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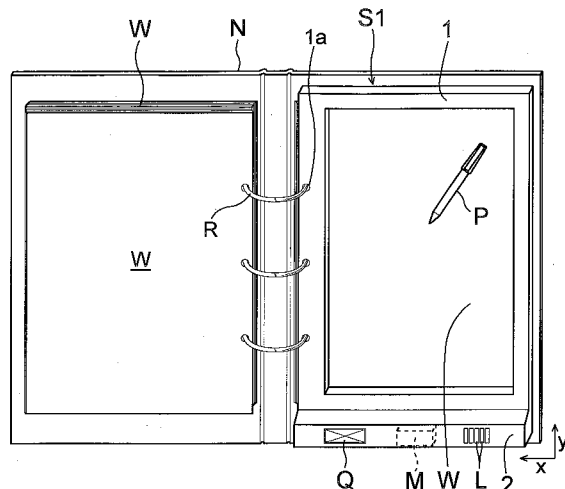
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- (54) **Title:** NOTEBOOK DEVICE

FIG.1



- (57) **Abstract:** A notebook device is provided which records the movement path of a writing implement to store the movement path as electronic data by merely writing a note directly on a paper sheet placed within a frame with the writing implement. This notebook device includes a notebook, and an optical sensor including at least one pair of light-emitting and light-receiving elements mounted to a rectangular frame. The optical sensor senses the interception of light beams traveling from the light-emitting element to the light-receiving element which is caused by the writing implement within the frame to thereby output information on the position of the writing implement. When a writing operation is performed on part of a paper sheet revealed within the frame of this optical sensor with a writing implement, the movement path of the tip of the writing implement is stored as electronic data in a storage means.



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Description

NOTEBOOK DEVICE

Technical Field

5 The present invention relates to a notebook device including an optical position detecting means.

Background Art

 There are some notebooks, such as electronic
10 notebooks, that digitally process notes, schedules and the like (see Japanese Patent No. 3746378). Such a notebook includes a display for displaying a timetable and the like, and is configured to allow a user or an inputter to enter notes and the like into the display
15 with a purpose-built stylus. Specifically, the aforementioned display is provided with a touch sensor (to constitute a touch panel). By bringing the tip of the aforementioned purpose-built stylus into contact with the display and then moving the purpose-built stylus,
20 the movement path of the tip of the purpose-built stylus is inputted as a note and the like to the aforementioned display. With information such as the inputted note and the like superimposed on information such as a timetable and the like appearing on the aforementioned display,
25 such data is stored in the aforementioned electronic

notebook.

The electronic notebook as described above includes a touch position detecting means for detecting the touch position of the purpose-built stylus, a finger of a person who operates a device and the like two-dimensionally (in x- and y-directions). In cooperation with displays produced on a flat display such as a monitor and a liquid crystal screen disposed under the panel of the monitor, the touch position detecting means allows a user to operate the aforementioned electronic notebook and the like. Conventionally, examples of this touch position detecting means (touch sensor) used in many cases include those employing a resistivemethod, a capacitivemethod, anelectromagnetic inductionmethod and the like from the viewpoints of cost, performance, durability and the like. The touch panels based on these methods have a structure such that a large number of electrical contacts are arranged in a matrix near the surface of the panel.

20

Summary of Invention

An electronic notebook device as mentioned above is convenient because a user can easily enter characters, schedules and the like thereinto. However, there is still a strong demand mainly from users unskilled in the

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manipulation of computers, electronic information devices and the like and from elderly people to perform a writing operation so that their handwriting is left directly on media such as paper sheets, rather than such
5 an electronic notebook that their handwriting, characters and the like virtually appear on a display and the like.

A notebook device is provided which records the movement path of a conventional writing implement and the like to store the movement path as electronic data
10 by merely writing a note, a schedule and the like directly on a paper sheet placed within a frame with the conventional writing implement.

The notebook device comprises: a notebook capable of having a paper sheet filed therein, the paper sheet
15 capable of being written upon by a writing implement; a frame-shaped optical sensor surrounding at least part of the paper sheet, the optical sensor including a rectangular frame, and at least one pair of light-emitting and light-receiving elements mounted to the rectangular
20 frame, the optical sensor sensing the interception of light beams traveling from the light-emitting element to the light-receiving element which is caused in association with the writing implement within the frame to thereby output information on the position of the
25 writing implement within the frame; and a storage means

for storing therein the movement path of a tip of the writing implement as electronic data when a writing operation is performed on part of the paper sheet revealed within the frame of the optical sensor with the writing
5 implement.

The notebook device includes the aforementioned frame-shaped optical sensor placed on a writing paper sheet (a paper sheet of the notebook) so that at least part of the paper sheet is revealed within the frame
10 thereof, and the storage means for storing therein the movement path information on the writing implement obtained from this optical sensor as electronic data. Thus, when the writing operation is performed on part of the paper sheet revealed within the frame of the
15 aforementioned optical sensor with the writing implement and the like, the path (handwriting) is left on the aforementioned paper sheet, and is also stored as electronic data in the aforementioned storage means. Thus, the notebook device automatically converts the
20 movement path of the conventional writing implement into electronic form by merely writing a note, a schedule and the like directly on the paper sheet placed within the frame with the conventional writing implement without giving special consideration to the conversion into
25 electronic form. Also, the aforementioned information

in electronic form may be taken (reproduced) from the
aforementioned storage means by the use of a personal
computer and the like. The sharing of the information
with others and the storing of knowledge, records and
5 the like are accomplished easily. This provides
convenience.

The notebook device includes, as a means (optical
sensor) for detecting the touch position of the tip of
the writing implement, the optical sensor including the
10 rectangular frame, and the at least one pair of
light-emitting and light-receiving elements mounted to
the rectangular frame, the optical sensor sensing the
interception of light beams traveling from the
light-emitting element to the light-receiving element
15 which is caused in association with the writing implement
within the frame to thereby output information on the
position of the writing implement within the frame. The
surface for the detection of the touch position has no
electrical (physical) contacts. The notebook device
20 therefore has high durability, and is less susceptible
to dust, contamination, and the like. Additionally, a
high writing pressure as in a resistive method, a
capacitive method, an electromagnetic induction method
and the like is not required during the writing operation
25 with a writing implement. Thus, the writing operation

is performed in a natural manner without concern for the sensor.

A notebook device employs, as the aforementioned frame-shaped optical sensor, an optical sensor such that:

5 the frame of the frame-shaped optical sensor includes first and second sections opposed to each other in the form of the frame; light-emitting elements are arranged in the first section and light-receiving elements are arranged in the second section; the light-emitting

10 elements and the light-receiving elements are positioned to face the interior of the frame; and light beams emitted from the light-emitting elements toward the

light-receiving elements produce a lattice of vertical and horizontal light beams crossing each other within

15 the frame, can employ general-purpose components, for example, a light-emitting diode (LED) and the like serving as the light-emitting element (a light source) and a photodiode (PD) serving as the light-receiving element. This advantageously allows the formation of the

20 aforementioned optical sensor at low cost. Additional advantages lie in high impact resistance and in high durability.

A notebook device employs, as the aforementioned frame-shaped optical sensor, an optical sensor such that:

25 modules each including a light-receiving element array

composed of a plurality of light-receiving elements and
the light-emitting element in vertically stacked relation
are disposed on two corners, respectively, on opposite
ends of one side among the four sides of the frame of
5 the frame-shaped optical sensor; a tape-like
retroreflector is provided on the inner side surface of
three sides other than the one side lying between these
modules; and light beams emitted from the light-emitting
element of one of the modules are reflected from the
10 retroreflector to travel back into the light-receiving
element array of the one module, can specify the position
of the tip of the aforementioned input element by
triangulation through the use of a small number of
components. This notebook device also has the advantage
15 of being formed at low cost by using general-purpose
components.

Brief Description of Drawings

FIG. 1 is a view illustrating an overall
20 configuration of a notebook device according to a first
embodiment.

FIG. 2 is a plan view illustrating a
configuration of one example of an optical sensor for
use in the notebook device.

25 FIG. 3(a) is a plan view illustrating a

configuration of another example of the optical sensor for use in the notebook device, and (b) is an enlarged view of a portion indicated by Z thereof.

FIGS. 4(a) to (c) are views illustrating a
5 configuration of the notebook device according to a second embodiment.

FIGS. 5(a) to (c) are views illustrating a configuration of the notebook device according to a third embodiment.

10 FIGS. 6(a) to (f) are views illustrating a configuration of the notebook device according to a fourth embodiment.

FIG. 7 is a perspective view illustrating a configuration of the optical sensor for use in the notebook
15 device according to a fifth embodiment.

FIGS. 8(a) and (b) are views illustrating a partial structure of the optical sensor for use in the notebook device.

FIG. 9 is a view illustrating a configuration
20 of the notebook device according to a sixth embodiment.

Description of Embodiments

Next, embodiments according to the present invention will now be described in detail with reference
25 to the drawings. It should be noted that the present

invention is not limited to the embodiments.

