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(54) **Computer joystick**

(57) A computer joystick (10; 60) comprising a joystick handle (14), a joystick mechanism (20) having two mutually perpendicular rotatable shafts (38, 40) in frictional contact with an engaging element (24) at the bottom end of said joystick handle, and a transducer associated with each of said shafts is characterized in that said transducers consist of optical sensors (42, 44) in proximity to corresponding optically readable rotation indication elements (41, 43) on said shafts and wired to a control circuit (48) having a memory (50) for storing coordinates indicating the positions of said joystick handle (14) and a processor (54) for updating the coordinate storage in said memory according to displacement signals from said optical sensors (42, 44) and generating vector signals according to the stored coordinates to indicate the current position of the joystick handle (14). Thereby the problem is overcome that the joystick is susceptible to wear or forceful handling.

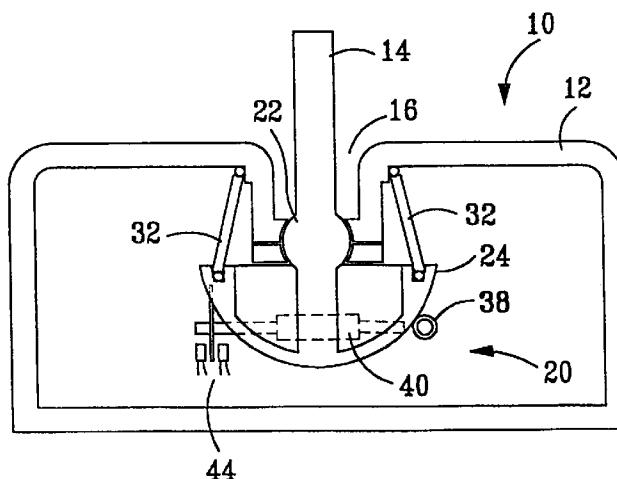


FIG. 2

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Description

[0001] The present invention relates to a computer joystick of the kind specified in the preamble of claim 1.

[0002] Computer joysticks are usually used as two-dimensional pointing control systems which employ a rotatable joystick handle to continuously generate two-dimensional vector signals each representing a current position of the joystick handle. The vector signals generated by a joystick are different from the displacement signals generated by a mouse which indicate the amount and direction of each displacement of the mouse instead of a position of the mouse.

[0003] A conventional computer joystick usually comprises a housing, a joystick handle rotatably installed in the housing for driving two rotatable shafts inside the housing, two position detectors consisting of variable resistors to detect rotation angles of the two shafts, and a control circuit connected to the two position detectors for generating vector signals to indicate the rotation angles of the two shafts which indicate the current position of the joystick handle. One major drawback of the conventional computer joystick is that the two variable resistors can easily be damaged by frequent or forceful use of the joystick handle. Also, inaccurate values of the rotation angles of the two shafts may be reported by the two variable resistors when they are damaged by frictional forces exerted inside thereof.

[0004] This in mind, the present invention as claimed aims at providing a computer joystick not subject to wear or inaccurate indications caused by friction or damage due to forceful use.

[0005] This is achieved by the present invention as claimed in claim 1 in that the computer joystick employs two optical sensors for detecting movements of the joystick handle. Preferred embodiments can be seen in the dependent claims.

[0006] In the following the invention will be illustrated by way of example with reference to the accompanying drawings, in which

Fig. 1 is a perspective view of a computer joystick according to the present invention,

Fig. 2 is a sectional view along line 2-2 of the computer joystick shown in Fig. 1,

Fig. 3 is a diagrammatic view showing the control circuit and two optical sensors of the joystick shown in the Figs. 1 and 2, and

Fig. 4 is a sectional view of a variation of the computer joystick shown in the Figs. 1 to 3.

[0007] The computer joystick 10 shown in the Figs. 1 and 2 comprises a housing 12 with an opening 16 at its top, a joystick handle 14 tiltably installed in the opening 16 and tiltably within an angle 18, and a calibrating but-

ton 15 for calibrating the indication of the position of the joystick handle 14.

