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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 January 2008 (31.01.2008)

PCT

(10) International Publication Number
WO 2008/014128 A2

(51) International Patent Classification:
G09G 5/00 (2006.01)

(21) International Application Number:
PCT/US2007/073416

(22) International Filing Date: 13 July 2007 (13.07.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
11/459,516 24 July 2006 (24.07.2006) US

(71) Applicant *(for all designated States except US)*: **MOTOROLA, INC.** [US/US]; 1303 East Algonquin Road, Schaumburg, Illinois 60196 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **BARAZ, Benjamin** [IL/IL]; 5 Giborey Israel, 44227 Kfar-Saba (IL). **NEWMAN, Yona** [IL/IL]; 22/7 Shwartz Street, 43213 Ra-anana (IL).

(74) Agents: **LABUDDA, Kenneth, A.** et al.; 1303 East Algonquin Road, Schaumburg, Illinois 60196 (US).

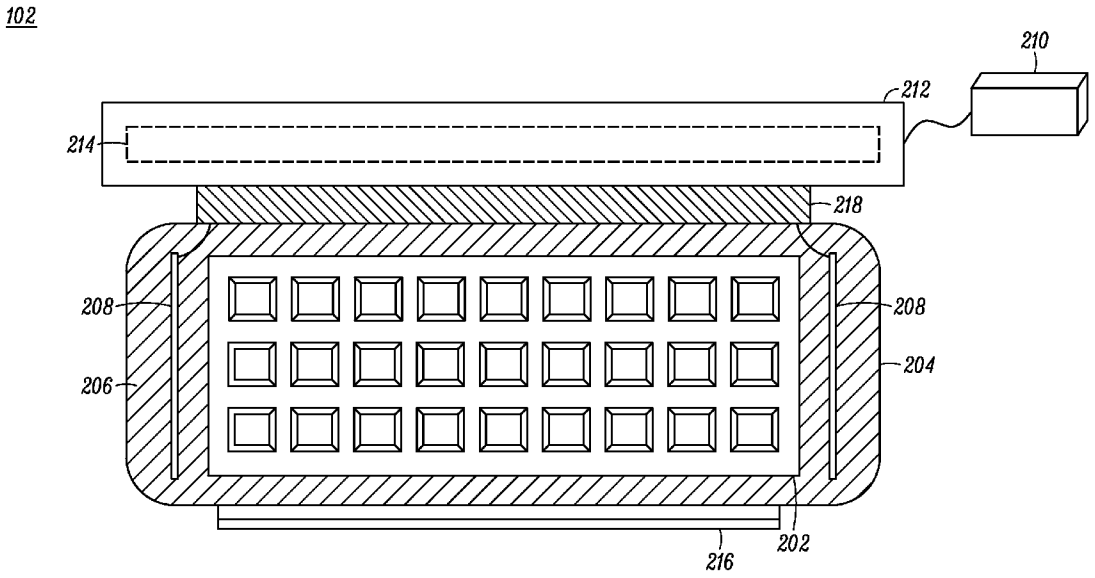
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, 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).

Published:
— *without international search report and to be republished upon receipt of that report*

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

(54) **Title:** USER INTERFACE SYSTEM



(57) **Abstract:** A user interface system (102) for a portable electronic device (100) is disclosed. The user interface system includes an interface (202) that is made of a flexible material and has an active position and an inactive position. The interface is coupled with a reservoir (204). The reservoir is used for storing electrorheological fluid (206). The user interface system also includes a source (208) that is coupled to the reservoir. The source is used for applying an electric field to the electrorheological fluid when the interface is in the active position.

WO 2008/014128 A2

USER INTERFACE SYSTEM

FIELD OF THE INVENTION

[0001] The invention relates in general to the field of portable electronic devices, and more particularly, to a user interface system for a portable electronic device.

BACKGROUND OF THE INVENTION

[0002] Nowadays, electronic devices, for example, a mobile telephone, a personal digital assistant (PDA), a laptop computer and/or a smart telephone, are becoming increasingly popular. An electronic device generally has a user interface system, which facilitates user interaction with the electronic device. The user interface system, such as a keyboard, a keypad and a touch screen, can be used to input data to the electronic device or provide commands to the electronic device. Further, the user interface system, such as a Liquid Crystal Display (LCD), an electronic (E) paper, and a touch screen, can be used to display information. These user interface systems tend to be bulky and inflexible, causing inconvenience in portability and problems in handling.

[0003] Currently, there exist various user interface systems, which are portable to a certain degree. In one such user interface system, various components of the user interface system can be disassembled and assembled whenever required. However, such a user interface system requires manual effort to assemble and disassemble that can be time-consuming and tiresome. Further, the user interface

system becomes bulky after being re-assembled. Moreover, this user interface system may not facilitate portability since it might not be convenient for a user to disassemble and assemble the system frequently.