FIG. 1 is a view illustrating an overall configuration of a notebook device according to a first embodiment.

5 This notebook device includes a frame-shaped optical sensor S1 surrounding at least part of a paper sheet W (a sheet of refill paper for a notebook) capable of being written upon by a writing implement P, and a storage means M for storing the movement path of the tip
10 of the writing implement P within the frame of the optical sensor S1 as electronic data. The aforementioned optical sensor S1 includes a rectangular frame 1, and at least one pair of light-emitting and light-receiving elements (both not shown) mounted to this frame 1. The optical
15 sensor S1 senses the interception of light beams traveling from the aforementioned light-emitting element to the light-receiving element which is caused in association with the writing implement P within the aforementioned frame 1 to thereby output information on the position
20 of the aforementioned writing implement P and the like within the frame 1.

 In the aforementioned notebook device, the aforementioned optical sensor S1 and the storage means M are integrally formed as a storage device. The storage
25 device is capable of receiving ring-shaped holding

members R of a notebook jacket (a jacket for a personal organizer) N through holes 1a provided in the aforementioned frame 1. Thus, the aforementioned optical sensor S1 is placeable on or removable from a paper sheet, so that the aforementioned paper sheet W is easily replaceable with a new one. The notebook device further has a characteristic in that, even when the paper sheet W is replaced with a new one, the aforementioned stored information (movement path) may be easily taken (reproduced) from the storage means of the aforementioned storage device by the use of a computer and the like.

The aforementioned notebook device is provided with an input operation stop (input cancel) switch Q for manually stopping an input operation, lamps L for indicating an anomaly, a warning and the like, an input inhibit switch (not shown) for disabling the input operation when the optical sensor S1 is lifted, and the like, which will be described later. Also, a communication (power) cable (optional), a battery for driving the communication (power) cable, a control means such as a driver for the aforementioned light-emitting element and the light-receiving element, and a communication means (wired or wireless) for communicating with information devices such as computers are incorporated in a thick-walled thick-frame section 2 and

the like, but all are not shown.

Next, two types of optical sensors will be described as specific examples of the optical sensors (the aforementioned S1, or S2 to S6 to be described later)

5 for use in the embodiments. The two types are as follows:

an optical sensor Sa of the type which detects a touch position of the writing implement P, based on the

interception of light beams traveling in the form of an

orthogonal lattice; and an optical sensor Sb of the type

10 which determines the position where light beams are

intercepted by the writing implement P, based on

triangulation.

As a first specific example of the optical sensor for use in the aforementioned notebook device, the optical

15 sensor Sa will be first described in which a large number

of light-emitting diodes (LEDs) serving as light-emitting

elements (a light source) and a large number of photodiodes

(PDs) serving as light-receiving elements are arranged

in the frame 1 of the optical sensor (Sa) to form a lattice

20 of light beams for the detection of the tip (T) of the

writing implement P within the frame of the optical sensor.

FIG. 2 is a plan view illustrating a schematic configuration of the first example (Sa) of the optical

sensor for use in the notebook device. For ease of

25 description in this figure, the direction of the short

sides X1 and X2 of the frame 1 is defined as a horizontal direction (x-direction) whereas the direction of the long sides Y1 and Y2 of the frame 1 is defined as a vertical direction (y-direction), and light beams (invisible infrared light) in a lattice form within the frame 1 are indicated by dash-double-dot lines. The number of LEDs and PDs and the number of light beams in a lattice form are shown as abbreviated, and electrical interconnect lines and the like within this frame 1 are indicated by dotted lines. A battery for driving the notebook device, a communication means (a cable or a radio antenna) for communicating with information devices such as personal computers, and the like are not shown (the same applies to FIG. 3 to be described later).

The optical sensor Sa according to this first example includes: a touch position detecting means for detecting the position (x and y coordinates) of the tip (touch position T) of the writing implement P in the rectangular region (sensing region) within the frame-shaped frame 1 by being placed on a paper sheet W capable of being written upon by the writing implement P; a storage means M (built-in) for storing movement path information (change in x and y positions) on the tip position of the writing implement P obtained by this optical sensor Sa and also serving as a control means

for the light-emitting elements and the light-receiving elements; the input operation stop switch Q capable of manually stopping the input operation with the aforementioned writing implement P; and the plurality
5 of lamps L for indicating anomalies in devices, warnings and the like.

As shown in FIG. 2, a light source including a large number of LEDs 3 serving as a light-emitting section of the aforementioned touch position detecting means and
10 arranged within the frame 1 are provided in part of the frame 1 of the optical sensor Sa. A light-receiving section including a large number of PDs 4 corresponding to the respective LEDs 3 is provided in part (the sides X2 and Y2) of the frame 1 opposed to the part (the sides
15 X1 and Y1) of the frame 1 where the aforementioned LEDs 3 are arranged. These LEDs 3 and the PDs 4 are arranged and positioned along the inner edges of the aforementioned frame-shaped frame 1 so that the tips thereof face inward. Under the control of the storage means M serving also
20 as a controller (control means) for both the LEDs 3 and the PDs 4, the aforementioned LEDs 3 are caused to emit light beams simultaneously or sequentially in a scanning direction, thereby forming a lattice of vertical and horizontal light beams orthogonal to each other
25 (dash-double-dot lines) in the rectangular sensing region

within the frame 1.

Infrared LEDs (infrared light-emitting diodes) of the type which emit near-infrared light beams (at a wavelength of 700 to 2500 nm) are preferable as the LEDs
5 3 used as the aforementioned light-emitting elements (light source). A linear sensor array including a large number of light-receiving elements arranged in a line in the form of a bar or an array, an image sensor, and the like in addition to the aforementioned photodiodes
10 (PDs) may be used as the light-receiving elements.

The detection of the touch position T of the writing implement P using the optical sensor Sa in the aforementioned first example is done by the following procedure. First, the optical sensor Sa (the storage
15 device) including the storage means M serving also as the controller is placed on the writable paper sheet W so as to surround at least part of the paper sheet W (with reference to FIG. 1). Next, for calibration, while the LEDs 3 of the aforementioned light-emitting section are
20 caused to emit light beams sequentially one by one (from the end), the intensity of light beams (lattice light beams) reaching the PDs 4 corresponding to (opposed to) the LEDs 3 is measured when the light beams are emitted and when the light beams are not emitted, and threshold
25 values for the detection and non-detection of the writing

implement P based on the interception of light beams are determined for each of the PDs 4, and are stored in the form of a table and the like in the aforementioned storage means M.

5 Next, the storage means M serving also as the aforementioned controller causes the aforementioned LEDs 3 to sequentially emit light beams. While the sensing region of the optical sensor Sa is scanned, the tip of the writing implement P is brought down onto part of the
10 paper sheet W revealed within the frame of this optical sensor Sa. Then, as shown in FIG. 2, some of the light beams travelling in a lattice form within the aforementioned frame are intercepted by the tip of the writing implement P. Such an intercepted location is
15 sensed by corresponding ones of the PDs 4 of the aforementioned touch position detecting means, whereby the coordinate positions (x and y axes; with reference to the "touch position T" in FIG. 2) of the tip of the aforementioned writing implement P within the frame are
20 specified. The coordinates are stored in the aforementioned storage means M. The scanning of the aforementioned sensing region is stopped and the aforementioned lamps L turn on, for example, to provide notification (a warning) about a sensing anomaly, when
25 the coordinates of the tip of the writing implement P

cannot be specified, for example when the presence of a plurality of (two or more) light intercepted locations described above within the sensing region is detected or when the aforementioned light intercepted location is not correctly detected under the influence of sunlight, lamp light and the like.

Then, when a user moves the aforementioned writing implement P to write a note, a schedule and the like, the path (written information on the note and the like) of the tip of the aforementioned writing implement P in accordance with the movement is detected, and the path is stored as digital data (electronic data) in the aforementioned storage means M. That is, at the same time that the user writes a note, a schedule and the like on part of the paper sheet W revealed within the frame of the optical sensor Sa with the writing implement P, the information such as the note is recorded in a memory and the like in the storage means M serving also as the aforementioned controller.

The switch Q for stopping the input operation as mentioned above is provided on the upper surface of a portion (the thick-walled thick-frame section 2) of the aforementioned frame 1 (with reference to FIG. 2). This input operation stop switch Q is provided to disable the detection of the tip and the like of the writing implement

P by the use of the aforementioned touch position detecting means. The ON-OFF operation of the input operation stop switch Q may be performed to stop the light emission from the aforementioned LEDs 3 or the light reception of the
5 aforementioned PDs 4 or to stop the computation in the aforementioned storage means M, thereby stopping the input of information with the aforementioned writing implement P and the like at any time intended by an inputter. The use of the switch Q for stopping the input operation
10 prevents misoperations (false detection) occurring during the movement and the like of the optical sensor Sa for the replacement of the paper sheet W and paging.