[0008] As shown in the Figs. 2 and 3, a joystick mechanism 20 contained in the housing 12 includes two optical sensors 42 and 44 and a control circuit 48. The joystick mechanism 20 comprises two mutually perpendicular shafts 38 and 40 rotatably installed inside the housing 12 for measuring rotations of the joystick handle 14 in X and Y directions, the joystick handle 14 rotatably mounted in the opening 16 by a ball-shaped knob 22 on the middle portion of the joystick handle, a hemispherical engaging element 24 connected to the bottom of the joystick handle 14 for frictionally engaging the two shafts 38 and 40, and a plurality of coil springs 32 installed between the engaging element 24 and the housing 12 for maintaining the joystick handle 14 in an upright position.

[0009] The two optical sensors 42 and 44 are installed in the housing 12 next to two perforated discs 41 and 43 mounted on shaft 38 and 40, respectively, for detecting rotations of the shafts 38 and 40 and generating corresponding displacement signals. The control circuit 48 comprises a memory 50 for storing coordinates indicating the position of the joystick handle 14, and a processor 54 wired to the two optical sensors 42 and 44 for updating the coordinates according to the displacement signals so that the coordinates stored in the memory 50 always indicate the current position of the joystick handle 14. The processor 54 further generates vector signals according to the coordinates to indicate the current position of the joystick handle 14 and transmits the vector signals to a connected computer (not shown) through an output port 52.

[0010] When the upper end of the joystick handle 14 is tilted by a hand, the hemispherical engaging element 24 will cause corresponding rotations of the two shafts 38 and 40 and the two optical sensors 42 and 44 will generate corresponding displacement signals for the X and Y directions. The processor 54 will calculate therefrom displacements ΔX and ΔY , and update the coordinates stored in the memory 50 so that the current position of the joystick handle 14 can be maintained. Meanwhile, the processor 54 continues to supply vector signals to the output port 52 according to the position of the joystick handle 14 stored in the memory 50.

[0011] If any errors should occur in the updating process due to erroneous signals or any other reason, these errors would be accumulated in the stored coordinates. Therefore the coordinate storage in the memory 50 can be calibrated. Besides that, the joystick 10 should be calibrated upon power on to set initial coordinates in the memory 50.

[0012] Many methods can be devised to calibrate the coordinate storage of the joystick handle 14 in the memory 50. One of them is to set the coordinate storage to a start position such as (0,0) when the joystick handle 14 is in an upright position with no external force exerted on it and then to depress the calibrating button 15,

whereupon the processor 54 will immediately set the coordinate storage to (0,0). Alternatively, the computer connected to the joystick 10 can be used to calibrate the coordinate storage. It can provide an instruction on its monitor to have the user set the joystick handle 14 to a predetermined position and then give an instruction to the joystick 10 to have the processor 54 adjust the coordinate storage to this predetermined position. In this case the calibrating button 15 can be deleted to reduce the cost of the joystick 10.

[0013] However, manual calibration methods require human interaction and thus are inconvenient to end users. Therefore, automatic calibration methods can be devised to solve such problems and Fig. 4 shows an example. The computer joystick 60 of Fig. 4 differs from the computer joystick 10 in that it employs a detector 62 for calibrating the coordinate storage of the joystick handle 14 instead of a calibrating button or the like. The control circuit of the computer joystick 60 is similar to that one of the computer joystick 10 shown in Fig. 3 except that the calibrating button 15 is replaced by the detector 62.

[0014] The detector 62 is installed under the engaging element 24. It comprises a reflecting device 64 mounted at the bottom of the engaging element 24, a light source 66, and a light detector 68 for receiving light from the light source 66 when this is reflected by the reflecting device 64 as this is the case when the joystick handle 14 is in a predetermined, preferably its upright position. Whenever the light detector 68 receives light reflected by the reflecting device 64, the processor 54 will immediately set the coordinate storage to a predetermined start or reference position such as (0,0). In this case the processor 54 can automatically calibrate the coordinate storage whenever the joystick handle 14 reaches the predetermined upright position, and no manual calibration is required.

