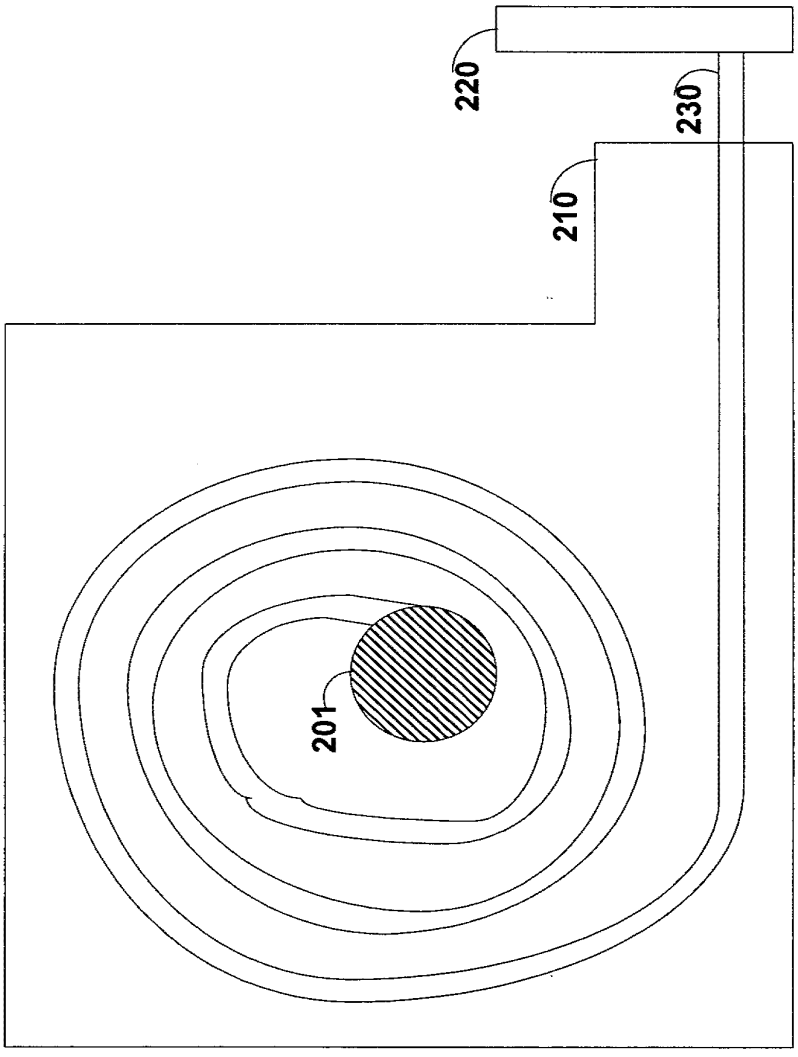

FIG. 2

300

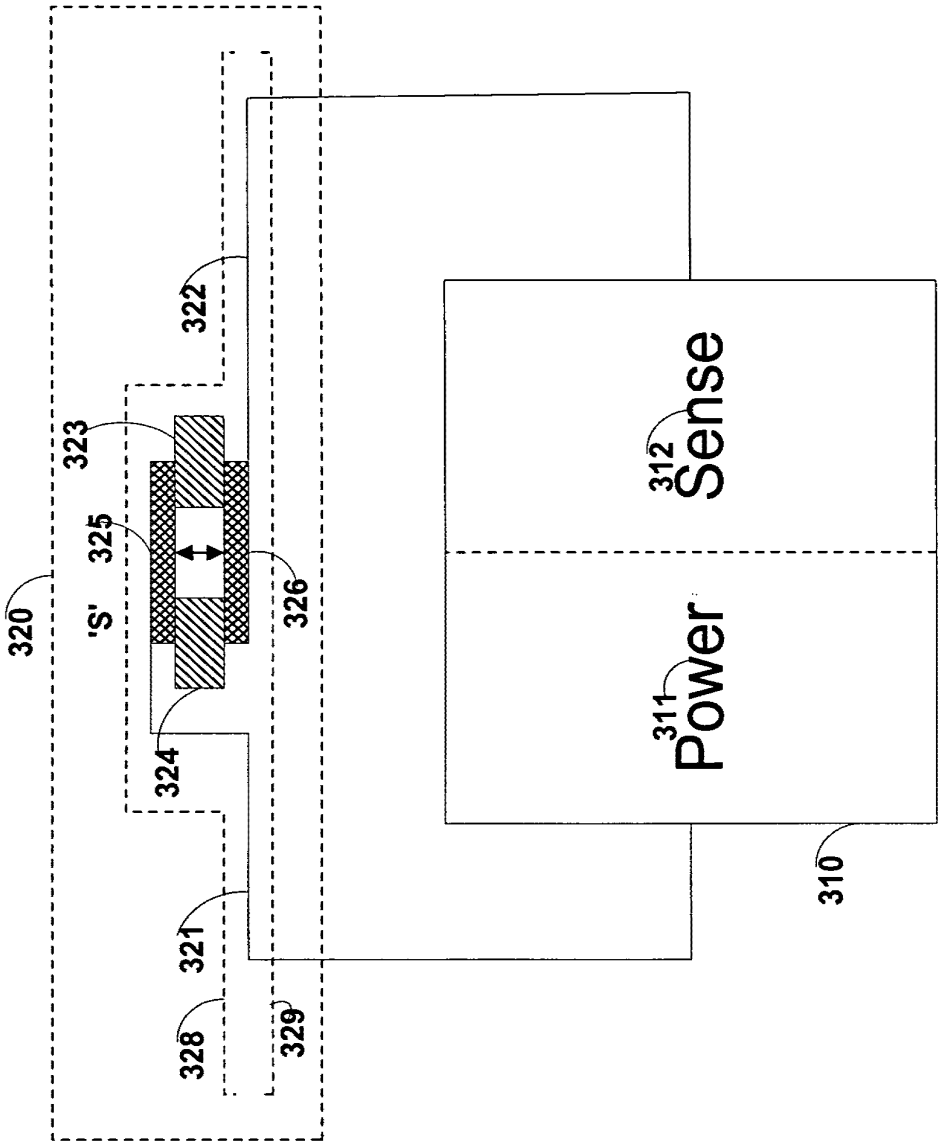

FIG. 3

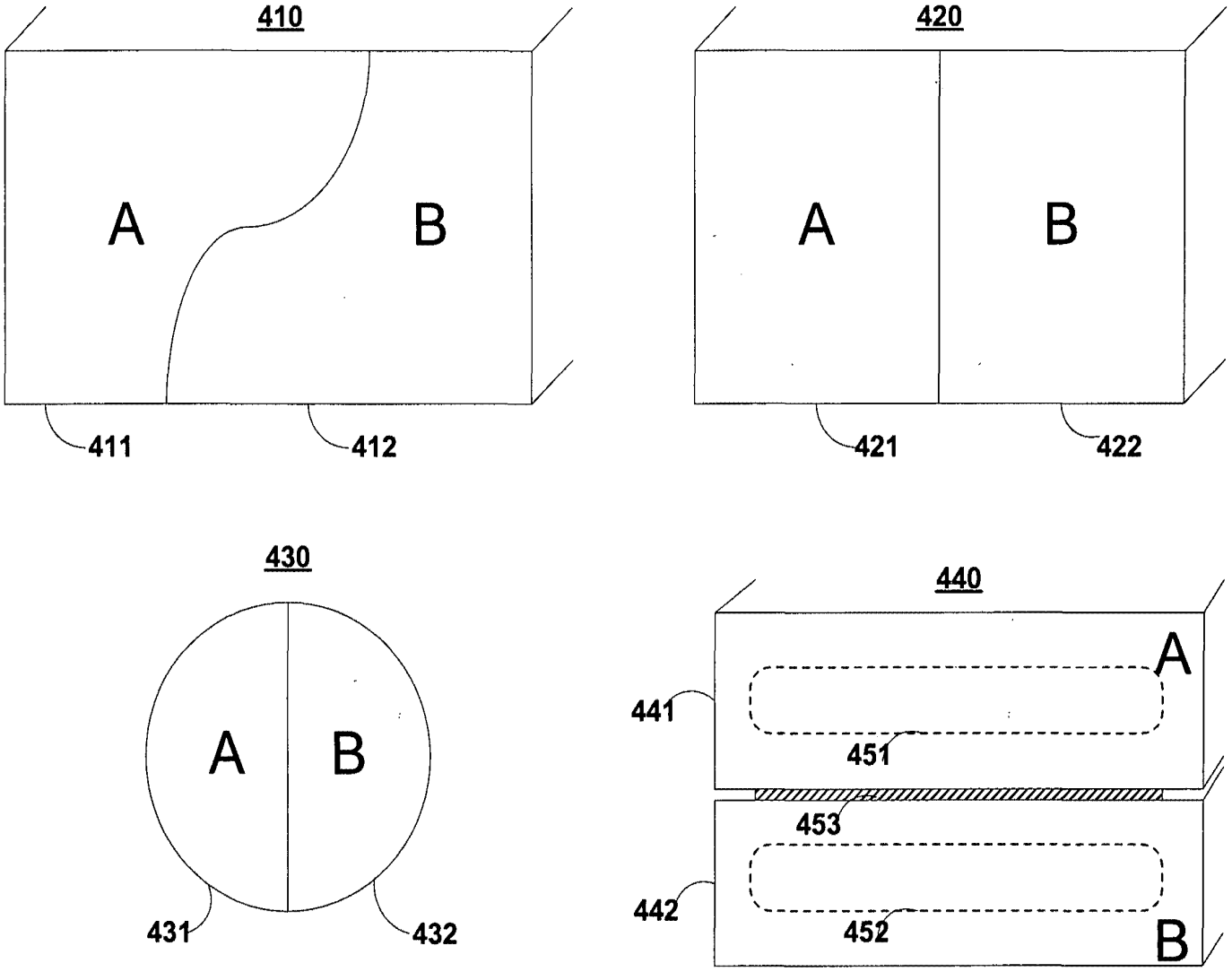

