

EUROPEAN QUALIFYING EXAMINATION 2008

PAPER B ELECTRICITY / MECHANICS

This paper comprises:

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Description of the Application

[001] The invention relates to data input devices for computers, such as joysticks and graphics tablets.

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[002] A joystick comprises a moveable operating element, hereinafter referred to as an actuator. The actuator can pivot in any direction about a fixed point. A joystick is used to input data representing the position of the actuator to a computer, for example in a flight simulator.

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[003] A graphics tablet comprises a panel and a freely movable operating element, hereinafter referred to as an actuator. A graphics tablet is used to input data to a computer by moving the actuator relative to the panel. The data represents the position of the actuator with respect to the panel. A graphics tablet can for example be used to control the position of a cursor on a screen or for drawing with a computer aided drawing programme.

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[004] D1 discloses a prior art joystick. It comprises an actuator and a hollow, hemispherical and electrically insulating support on which a resistive layer is arranged.

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The resistive layer is a band in the form of a spiral. The resistive layer is connected to a voltage supply via contacts at the ends of the band. The voltage varies linearly along the band with distance to either of the contacts. The actuator comprises a conductive element at one of its ends. When the conductive element is in contact with the resistive layer, it picks the voltage off the resistive layer at the contact point. The voltage picked off is characteristic of the position of the actuator.

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[005] A problem with the joystick of D1 is that the determination of the position of the actuator is inaccurate for two reasons. Firstly, the conductive element picks off the same voltage at all points lying on a line across the band at a given distance from one of the contacts. Secondly, no voltage can be picked off when the conductive element is directly
5 in contact with the insulating support in the separating region between adjacent turns of the band. The above problem is solved by the subject matter of the appended claims.

[006] Fig. 1 is a perspective view of a data input device according to a first embodiment of the invention with part cut-away.
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[007] Fig. 2 is a block diagram of the components of the device of Fig. 1.

[008] Figs. 3A and 3B are schematic plan views of the resistive layer of the device of Fig. 1.
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[009] Fig. 4 is a perspective view of a data input device according to a second embodiment of the invention with part cut-away.

[010] Fig. 5 is a perspective view of a data input device according to a third embodiment of the invention.
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[011] As shown in Fig. 1, a joystick 1 according to the invention comprises a hollow, hemispherical and electrically insulating support 2 which is closed by a cover 3. An actuator 4 is pivotally mounted at the centre of the cover 3 by means of a ball-joint. The
25 ball-joint comprises a ball 5 arranged on the actuator 4 and a socket arranged in the cover 3 for retaining the ball.

[012] The interior surface of the hemispherical support 2 is provided with a resistive layer 6. The resistive layer 6 is preferably coated directly on the support, but it could also be fixed to the support by means of an adhesive layer (not shown). The actuator 4 comprises a conductive element 8 at one of its ends. The conductive element 8 is in contact with the resistive layer 6. The conductive element 8 is electrically connected to a control unit 9 via contact areas (not shown) on the ball 5 and on the socket of the ball-joint. The control unit 9 is mounted on the cover 3.

[013] A first pair of contacts A, B and a second pair of contacts C, D are provided at the periphery of the resistive layer 6. The resistive layer 6 can be connected to a voltage supply via the contacts A, B, C, D. As shown in Fig. 2, the control unit 9 comprises a switch 91 which alternately connects the first pair of contacts and the second pair of contacts to the voltage supply for consecutive time periods t_1 , t_2 , t_1 , t_2 ... etc. The time periods t_1 and t_2 are defined by a clock 93. During each first time period t_1 , a voltage $-V$ is supplied to contact A, a voltage $+V$ is supplied to contact B and contacts C and D are disconnected from the voltage supply. During each second time period t_2 a voltage $-V$ is supplied to contact C, a voltage $+V$ is supplied to contact D and contacts A and B are disconnected from the voltage supply. In this way, a first predetermined voltage distribution on the resistive layer during the time periods t_1 is alternated with a second predetermined voltage distribution on the resistive layer during the time periods t_2 .

[014] Fig. 3A shows the voltage distribution during time periods t_1 . Fig. 3B shows the voltage distribution during time periods t_2 . The dashed lines represent equipotential lines on the resistive layer 6. Equipotential lines are defined as lines linking points at which the voltage is the same at a given moment in time. In other words, during one of the time periods t_1 or t_2 , the voltage picked off by the conductive element is the same at any point on a given equipotential line.

[015] Referring to Figs. 2, 3A and 3B, the determination of the position of the actuator will now be explained as follows. Let us consider that the actuator is not moving and the conductive element is in contact with the resistive layer 6 at a point P. During the time period t1 (Fig. 3A) the point P lies on the equipotential line V1 and the conductive element picks off the voltage V1. During the time period t2 (Fig. 3B) the point P lies on the equipotential line V2 and the conductive element picks off the voltage V2. The combination of the voltage V1 in time period t1 and the voltage V2 in time period t2 uniquely characterises the point P. As shown in Fig. 2, the control unit 9 includes a processing unit 92 that receives voltages picked off by the conductive element and a clock signal from the clock 93. The processing unit 92 is synchronised with the switch 91 by means of the clock 93. The processing unit 92 converts a pair of voltages V1,V2 picked off in consecutive time periods t1 and t2 into an output signal for a computer representing a pair of coordinates x,y of the point P.