Claims

1. A computer joystick (10; 60) comprising a housing (12) having an opening (16) at its top, and a joystick mechanism (20) having two mutually perpendicular shafts (38, 40) rotatably installed inside said housing (12), a joystick handle (14) tiltably mounted in said opening (16), an engaging element (24) mounted at the bottom end of said joystick handle for frictionally engaging said two shafts (38, 40), and a signal generator associated with each of said shafts for providing electrical displacement signals corresponding to the rotation angles of said shafts, **characterized** in that said signal generators comprise optical sensors (42, 44) installed in said housing (12) in proximity to corresponding optically readable rotation indication elements (41, 43) on said two shafts (38, 40) and wired to a control circuit (48) including a memory (50) for storing coordinates indicating the positions of said joystick handle (14) and a processor (54) for updating the coordinate storage in said memory according to said displacement signals from said two optical sensors (42, 44) and generating vector signals according to the stored coordinates to indicate the current position of the joystick handle (14).
2. The computer joystick (10) of claim 1 further comprising a predetermined reference position stored in said memory (50) and a calibrating button (15) installed on said housing (12) and wired to said processor (54) for causing said processor (54) to set said predetermined reference position as the starting coordinates of said joystick handle (14).
3. The computer joystick (10) of claim 1, wherein a predetermined reference position is stored in said memory (50) and said vector signals are transmitted to a computer connected to the computer joystick (10) for causing said computer to send a calibrating signal to the computer joystick whereupon said processor (54) of said control circuit (48) will set said predetermined reference position as the starting coordinates of said joystick handle (14).
4. The computer joystick (60) of claim 1 further comprising a detector (62) installed in said housing (12) and wired to said processor (54) of said control circuit (48) for detecting a predetermined reference position of said joystick handle (14) and thereupon causing said processor (54) to set the predetermined reference position as the starting coordinates of said joystick handle (14).
5. The computer joystick (60) of claim 4, wherein said predetermined reference position of said joystick handle (14) is the vertical position thereof assumed when said joystick handle is not subject to any external force.
6. The computer joystick (60) of claim 4 or 5, wherein said detector (62) comprises a reflecting device (64) installed at the bottom end of said joystick handle (14) and a light source (66) and light detector (68) each installed in said housing (12) in a way so that, when said joystick handle (14) assumes said predetermined reference position, the light emitted from said light source (66) is reflected by said reflecting device (64) towards said light detector (68).