Examples of the aforementioned input operation stop switch Q used herein may include electromagnetic
15 or optical switches such as a touch switch and a pressure-sensitive switch, in addition to various mechanical switches such as push, button, tact and slide switches. A warning indication may be provided, for example, by turning on the aforementioned lamps L to
20 clearly show that "the input operation is now being stopped" when the aforementioned input operation stop switch Q is operated.

The notebook device including the optical sensor Sa according to the first example as mentioned above
25 automatically converts the movement path of the

conventional writing implement into electronic form by merely writing a note, a schedule and the like directly on the paper sheet placed within the frame with the conventional writing implement without giving special consideration to the conversion into electronic form. Also, the aforementioned information in electronic form may be taken (reproduced) from the aforementioned storage means M by the use of a computer and the like. The sharing of the information with others and the storing of knowledge, records and the like are accomplished easily. Further, the optical sensor Sa according to the aforementioned first example may employ general-purpose components, for example, light-emitting diodes (LEDs) serving as the light-emitting elements (light source) and photodiodes (PDs) serving as the light-receiving elements. This allows the formation of the notebook device at low costs.

Next, the optical sensor Sb according to a second example will be described which includes modules (C1 and C2) disposed on two corners, respectively, of the frame 1 of the optical sensor (Sb) and each including a light-emitting element and a light-receiving element array, and which specifies the position of the tip of the writing implement P within the frame by a triangulation method by means of the two modules.

FIG. 3(a) is a plan view illustrating a schematic

configuration of the second example (Sb) of the optical sensor for use in the notebook device according to the present invention, and FIG. 3(b) is an enlarged view of a portion indicated by Z of FIG. 3(a). Also in these 5 figures, the direction of the short sides X1 and X2 of the frame 1 is defined as a horizontal direction (x-direction) whereas the direction of the long sides Y1 and Y2 of the frame 1 is defined as a vertical direction (y-direction), and a battery, a communication means and 10 the like which are provided in the aforementioned thick-frame section 2 are not shown.

The optical sensor Sb according to this second example includes: a touch position detecting means for detecting the position (x and y coordinates) of the tip 15 (touch position T) of the writing implement P in the rectangular region (sensing region) within the frame-shaped frame 1 by being placed on a paper sheet W capable of being written upon by the writing implement P; the storage means M (built-in) for storing movement 20 path information (change in x and y positions) on the tip position of the writing implement P obtained by this optical sensor Sb; the input operation stop switch Q capable of manually stopping the input operation with the aforementioned writing implement P; and the plurality 25 of lamps L for indicating anomalies in devices, warnings

and the like.

The optical sensor Sb according to the
aforementioned second example is different from the
optical sensor Sa according to the above first example
5 in that the light-receiving and -emitting modules (camera
modules C1 and C2) each including a vertical combination
of the light-emitting element (LED 3) and the
light-receiving element array (image sensor 5) as shown
in FIG. 3(b) are disposed on the corners 1b and 1c,
10 respectively, on opposite ends of one side (in this example,
X2) among the four sides of the frame 1 of the optical
sensor Sb, and in that a tape-like retroreflector
(retroreflective tape 6) is affixed to the inner side
surface of three sides (X1, Y1 and Y2) other than the
15 aforementioned one side (X2) lying between these camera
modules C1 and C2, as shown in FIG. 3(a). The storage
means M serves also as a controller (control means) for
the LEDs 3 and the image sensors 5, as in the aforementioned
first embodiment.

20 In the optical sensor Sb according to the
aforementioned second example having this configuration,
light beams emitted from the LEDs 3 in the respective
camera modules C1 and C2 are reflected from the
aforementioned retroreflective tape 6 to travel back
25 toward the camera modules C1 and C2 from which the light

beams are emitted, so that crossing of radial light beams occurs within the frame in such a manner that the light beams from each of the camera modules C1 and C2 diverge in a ripple or wave pattern, as shown in FIG. 3(a).

5 Infrared LEDs (infrared light-emitting diodes) of the type which emit near-infrared light beams (at a wavelength of 700 to 2500 nm) are preferable as the light-emitting elements (light source) for the
aforementioned camera modules C1 and C2. An image sensor
10 such as CCD and CMOS image sensors, a CMOS linear sensor array including a large number of light-receiving elements arranged in a line, and the like may be used as the light-receiving element array.

The retroreflector attached to the inner side
15 surface of the three sides (X1, Y1 and Y2) of the aforementioned frame 1 may be either of a microprism type or of a glass bead type. For ease of handling, the tape-like form is used as the retroreflector in the aforementioned example. Instead, a coating having a
20 retroreflective property may be applied to the inner side surface of the aforementioned three sides (X1, Y1 and Y2).

The detection of the touch position T of the writing implement P using the optical sensor Sb in the
25 aforementioned second example is done by the following

procedure. First, the optical sensor Sb (storage device) including the storage means M serving also as the controller is placed on a writable paper sheet W so as to surround at least part of the paper sheet W (with reference to FIG. 1). Next, for calibration, while the LEDs 3 of the aforementioned respective camera modules C1 and C2 are caused to emit light beams, the intensity of light beams (retroreflected light beams) traveling back to the image sensors 5 of the respective camera modules C1 and C2 is measured when the light beams are emitted and when the light beams are not emitted, and threshold values for the detection and non-detection of the writing implement P based on the interception of light beams are determined for each of the camera modules C1 and C2, and are stored in the form of a table and the like in the aforementioned storage means M.

Next, while the storage means M serving also as the aforementioned controller causes the aforementioned LEDs 3 to emit light beams, the tip of the writing implement P is brought down onto part of the paper sheet W revealed within the frame of this optical sensor Sb. Then, as shown in FIG. 3(a), some of the crossing light beams travelling within the aforementioned frame are intercepted by the tip of the writing implement P. Such an intercepted location is sensed by corresponding

light-receiving elements in the aforementioned camera modules C1 and C2. Using a computation device and the like (not shown), the intercepted (light-intercepted) position sensed by the storage means M serving also as
5 the aforementioned controller is determined by the triangulation method, and the coordinate positions (x and y axes; with reference to the "touch position T" in FIG. 3(a)) of the tip of the aforementioned writing implement P within the frame are specified. The
10 coordinates are stored in the storage means M.

As in the case of the optical sensor Sa which detects the coordinates by using the light beams in the aforementioned lattice form, the scanning of the aforementioned sensing region is stopped and the
15 aforementioned lamps L turn on, for example, to provide notification (a warning) about a sensing anomaly, when the coordinates of the tip of the writing implement P cannot be specified, for example when the presence of a plurality of (two or more) light intercepted locations
20 described above within the sensing region is detected or when the aforementioned light intercepted location is not correctly detected under the influence of sunlight, lamp light and the like.

Then, when a user moves the aforementioned writing
25 implement W to write a note, a schedule and the like,

the path (written information such as the note and the like) of the tip of the aforementioned writing implement P in accordance with the movement is detected and computed, and digital data (electronic data) on the path is stored
5 in the aforementioned storage means M. That is, at the same time that the user writes a note, a schedule and the like on part of the paper sheet W revealed within the frame of the optical sensor Sb with the writing implement P, the information such as the note is recorded
10 in a memory and the like in the storage means M serving also as the aforementioned controller.

The notebook device including the optical sensor Sb according to the second example as mentioned above automatically converts the movement path of the
15 conventional writing implement into electronic form by merely writing a note and the like directly on the paper sheet placed within the frame with the conventional writing implement without giving special consideration to the conversion into electronic form. Also, the
20 optical sensor Sb according to the aforementioned second example may employ general-purpose components, for example the light-emitting diodes (LEDs) serving as the light-emitting elements (the light source) and the image sensors such as CCD and CMOS sensors serving as the
25 light-receiving element array. Combined with a small

number of optical components constituting the optical sensor Sb, this allows the formation of the notebook device at low cost.

Next, various variations (second to sixth
5 embodiments) of the notebook device will be described, each of which uses either of the two types of optical sensors described above (Sa which uses light beams in a lattice form or Sb which uses triangulation). Like reference numerals and characters are used in figures
10 to be described later to designate components similar in function to those of the optical sensors in the aforementioned first embodiment (FIG. 1) and in the aforementioned first example (FIG. 2) and the second example (FIG. 3), and detailed description thereon will
15 not be given. Also for description, the direction of the short sides of the frame 1 is defined as a horizontal direction (x-direction) whereas the direction of the long sides of the frame 1 is defined as a vertical direction (y-direction). In the figures to be described later,
20 1 designates a frame-shaped frame; 2 (and 2A, 2B, 2C, 2D, 2E, 2F and 2G) designates a thick-frame section of the frame 1; M designates a storage means or a storage means also serving as a controller (control means); N designates a notebook jacket; R designates ring-shaped
25 holding members of a personal organizer; W designates

a paper sheet for a notebook; Q designates a switch for stopping an input operation; L designates lamps for warnings; and 1a designates holes for receiving the ring-shaped holding members R of the personal organizer.