[0004] In view of the foregoing discussion, there exists a need for a user interface system which occupies the minimum amount of workspace and is easy to carry as well.

BRIEF DESCRIPTION OF THE FIGURES

[0005] The accompanying figures, where like reference numerals refer to identical or functionally similar elements throughout the separate views, and which, together with the detailed description below, are incorporated in and form part of the specification, serve to further illustrate various embodiments as well as explain various principles and advantages, all in accordance with the present invention.

[0006] **FIG. 1** illustrates an exemplary portable electronic device, in accordance with an embodiment of the present invention;

[0007] **FIG. 2** illustrates a top view of a user interface system, in accordance with an embodiment of the present invention;

[0008] **FIG. 3** illustrates a side view of the user interface system, in accordance with an embodiment of the present invention;

[0009] **FIG. 4** illustrates a front view of a user interface system, in accordance with another embodiment of the present invention;

[0010] **FIG. 5** is a flow diagram illustrating a method for operating the user interface system, in accordance with an embodiment of the present invention; and

[0011] **FIG. 6** illustrates a rolled-up view of a user interface system, in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

[0012] In an embodiment, a user interface system is provided. The user interface system includes an interface, a reservoir and a source. The interface is made of flexible material. The interface has an active position and an inactive position. Further, the interface is coupled to the reservoir, which stores an electrorheological fluid. Moreover, the source is also coupled to the reservoir. The source can apply an electric field to the electrorheological fluid, making the interface rigid when in the active position.

[0013] In another embodiment, a method for operating a user interface system is provided. The method includes coupling a reservoir to the user interface system. The reservoir stores an electrorheological fluid. The method further includes maintaining the user interface system in an inactive position. When an activation of the user interface system is detected the electric field is applied to the electrorheological fluid. As a result, the electrorheological fluid changes its physical state from a liquid to a semi-solid state. Thereafter, the user interface system is operated in an active position.

[0014] Before describing in detail the particular user interface system, in accordance with various embodiments of the present invention, it should be observed

that the present invention resides primarily in combinations of apparatus components and method steps related to a user interface system. Accordingly, the apparatus components and method steps have been represented, where appropriate, by conventional symbols in the drawings, showing only those specific details that are pertinent for an understanding of the present invention, so as not to obscure the disclosure with details that will be readily apparent to those with ordinary skill in the art, having the benefit of the description herein.

[0015] In this document, the terms "comprises," "comprising," or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such a process, method, article or apparatus. An element proceeded by “comprises … a” does not, without more constraints, preclude the existence of additional identical elements in the process, method, article or apparatus that comprises the element. The term “another,” as used in this document, is defined as at least a second or more. The term “includes,” as used herein, is defined as comprising.

[0016] **FIG. 1** illustrates an exemplary portable electronic device **100**, in accordance with an embodiment of the present invention. Examples of the portable electronic device **100** include, but are not limited to, a mobile telephone, a smart telephone, a laptop computer, a desktop computer and a personal digital assistant (PDA). The portable electronic device **100** includes user interface systems **102** and **104**. In the **FIG.1**, the user interface systems **102** and **104** are shown as a keypad and a display of a mobile phone respectively. An input is provided to the portable

electronic device **100** through the user interface systems **102** (shown as a keypad). It will be appreciated that the input to the portable electronic device **100** can be entered using any other user interface system such as a touch screen. Thereafter, based on the input, information is displayed on the user interface systems **104** (shown as a display). It should be noted that the invention can be implemented for other suitable user interface system such as a flexible key matrix, an electronic (E) paper, and a touch screen.

[0017] **FIG. 2** illustrates a top view of the user interface system **102** (shown as a keypad in **FIG.1**), in accordance with an embodiment of the present invention. In this figure, the user interface system **102** is represented as a keypad. Hereinafter, in this figure, the user interface system **102** is referred to as the keypad. The keypad includes an interface **202**, a reservoir **204**, an electrorheological fluid **206**, and a source **208**. The keypad also includes a portable power unit **210**, an enclosure **212**, a reservoir enclosure **214**, a handle **216**, and a strip **218**. The interface **202** is made of a flexible and rollable material such as silicon-based materials, rubber, plastic, and so forth. Examples of the interface **202** include, but are not limited to, a key matrix, and a projector screen. The interface **202** is coupled to the reservoir **204**. In an embodiment, the interface **202** is attached or fixed at the top of the reservoir **204**. The reservoir **204** can be made up of a flexible material such as plastic, silicon, rubber, and so forth. The reservoir **204** can store the electrorheological fluid **206** in it. The electrorheological fluid **206**, such as lithium polymethacrylate, changes from a liquid state to a semi-solid (or solid) state due to change in its viscosity, when the electric field is applied to it. For example, when the electric field is applied to lithium polymethacrylate, its viscosity increases by '10^5' times.

[0018] As a result, the interface **202** and the reservoir **204** become rigid; this position being referred to as an active position of the interface **202** and the user interface system **102**. In **FIG. 2**, the user interface system **102** is shown in the active position.