FIG. 4

500

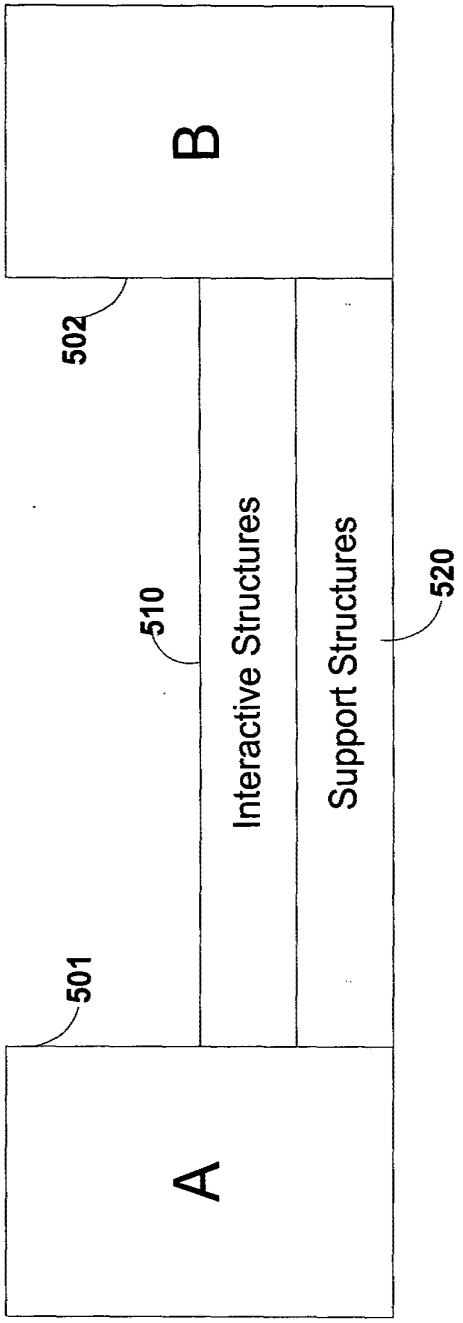
B
502
Interactive Structures
510
Support Structures
520