5 FIG. 4(a) is a plan view illustrating a configuration of the notebook device according to a second embodiment. FIG. 4(b) is a side view of the notebook device which is in a closed condition as seen from a lateral side of the notebook. FIG. 4(c) is a bottom view of the
10 notebook device which is in the closed condition as seen from the lower side of the notebook.

The notebook device according to the second embodiment is different from the notebook device according to the aforementioned first embodiment in that
15 the thick-walled thick-frame sections 2 (2A and 2B) are provided on both of the vertical upper and lower sides, respectively, of (as seen in the figure, over and under) the frame-shaped frame 1 of an optical sensor S2, as shown in FIG. 4(a) described above. This allows various thick
20 modules and parts (for example, a control means such as a controller for a light-emitting element and a light-receiving element, a computation means, a communication means, a battery, a cable, a connector and the like) which cannot be accommodated in a frame portion
25 of the sheet-like frame 1 to be distributed efficiently

to the two thick-frame sections 2A and 2B and to be accommodated in a space-saving manner.

In the notebook device according to this embodiment having such a configuration, each of the thick-frame sections 2A and 2B of the aforementioned optical sensor S2 fits in a space (gap) defined between this notebook jacket N and paper sheets W and does not protrude from the lateral side of the notebook device even when the notebook jacket N of the personal organizer is in a closed condition, as shown in FIG. 4(b). Thus, this optical sensor S2 is prevented from being damaged or broken. Additionally, the notebook device according to this embodiment has advantages over the notebook device including the optical sensor (S1) according to the first embodiment which has the only one thick-frame section (2) in that the entire notebook is compact and less bulky during storage when the sensor is not used and in that the notebook is less prone to serve as an impediment when being carried, for example.

Next, FIG. 5(a) is a plan view illustrating a configuration of the notebook device according to a third embodiment. FIG. 5(b) is a side view of the notebook device which is in a closed condition as seen from a lateral side of the notebook. FIG. 5(c) is a bottom view of the notebook device which is in the closed condition as seen

from the lower side of the notebook.

The notebook device according to this third embodiment is different from the notebook devices according to the aforementioned first and second
5 embodiments in that the thick-walled thick-frame section 2 (2C) is provided lateral to (as seen in the figure, on the right-hand side of) the frame-shaped frame 1 of an optical sensor S3, as shown in FIG. 5(a) described above, and in that various thick modules and parts which
10 cannot be accommodated in the frame portion of the sheet-like frame 1 are accommodated in the thick-frame section 2C.

In the notebook device according to this embodiment having such a configuration, as in the aforementioned
15 second embodiment, the thick-frame section 2C of the aforementioned optical sensor S3 fits in a space (gap) defined between this notebook jacket N and the paper sheets W and does not protrude from the lateral side of the notebook device even when the notebook jacket N of the
20 personal organizer is in a closed condition, as shown in FIG. 5(c). Thus, also in this notebook device, the optical sensor S3 is prevented from being damaged or broken. Additionally, the entire notebook is less bulky during storage when the sensor is not used, and the notebook
25 is compact when being carried.

Next, FIGS. 6(a) and (b) are plan views illustrating a configuration of the notebook device according to a fourth embodiment. FIG. 6(c) is a side view of the notebook device which is in a closed condition as seen from a lateral side of the notebook. FIG. 6(e) is a bottom view of the notebook device which is in the closed condition as seen from the lower side of the notebook. FIG. 6(d) is a view schematically showing a vertical outside shape of the thick-frame sections 2D and 2E of an optical sensor S4 for use in the aforementioned notebook device. FIG. 6(f) is a view schematically showing a horizontal outside shape of the thick-frame section 2F of the aforementioned optical sensor S4.

The optical sensor S4 for the notebook device according to the aforementioned fourth embodiment is configured for use for either of the left-hand and right-hand pages of a double spread of a personal organizer. As shown in the view of FIG. 6(a) showing the use for the right-hand page and in the view of FIG. 6(b) showing the use for the left-hand page, the switch Q for stopping the input operation and the lamps L for warnings are provided on each of the front and back surfaces of the aforementioned optical sensor S4, as designated by Q' and L' for example, so as to be used in either condition. The thick-frame sections 2 (2D, 2E and 2F) for

accommodating various thick modules and parts are formed on both of the vertical upper and lower sides of (as seen in the figure, over and under) and lateral to (as seen in the figure, on the right-hand side of) the frame-shaped frame 1, that is, on three sides thereof other than one side where the holes 1a for receiving the ring-shaped holding members R of the personal organizer are formed.

Unlike the thick-frame sections (2A and 2B; with reference to FIG. 4(b)) according to the aforementioned second embodiment, the thick-frame sections 2D and 2E on both of the vertical upper and lower sides of (as seen in the figure, over and under) the frame 1 are shaped to bulge toward the front and back surfaces of the frame 1, as shown in FIG. 6(d), so as to adapt to the aforementioned use for the left-hand and right-hand pages. Like the aforementioned thick-frame sections 2D and 2E, the thick-frame section 2F lateral to (as seen in the figure, on the right-hand side of) the frame 1 is also shaped to bulge toward the front and back surfaces of the frame 1, as shown in FIG. 6(f) (See the thick-frame section 2C according to the aforementioned third embodiment in FIG. 5(c) for purposes of reference).

In the notebook device according to this embodiment having such a configuration, as in the aforementioned second and third embodiments, each of the thick-frame

sections 2D, 2E and 2F of the aforementioned optical sensor S4 fits in a space (gap) defined between this notebook jacket N and the paper sheets W and does not protrude from the lateral side of the notebook device even when the notebook jacket N of the personal organizer is in a closed condition, as shown in FIGS. 6(c) and (e). Thus, also in this notebook device, the optical sensor S4 is prevented from being damaged or broken. Additionally, the entire notebook is less bulky during storage when the sensor is not used, and the notebook is compact when being carried. Additionally, the notebook device according to this embodiment has an advantage in facilitating the alignment of the paper sheets W because the aforementioned thick-frame sections 2D, 2E and 2F are shaped to bulge toward the front and back surfaces of the frame 1 and are formed on the three sides of the frame 1 surrounding the paper sheets W.

Next, modifications of the optical sensors (S1 to S4) for use in the notebook device according to the aforementioned embodiments will be described.

FIG. 7 is a perspective view showing an exemplary configuration of an optical sensor S5 for use in the notebook device according to a fifth embodiment. FIG. 8(a) is a side view of this optical sensor S5 as seen from a lateral side (in the x-direction), and FIG. 8(b)

is a partially enlarged sectional view of the thick-frame section 2G of the aforementioned optical sensor S5. In FIGS. 7 and 8 described above, the storage means (M) for the optical sensor S5 is not shown.

5 The optical sensor S5 of the notebook device according to this embodiment is different from the optical sensors (S1 to S4) according to the other embodiments in that a section (a positioning section 7 which is part of the frame 1) in which the holes 1a for receiving the
10 ring-shaped holding members R of the personal organizer are formed is separable from the frame portion of the frame 1. Also, the thick-frame section 2 (2G) for accommodating various thick modules and parts is formed on the vertical upper side of (as seen in the figure,
15 on the right-hand side of) the frame-shaped frame 1. An input inhibit switch K mounted so as to be directed toward the bottom surface (lower surface) of the frame 1, as shown in FIG. 8(b), is incorporated in the thick-frame section 2G. Further, as shown in FIG. 7, the
20 aforementioned optical sensor S5 has scale marks 1g formed in inner edge portions (edge portions of the "sensing region" within the frame) of the front surface of the frame-shaped frame 1 and is usable as a guide for drawing lines and as a ruler. A pen holder 1h capable of holding
25 the aforementioned writing implement P and other writing

tools is attached to part of an outer edge of the front surface of the frame 1.

The connection (coupling) between the aforementioned frame (main body) 1 and the separable positioning section 7 is made by geometrically engaging and to-be-engaged structures or by attraction and the like using magnets incorporated in opposed surfaces of the frame (main body) 1 and the positioning section 7. Alternatively, the frame (main body) 1 and the positioning section 7 may be coupled to each other with another member (a coupling member).

As shown in sectional view of FIG. 8(b), the aforementioned input inhibit switch K is provided in a recess 2a provided inside the thick-frame section 2G of the aforementioned frame 1 and opening toward the back surface side so as to be directed toward the lower side of the frame. By lifting the frame 1 of the aforementioned optical sensor S5, as shown in phantom lines (dash-double-dot lines) in the figure, the tip of the aforementioned input inhibit switch K protrudes from the back surface of the frame in the direction of the arrow whereby the input inhibit switch K comes into operation. This operation of the input inhibit switch K (automatically) disables the input of information with the aforementioned writing implement P and the like by

stopping the computation in the touch position detecting means, the storage means M or the like incorporated in the optical sensor S5, by turning off power to the entire optical sensor S5 or by other methods. This prevents the aforementioned new information from being inputted to (stored in) the optical sensor S5 in a condition unsuitable for input operation, for example in a condition where the aforementioned optical sensor S5 hangs in the air or in a condition where the optical sensor S5 is not properly placed in position on the paper sheet W and the like. Also, when a finger or the like is put within the frame of the aforementioned frame 1, for example, during the attachment and detachment of the aforementioned frame (main body) 1 to and from the separable positioning section 7 or during the replacement of a paper sheet W or a page, the input inhibit switch R is convenient because an erroneous input operation resulting from this finger or the like does not occur and because the input operation is restarted immediately at a site where the frame 1 is placed.