[0019] The electric field can be applied to the electrorheological fluid **206** through the source **208**. The source **208** can be a plurality of electrodes, shown in **FIG. 2**. The source **208** can be made of flexible materials such as copper, silver, aluminum, gold, gold plated/flashed over nickel, and so forth. In an embodiment, the electric field can be applied through the source **208** using the portable power unit **210** such as a portable battery. The portable power unit **210** may be an AC battery or a DC battery.

[0020] Further, when the electric field is removed from the electrorheological fluid **206**, the viscosity reduces and electrorheological fluid **206** again reverts to a liquid state. As a result, the interface **202** and the reservoir **204** become flexible again. In an embodiment, the interface **202** and the reservoir **204** are coiled and enclosed in the enclosure **212**. In an embodiment, the reservoir **204** is enclosed in the reservoir enclosure **214**. Such a position is referred to as an inactive position of the interface **202** and the user interface system **102**. In an embodiment, a spring, not shown in **FIG. 2**, can be used to enable coiling of the interface **202** and the reservoir **204** in the enclosure **212**. The spring is explained in detail in conjunction with **FIG. 3**.

[0021] In an embodiment, the handle **216** is attached to the reservoir **204**. The handle **216** facilitates uncoiling of the interface **202**, along with the reservoir **204**,

from the inactive position. In other words, the interface **202** is pulled with the help of the handle **216**. This enables uncoiling of the interface **202** and the reservoir **204**.

[0022] In an embodiment, the strip **218** connects the reservoir **204** to the enclosure **212**. In another embodiment, the strip **218** connects the interface **202** to the enclosure **212**. In yet another embodiment, the strip **218** connects the reservoir **204** and the interface **202** to the enclosure **212**. The strip **218** can be made of electrically conducting sections such as a copper section, a silver section, and so forth. In an embodiment, the conducting sections are coated with electrically non-conducting materials such that they are isolated from each other.

[0023] **FIG. 3** illustrates a side view of the user interface system **102** (shown as a keypad in **FIG. 1**), in accordance with an embodiment of the present invention. The interface **202** is attached on top of the reservoir **204**. The reservoir **204** stores the electrorheological fluid **206** and includes the source **208** (or electrodes). One end of the reservoir **204** is connected to the handle **216**. The other end of the reservoir **204** and/or the interface **202** can be connected to the enclosure **212** through the strip **218**. The enclosure **212** can enclose the interface **202** and the reservoir **204**. In an embodiment, the reservoir **204** is enclosed in the reservoir enclosure **214**. The enclosure **212** also includes the spring **302** that enables coiling of the reservoir **204** in the enclosure **212** when the electric field is removed from the electrorheological fluid **206**. It should be noted that though the spring **302** as a coil spring, it will be understood by a person ordinarily skilled in the spring **302** can be any other type of spring as well. In other words, when a portable power unit **210**, such as a portable battery, is disconnected from the electrorheological fluid **206**, the physical state of the

electrorheological fluid **206** changes to a liquid state. Thus the interface **202** becomes flexible. Thereafter, the spring **302** exerts a pulling force on the reservoir **204**, enabling coiling of the reservoir **204** back in the enclosure **212**.

[0024] In an example, the user interface system **102** may be used as a keyboard for an on-board computer in an automobile. In another example, the interface **202** is keypad of a mobile telephone. In yet another example, the interface **202** is display screen of a mobile telephone or a computer. The enclosure **212**, enclosing the interface **202**, and the reservoir **204** may be fitted in the dashboard. When the on-board computer is required by a user, the interface **202** can be pulled out by the user. Further, power supply is provided to the electrorheological fluid **206**, making the interface **202** rigid. After use, the power supply is switched off, making the interface **202** flexible again. Thereafter, the spring **302** coils the interface **202** back in the enclosure **212**.

[0025] **FIG. 4** illustrates a front view of the user interface system **104** (shown as a display in **FIG. 1**), in accordance with an embodiment of the present invention. In this embodiment, an interface **402** is a scrollable E paper. The E paper enables the text to be re-written on it. Further, it can be used as a display of an electronic device. In an embodiment, the E paper is made of flexible and scrollable material. The other details of the display are similar to that of the keypad, described in **FIGs. 2** and **3**.

[0026] In another embodiment, the user interface system **104** can be a work surface that can be used as a support for writing or for other purposes. Such a user interface system is specifically suitable for the use in workshops.

[0027] In yet another embodiment, the user interface system **104** can be used in safety equipments such as jackets, which can harden on demand, to provide extra safety to security personnel.

[0028] In yet another embodiment, the user interface system **104** can act as a divider that can be used to partition two sections of an enclosed space, for example, in an automobile, partitioning the driver's seat from the back seat.