[016] In practice, the actuator is usually being moved by a user. In order to ensure that, even when the actuator is being moved quickly, the output signals accurately represent the actual positions of the actuator, the time periods t1 and t2 have to be very short. For example, each of the time periods t1 and t2 can be 0.01 seconds.

[017] Fig. 4 shows another joystick 11, which is a second embodiment of the invention. This joystick has a flat support 12 on which a resistive layer 16 is coated or glued, a cover 13 and a telescopic actuator 14. The actuator comprises a conductive element 18 at one of its ends and a spring 20, which urges the conductive element 18 onto the resistive layer 16. This ensures that the conductive element 18 is in contact with the resistive layer 16 for all positions of the actuator. All other parts of the joystick correspond to those of the first embodiment.

[018] Fig. 5 shows a graphics tablet 21, which is a third embodiment of the invention. This graphics tablet comprises a panel and an actuator 24 which can be freely moved. The panel comprises a flat support 22 on which a resistive layer 26 is coated or glued. A first pair of contacts A, B and a second pair of contacts C, D are provided at the periphery of the resistive layer 26. The actuator 24 comprises a conductive element 28 at one of its ends. The conductive element 28 is electrically connected to a control unit 29 via a cable 30 which passes through the actuator 24. The control unit 29 is mounted on a side of the support 22 and supplies voltages to the contacts A, B, C, D.

[019] A user manipulates the actuator 24 like a pen, so that the conductive element 28 makes contact with the resistive layer 26 and picks voltages off the resistive layer. As described in conjunction with the first embodiment, the control unit 29 converts voltages picked off by the conductive element 28 into output signals for a computer. These output signals represent coordinates of the points of contact of the conductive element 28 with the resistive layer 26 and may be used by the computer to create drawings.

[020] Fig. 5 furthermore shows selection zones 31, 32 which are graphically represented on the resistive layer 26, for example by printing with conductive ink. If the user wishes to draw thick lines with the computer, he brings the conductive element into contact with the resistive layer within the selection zone 31. After the computer has received output signals representing positions of the conductive element 28 anywhere within the selection zone 31, it draws thick lines. In the same way, the selection zone 32 can be used to instruct the computer to draw thin lines.

Claims

1. Data input device (1, 11, 21) for a computer comprising:
 - a support (2, 12, 22);
 - a resistive layer (6, 16, 26) which is arranged on the support (2, 12, 22) and which is connectable to a voltage supply;
 - a movable actuator (4, 14, 24);
 - a conductive element (8, 18, 28) for picking voltages off the resistive layer (6, 16, 26); and
 - a processing unit (92) for converting the voltages into output signals for the computer which represent positions of the actuator.
2. Data input device (1, 11, 21) according to claim 1 wherein the resistive layer (6, 16, 26) is continuous and covers the entire support (2, 12, 22).
3. Data input device (1, 11, 21) according to claim 1 or 2, comprising means for alternately generating a first voltage distribution and a second voltage distribution on the resistive layer (6, 16, 26), said means being synchronised with the processing unit (92).
4. Data input device (1, 11, 21) according to claim 3 wherein said means comprises first and second pairs of contacts (A, B and C, D) for connecting the resistive layer (6, 16, 26) to the voltage supply, and a switch (91) for alternately connecting the first pair of contacts and the second pair of contacts to the voltage supply for consecutive time periods (t1, t2).
5. Data input device (1, 11, 21) according to claim 4 wherein each of the time periods (t1, t2) is 0.01 seconds.
6. Data input device (1, 11) according to any of the preceding claims wherein the data input device is a joystick (1, 11).

7. Data input device (1) according to claim 6 wherein the support (2) has a hemispherical shape.
8. Data input device (21) according to any of claims 1 to 5 wherein the actuator (24) is freely movable.