Examples of the aforementioned input inhibit switch K used herein may include electromagnetic switches such as a pressure-sensitive switch, and optical switches for sensing a reflectivity, light and dark and the like, in addition to mechanical switches such as a push switch.

As in the case of the aforementioned input operation stop switch Q, a warning indication may be provided by using the lamps L and the like on the aforementioned frame 1 to clearly show that "input is now being inhibited." A
5 warning using an alarm sound and the like may be added to call further attention. Also, the aforementioned input inhibit switch K may be provided on the optical sensors S1 to S4 according to the aforementioned first to fourth embodiments. For the optical sensors S1 to
10 S3 which are used only on one surface, the input inhibit switch R may be provided on the back surface side of the frame 1 in a manner similar to that described above. For the optical sensor S4 which is used on opposite surfaces, it is preferable that the input inhibit switch K is
15 provided on each of the front and back surface sides of the frame 1 separately from the input operation stop switch Q.

The aforementioned scale marks 1g are formed by inscription, printing or other methods in the inner edge
20 portions (edge portions of the "sensing region" within the frame) of the front surface of the frame 1. Any scale spacing and pattern of the scale marks 1g may be set. Also, the shape, placement, material and the like of the aforementioned pen holder 1h may be changed as appropriate
25 depending on the shape of the writing implement P and

the like to be carried therewith.

Even when the optical sensor S5 having the above configuration is used, the coordinate positions of the aforementioned writing implement P and the like within the frame are detected and specified, as in the notebook devices according to the aforementioned first to fourth embodiments. Then, when a user moves the aforementioned writing implement W and the like to write a note, a schedule and the like, the path (written information such as the note and the like) of the tip of the aforementioned writing implement P in accordance with the movement is detected, and the path is stored as digital data (electronic data) in the aforementioned storage means M and the like. Further, the optical sensor S5 is provided with erroneous input avoiding means including the input operation stop switch Q, the input inhibit switch K and the like, and input assisting means such as the scale marks 1g for supporting the aforementioned input operation. This achieves the input of precise information more easily.

Next, the notebook device according to a sixth embodiment including an optical sensor S6 having the simplest structure will be described. FIG. 9 is a plan view illustrating a configuration of the notebook device according to the sixth embodiment. The optical sensor S6 according to this sixth embodiment is similar in

configuration to the optical sensor S5 according to the
aforementioned fifth embodiment from which a section (the
positioning section 7) of the frame 1 having the holes
(1a) is detached, and detailed description thereon will
5 not be given.

As shown in FIG. 9 described above, the optical
sensor S6 in the notebook device according to the sixth
embodiment does not include the holes 1a and the like
for receiving the ring-shaped holding members R as in
10 the other embodiments in the frame-shaped frame 1.
Accordingly, the aforementioned frame 1 itself becomes
a thin frame, and the entire frame 1 becomes compact.
The notebook jacket N in the notebook device according
to this sixth embodiment is provided with a pocket U for
15 storing the aforementioned optical sensor S6 when the
notebook device is not in use but is stored or when it
is carried.

The aforementioned configuration is capable of
producing functions and effects similar to those of the
20 notebook devices according to the aforementioned first
to fifth embodiments. Additionally, the notebook device
according to the aforementioned sixth embodiment becomes
a notebook device which is lighter in weight and lower
in cost.

25 <Operation Check of Notebook Device>

The optical sensor described in each of the
aforementioned first to sixth embodiments in which the
holes received the ring-shaped holding members was placed
on a sheet of refill paper of this notebook. A note or
5 a schedule was written on part of the paper sheet revealed
within the frame with a writing implement. Then, each
notebook device and a notebook-sized personal computer
were connected to each other via a wireless LAN so that
communication was established therebetween.

10 Information stored in the memory of the aforementioned
notebook device was reproduced using the notebook-sized
personal computer. The result was that a note or a
schedule identical with that written on the
aforementioned paper sheet appeared on a display of the
15 aforementioned notebook-sized personal computer.

Although a specific form of embodiment of the
instant invention has been described above and
illustrated in the accompanying drawings in order to be
more clearly understood, the above description is made
20 by way of example and not as a limitation to the scope
of the instant invention. It is contemplated that
various modifications apparent to one of ordinary skill
in the art could be made without departing from the scope
of the invention which is to be determined by the following
25 claims.

The notebook device according to the present invention is capable of converting information such as a note into electronic form at the same time that the information such as a note, a schedule and the like is
5 written on a paper sheet revealed within the frame.

Claims

1. A notebook device comprising:

a notebook capable of having a paper sheet filed therein, the paper sheet being capable of being written
5 upon by a writing implement;

a frame-shaped optical sensor surrounding at least part of the paper sheet, the optical sensor including a rectangular frame, and at least one pair of light-emitting and light-receiving elements mounted to
10 the rectangular frame, the optical sensor sensing the interception of light beams traveling from the light-emitting element to the light-receiving element which is caused in association with the writing implement within the frame, to thereby output information on the
15 position of the writing implement within the frame; and

a storage means for storing therein the movement path of a tip of the writing implement as electronic data when a writing operation is performed on part of the paper sheet revealed within the frame of the optical sensor
20 with the writing implement.

2. The notebook device according to claim 1,

wherein the frame of the frame-shaped optical sensor includes first and second sections opposed to each other in the form of the frame;

25. wherein light-emitting elements are arranged in

the first section and light-receiving elements are arranged in the second section;

wherein the light-emitting elements and the light-receiving elements are positioned to face an interior of the frame; and

wherein light beams emitted from the light-emitting elements toward the light-receiving elements produce a lattice of vertical and horizontal light beams crossing each other within the frame.

3. The notebook device according to claim 1, wherein modules, each including a light-receiving element array composed of a plurality of the light-receiving elements and the light-emitting element in a vertically stacked relationship, are disposed on two corners, respectively, on opposite ends of one side among the four sides of the frame of the frame-shaped optical sensor;

wherein a tape-like retroreflector is provided on the inner side surface of three sides other than the one side lying between the modules; and

wherein light beams emitted from the light-emitting element of one of the modules are reflected from the retroreflector to travel back into the light-receiving element array of the one module.