[0029] In yet another embodiment, the user interface system **104** can be a windscreen of an automobile. The windscreen can be made active when protection is required, and can be coiled and made inactive when not in use. Further, the user interface system **104** can be used as the bumper and/or the engine cover. The bumper can be used as side protection of side doors of a vehicle. The bumper may collapse partially in an event of an accident, in an attempt to prevent injuries to a pedestrian.

[0030] It will be apparent to a person ordinarily skilled in the art that the concept of the change in the physical state of the electrorheological fluid **206**, described above, can be applied for various other applications such as folding chairs, curtains, and so forth.

[0031] **FIG. 5** is a flow diagram illustrating a method for operating the user interface system **102** (shown as a keypad in **FIG. 1**), in accordance with an embodiment of the present invention. It should be noted that though the flow diagram is described with reference to the user interface system **102**, the flow diagram can be implemented with any other suitable embodiment of the invention as well. After initiating the process at step **502**, the reservoir **204** is coupled to the user interface

system **102** at step **504**. The reservoir **204** can store the electrorheological fluid **206**. In an embodiment, the reservoir **204** includes a flexible frame surrounding the interface **202**. At step **506**, the user interface system **102** is maintained in an inactive position. In the inactive position, the interface **202** of the user interface system **102** can be enclosed in the enclosure **212**. In an embodiment, the interface **202** is coiled in the enclosure **212**. The spring **302** enables coiling of the reservoir **204** and/or the interface **202**.

[0032] At step **508**, an activation of the user interface system **102** is detected. In other words, a user can pull out the coiled interface **202** and the reservoir **204** from the enclosure **212** by pulling the handle **216**.

[0033] At step **510**, an electric field is applied to the electrorheological fluid **206**. This changes the physical state of the electrorheological fluid **206,** stored in the reservoir **204,** to a semi-solid (or solid) state. In an embodiment, the flexible frame surrounding the interface **202** becomes semi-solid (or solid) when the electrorheological fluid **206** becomes semi-solid (or solid). As a result, the interface **202**, coupled to the reservoir **204**, becomes rigid. At step **512**, the interface **202** is operated in an active position. Thereafter, the process terminates at step **514**.

[0034] **FIG. 6** illustrates a rolled-up view of the portable electronic device **100** including a user interface system **104** comprising a keypad **102,** in accordance with an embodiment of the present invention. The user interface system **104** is shown to be rolled in an enclosure when the portable electronic device **100** is not in use. The user interface system **104** can be pulled out from the enclosure **104** using the handle **216**.

[0035] Various embodiments, as described above, provide a user interface system. The user interface system enables a user to enclose the interface in an enclosure, when not in use. Further, the user can enclose the interface conveniently and quickly. Moreover, the user interface system occupies the minimum amount of workspace and is easy to carry as well. The user interface system is lightweight, portable and easy to handle while traveling.

[0036] In the foregoing specification, the invention and its benefits and advantages have been described with reference to specific embodiments. However, one with ordinary skill in the art would appreciate that various modifications and changes can be made without departing from the scope of the present invention, as set forth in the claims below. Accordingly, the specification and figures are to be regarded in an illustrative rather than a restrictive sense, and all such modifications are intended to be included within the scope of the present invention. The benefits, advantages, solutions to problems, and any element(s) that may cause any benefit, advantage or solution to occur or become more pronounced are not to be construed as critical, required or essential features or elements of any or all the claims. The invention is defined solely by the appended claims, including any amendments made during the pendency of this application, and all equivalents of those claims as issued.

WHAT IS CLAIMED IS:

1. A user interface system comprising:

an interface comprising a flexible material, the interface has an active position and an inactive position;

a reservoir coupled to the interface, wherein the reservoir stores an electrorheological fluid; and

a source coupled to the reservoir, wherein the source apply an electric field to the electrorheological fluid when the interface is in the active position.

2. A user interface system as claimed in claim 1, wherein the reservoir is one of a flexible bag and a flexible plastic frame.

3. A user interface system as claimed in claim 1, wherein the flexible material comprises a rollable material, and further wherein the active position comprises a rolled-out position and the inactive position comprises a rolled-up position.

4. A user interface system as claimed in claim 1 further comprising:

an enclosure coupled to the interface, wherein the enclosure stores the interface when the interface is in the inactive position.

5. A user interface system as claimed in claim 1, wherein the electrorheological fluid is adapted to stiffen into a semi-solid state when subjected to the electric field.

6. A user interface system as claimed in claim 5, wherein the electrorheological fluid is coupled to the interface such that the interface stiffens into a semi-solid state when the electrorheological fluid stiffens into a semi-solid.

7. A user interface system as claimed in claim 5, wherein the reservoir comprises a flexible frame surrounding the interface, and further wherein the flexible frame stiffens into a semi-solid state when the electrorheological fluid stiffens into the semi-solid state to create a rigidity of the interface.

8. A user interface system as claimed in claim 1, wherein the source comprises a plurality of electrodes for applying the electric field to the electrorheological fluid.