Drawings of the application

1/3

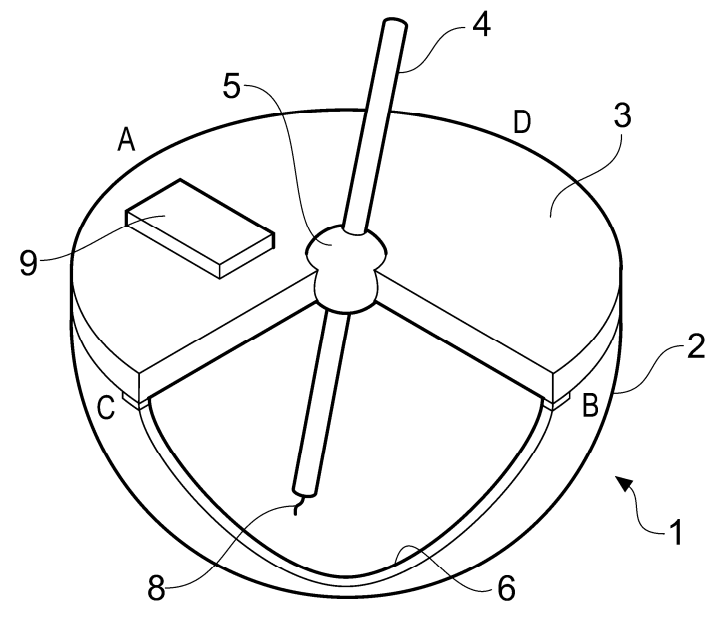


Fig. 1

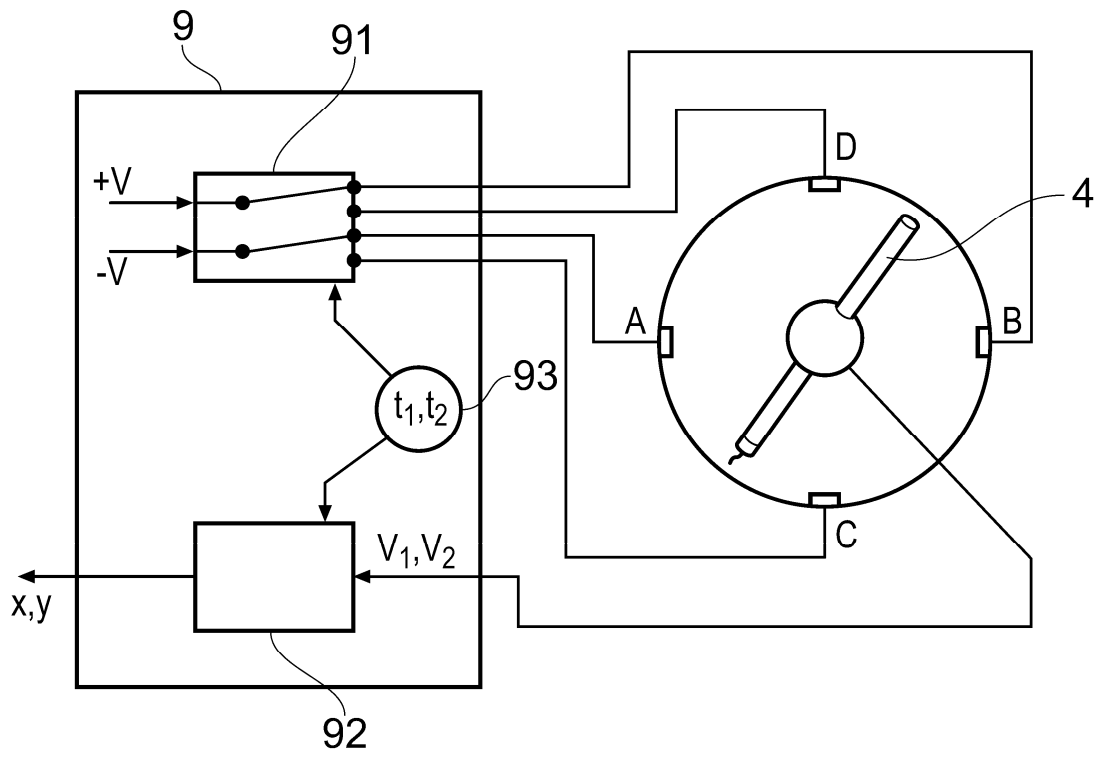


Fig. 2

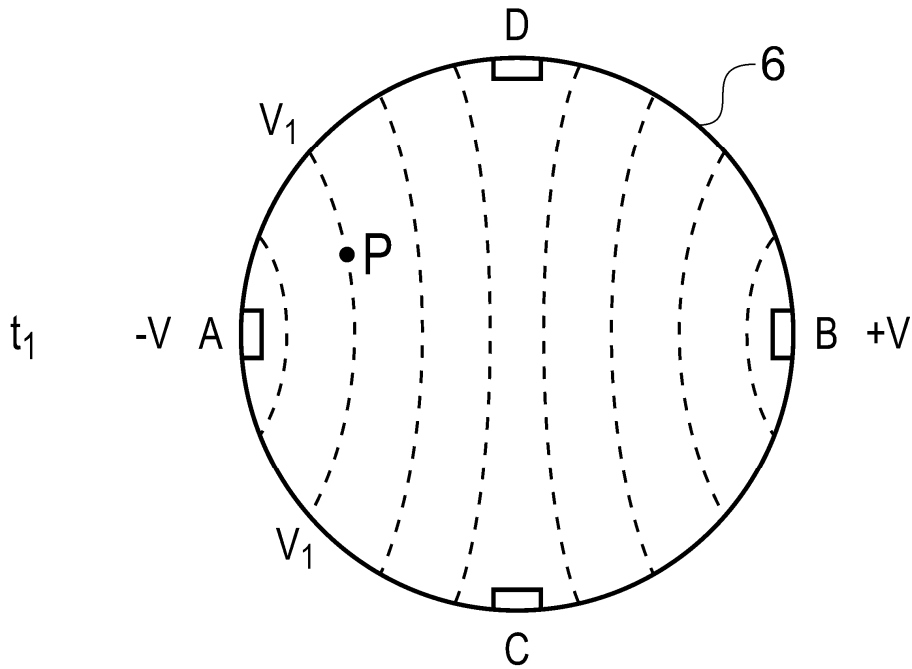


Fig. 3A

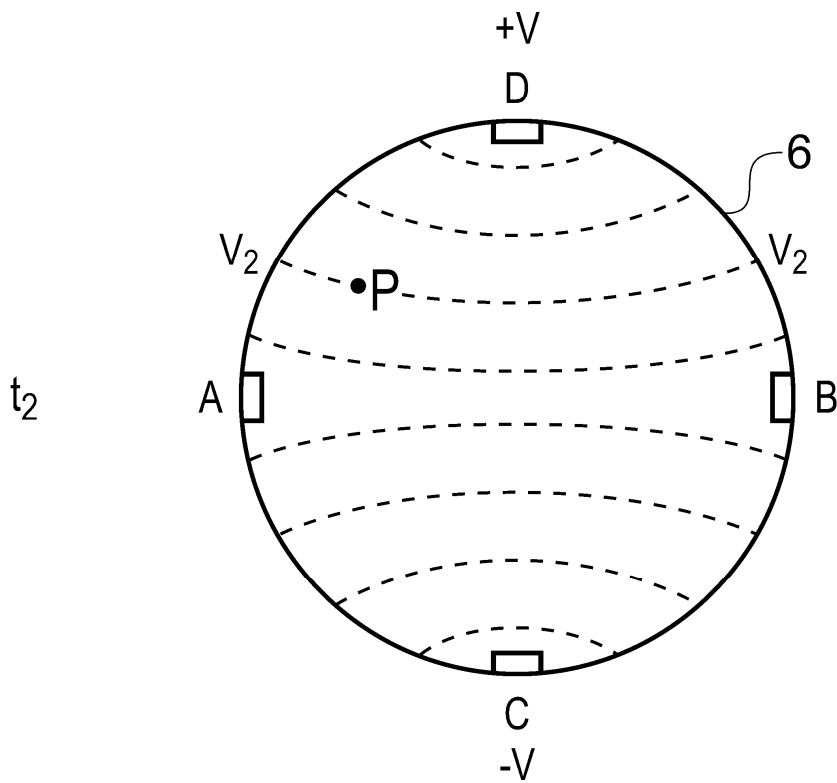