501
A

FIG. 5

600

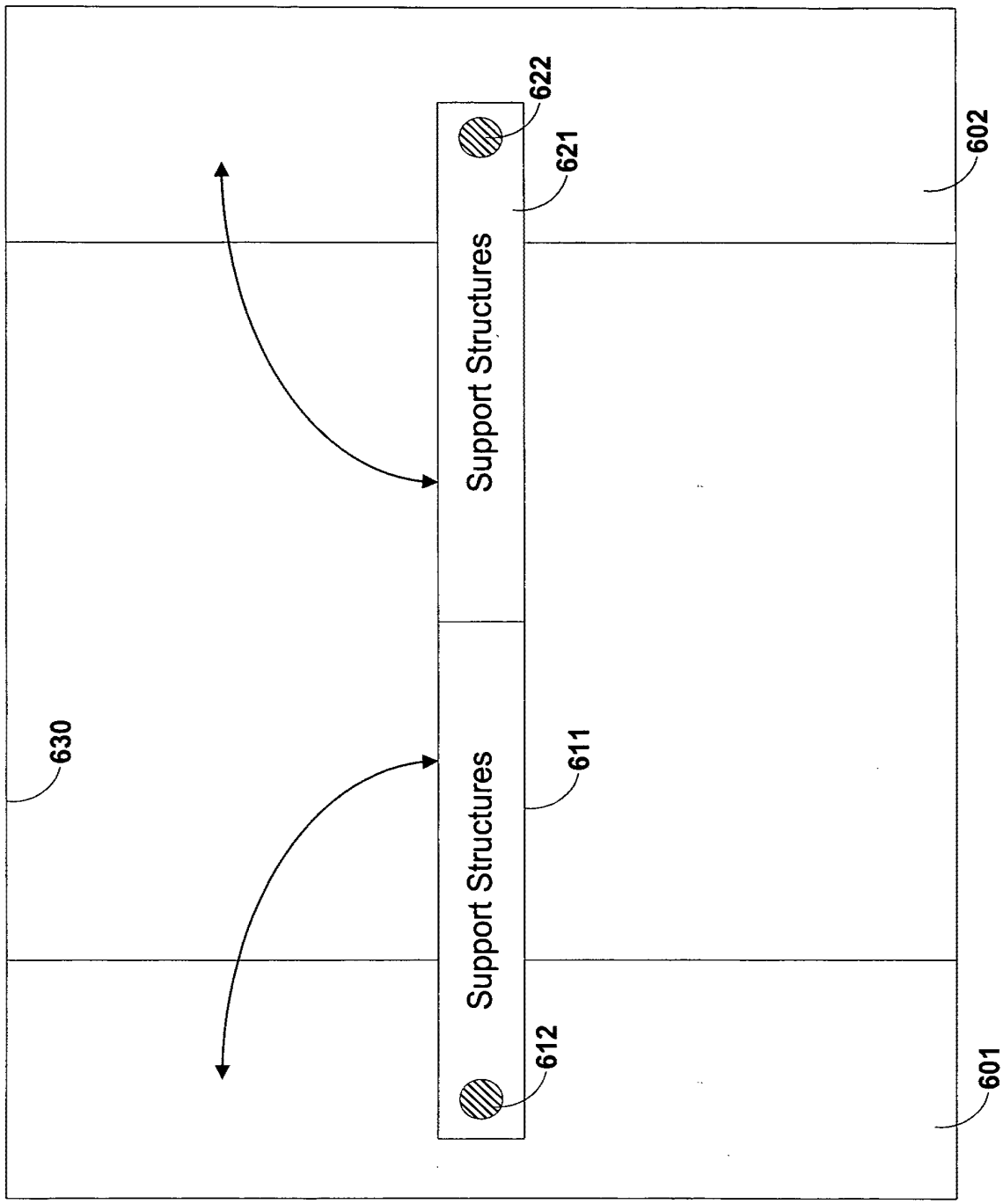
622
621
602
Support Structures
630
611
Support Structures
612
601