9. A user interface system as claimed in claim 1, further comprising a reservoir enclosure for storing the reservoir when the interface is in the inactive position.

10. A user interface as claimed in claim 9, wherein the reservoir is coiled up into the reservoir enclosure, and further wherein the reservoir enclosure comprises a spring for enabling coiling of the reservoir.

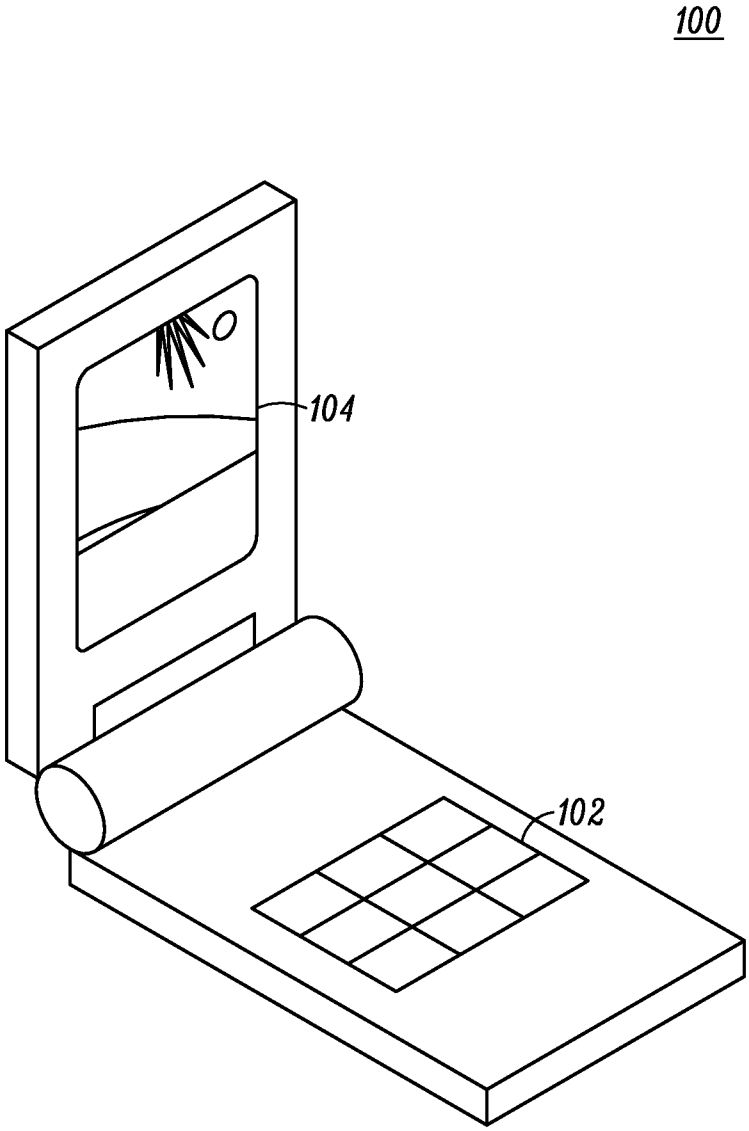


FIG. 1

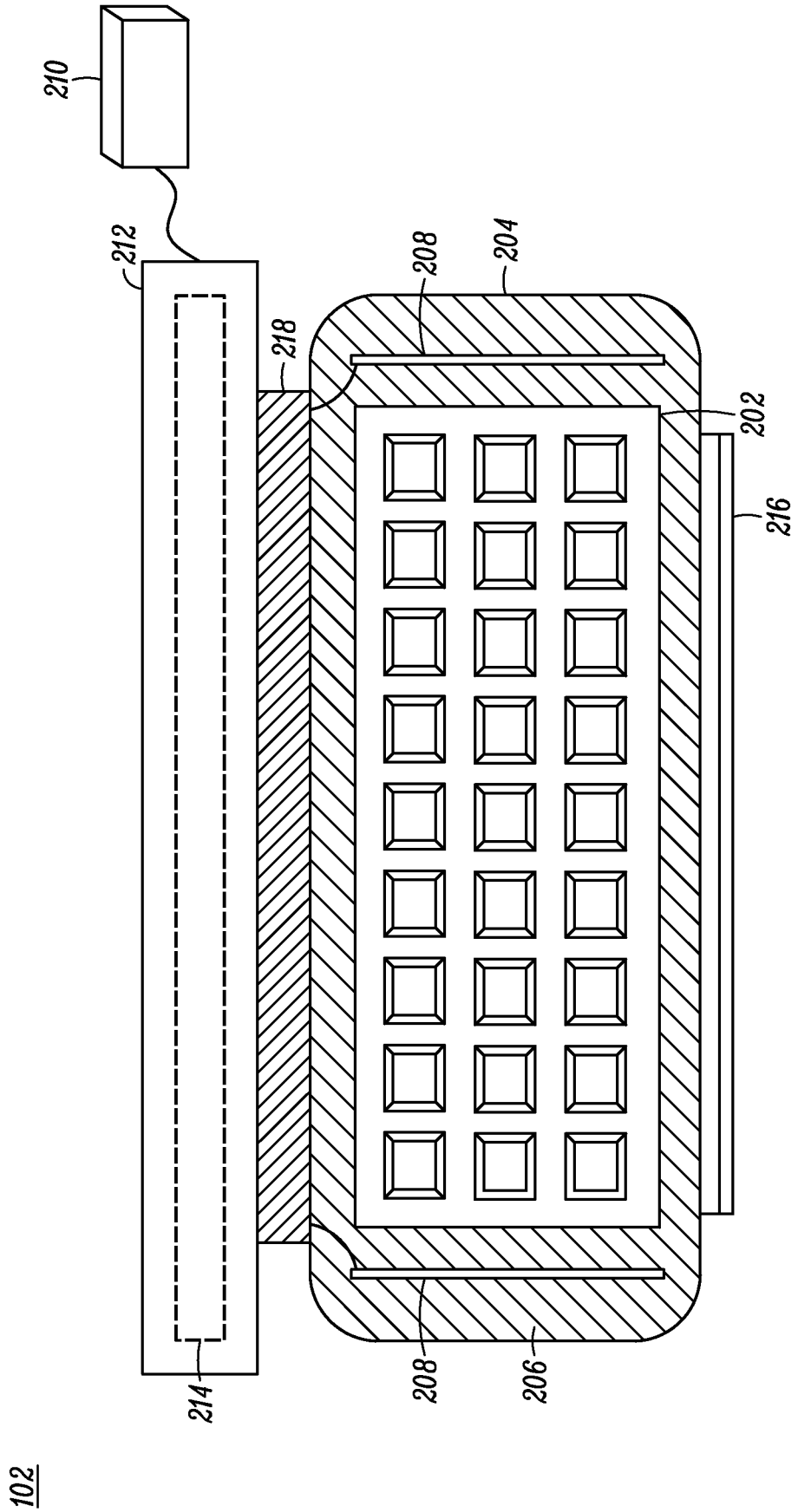


FIG. 2