Fig. 3B

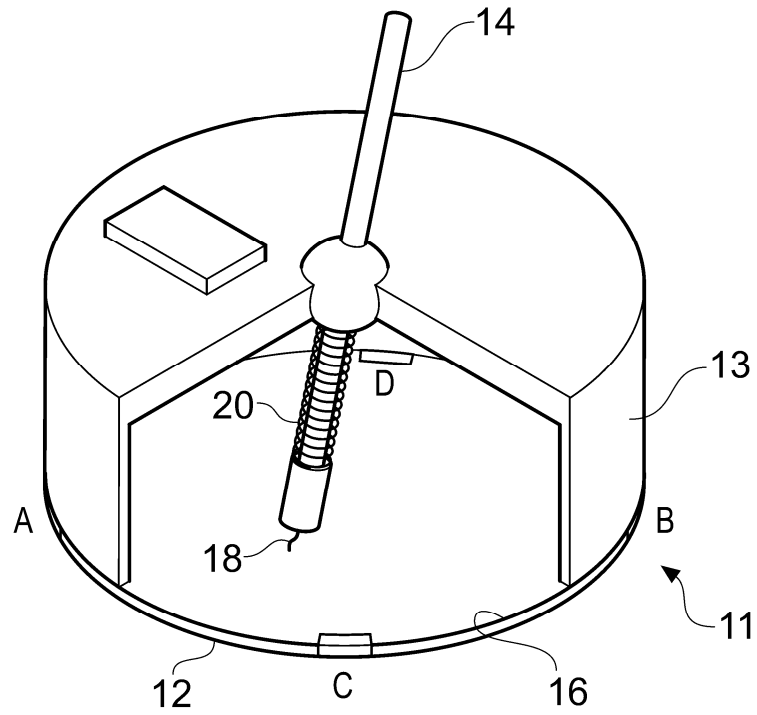


Fig. 4

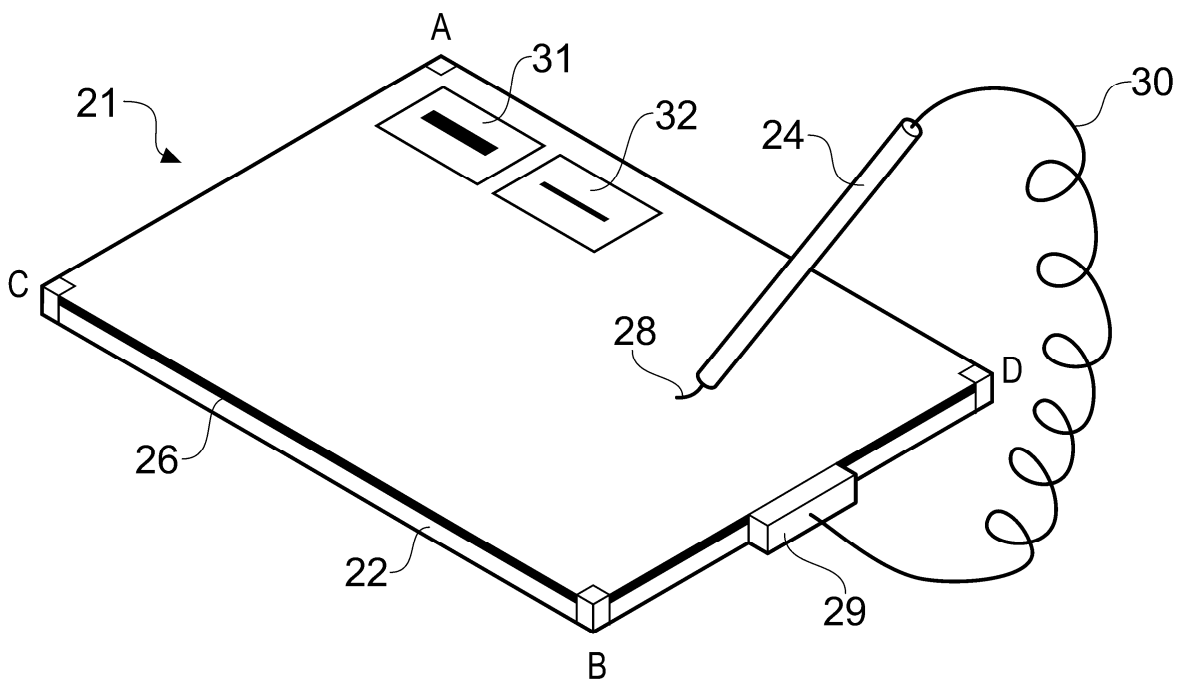


Fig. 5

Document D1

[001] The invention relates to a joystick. Joysticks are used as data input devices for computers.