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FIG.1

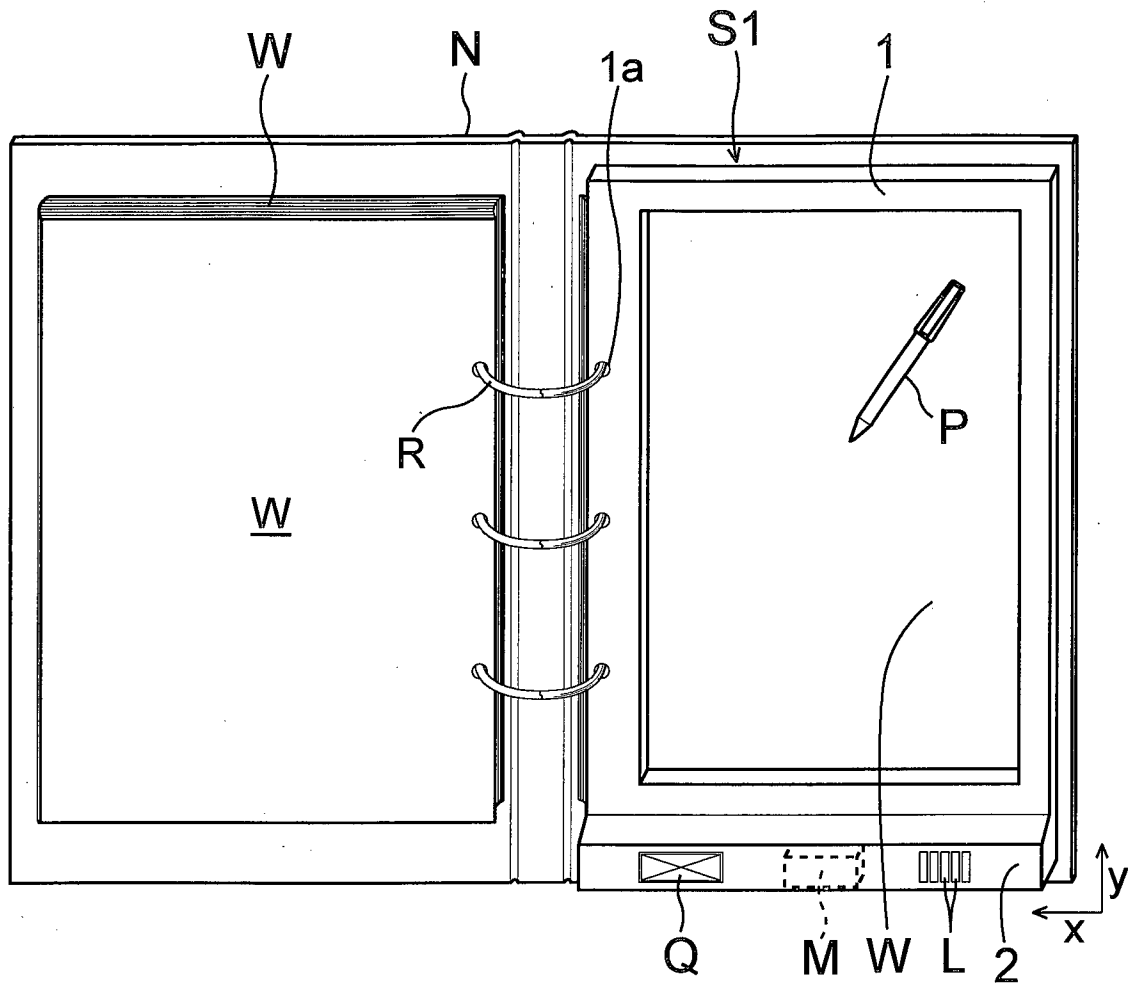


FIG.2

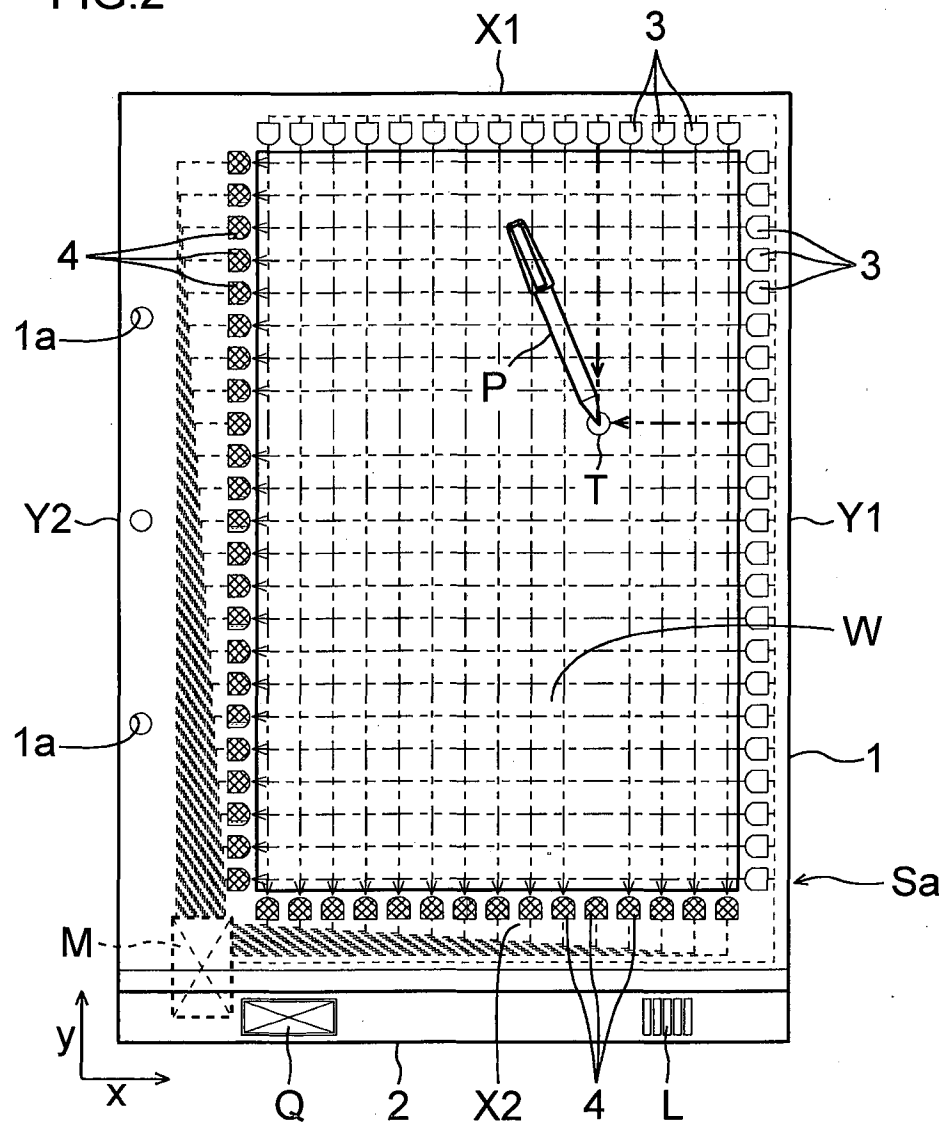
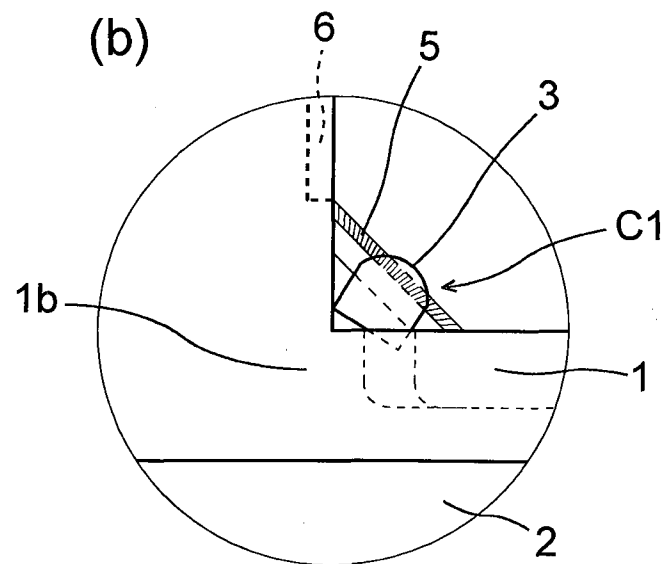
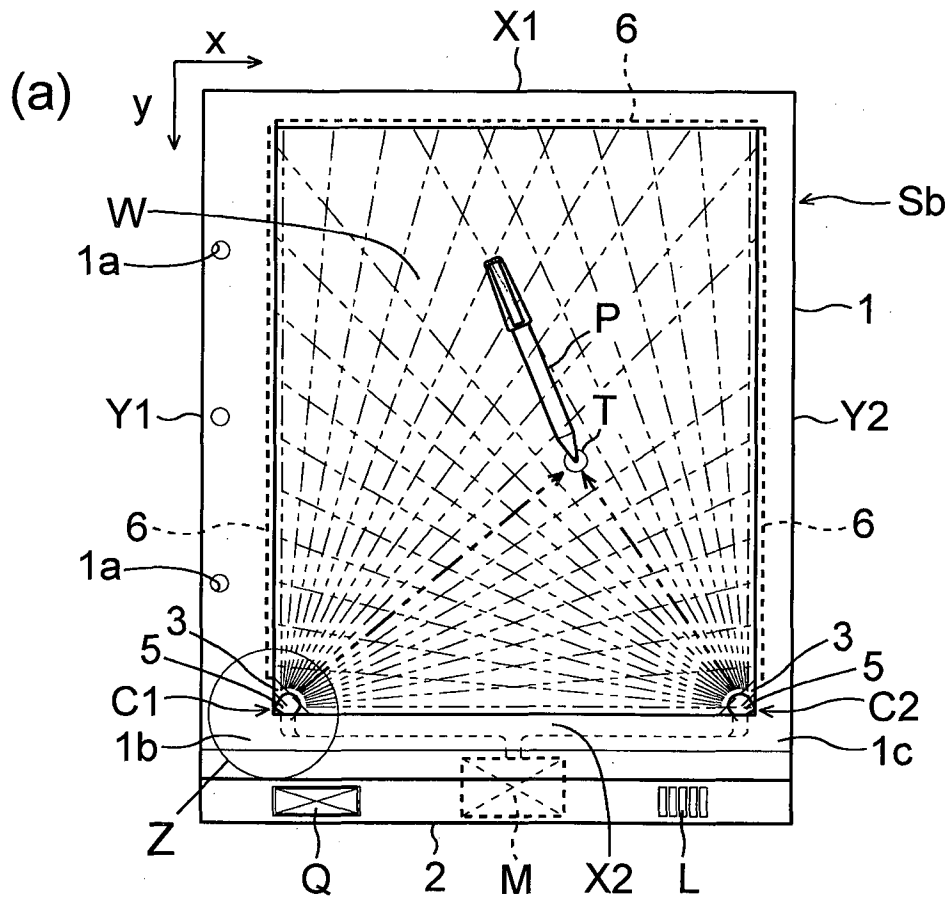