FIG. 6

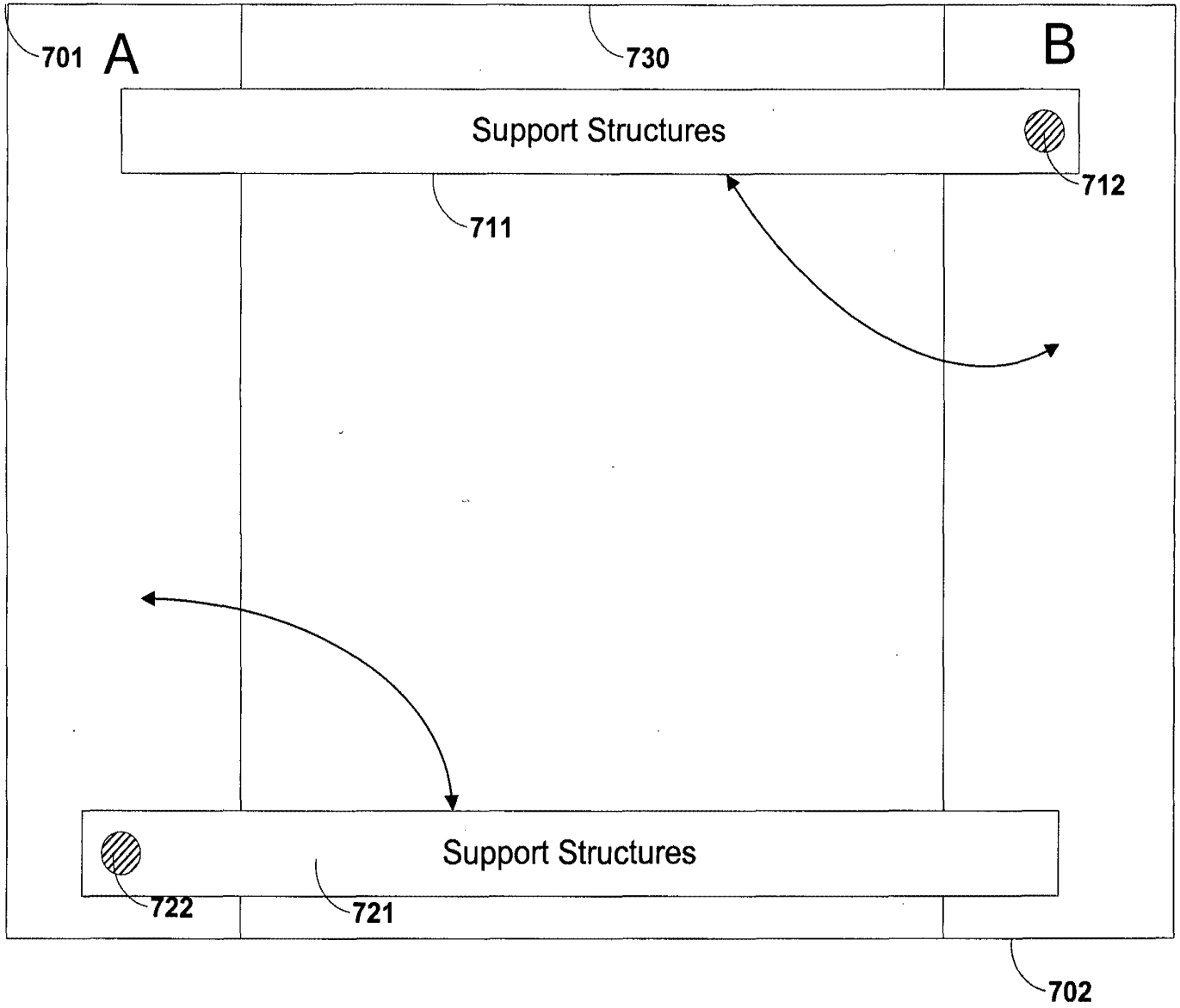

FIG. 7

800