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[002] Fig. 1 shows a known potentiometer 101 which can be used as a data input device for a computer. The potentiometer 101 comprises a flat elongate support 102 and an actuator 104. A resistive layer 106 is coated on the support 102. The resistive layer is a straight band. The resistive layer is connected to a voltage supply via a pair of
10 contacts A, B. The contact A is located at a first end of the band and a constant voltage $-V$ is applied to it. The contact B is located at a second end of the band and a constant voltage $+V$ is applied to it.

[003] The actuator 104 comprises a conductive element 108. The conductive
15 element 108 is in contact with the resistive layer 106 and picks the voltage off the resistive layer 106. The actuator is configured so that the conductive element can slide along the band between the contacts A and B. Because the voltage varies linearly along the band with distance to either of the contacts, the position of the actuator 104 can be derived from the voltage picked off by the element 108.

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[004] Our invention is a joystick which is based on the principle of operation of the potentiometer described above. As shown in Fig. 2, the joystick 111 comprises a hollow, hemispherical and electrically insulating support 112 which is closed by a cover 113. An actuator 114 is pivotally mounted at the centre of the cover by means of a ball-joint. The
25 ball-joint comprises a ball 115 arranged on the actuator 114 and a socket arranged in the cover 113 for retaining the ball 115.

[005] The interior surface of the hemispherical support 112 is provided with a resistive layer 116. The resistive layer is a continuous band in the form of a spiral. A narrow separating region 120 of the support 112 electrically isolates adjacent turns of the band. The resistive layer 116 is connected to a voltage supply in a control unit 119 via a pair of contacts A, B, located at the ends of the band. The control unit 119 is mounted on the cover 113.

[006]. The actuator 114 comprises a conductive element 118 at one of its ends. The conductive element 118 is in contact with the resistive layer 116 and picks the voltage off the resistive layer at the contact point. Since the voltage varies linearly along the band with distance to either of the contacts, the voltage picked off is characteristic of the position of the actuator. The conductive element 118 is electrically connected to the control unit 119 via contact areas (not shown) on the ball 115 and on the socket of the ball-joint. The control unit 119 comprises a processing unit for converting the voltages picked off by the conductive element 118 into output signals for a computer in the form of pairs of coordinates that represent positions of the actuator 114.

[007] When the conductive element 118 is in contact with the separating region 120, no voltage is picked off. As soon as the control unit 119 senses this condition it continues to generate the output signal derived from the voltage previously picked off by the conductive element 118. In this way the control unit 119 continuously generates an output signal that approximately represents the position of the actuator 114.

Drawings of Document D1

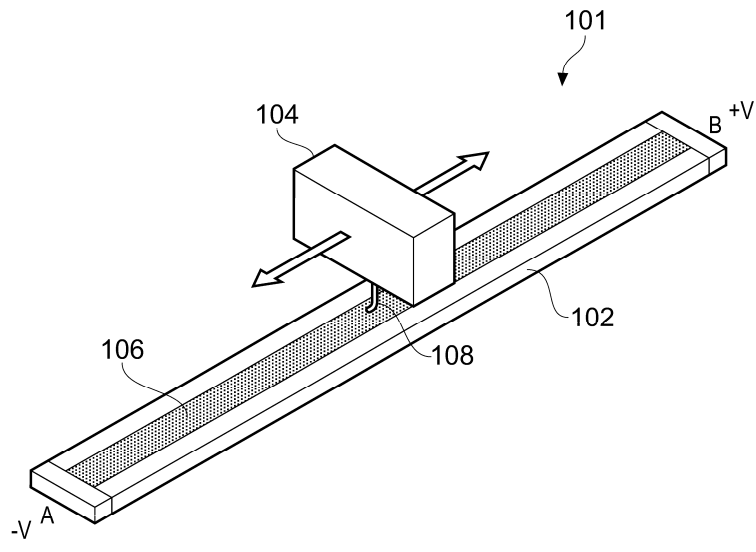


Fig. 1 (PRIOR ART)