FIG.3



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FIG.4

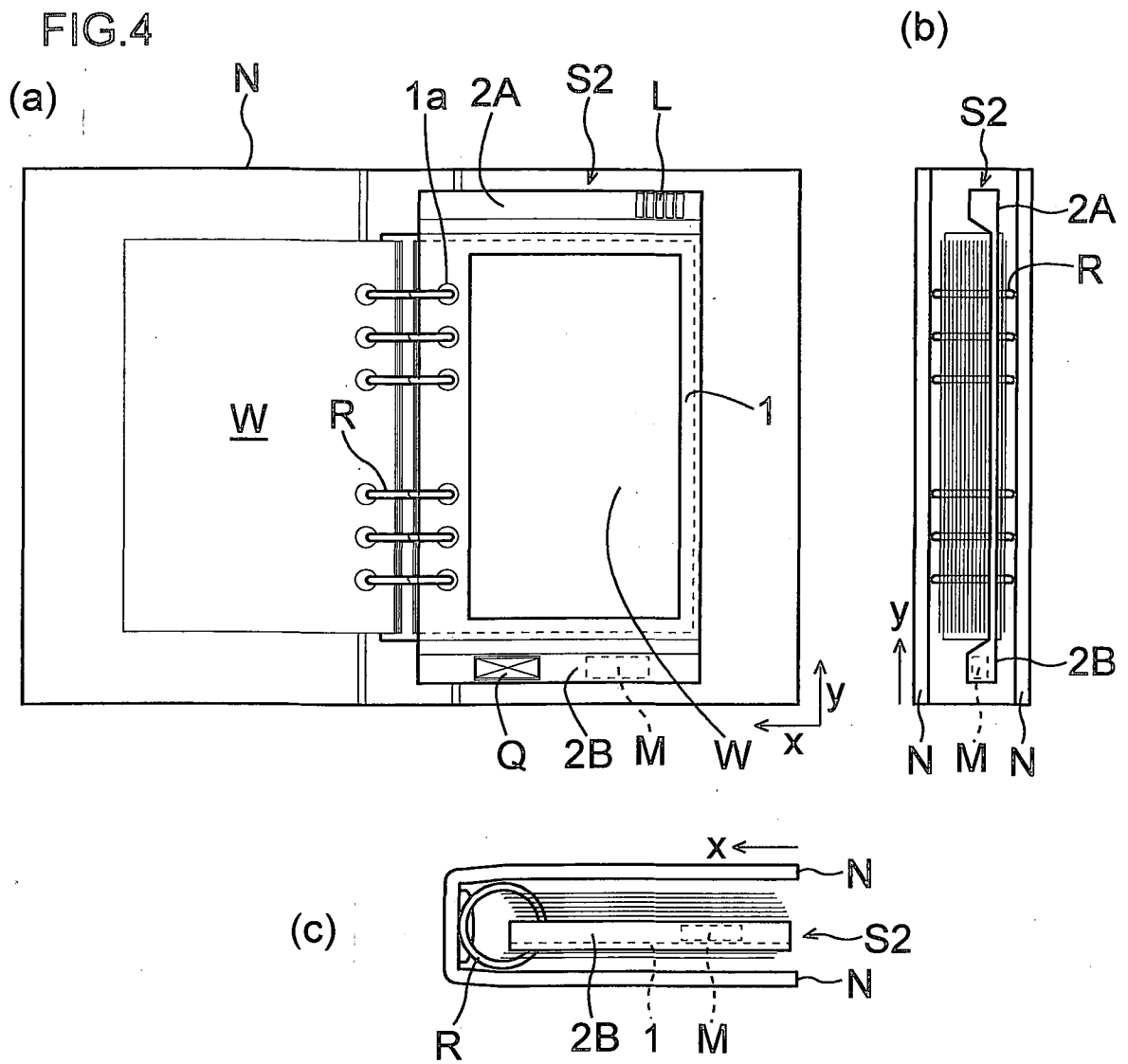
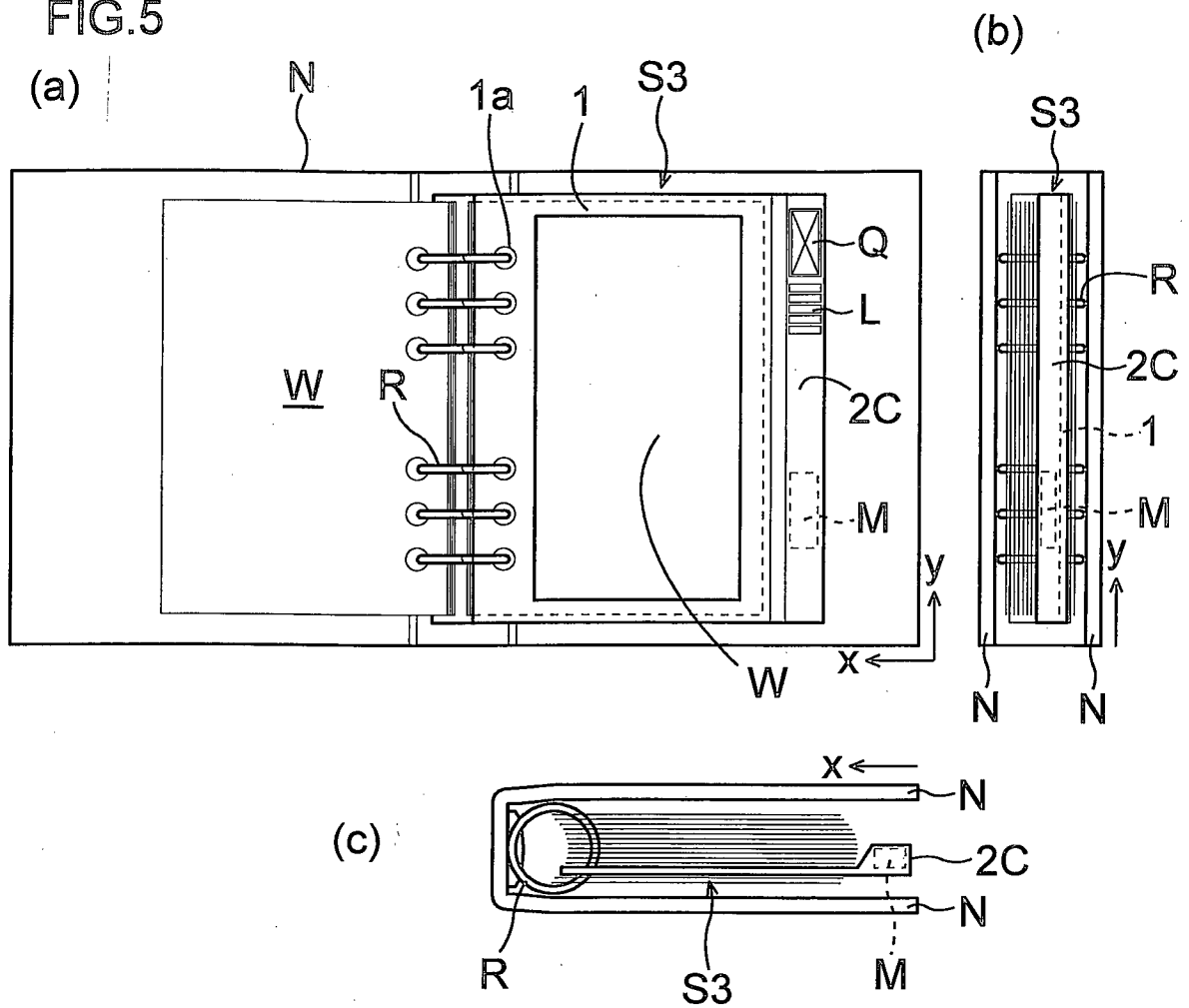
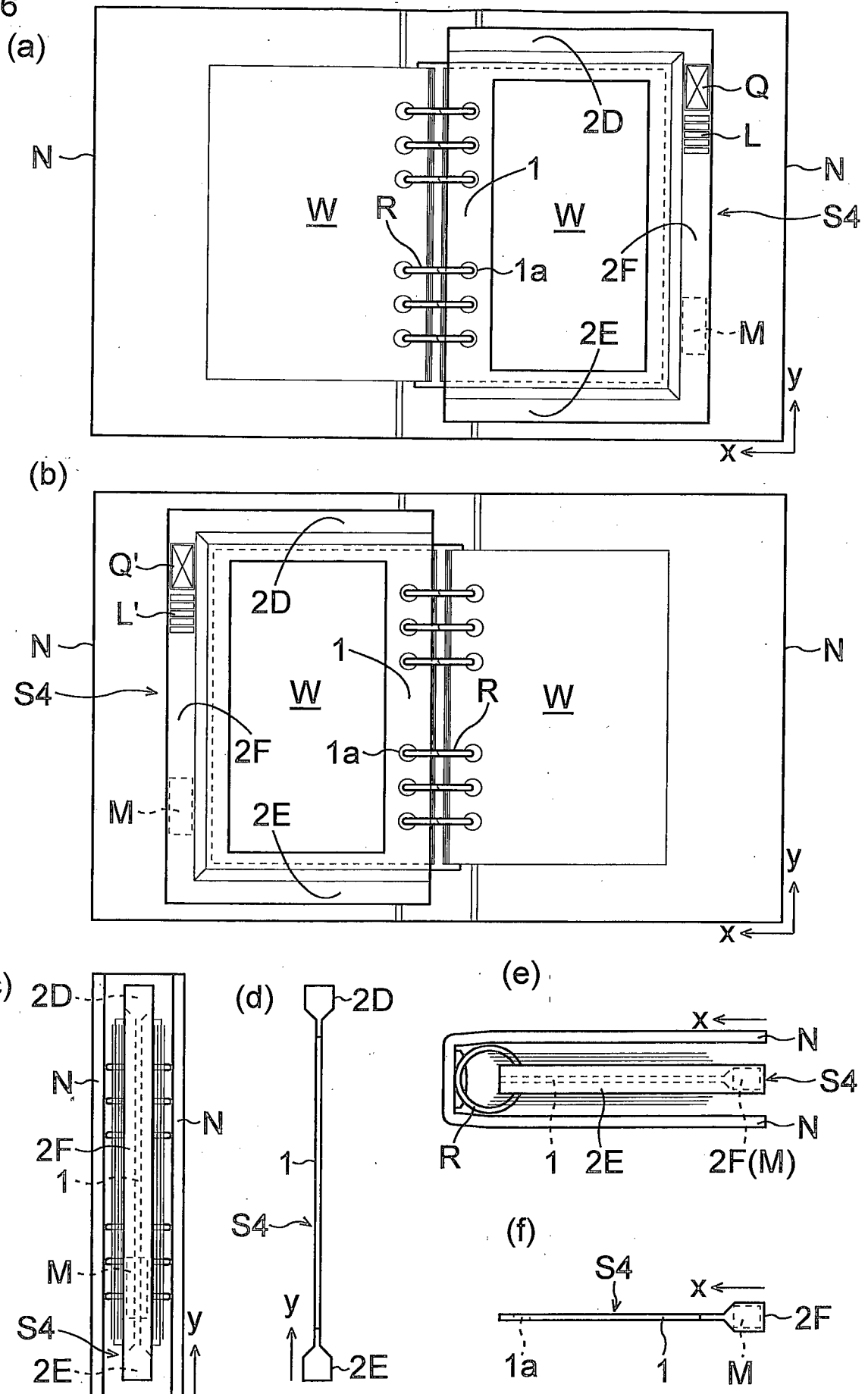