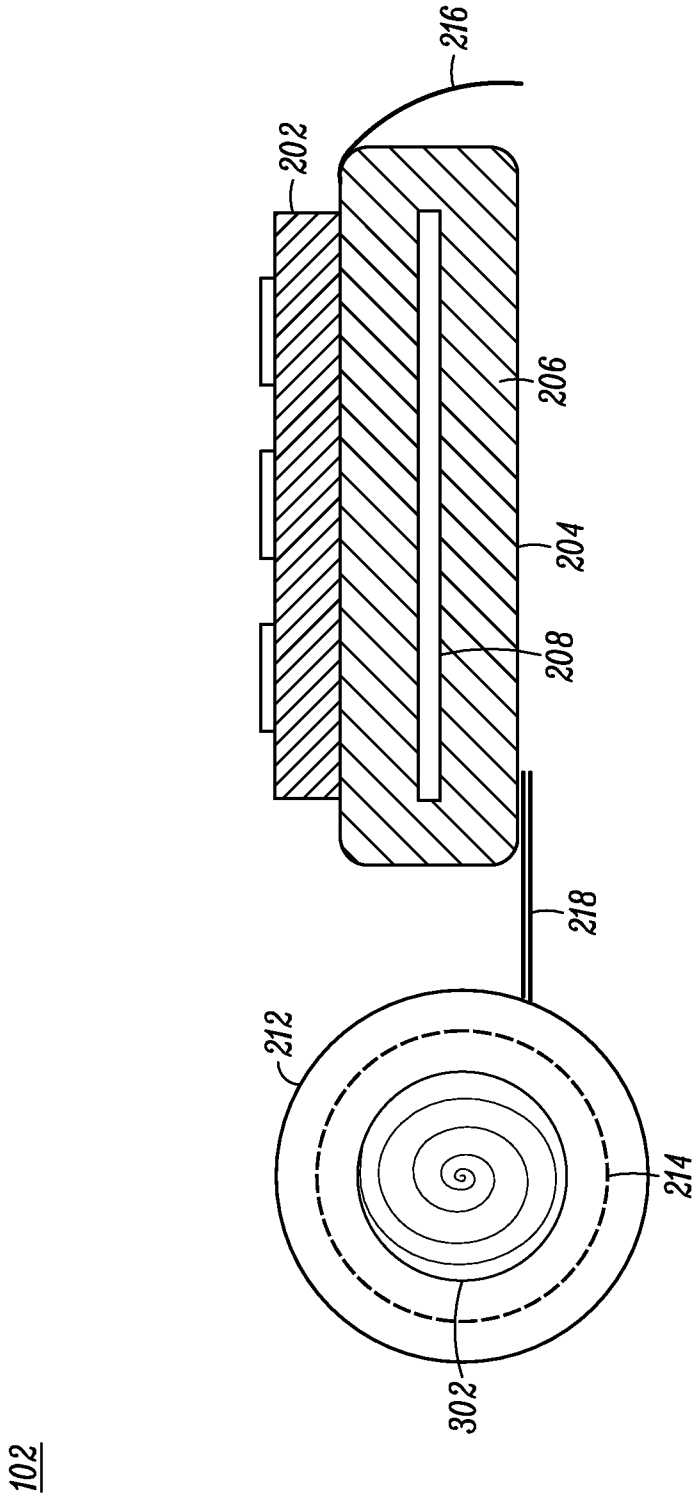


FIG. 3

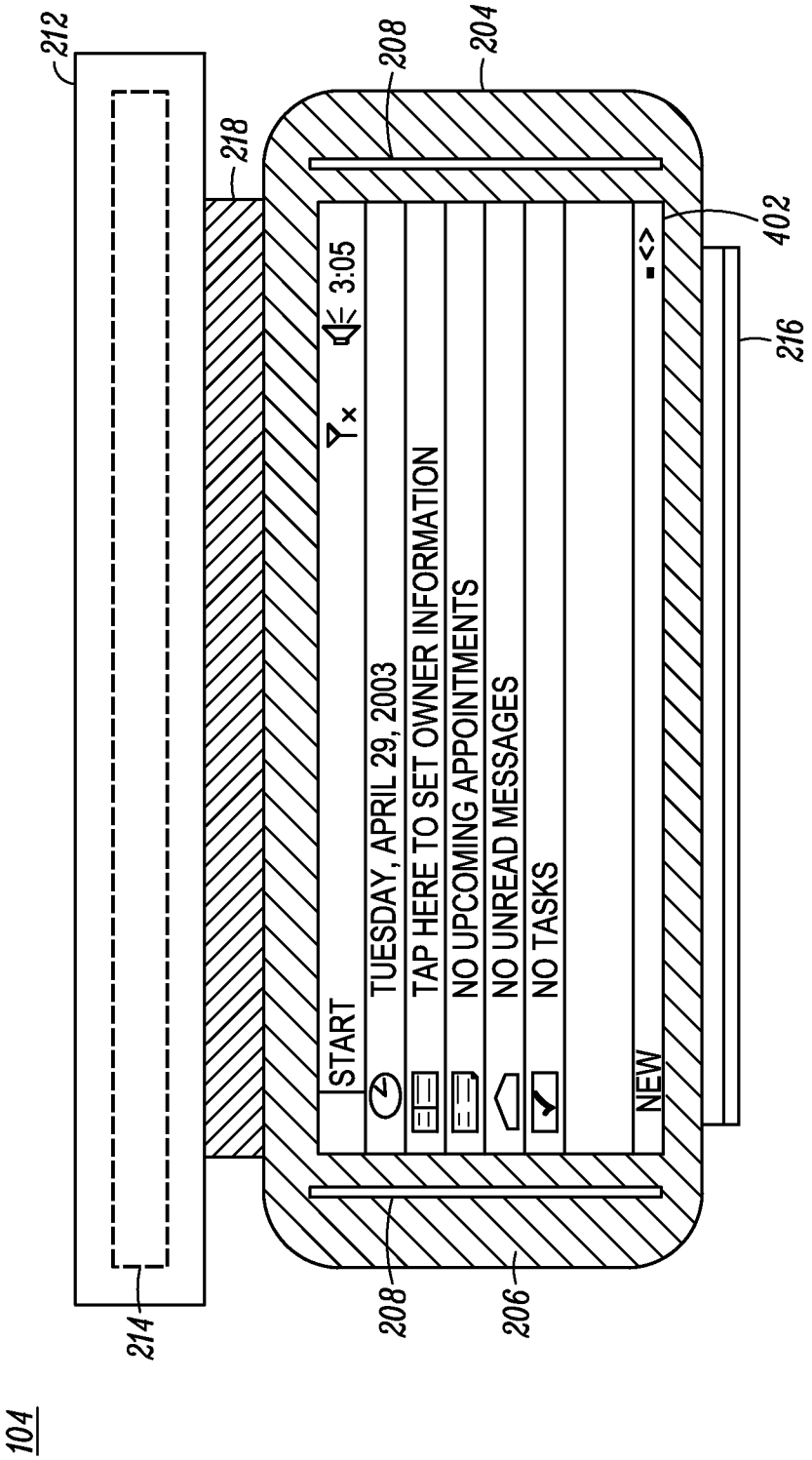

104
212
214
218
208
204
206
208
402
216
START
TUESDAY, APRIL 29, 2003
TAP HERE TO SET OWNER INFORMATION
NO UPCOMING APPOINTMENTS
NO UNREAD MESSAGES
NO TASKS
NEW
3:05