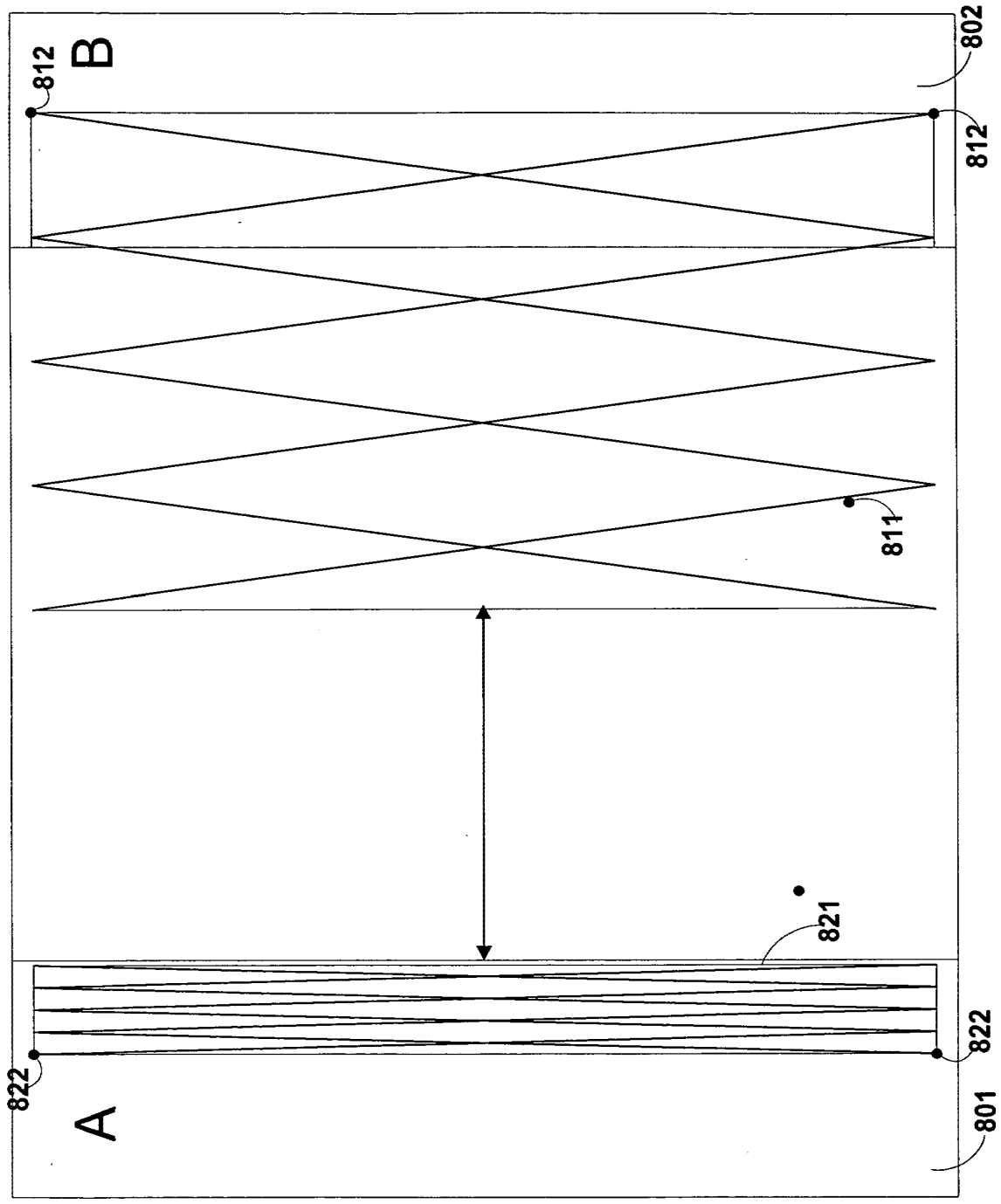

FIG. 8

900

