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Martin et al.

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(54) **METHOD AND APPARATUS FOR PROVIDING TACTILE SENSATIONS**

(58) **Field of Classification Search**

USPC 345/163, 167-169, 173
See application file for complete search history.

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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This patent is subject to a terminal disclaimer.

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(21) Appl. No.: **13/362,113**

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(65) **Prior Publication Data**

(Continued)

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Related U.S. Application Data

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(57) **ABSTRACT**

Systems and methods for providing tactile sensations are disclosed. For example, one disclosed method includes the steps of outputting a display signal configured to display a graphical object on a touch-sensitive input device; receiving a sensor signal from the touch-sensitive input device, the sensor signal indicating an object contacting the touch-sensitive input device; determining an interaction between the object contacting the touch-sensitive input device and the graphical object; and generating an actuator signal based at least in part on the interaction.

(51) **Int. Cl.**
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(52) **U.S. Cl.**
USPC **345/163; 345/167**

26 Claims, 11 Drawing Sheets

INPUT DEVICE	INPUT SIGNAL	POSITION DATA	PRESSURE DATA	FUNCTION	TACTILE SENSATION
1	--	Location 1	< Pressure 1	Search	Sensation 1
	Input 1	Location 1	Pressure 1 <=	Select	Sensation 2
2	--	Position 1	--	On	Sensation 3
	--	Position 2	--	Off	Sensation 4
	Input 2A	--	Pressure 1	9	Sensation 5
3	Input 2B	--	Pressure 2	W	Sensation 6
	Input 2C	--	Pressure 3	X	Sensation 7
	Input 2D	--	Pressure 4	Y	Sensation 8
	Input 2E	--	Pressure 5	Z	Sensation 9
	--	--	Pressure 1	Menu 1	Sensation 10
4	Input 3	--	Pressure 2	Menu 2	Sensation 11
		--	Pressure 3	Menu 3	Sensation 12
		--	Pressure 1	2	Sensation 13
5	---	--	Pressure 2	A	Sensation 14
		--	Pressure 3	B	Sensation 15
		--	Pressure 4	C	Sensation 16
		--	Pressure 1	Function 1	Sensation 17
6	Input 4	Position 1	Pressure 1	Function 1	Sensation 17
	Input 5	Position 2	Pressure 2	Function 2	Sensation 18
	Input 6	Position 3	Pressure 3	Function 3	Sensation 19
7	Input 7	Location 1	Pressure 1	Function 1	Sensation 20
	Input 8	Location 2	Pressure 2	Function 2	Sensation 21
--	AMBIGUOUS	--	--	--	Sensation 22
--	Function Failure	--	--	--	Sensation 23