FIG. 4

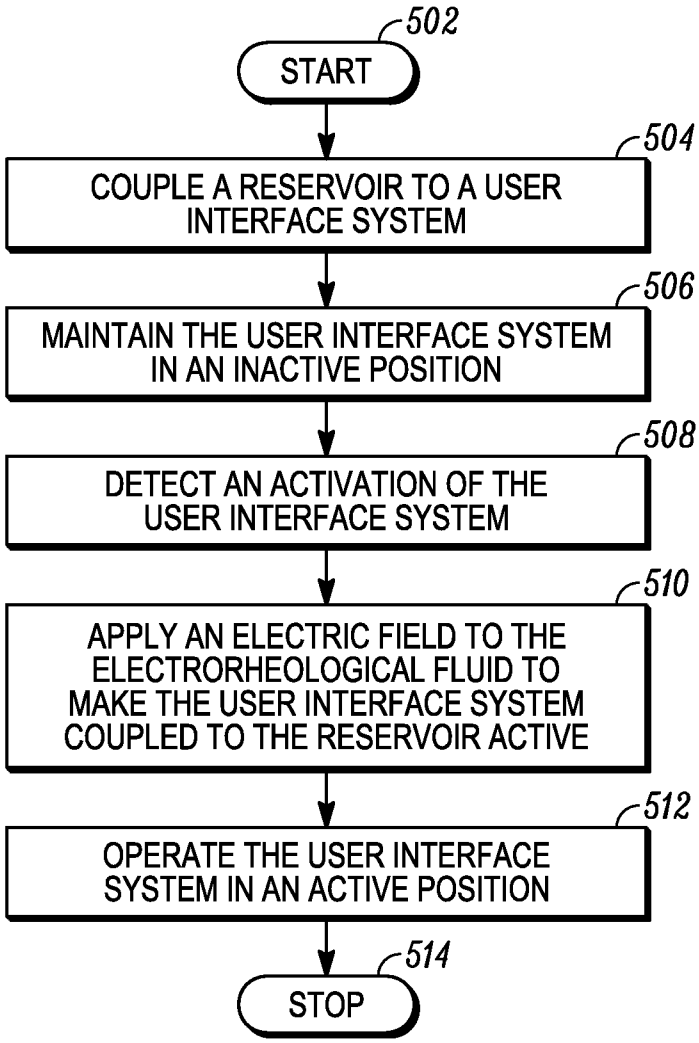

502
START
504
COUPLE A RESERVOIR TO A USER INTERFACE SYSTEM
506
MAINTAIN THE USER INTERFACE SYSTEM IN AN INACTIVE POSITION
508
DETECT AN ACTIVATION OF THE USER INTERFACE SYSTEM
510
APPLY AN ELECTRIC FIELD TO THE ELECTRORHEOLOGICAL FLUID TO MAKE THE USER INTERFACE SYSTEM COUPLED TO THE RESERVOIR ACTIVE
512
OPERATE THE USER INTERFACE SYSTEM IN AN ACTIVE POSITION
514
STOP

FIG. 5

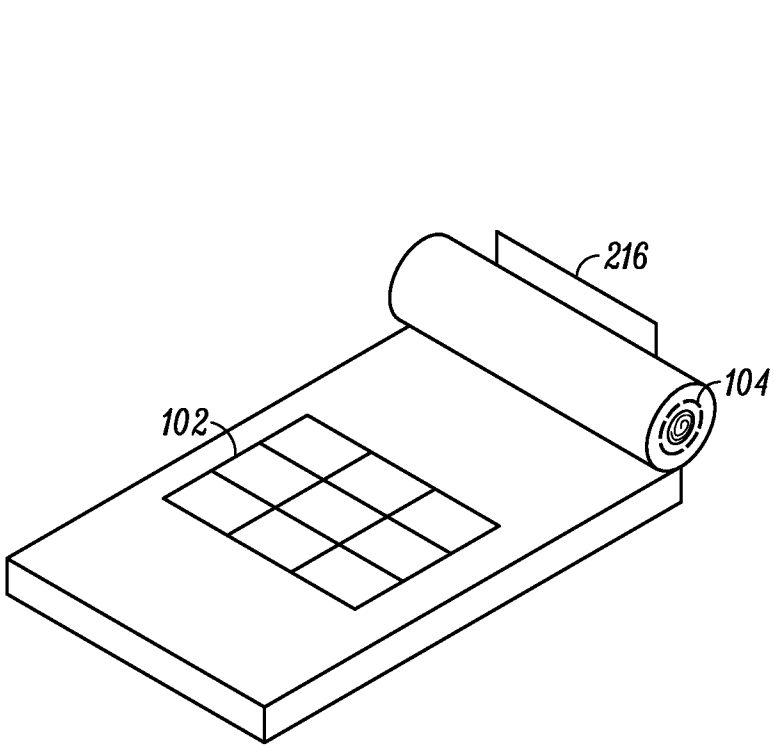


FIG. 6