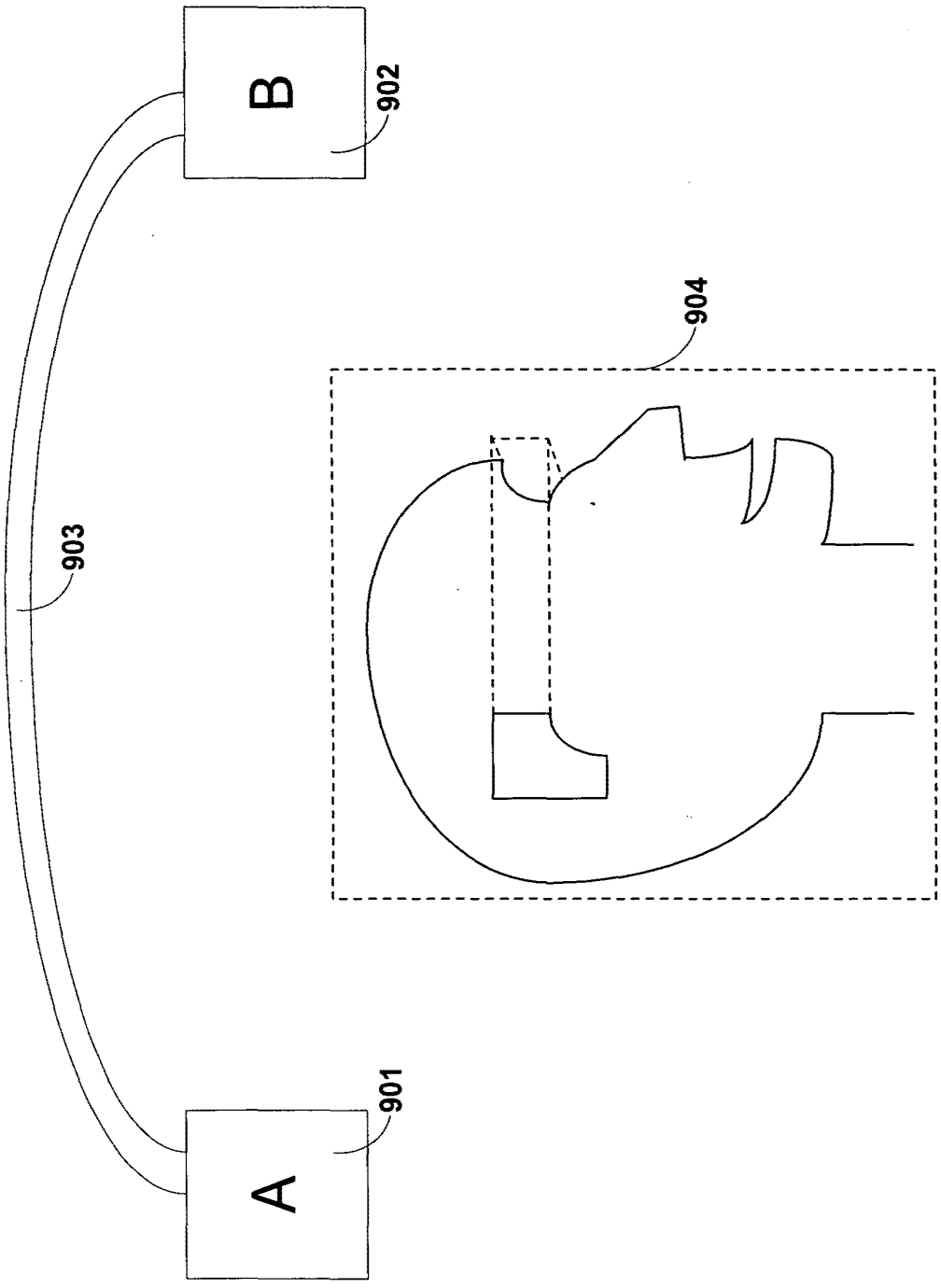

FIG. 9

1000

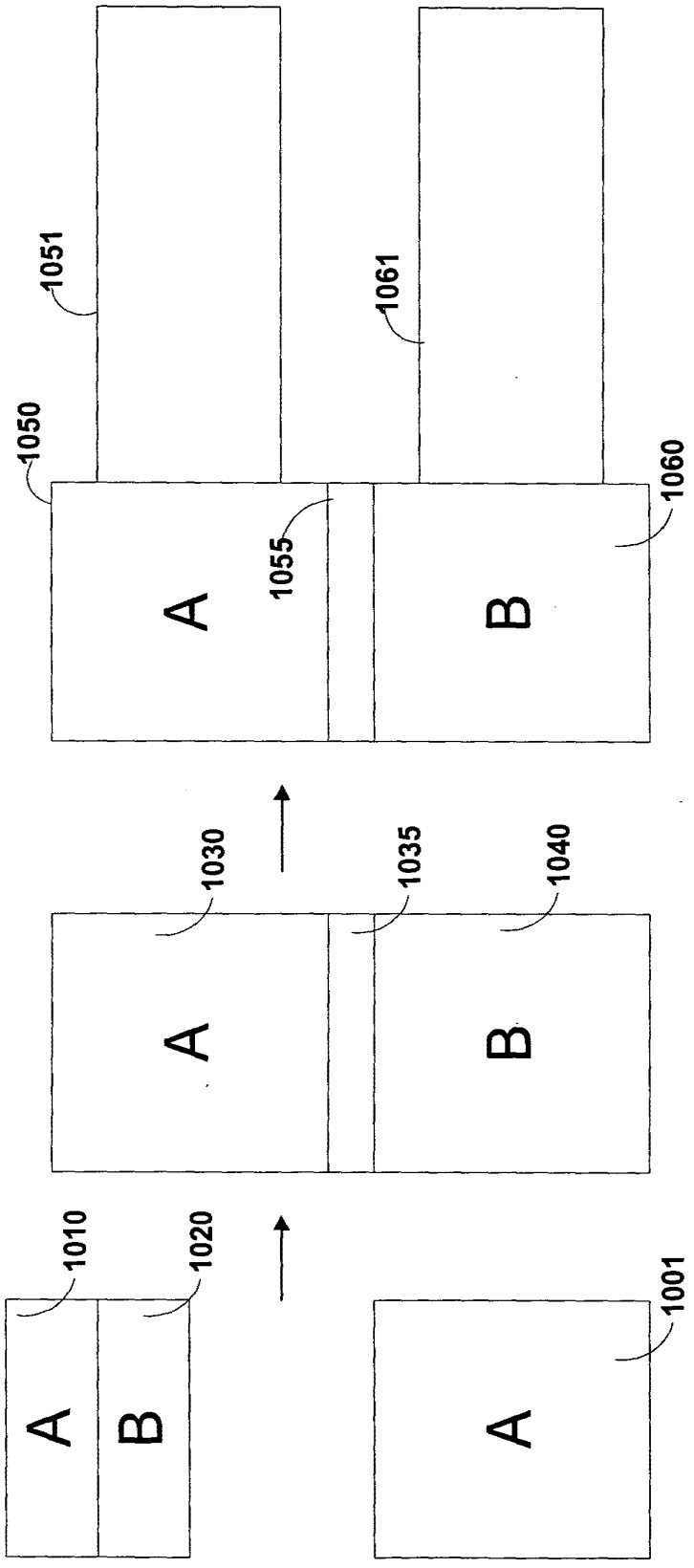