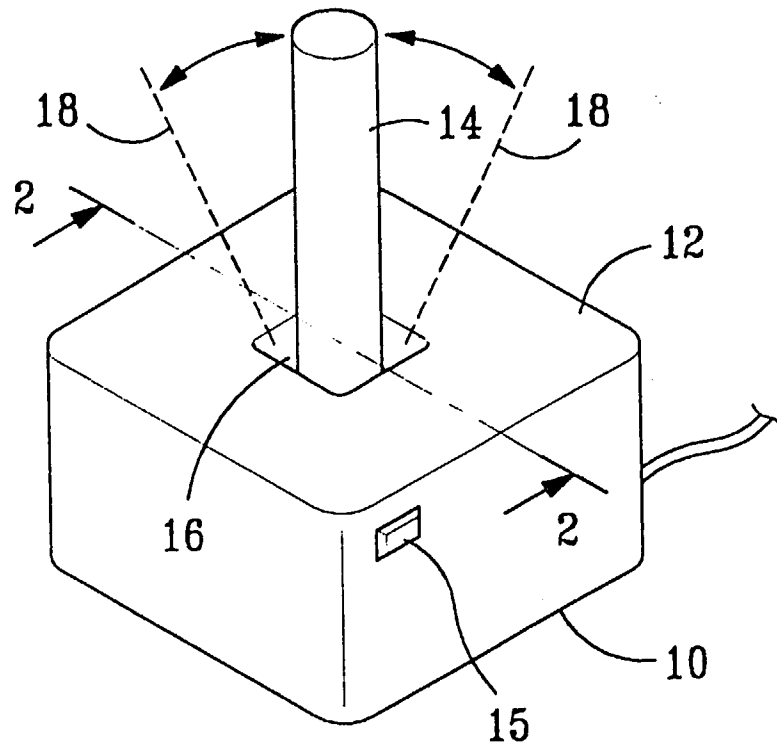


FIG. 1

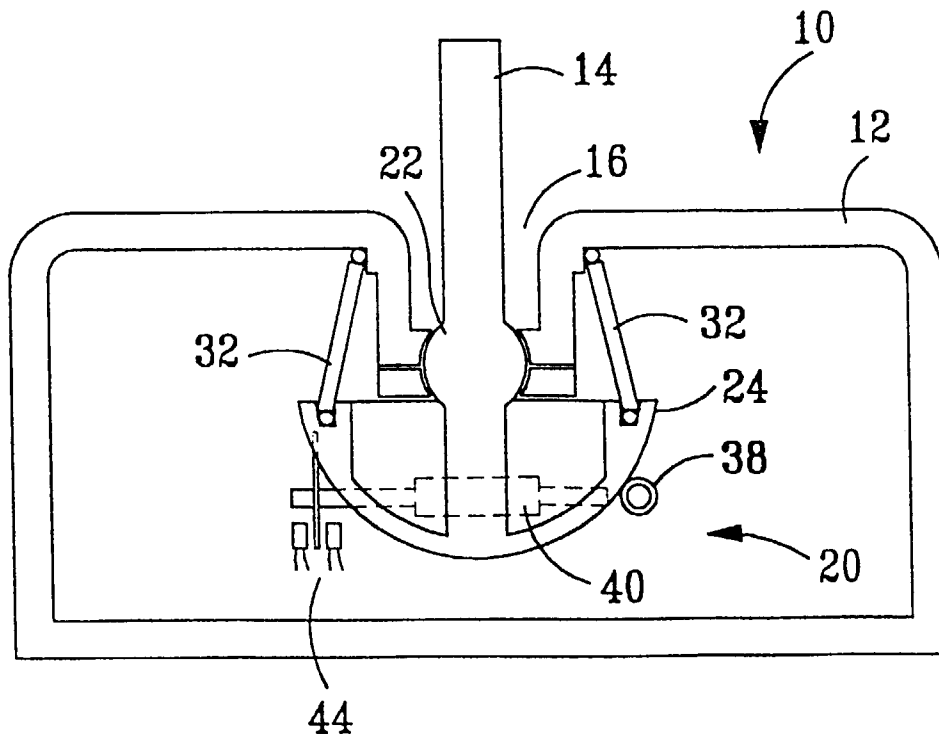


FIG. 2

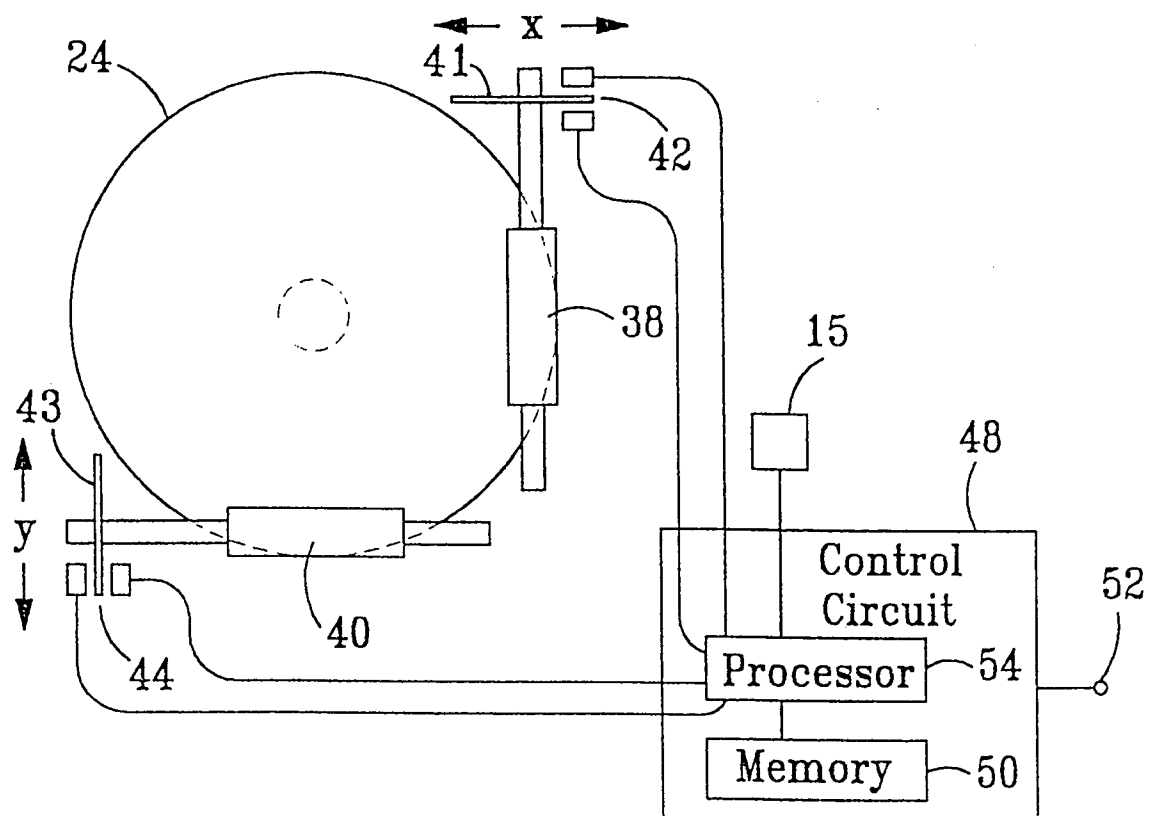


FIG. 3

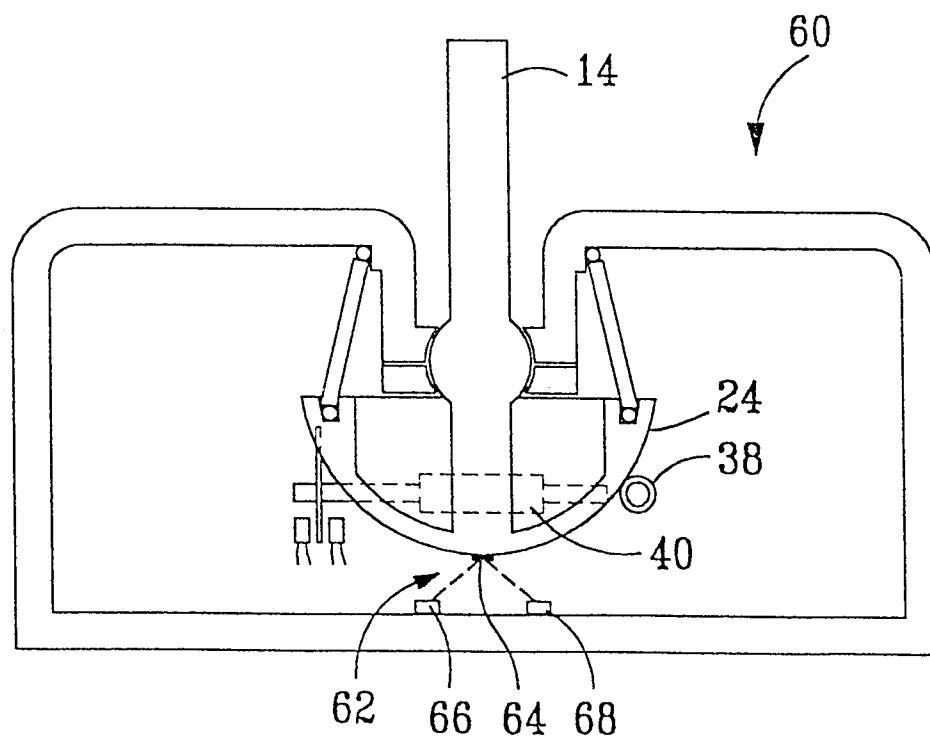


FIG. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 98 10 2273

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 5 561 445 A (MIWA MICHIO ET AL) 1 October 1996	1	G05G9/047
A	* column 22, line 30 - line 40; figures 6,19 * * column 15, line 18-41 * ---	2,3	
A	EP 0 782 093 A (THOMSON MULTIMEDIA SA) 2 July 1997 * the whole document * -----	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6) G05G G06K
Place of search THE HAGUE		Date of completion of the search 23 October 1998	Examiner Areso y Salinas, J
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