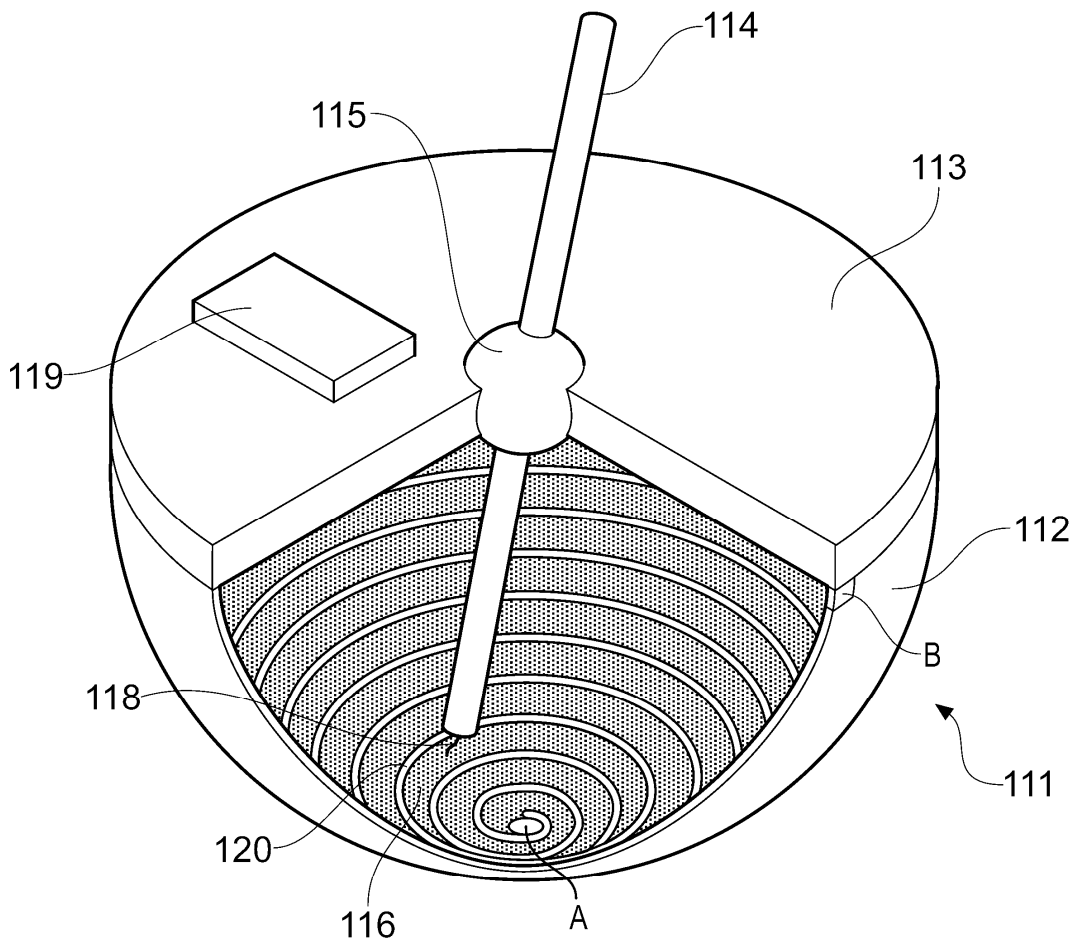


Fig. 2

Document D2

[001] Our company has developed a data input device for computers and vending machines.

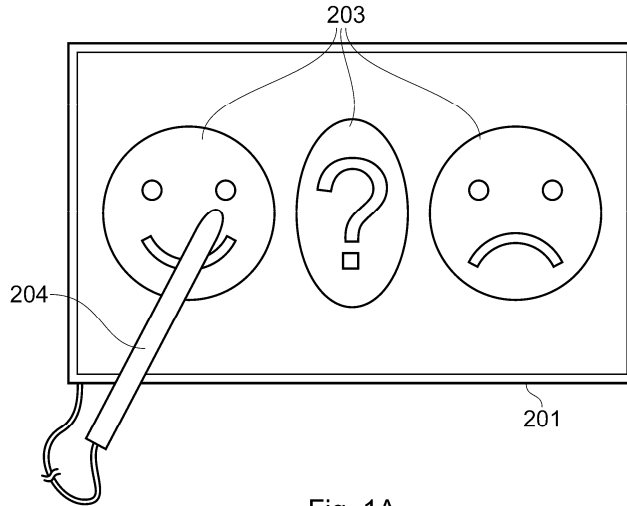


Fig. 1A

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[002] Fig. 1A shows one of our devices designed for a computer based questionnaire. It has a panel 201 and a stick 204. As shown in Fig. 1A, the stick 204 can be used as an actuator to select one of three possible answers.

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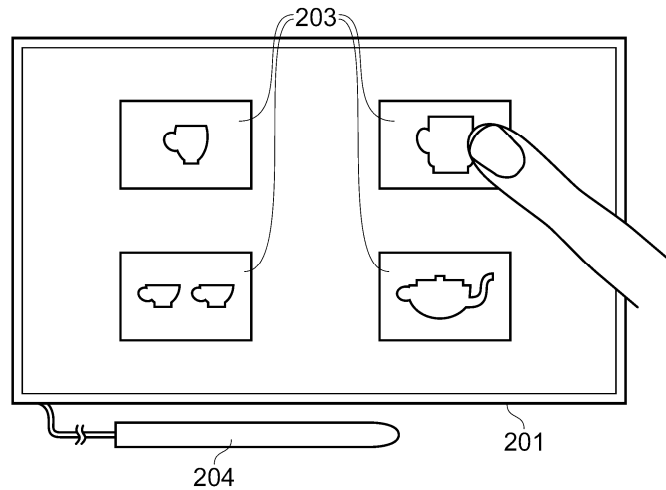


Fig. 1B

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[003] Fig. 1B shows one of our devices designed for a hot drinks vending machine. It also has a panel 201 and a stick 204 that can be used as an actuator to select a drink. As shown in Fig. 1B, a selection can also be made with a finger.