FIG.5



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FIG. 6



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FIG.7

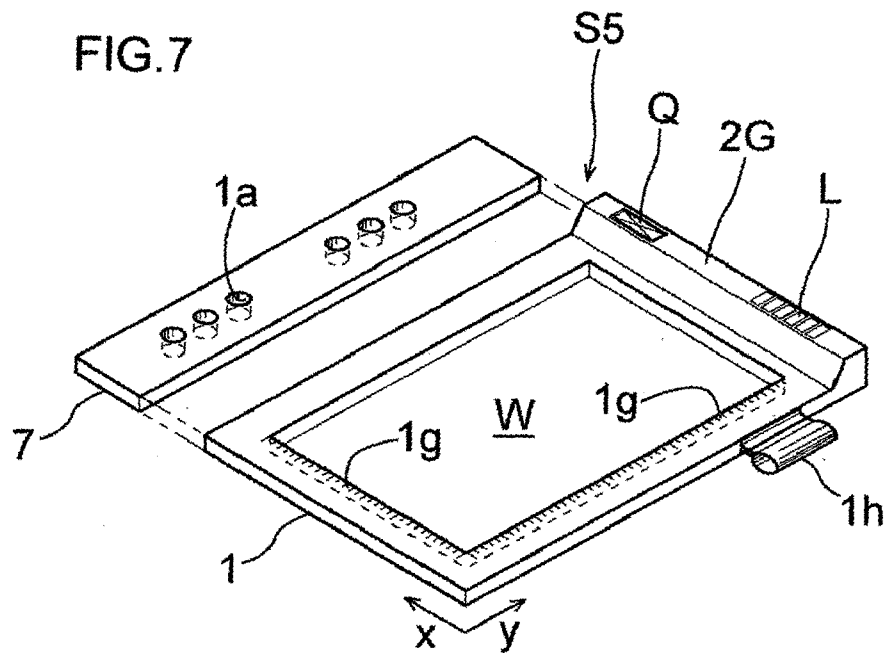


FIG.8

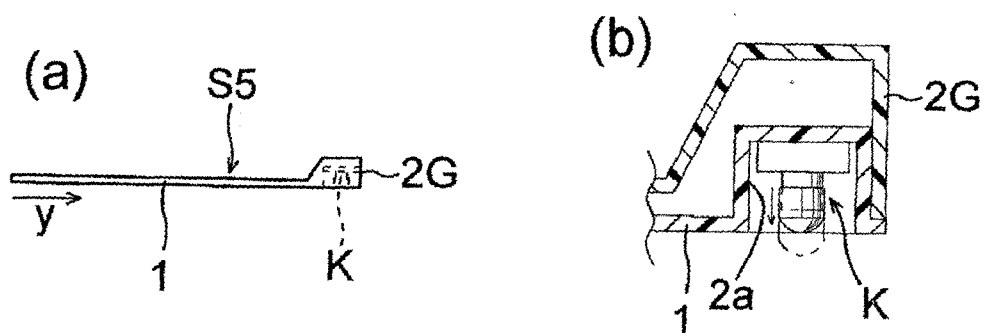
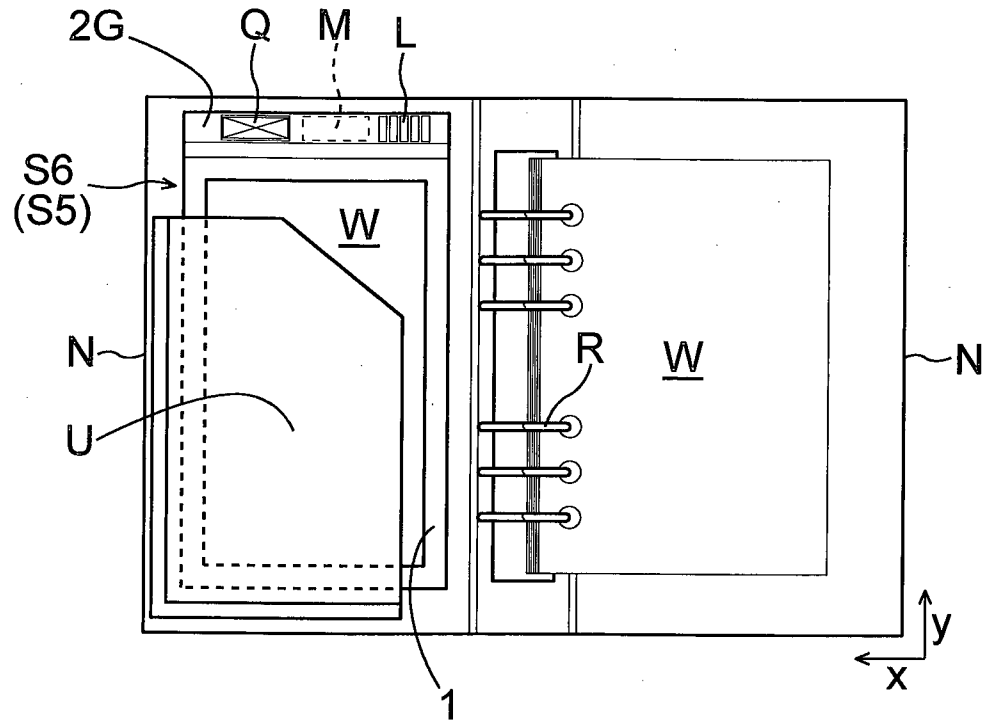


FIG.9



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/056948

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. G06F3/042 (2006.01) i, B42D15/00 (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)

Int.Cl. G06F3/042, B42D15/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
 Published unexamined utility model applications of Japan 1971-2012
 Registered utility model specifications of Japan 1996-2012
 Published registered utility model applications of Japan 1994-2012

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	YAMADA Tatsushi, Mobilers, DOS/V POWER REPORT, 2000.02.04 (date of receipt), Vol. 10, No. 3, Page 310-311	1-3
Y	US 5509087 A (Casio Computer Co., Ltd.) 1996.04.16, column 2, line 45 - column 3, line 43, fig 1,2 & JP 4-274510 A	1,2
Y	US 6362468 B1 (Saeilo Japan, Inc.) 2002.03.26, column 7, line 63 - column 8, line 22, fig 7 & JP 2000-353048 A & EP 1059605 A2 & KR 10-2001-0014970 A & CN 1277349 A	3
A	JP 10-301669 A (PFU limited) 1998.11.13, [0035]-[0039], Fig 1 (No Family)	1-3

☐ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

16.04.2012

Date of mailing of the international search report

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