FIG. 10

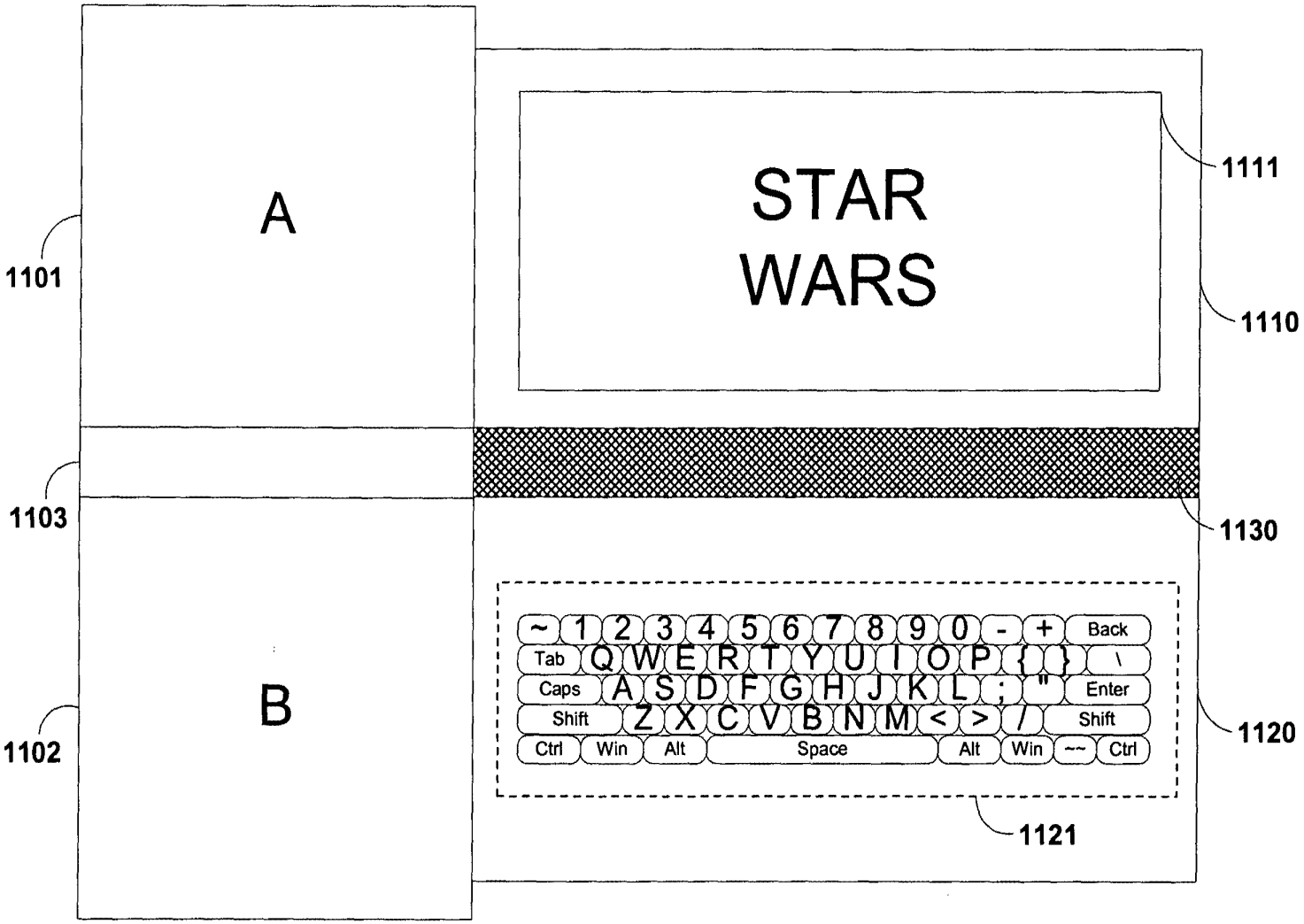