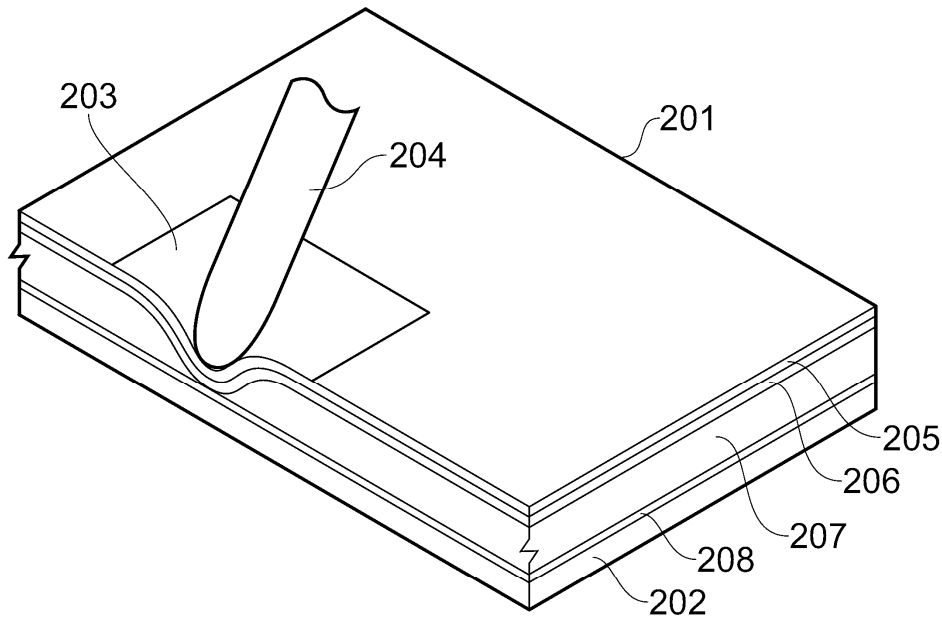


Fig. 2

[004] Fig. 2 shows a partial section through the device of Fig. 1B. The stick 204 is shown being pressed against the panel 201 in order to select a drink.

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[005] The panel 201 has a rigid support 202 made of electrically insulating material. A conductive layer 208, an electrically insulating gel layer 207, a resistive layer 206 and an electrically insulating protective layer 205 are provided on the rigid support 202 in this order. Each of the layers is continuous and covers the entire support. The resistive layer 206 and the protective layer 205 are relatively thin so that they deform when pressure is locally applied to the panel 201. The conductive layer 208 is electrically connected to a control unit (not shown).

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[006] As shown in Fig. 2, when the stick 204 is pressed against the panel 201, the protective layer 205, the resistive layer 206 and the gel layer 207 are locally deformed until the resistive layer 206 is in electrical contact with the conductive layer 208. The gel layer 207 is thick enough to prevent unintentional contact between the resistive layer 206 and the conductive layer 208, for example when a user merely touches the panel without applying significant pressure.

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[007] The stick 204 must be blunt so that when it is used to exert pressure on the
the resistive layer 206 and the protective layer 205 are not punctured. The use of a blunt
stick or a finger furthermore results in a relatively large area of contact between the
resistive layer 206 and the conductive layer 208. Therefore a reliable electrical contact
5 can be achieved.

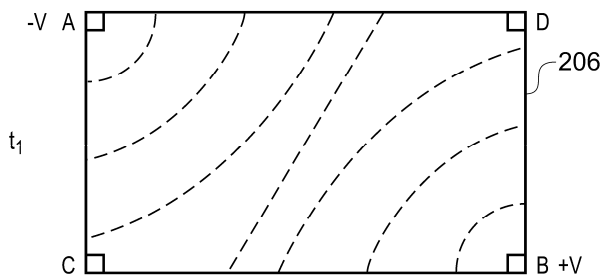


Fig. 3A

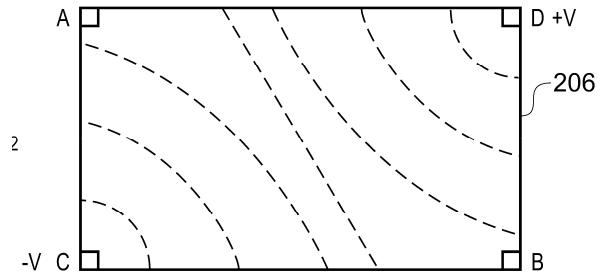


Fig. 3B

[008] We will now explain how our device functions with reference to Figs. 3A and 3B. A
10 first pair of contacts A, B and a second pair of contacts C, D are provided at the
periphery of the resistive layer 206. The resistive layer 206 can be connected to a
voltage supply in the control unit (not shown) via the contacts A, B, C, D. The control unit
comprises a switch which alternately connects the first pair of contacts and the second
pair of contacts to the voltage supply for consecutive time periods t1, t2, t1, t2 ... etc.
15 During each first time period t1, a voltage -V is supplied to contact A, a voltage +V is
supplied to contact B and contacts C and D are disconnected from the voltage supply.
During each second time period t2 a voltage -V is supplied to contact C, a voltage +V is
supplied to contact D and contacts A and B are disconnected from the voltage supply. In
this way, a first predetermined voltage distribution on the resistive layer during the time
20 periods t1 is alternated with a second predetermined voltage distribution on the resistive
layer during the time periods t2.

[009] Fig. 3A shows the voltage distribution during time periods t1. Fig. 3B shows the
voltage distribution during time periods t2. The dashed lines represent equipotential lines
25 on the resistive layer 206.