FIG. 11

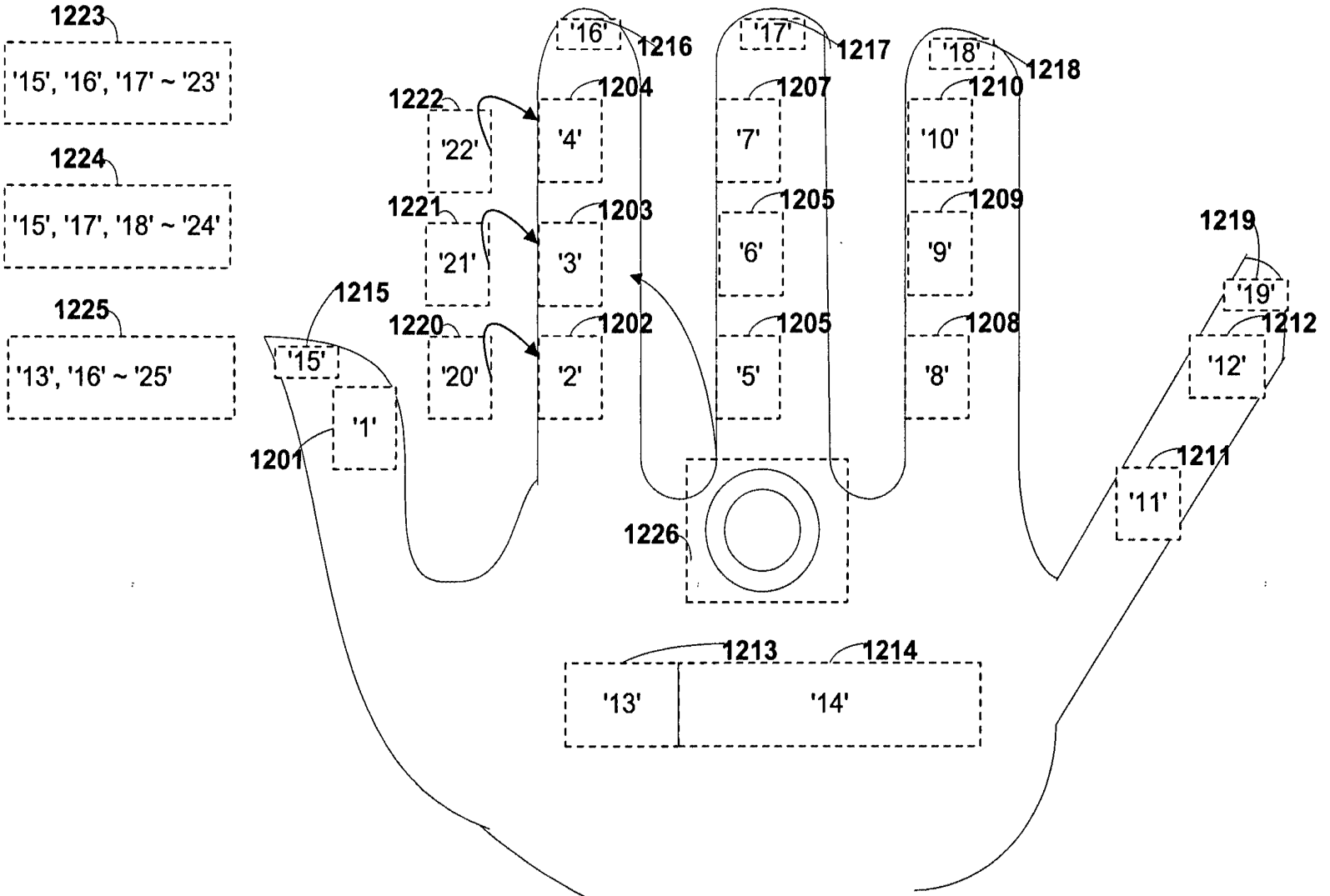

FIG. 12