[010] When the stick or a finger is pressed against the panel so that the resistive layer 206 is brought into contact with the conductive layer 208, the conductive layer 208 picks two voltages off the resistive layer 206 in two consecutive time periods. The combination of a first voltage in time period t1 and a second voltage in time period t2 characterises the contact area between the resistive layer 206 and the conductive layer 208, and therefore also the area of the panel on which pressure is exerted. Time periods t1, t2 of 0.25 seconds have proven to be long enough to reliably detect whether pressure is exerted in this area.

[011] The control unit comprises a processing unit which is synchronised with the switch and generates output signals based on the first and second voltages. For example, as shown in Fig. 1B, when the user wishes to have a large coffee, he pushes on the panel within the corresponding selection zone 203. The processing unit then receives voltages characterising a region within this selection zone and generates an output signal instructing the hot drinks vending machine to prepare a large coffee.

Communication pursuant to Article 94(3) EPC

1. Reference is made to the following documents: D1 and D2. The document D1 has been cited by the applicant in the description. Both documents were published before the priority date of the present application.
2. The present application does not meet the requirements of Article 52(1) EPC, because the subject-matter of claims 1 to 4 and 6 to 8 is not new in the sense of Article 54(1) and (2) EPC.

2.1 The subject matter of claims 1, 6 and 7 lacks novelty with respect to D1.

2.1.1 Claim 1:

D1 discloses (see par. [004] to [006] and Fig. 2) a data input device (111) for a computer comprising:

- a support (112);
- a resistive layer (116) which is arranged on the support (112) and which is connectable to a voltage supply;
- a movable actuator (114);
- a conductive element (118) for picking voltages off the resistive layer (116); and
- a processing unit (in the control unit 119) for converting the voltages into output signals for the computer which represent positions of the actuator.

2.1.2 Claim 6:

The data input device disclosed in D1 is a joystick (see par. [004]).

2.1.3 Claim 7:

The support (112) of the data input device disclosed in D1 also has a hemispherical shape (see par. [004]).

2.2 The subject matter of claims 1 to 4 and 8 lacks novelty with respect to D2.

2.2.1 Claim 1:

D2 discloses (see par. [001], [005], [006], [010], [011] and Fig. 2) a data input device for a computer comprising:

- a support (202);
- a resistive layer (206) which is arranged on the support (202; this expression does not exclude there being intermediate layers between the resistive layer and the support) and which is connectable to a voltage supply;
- a movable actuator (stick 204);
- a conductive element (conductive layer 208) for picking voltages off the resistive layer (206); and
- a processing unit for converting the voltages into output signals for the computer which represent positions of the actuator (the output signals depend on the position of the stick 204 on the panel 201).

2.2.2 Claim 2:

The resistive layer (206) of the data input device of D2 is continuous and covers the entire support (see par. [005]).

2.2.3 Claim 3:

The data input device of D2 further comprises means (pairs of contacts A, B and C, D and a switch) for alternately generating a first voltage distribution and a second voltage distribution on the resistive layer (see par. [008]), said means being synchronised with the processing unit (see par. [010]).

2.2.4 Claim 4:

The data input device of D2 further comprises all the features of claim 4 (see point 2.2.3 above)

2.2.5 Claim 8:

The actuator (stick 204) of the data input device of D2 is freely movable (see par. [003] and Fig. 1B).

3. The applicant is invited to file new claims which take account of the above objections.

Letter from the applicant

Dear Mr. Spielbub,

Despite the negative communication of the EPO, we are confident that you will be able to help us to obtain patent protection for all the embodiments of our invention.

We wish to prevent any of our competitors from later being able to work around our patent by producing a data input device having a plurality of discrete resistive layers arranged side by side on a support. Please ensure that any amended independent claim you file does not exclude such a device.

Please also ensure that the second embodiment of the joystick is claimed in more detail in the dependent claims you will file.

Please file new claims which will achieve the broadest possible protection for our invention, taking the above comments into account.

Yours truly,

André Deudonné

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Claims

1. Data input device (1, 11, 21) for a computer comprising:
 - a support (2, 12, 22);
 - a resistive layer (6, 16, 26) which is arranged on the support (2, 12, 22) and which is connectable to a voltage supply;
 - a movable actuator (4, 14, 24);
 - a conductive element (8, 18, 28) for picking voltages off the resistive layer (6, 16, 26); and
 - a processing unit (92) for converting the voltages into output signals for the computer which represent positions of the actuator.

2. Data input device (1, 11, 21) according to claim 1 wherein the resistive layer (6, 16, 26) is continuous and covers the entire support (2, 12, 22).

3. Data input device (1, 11, 21) according to claim 1 or 2, comprising means for alternately generating a first voltage distribution and a second voltage distribution on the resistive layer (6, 16, 26), said means being synchronised with the processing unit (92).

4. Data input device (1, 11, 21) according to claim 3 wherein said means comprises first and second pairs of contacts (A, B and C, D) for connecting the resistive layer (6, 16, 26) to the voltage supply, and a switch (91) for alternately connecting the first pair of contacts and the second pair of contacts to the voltage supply for consecutive time periods (t1, t2).

5. Data input device (1, 11, 21) according to claim 4 wherein each of the time periods (t1, t2) is 0.01 seconds.

6. Data input device (1, 11) according to any of the preceding claims wherein the input device is a joystick (1, 11).
7. Data input device (1) according to claim 6 wherein the support (2) has a hemispherical shape.
8. Data input device (21) according to any of claims 1 to 5 wherein the actuator (24) is freely movable.